

# Technology Innovation News Survey

Entries for May 1-15, 2024

## Market/Commercialization Information

### SOURCES SOUGHT \$249M W9128F24SS003 FOR ENVIRONMENTAL REMEDIATION SERVICES (ERS) (SRCSGT)

U.S. Army Corps of Engineers, Northwestern Division, Omaha District, Omaha, NE  
Contract Opportunities on SAM.gov W9128F24SS003, 2024

This is a sources sought notices for marketing research purposes only. The U.S. Army Corps of Engineers is seeking information from interested, qualified Small Business Community members (e.g., Small Businesses, 8(a), HUBZone, Small Disadvantaged Businesses, Service Disable Veteran Owned Small Businesses, Women-Owned Small Businesses), and other-than-Small Business firms ("Large" businesses) under NAICS code 562910 that are capable of providing environmental remediation services that support the Northwestern Division and approved customers at hazardous toxic and radioactive waste sites and Military Munitions Response Program sites for both civilian and military agencies of the Federal Government. Projects will include the construction of treatment systems (acid rock drainage, PFAS), dredging, hard rock mine reclamation, time-critical and non-time-critical removal actions, residential remedial action, and complex groundwater sites with significant technical challenges in achieving cleanup goals within a reasonable timeframe due to the nature and extent of contamination, geologic setting, stringent cleanup goals, and lack of effective remedial options. These types of projects require a rigorous understanding of environmental laws and agency requirements; interdisciplinary collaboration from program and project management, contract management, construction, geology, chemistry, biology, safety, and engineers such as environmental, civil, geotechnical, structural, and hydrological engineers; innovative measures to achieve schedules and program metrics; significant community involvement; adaptive management; investment of startup capital; and bonding. Services include activities such as the assessment, inspection, investigation, study, control, characterization, containment, removal and/or treatment of environmental contamination from pollutants, toxic substances, PFAS, radioactive materials, and hazardous materials. Additional requirements may be identified at task order level. ERS contracts will include services related to requirements of CERCLA, RCRA, the EPA Emerging Contaminant Program; the National Oil and Hazardous Substances Pollution Contingency Plan, Military Munitions Response Program, the Clean Water Act, the Clean Air Act, NEPA, National Historic Preservation Act, Endangered Species Act and other related Federal Programs in addition to State/Local specific regulations/requirements dealing with hazardous waste management/disposal, radioactive waste/mixed waste management/disposal, and with Underground Storage Tanks, and other fuels related issues. Responses are due by 2:00 PM CDT on July 8, 2024. <https://sam.gov/opp/26d0005c9e9490c8afa6ac3241af1112/view>

### ENVIRONMENTAL CONSULTING SERVICES SATOC (SOL)

U.S. Army Corps of Engineers, Savannah District, Savannah, GA  
Contract Opportunities on SAM.gov W912HN24R1003, 2024

This is a total small business set-aside under NAICS code 541620. The U.S. Army Corps of Engineers, Savannah District, requires a contractor for a \$10M Environmental Consulting Services, Single Award Task Order contract. The environmental and base support services under this contract will consist of environmental compliance, environmental restoration, environmental conservation, UXO anomaly avoidance, pollution prevention, real estate, SRM, energy management and sustainability services. The contractor shall provide support related to requirements of RCRA, CERCLA, the Clean Air Act, NEPA and other related Federal Programs in addition to State/Local specific regulations/requirements. Contractors will be evaluated using the Lowest Price Technically Acceptable Methodology based on Price, Technical Approach, and Past Performance. This acquisition is being offered as a 100% set-aside for small business competition and will result in a Firm-Fixed-Price Contract Award. Offers are due by 2:00 PM EDT on July 9, 2024. <https://sam.gov/opp/b2fc25c82ba5405fa5418848a6f7656c/view>

### F -- DRAFT EPA SATOC ACW JACKSON (PRESOL)

Contract Opportunities on SAM.gov W912HN24R1004, 2024  
U.S. Army Corps of Engineers, Savannah District, Savannah, GA

When this solicitation is released on or about July 15, 2024, it will be competed as a total small business set-aside under NAICS code 562910. The U.S. Army Corps of Engineers intends to issue a solicitation for a \$1M EPA, Single Award Task Order contract (SATOC) for the American Creosote Site (ACW) in Jackson, Tennessee. This acquisition will be offered as a 100% set-aside for small business competition and will result in a Firm Fixed Price Contract Award. The purpose of this contract is to provide a full range of environmental remediation services for the American Creosote Works Superfund Site. The environmental remediation services will consist of environmental remediation for hazardous toxic and radioactive waste and wetland mitigation. This will NOT include services that are related to military munitions response and range and UXO support. Services may include, but are not limited to, the assessment, inspection, investigation, study, control, characterization, containment, removal and/or treatment of environmental contamination from pollutants, toxic substances, perfluorinated compounds, preparing workplans, remedial design documents, and reporting. The projects performed under this SATOC will be solely for the United States Environmental Protection Agency for the ACW Site. There is no solicitation at this time. <https://sam.gov/opp/74c2679ee0064001159d49111abf6f6f/view>

## Cleanup News

### ENHANCED AEROBIC BIOSTIMULATION AND BIOAUGMENTATION OF CHLORINATED SOLVENTS AND 1,4-DIOXANE IN GROUNDWATER

Stamatovski B.H., L. LaPat-Polasko, and A.L. Polasko. 119th Annual Environmental Professionals of Arizona Conference, 26-27 February, Tempe, AZ, 41 slides, 2024

In situ bioremediation (ISB) systems were engineered to promote microbial-enhanced oxidation of 1,4-dioxane (1,4-D) and cVOCs, including cis-1,2-DCE and VC, in groundwater by integrating biostimulation and bioaugmentation. The plume was originally treated with enhanced reductive dechlorination, which resulted in elevated concentrations of cis-1,2-DCE, VC, 1,1-DCE, and 1,4-D. Aerobic biodegradation was promoted via air sparging and bioaugmentation with *Pseudonocardia dioxanivorans* CB1190 (CB1190) or 1,4-D-Stroy™ and a nutrient medium (e.g., nitrogen, phosphorus, potassium and calcium) to support microbe growth. A series of injection and monitoring wells were used in areas with elevated cVOCs and 1,4-D to distribute the aerobic bioremediation amendments. A groundwater monitoring program was used to evaluate the treatment system's effectiveness and measure parameters such as cVOCs and 1,4-D concentrations, key microbial gene abundances, and geochemical levels. A second in situ bioaugmentation was performed using CB1190 or 1,4-D-Stroy. Monthly or quarterly sampling of major electron acceptors, oxidation-reduction potential, key microbial genes, 1,4-D, and cVOCs was performed to evaluate the effectiveness of the microbes to biodegrade 1,4-D and cVOCs. An increase in total organic carbon (TOC) was observed in the impacted monitoring wells three months after dechlorination, corresponding to a significant decline in competing electron acceptors and PCE and TCE in wells affected by biostimulation and bioaugmentation. A major increase in dissolved oxygen and nutrients, and a significant increase in the CB1190 microbial population occurred in areas where CB1190 was applied, leading to a significant reduction in cis-1,2-DCE, VC, and 1,4-D in groundwater. The presentation discusses results of the bioaugmentation event and the impact of the injection on the distribution of various amendments in the groundwater and compares the efficacy of CB1190 and 1,4-D-Stroy in biodegrading chlorinated ethenes and 1,4-D. [https://www.epa.gov/assets/docs/conference/2024/Day1\\_1a\\_Hoagland\\_ISB%20CVCs\\_Dioxane\\_LaPat-Polasko\\_Hoagland.pdf](https://www.epa.gov/assets/docs/conference/2024/Day1_1a_Hoagland_ISB%20CVCs_Dioxane_LaPat-Polasko_Hoagland.pdf)

### END-STATE DRIVEN PERFORMANCE-BASED MANAGEMENT OF PUMP-AND-TREAT REMEDIES

Demirkani, I. and X. Song. I PNNL Center for the Remediation of Complex Sites (RemPlex) Seminars, 23 April, 72 minutes, 2024

Pump-and-treat (P&T) systems are commonly used to hydraulically contain and treat contaminated groundwater. While they can effectively treat groundwater, maintaining their performance is challenging at many sites. As the remedy progresses, contaminant removal typically diminishes due to site complexities, such as heterogeneous geology, large capture zones requiring multiple pore volume flushes, the presence of source zones, diffusion-limited mass transfer, co-located and/or recalcitrant contaminants, and dispersed contaminant distributions. At many sites using P&T, short-term response actions were needed at startup to mitigate immediate risks to receptors. As a result, the initial P&T design often focused on large-scale containment and bulk treatment rather than the most optimized system to provide maximized and/or sustained contaminant removal to achieve a certain end state, contributing to plume persistence and limited effectiveness of the P&T systems. Performance-based optimization and management of P&T remedies is critical to maintain contaminant removal effectiveness throughout the remedy's lifetime and manage systems toward a certain end-state for site completion or a remedy transition. This RemPlex seminar presents a pre-screening tool developed to conduct end-state-driven pump & treat (P&T) performance evaluations. The tool provides a systematic and adaptive approach that couples a simplified field-scale model with optimization algorithms to assess the potential impacts of various P&T management strategies and specific site features on multiple remedy objectives. The tool does not replace more comprehensive high-resolution P&T models but provides a pre-screening level comparison of P&T system behavior to achieve a certain end state.

**YouTube video:** <https://www.youtube.com/watch?v=5BvLUJ6D1H4>

**Slides:** [https://www.pnnl.gov/sites/default/files/media/file/RemPlex\\_Pump-and-Treat\\_Seminar\\_20Feb2024.pdf](https://www.pnnl.gov/sites/default/files/media/file/RemPlex_Pump-and-Treat_Seminar_20Feb2024.pdf)

### COMBINING ZERO VALENT IRON WITH ENHANCED BIOREMEDIATION FOR TREATMENT OF LOW-PERMEABILITY SITES – CONCEPTS AND CASE STUDIES

Baird, D. I DCHWS West 2023 Fall Symposium, 25-27 October, Denver, CO, 18 slides, 2023

This presentation focuses on hydraulic fracturing to deliver an engineered high-solids ZVI slurry (up to 70% by weight ZVI) and injection of bioremediation amendments through the permeable ZVI fractures. It presents hydraulic fracturing-based delivery methods for ZVI and bioremediation amendments and describes each treatment mechanism. Two case studies are used to demonstrate the successful application of hydraulic fracturing to deliver ZVI and bioremediation amendments to low permeability sites impacted with chlorinated solvents. At a site in Kansas, 95,000 lbs of ZVI were injected via hydraulic fracturing, and select injection locations were converted to dedicated injection wells for injection of 3,250 gals of emulsified vegetable oil (EVO) solution and a bioaugmentation culture. The total mass of chlorinated ethenes in groundwater decreased by ~70% after 23 months. A similar approach was employed during a pilot test at a site in Louisiana, where 12,000 lbs of ZVI was delivered during fracturing activities, followed by injection of 440 gals of EVO solution and a bioaugmentation culture. After four years, total concentrations of chlorinated ethenes, chloroform, and carbon tetrachloride decreased by ~90% in groundwater in four of six performance monitoring wells. The full-scale project incorporated a new approach for delivering high-solids ZVI slurry mixed with short- and long-term electron donors in a single fracturing step. Combining ZVI with enhanced bioremediation yields several advantages over treating with ZVI alone, including:

- Treating a greater range of compounds of concern;
- Penetrating low permeability zones via chemical diffusion and other mechanisms; and
- Polishing of COCs near the end of the reactive life of the ZVI.

<https://media.cdn.guidetobook.com/uploads/205632/Gb1qlUG7SaR5WX0BmDipNltzyvb8b3kwtHJfj.pdf>

## Demonstrations / Feasibility Studies

### MULTIMETHOD ANALYSIS OF NSZD AND ENHANCED SZD BY SOLAR-POWERED BIOVENTING AT THE GUADALUPE RESTORATION PROJECT

McAlexander, B., E.J. Daniels, N. Sihota, J. Eichert, and C. Smith.  
Groundwater Monitoring & Remediation 44(2):72-85(2024)

An approach combining natural source zone depletion (NSZD) measurements and monitoring technology was applied at the Guadalupe Restoration Project to quantify biodegradation enhancements and sustainably increase the rate of source zone depletion. NSZD quantification was conducted using CO<sub>2</sub> efflux measurements and subsurface temperature profiling. Results fell within the range of previously reported estimates based on soil-gas profiling in the early 2000s, demonstrating the viability of the new methods. Data collection methods were then deployed during pilot testing of solar-powered bioventing. The system used seven 400-W solar panels to power a regenerative blower that delivered ~0.85 m<sup>3</sup>/minute (30 cfm) air to the LNAPL-impacted vadose soil near the interface with the groundwater table. Soil-gas data indicated an upward fanning of injected air toward ground surface. Elevated temperature due to hydrocarbon oxidation yielded an ~10.2 kg/day source depletion rate above the baseline NSZD mass removal rate over a ~30 m (100 ft) radius of influence, which aligned well with an 8.2 kg/day rate estimated from CO<sub>2</sub> efflux measurements. Introducing O<sub>2</sub> via bioventing substantially increased the LNAPL biodegradation rate from baseline NSZD processes by almost an order of magnitude. Results demonstrate that site management can proceed along a sequenced program that began with aggressive hydraulic recovery of hydrocarbon product, transitions to enhanced SZD in areas with poorly recoverable LNAPL, and then to NSZD without intervention to address residual LNAPL across the full footprint of the LNAPL bodies. <https://ngwa.onlinelibrary.wiley.com/doi/epdf/10.1111/gwmr.12647>

### IN SITU BIOREMEDIATION OF 1,4-DIOXANE IN MIXED CONTAMINANT PLUME WITH METABOLIC BIOAUGMENTATION AND COMETABOLISM

Krembs, F.J., K. McDonald, M. Olson, and S. Dworatzek.  
2023 Bioremediation Symposium Proceedings, 8-11 May, Austin, TX, 29 slides, 2023

IN SITU BIOREMEDIATION OF 1,4-DIOXANE IN MIXED CONTAMINANT PLUME WITH METABOLIC BIOAUGMENTATION AND COMETABOLISM Krembs, F.J., K. McDonald, M. Olson, and S. Dworatzek. 2023 Bioremediation Symposium Proceedings, 8-11 May, Austin, TX, 29 slides, 2023 The source area at an industrial site in Puerto Rico is impacted with mixed constituents,

including chlorinated solvents, hydrocarbons, and 1,4-dioxane. A side-by-side aerobic bioremediation pilot test investigated direct metabolism and cometabolism via a single biosparger system that delivers air at moderate flow rates and pressures to establish aerobic conditions. Bioaugmentation was performed to support direct metabolism. The DXO-88Tm bioaugmentation culture, isolated from industrial sludges where 1,4-dioxane degradation was observed, was injected into sparge wells and pushed into the formation with the biosparger system. Cometabolism was implemented by propane sparging. Results of groundwater sampling for VOCs, 1,4-dioxane, geochemical parameters, and microbial community evaluation (qPCR and NextGen sequencing) indicate that target conditions amenable to degradation of 1,4-dioxane are becoming established. The results suggest that simultaneous implementation of bioaugmentation and cometabolism at portions of the site are a feasible remedy for 1,4-dioxane source areas. Preliminary data indicates that 1,4-dioxane concentration reductions of 40-75% were attained within 4 months of system startup.

Slides: [https://www.battelle.org/docs/default-source/hidden/2023-bin-symp-presentations/track-by/h10\\_1415\\_203\\_krembs\\_aui\\_rev\\_gptx.pdf?sfvrsn=e5071ffc\\_3](https://www.battelle.org/docs/default-source/hidden/2023-bin-symp-presentations/track-by/h10_1415_203_krembs_aui_rev_gptx.pdf?sfvrsn=e5071ffc_3)  
Longer abstract: [https://www.battelle.org/docs/default-source/hidden/2023-bin-symp-abstracts/203\\_tpdabs.pdf?sfvrsn=59d69fa\\_3](https://www.battelle.org/docs/default-source/hidden/2023-bin-symp-abstracts/203_tpdabs.pdf?sfvrsn=59d69fa_3)

## DESIGN CONSIDERATIONS FOR PFAS TREATMENT USING A COLLOIDAL ACTIVATED CARBON BARRIER

Cronk, G., A. Elsof, S. Palakum, C. Sandefur, D. Nunez, R. Mayer, N. Johnson, P. Hatzinger, M. Lightner, M. Parker, D. Darrow, and A. Bollweg | AEHS Foundation 33rd Annual International Conference on Soil, Water, Energy, and Air, 18-21 March, San Diego, CA, 2022 slides, 2024

A permeable barrier with colloidal activated carbon (CAC) was used to treat a PFAS plume in groundwater at a former Naval Air Station in Alameda, California. The approach involved injecting CAC into the aquifer to enhance the sorption of PFAS onto aquifer solids, greatly reducing transport in groundwater. A pilot test was conducted to verify the performance of a CAC barrier to reduce migration of PFAS into the Oakland Inner Harbor. Before injecting CAC, multiple tests were conducted to aid in designing and placing the barrier. A column study was conducted to provide data concerning the adsorption capacity of CAC for representative samples to support field-scale design. Three flow-through columns containing 0%, 0.5%, or 2% CAC in sediment and groundwater with PFAS were passed through the columns to simulate ~20 months of groundwater flow. Data indicated that CAC at a concentration of 2% or higher could appreciably reduce dissolved PFAS concentrations. The barrier was constructed by injecting CAC at different concentrations into 278 direct push injection points over 720 feet parallel to the shoreline of Oakland Inner Harbor. Passive flux meters were used in monitoring wells to define the lithologic zones with the highest groundwater velocity and mass flux. Soil cores and discrete groundwater samples were collected along the planned barrier to determine the vertical variations in PFAS and PFOS concentrations. After the design considerations were evaluated, the CAC pilot study barrier was constructed; three different concentrations of PlumeStop (2.6%, 5.0%, and 7.5%) were injected to a depth of 17 ft across the 720 ft barrier.

[https://www.xcdsystem.com/AEHS/abstract/File232933/PDFforhandout/attendeesont\\_161\\_0321110345.pdf](https://www.xcdsystem.com/AEHS/abstract/File232933/PDFforhandout/attendeesont_161_0321110345.pdf)

## Research

### TREE BARKS FOR RETROSPECTIVE MEASUREMENT AND SOURCE APPOINTMENT OF AIRBORNE PERFLUOROALKYL AND POLYFLUOROALKYL SUBSTANCES

Liu, J., L. Dong, L. Zhou, W. Yang, S. Shi, S. Dong, H. Zhang, X. Zhang, J. Guo, and L. Zhang  
Environmental Pollution 344:123346(2024)

Work systematically studied tree barks as a bioindicator of airborne PFAS. Compared with active and passive samplers, barks could produce long-term airborne PFAS measurements and record historical PFAS emissions with retrospective time frames of as long as decades. Factors (tree type, trunk diameter, and sampling depth) can affect PFAS accumulation in barks and should be kept consistent during sampling. In a study area, the spatial distribution of airborne PFAS was obtained by interpolating bark results to locate the source region. Properties of the emission sources can be characterized, the potential sources can be tracked based on the bark results, and contributions can be further estimated by source appointment strategies. In eight economically and industrially developed study areas in the southern Jiangsu Province of China, the total ionic PFAS concentration of camphor bark samples collected in 34 sites was 0.44-359 ng/g dw, dominated by PFCAs. Two possible sources (fluoropolymer manufacturing and textile industries) were characterized by long-chained PFCAs and PFOA as the main components. Their relative contribution was estimated as 32.5% and 67.5%, respectively. Based on the bark results, effective strategies can be further made for PFAS pollution elimination and risk control.

### BLACK CARBON IMPACTS ON PARABURKHOLDERIA XENOVORANS STRAIN LB400 CELL ENRICHMENT AND ACTIVITY: IMPLICATIONS TOWARD LOWER-CHLORINATED POLYCHLORINATED BIPHENYLS BIODEGRADATION POTENTIAL

Dong, Q., G.H. LeFevre and T.E. Mattes.  
Environmental Science & Technology 58(8):3895-3907(2024)

Combining biodegradation with black carbon (BC) materials is an emerging bioaugmentation approach to remove PCBs from sediment. However, development of aerobic biofilms on BC for long-term sustained lower-chlorinated polychlorinated biphenyl (LC-PCB) remediation is poorly understood. This study aimed to characterize the cell enrichment and activity of biphenyl- and benzoate-grown *Paraburkholderia xenovorans* strain LB400 on various BCs. Measuring the abundance of the biphenyl dioxygenase gene (*bphA*) abundance on four BC types demonstrated corn kernel biochar hosted at least 4 orders of magnitude more attached cells per gram than other feedstocks. Microscopic imaging revealed the attached live cell fraction was >1.5x more on corn kernel biochar than GAC. BC characteristics (i.e., sorption potential, pore size, pH) appeared to contribute to cell attachment differences. Reverse transcription qPCR indicated that BC feedstocks significantly influenced *bphA* expression in attached cells. The *bphA* transcript-per-gene ratio of attached cells was >10-fold more than suspended cells, confirmed by transcriptomics. RNA-seq also demonstrated significant upregulation of biphenyl and benzoate degradation pathways on attached cells, revealing biofilm formation potential/cell-cell communication pathways. Findings demonstrate aerobic PCB-degrading cell abundance and activity could be tuned by adjusting BC feedstocks/attributes to improve LC-PCBs biodegradation potential.

### DEFLUORINATION OF PFAS BY ACIDIMICROBIUM SP. STRAIN A6 AND POTENTIAL APPLICATIONS FOR REMEDIATION.

Jaffe, P.R., S. Huang, J. Park, M. Ruiz-Uriguen, W. Shuai and M. Sima.  
Methods in Enzymology 696:287-320(2024)

To explore potential applications for PFAS bioremediation, PFAS-contaminated biosolids were augmented with *Fe(III)* and *Acidimicrobium sp. strain A6*, resulting in PFAS degradation. Since the high demand of *Fe(III)* makes growing strain A6 in conventional reactors challenging, and strain A6 was shown to be electrogenic, it was grown in the absence of *Fe(III)* in microbial electrolysis cells, where it was shown to oxidize ammonium and degrade PFAS.

### NEW CONCEPT OF "RELEASE-CAPTURE-DESTRUCTION" TO ENABLE REMEDIATION OF PFAS IN SOURCE ZONE SOILS

Chiu, K.-H., J. Field, and T. Strathmann. SERDP Project ER22-3124, 65 pp, 2023 (published February 2024)

The overarching goal of this project was to develop an integrated treatment system for the effective treatment of PFAS-contaminated soil in source zones. Specifically, this project tested the treatment strategy based on the "Release-Capture-Destruction" concept. The technical objectives were to determine factors affecting the biodegradation of soil-bound precursors, accelerate the biodegradation of precursors in soil via bioaugmentation, determine the efficiency of PFAS removal by magnetic activated carbon (MAC) in soil, and assess whether hydrothermal alkaline treatment (HALT-PFAS) technology can destroy PFAS in spent MAC. Results filled in knowledge gaps on the poorly understood effects of co-contaminant hydrocarbon surfactants on the fate and biotransformation of PFAS precursors and the factors controlling biodegradation of the soil-bound precursors into more mobile PFAAs for subsequent treatments (i.e., capture and destruction technologies). The new knowledge on promoting biodegradation of precursors can lead to the success of the proposed treatment train of PFAS in soil and provides a foundation for the future development of precursor bioremediation. The successful application of MAC to sorb mobile PFAAs produced from precursor biodegradation, followed by using hydrothermal liquefaction for the destruction of PFAS-laden MAC, provided strong proof for the proposed "Release-Capture-Destruction" remediation strategy for PFAS-laden soil, which are present at numerous DoD sites.  
**Final Report:** [https://serdp-estrcp-storage.s3.us-gov-west-1.amazonaws.com/s3fs-public/2024-02/ER22-3124%20Final%20Report.pdf?VersionId=sacWsrMDN9\\_9qstNzFu0vrmCvdtAp\\_2nd](https://serdp-estrcp-storage.s3.us-gov-west-1.amazonaws.com/s3fs-public/2024-02/ER22-3124%20Final%20Report.pdf?VersionId=sacWsrMDN9_9qstNzFu0vrmCvdtAp_2nd)  
**Executive Summary:** [https://serdp-estrcp-storage.s3.us-gov-west-1.amazonaws.com/s3fs-public/2024-02/ER22-3124%20Executive%20Summary.pdf?VersionId=cWP9H7yD8\\_rPnpgNvYedqg1MahCv11](https://serdp-estrcp-storage.s3.us-gov-west-1.amazonaws.com/s3fs-public/2024-02/ER22-3124%20Executive%20Summary.pdf?VersionId=cWP9H7yD8_rPnpgNvYedqg1MahCv11)

### SOIL WASHING FOR REMOVAL OF PER- AND POLYFLUOROALKYL SUBSTANCES FROM INVESTIGATION-DERIVED WASTE

Miceli, J., J.R. Varghese, T.M. Holsen, and M. Crimi. Remediation 34(1):e21771(2024)

A systematic study of investigation-derived waste (IDW) washing explored the effect of water-, methanol-, and salt-based solutions typically used for ion exchange (IX) resin regeneration. These solutions were tested for PFAS removal using four field IDW solids with different pHs, total organic carbon content, and anion exchange capacity. In long washes extending to a week, distilled water was found to be effective in the removal of short-chain PFAS (PFCAs with fewer than seven fluorinated carbon atoms and PFASs with fewer than six fluorinated carbon atoms) and some long-chain PFAS including PFOA, but not PFOS. PFOS was only removed using water:methanol solutions with salt. Optimized 30-min washes containing water:methanol and salt effectively removed precursors and short- and long-chain PFAS. Kinetic, soil extraction and leaching experiments revealed that PFAS can be removed within minutes, with > 70% PFAS removal on the first wash; however, longer-chain PFAS required up to three washes to be removed. Important IDW wash solution relationships influencing PFAS desorption are discussed, and PFOS is proposed as an indicator species for IDW washing effectiveness. Results demonstrate that adapting components of IX regeneration solutions to IDW wash solutions facilitates an alternative means to separate PFAS contaminants from IDW, advancing PFAS remediation efforts.

### INTERPRETING CONCENTRATIONS SAMPLED IN LONG-SCREENED WELLS WITH BOREHOLE FLOW: AN INVERSE MODELING APPROACH

Day-Lewis, F.D., R.D. Mackley, and J. Thompson.  
Groundwater 61(6):834-845(2023)

A simple analytical model is presented for flow and transport within a well and interaction with the surrounding aquifer to assess contaminant mass based on samples from long-screened wells and open boreholes (LSW&OB). An inverse problem was formulated to estimate formation concentration based on sampled concentrations and data from flowmeter logs. The approach is demonstrated using synthetic examples. Results underscore the importance of interpreting sampled concentrations within the context of hydraulic conditions and aquifer/well exchange; demonstrate the value of flowmeter measurements for this purpose; and point to the potential of the new inverse approach to better interpret results from samples collected in LSW&OBs.  
<https://ngwa.onlinelibrary.wiley.com/doi/10.1111/gwat.13300>

### RAPID DETECTION OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) USING PAPER SPRAY-BASED MASS SPECTROMETRY

Tanim-Al Hassan, M., X. Chen, P.J. Joel Fnu, F.J. Osonga, O.A. Sadiq, M. Li, and H. Chen.  
Journal of Hazardous Materials 465:133366(2023)

This study reports fast detection of PFAS by paper spray (PS)-based mass spectrometry (MS) techniques that employ a triangular-shaped filter paper for sample loading and ionization (<= 3 min per sample). PS-MS was used for direct PFAS analysis of drinking water, tap water, and wastewater. Fold package paper materials can be directly cut and examined with PS-MS for possible PFAS contamination. For samples containing salt matrices that would suppress the PFAS ion signal, desalting paper spray mass spectrometry (DPS-MS) was shown to be capable of rapidly desalting, ionizing and detecting PFAS species such as PFOA and PFOS. The retention of PFAS on the paper substrate while salts are being washed away by water is likely due to hydrophilic interaction between the PFAS polar head (e.g., carboxylic acid, sulfonic acid) and the polar filter paper cellulose surface. The DPS-MS method is highly sensitive (limits of detection: 1.2-4.5 ppt) and can be used to directly analyze soil extract and soil samples. Results suggest the high potential of PS-MS and the related DPS-MS technique in real-world environmental analysis of PFAS.

## General News

### ELECTROKINETIC (EK) ENHANCED IN SITU REMEDIATION

EPA Office of Research and Development, Technical Support Coordination Division, EPA/600/R-23/329, 68 pp, 2024

EPA Engineering Issue Papers (EIPs) are a series of technology transfer documents that summarize the latest information on selected waste treatment and site remediation technologies and related issues and present it in a conveniently accessible manner to the user community. EIPs are designed to help remedial project managers, on-scene coordinators, contractors, and other practitioners understand the type of data and site characteristics needed to evaluate a technology for a specific site, as well as ways to design and optimize a technology for a particular application. This EIP summarizes the current knowledge on electrokinetic (EK) enhanced in situ remediation technologies deployed to remove contaminants in low-permeability (low-k) media. As a technical support document, it describes EK enhanced remediation with a focus on remedial scoping needs based on direct experience with the development and deployment of the technology in the field. This EIP also summarizes relevant information from peer-reviewed literature, government reports, and gray literature (e.g., websites, conference proceedings) and provides references for more in-depth information. [https://efpub.epa.gov/si/si\\_public\\_record\\_Report\\_dm2dfEntryId=3616458/lab=CESER](https://efpub.epa.gov/si/si_public_record_Report_dm2dfEntryId=3616458/lab=CESER)

## **OPTIMIZING REMEDIATION OUTCOMES THROUGH INTEGRATION OF GEOLOGIC AND GEOPHYSICAL DATA**

Cramer, R., M. Shultz, and J. Robinson. | PNNL RemPlex Seminars, 23 April, 83 minutes, 2024

The most challenging element of remediation projects, particularly with groundwater contamination, is the uncertainty and potential heterogeneity of subsurface conditions. Subsurface heterogeneity has confounded the progress, delayed remediation goals, and caused budget overruns for many groundwater restoration efforts. Conceptual site models (CSMs) must provide a reasonably accurate and complete representation of the subsurface to successfully guide groundwater remediation activities. This seminar discusses best practices for integrating geologic and geophysical data to enhance CSMs and optimize remediation outcomes.

**YouTube video:** [https://www.youtube.com/watch?v=D\\_lit7coaVQ](https://www.youtube.com/watch?v=D_lit7coaVQ)

**Slides:** <https://www.pnnl.gov/sites/default/files/media/file/RemPlex%20Presentation%20Optimizing%20Geophysical%20Data%2023April2024.pdf>

## **RECENT ADVANCES IN REMEDIATION STRATEGIES FOR MITIGATING THE IMPACTS OF EMERGING POLLUTANTS IN WATER AND ENSURING ENVIRONMENTAL SUSTAINABILITY**

Noorani, K.R.P.M., G. Flora, S. Surendramath, G.M. Stephy, K.T.T. Amesho, C. Chinglenhoiba, and N. Thajuddin. | Journal of Environmental Management 351:119674(2024)

This review focuses on the use of algal-based biological remediation processes for wastewater treatment, the environmental impacts of emerging pollutants (EPs), and the challenges associated with implementing algal bioremediation systems to effectively remove EPs.

## **A COMPREHENSIVE REVIEW OF NOVEL ADSORBENTS FOR PER- AND POLYFLUOROALKYL SUBSTANCES IN WATER**

Liu, F., J.J. Pignatello, R. Sun, X. Guan, and F. Xiao. ACS ES&T Water 4(4):1191-1205(2024)

This review provides a critical appraisal of recent innovations in adsorbent materials specifically designed to treat PFAS. Strategies to enhance nanopore capacity or introduce anion-exchange capabilities in adsorption materials have shown promise. Innovative materials such as carbon nanotubes, graphene, and graphene oxide are evaluated. Modified clay-based and silica-based adsorbents have demonstrated efficacy in removing PFAS, driven by the hydrophobic effect, Coulombic interactions, and electrostatic interactions. Polymers ranging from natural types to synthetic variants have shown promise in PFAS removal across a wide pH range. The review also describes mechanisms, including F-F interactions, ion-pair adsorption, and ion exchange for chemically and thermally modified adsorbents.

## **PFAS CONTAMINATION IN EUROPE: GENERATING KNOWLEDGE AND MAPPING KNOWN AND LIKELY CONTAMINATION WITH "EXPERT-REVIEWED" JOURNALISM**

Cordner, A., P. Brown, I.T. Cousins, M. Scheringer, L. Martinon, G. Dagorn, R. Aubert, L. Hosea, R. Salvidge, C. Felke, N. Tausche, D. Drepper, G. Liva, A. Tudela, A. Delgado, D. Salvatore, S. Pliz, and S. Horel. | Environmental Science & Technology 58(15):6616-6627(2024)

An unprecedented project of "expert-reviewed journalism" involving 29 journalists and seven scientific advisers by the "Forever Pollution Project" (FPP) drew on both scientific methods and investigative journalism techniques such as open-source intelligence and freedom of information requests to map PFAS contamination across Europe. The project made data public that had previously existed as "unseen science." The FPP identified 22,934 known contamination sites, including 20 PFAS manufacturing facilities, and 21,426 "presumptive contamination sites," including 13,745 sites presumably contaminated with fluorinated AFFF discharge, 2,911 industrial facilities, and 4,752 sites related to PFAS-containing waste. The FPP also identified 231 "known PFAS users," a new category for sites with an intermediate level of evidence of PFAS use and considered likely to be contamination sources. However, the true extent of contamination in Europe remains significantly underestimated due to a lack of comprehensive geolocation, sampling, and publicly available data. This model of knowledge production and dissemination offers lessons for researchers, policymakers, and journalists about cross-field collaborations and data transparency.

The Technology Innovation News Survey welcomes your comments and suggestions, as well as information about errors for correction. Please contact Michael Adam of the U.S. EPA Office of Superfund Remediation and Technology Innovation at [adam.michael@epa.gov](mailto:adam.michael@epa.gov) or (703) 603-9915 with any comments, suggestions, or corrections.

Mention of non-EPA documents, presentations, or papers does not constitute a U.S. EPA endorsement of their contents, only an acknowledgment that they exist and may be relevant to the Technology Innovation News Survey audience.