Technology Innovation News Survey

Entries for July 1-15, 2022

Market/Commercialization Information

SUPERFUND QUALITY AND SAMPLE SUPPORT (QSS)
Contract Opportunities at SAM.gov, Solicitation 68HERH21R0030, 2022
U.S. Environmental Protection Agency, Headquarters Acquisition Division, Washington, DC

This is a full and open competition under NAICS code 541611. EPA's Headquarters Acquisition Division seeks a contractor qualified to support the QSS Contract by providing program support and infrastructure through the application of professional, administrative, technical, scientific, analytical chemistry, quality assurance, and information technology services to the Analytical Services Branch (ASB). The QSS Contractor shall provide centralized production processes, and serve as a logistical, technical, systems, and process interface with ASB, EPA Regional personnel, contracted laboratories, and other EPA programs. The contractor shall support all task areas described in the Performance Work Statement including but not limited to, sample scheduling, information technology solutions, method support/evaluation, guidance development, data review and assessment, quality assurance, cost recovery, litigation support, invoicing support, and other support in accordance with ASB-approved Standard Operating Procedures (SOP) and ASB technical direction. The Contractor must be flexible and able to respond quickly to customers' needs; manage numerous concurrent activities with changing conditions; and provide daily communication, reporting, and problem resolution. Managing change is an important component of ASB's work. Responding to changes in laboratory contract requirements, improvement in procedures, and technological advancements is critical in successful contractor performance. The Government contemplates the award of an Indefinite-Delivery Indefinite-Quantity contract with fixed-rate and fixed-price task orders. The period of performance of this contract will be one 24-month period followed by three 24-month option periods. Offers are due by 4:30 PM EDT on September 13, 2022. https://sam.gov/opp/0565e1c5f86b4444a3381e6f2f1646f5/view

EINSTEIN MINE SITE INSPECTION, US FOREST SERVICE, MARK TWAIN NATIONAL FOREST
Contract Opportunities at SAM.gov, Solicitation 12444522Q0062, 2022
U.S. Department of Agriculture Forest Service, Atlanta, GA

This is a total small business set-aside under NAICS code 541990. The U.S. Department of Agriculture Forest Service requires a contractor to perform a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site Inspection (SI) at the Einstein Mine Site located in the Mark Twain National Forest (MTNF) in Madison County, Missouri. The Einstein Mine Site is an abandoned lead/silver mine that began operation in the 1870s and is believed to contain surface level tailings with high lead (Pb) concentrations. It is managed by the U.S. Forest Service. There has been minimal work in the past to evaluate the extent of contamination due to mining activities and any potential release of contaminants. The purpose of the SI is to determine if onsite soil contamination exists and its extent. The SI activity shall include soil sampling and producing an SI report. The sampling will include incremental sampling methodology (ISM) soil sample collection to be processed and analyzed in a laboratory to evaluate an unbiased estimate of the mean concentration of the COCs in soil. The work includes field collection of 29 soil samples along with 12 QA replicates for a total of 41 field samples with 30 aliquots each. The award will be a firm-fixed-price contract with a period of performance from award through September 2023. Offers are due by 5:00 PM CDT on August 26, 2022.
https://sam.gov/opp/0b85b604518b47e190e380a15e37476c/view

R7 ORONOGO-DUENWEG MINING BELT - OPERABLE UNIT 1 REMEDIAL ACTION, SOUTHWEST MISSOURI
Contract Opportunities at SAM.gov, Solicitation 68HE0722R0036, 2022
U.S. Environmental Protection Agency, Region 7 Contracting Office, Lenexa, KS

This is a total small business set-aside under NAICS code 562910. EPA Region 7 requires remediation of mine waste (surficial mine waste areas, contaminated soil, and contaminated intermittent stream sediment) located in multiple areas of Operable Unit 01 (OU1) of the Oronogo -Duenweg Mining Belt (ODMB) Superfund site (the Site) located in southwest Missouri. The work required covers a broad range of activities including obtaining property access, excavating mine waste, backfilling, implementing erosion controls, revegetation, and implementing repairs at properties remediated under previous contracts. The Contractor must also fill and install proper plugs in mine shafts identified by EPA. The work being conducted under this PWS is part of a Remedial Action (RA) conducted under the authority of 42 U.S. Code § 9606, CERCLA. As such, it is not necessary for the Contractor to apply for permits or pay permitting fees. However, the Contractor must identify and comply with the substantive technical requirements of applicable and relevant permits and must coordinate with the permitting agency prior to beginning work in each area and provide the permitting agency with the required information. The award will be an Indefinite-Delivery/Indefinite Quantity contract with fixed-unit prices consisting of a base period and four 12-month option periods. Offers are due by 4:30 PM CDT on August 26, 2022. https://sam.gov/opp/ef11812a15044cf6bee7bdb2426f2707/view

Cleanup News

LONG-TERM MONITORING OF AN IN SITU ACTIVATED CARBON TREATMENT TO REDUCE POLYCHLORINATED BIPHENYL AVAILABILITY IN AN ACTIVE HARBOR
Wang, P.A., J. Conder, B. Chadwick, and G. Rosen.
Environmental Toxicology and Chemistry 41(6):1568-1574(2022)

An activated carbon amendment was placed within a 0.5-acre amendment area adjacent to and underneath Pier 7 at the Puget Sound Naval Shipyard and Intermediate Maintenance Facility to reduce PCB availability. Multiple postplacement monitoring events over three years showed an 80%-90% reduction in PCBs, stability of activated carbon, and no significant negative impacts on the benthic community. A follow-on ~seven-year postplacement event was conducted to further evaluate the long-term performance. In situ porewater and bioaccumulation evaluations agreed with previous observations, indicating overall PCB availability reductions of ~80%-90% from pre-amendment conditions. Multiple measurement approaches for quantifying the presence of activated carbon and amendment indicated the amendment was present and stable in the area and that the activated carbon content was similar to levels previously observed. Results from carbon petrography corresponded within a factor of 1.3 (on average) with data for the black carbon content using a black carbon chemical oxidation method.

GROUNDWATER PUMP AND TREAT SYSTEM OPTIMIZATION REPORT U.S. DOE NNSA PANTEX PLANT, TEXAS
HydroGeoLogic, Inc for Consolidated Nuclear Security, LLC, 153 pp, 2021

HydroGeoLogic, Inc for Consolidated Nuclear Security, LLC, 153 pp, 2021 This document details the approach and presents the results of optimizing the perched groundwater pump and treat (P&T) systems at the Pantex Plant in the Texas panhandle following a 20-year optimization period. The objectives were to develop and evaluate six scenarios representing different system configurations and operations; compare results from each of the six scenarios to P&T system results with no changes to system configuration/operations; and discuss and present scenario results, including recommended system configuration(s)/operation(s) to maximize mass removal, reduce hydraulic gradients, and reduce potential off-site or vertical migration to the underlying aquifer to the maximum extent possible. Physics-Based Management Optimization (PBMO™) was used to optimize individual well pumping rates to maximize RDX removal; Cr(VI) and perchlorate responses were then evaluated, and select extraction well rates were adjusted to improve system performance. An optimization analysis plan was developed to document and analyze expected conditions and constraints over the simulation period. Results from the six scenarios were evaluated against the Baseline Scenario to quantify the relative improvement expected. Scenario results were also evaluated to determine the ability of each scenario to meet RAOs and address recommendations from the second FYR review. The report includes preliminary recommendations from the P&T optimization effort. https://www.osti.gov/servlets/purl/1834053
See presentation from 2022 Spring DCHWS Symposium on using PBMO at the site: https://drive.google.com/file/d/15Yib-jVcN19vHCpGN1RzS6OvH0_7rMYm/view

IN-SITU PERMEABLE REACTIVE BARRIER REMEDIATION OPTIMIZATION USING HIGH RESOLUTION SITE CHARACTERIZATION TOOLS - A CASE STUDY
O'Neill, P. | Remediation Technologies Symposium East, 1-3 June, Niagara Falls, Ontario, 26 slides, 2022

This presentation reviews two case studies where high-resolution site characterization (HRSC) tools were deployed and compared to targeted analytical data to design and implement permeable reactive barriers (PRBs). Potential information data gaps that would have arisen using traditional methods to collect data for the PRB designs are discussed. In addition, the final optimized designs were compared to the theoretical PRBs that would have been designed if data from the HRSC tools were not included to highlight potential pitfalls and optimization strategies for these in-situ remediation programs. https://esaa.org/wp-content/uploads/2022/06/RTE22ONeill.pdf

(A) MULTIDISCIPLINARY APPROACH TO REMEDIATE TETRACHLOROETHYLENE IMPACTED GROUNDWATER BENEATH A BUILDING
Pumphrey, K.-A. | Remediation Technologies Symposium East, 1-3 June, Niagara Falls, Ontario, 29 slides, 2022

PCE was identified in groundwater at concentrations that exceeded the Ontario regulatory site condition standards beneath a three-story commercial building with a basement and parking lot. An in-situ chemical reduction (ISCR) program consisting of temporary well points to inject zero-valent iron (ZVI) and permanent wells to inject EHC-L (electron donor) in the basement of the building and the parking lot was designed. During the initial injection phase, ZVI was daylighting through existing basement floor cracks and in adjacent monitoring wells. A denser slurry was injected during a subsequent injection event to address the daylighting. EHC-L was injected into the permanent injection wells during the second injection event. Injection work ceased when cracked drywall was observed and a geotechnical investigation was conducted to determine the cause. Engineered supports were installed to support a structural column identified as a concern. The injections were modified to allow for low-pressure injections of EHC-L into dedicated injection wells. The prescribed quantity of EHC-L was successfully injected during the first low-pressure injection; however, subsequent injections were not as successful, and the required quantity of EHC-L could not be delivered into the subsurface. Groundwater monitoring and sampling completed 62 days after the EHC-L injection indicated that a *cis*-DCE stall was potentially occurring, and another injection of EHC-L under gravity feed would not result in an acceptable dechlorination rate. Pressurized injections of 30 psi were needed to inject enough amendment into the ground with adequate subsurface distribution. Based on the geotechnical limitations of the site, "safe" injection pressures were determined based on distances from the various types of foundations. In addition to re-introducing pressure, *Dehalococcoides* sp. was added to ECH-L. Groundwater monitoring conducted 120 days post-injection indicated that the EHC-L was consumed more quickly than anticipated and the electron donor was changed for the next round of injections. https://esaa.org/wp-content/uploads/2022/06/RTE22Pumphrey.pdf

Demonstrations / Feasibility Studies

COMMERCIAL-SCALE REMEDIATION OF PER- AND POLYFLUOROALKYL SUBSTANCES FROM A LANDFILL LEACHATE CATCHMENT USING SURFACE-ACTIVE FOAM FRACTIONATION (SAFF®)
Burns, D.J., H.M. Hinrichsen, P. Stevenson, and P.J.C. Murphy.
Remediation 32(3):139-150(2022)

A commercial-scale field trial using Surface-Active Foam Fractionation (SAFF) was conducted to remove PFAS from a landfill leachate catchment at the Telge Recycling plant in Sweden. PFAS influent and effluent concentrations were sampled 23 times over 10 months, during which ~80,000 m3 of leachate feed was successfully treated without complex pretreatment. The throughput varied between 200 m^3 and 500 m^3 per day, depending upon the inventory of the upstream leachate catchment. SAFF successfully removed ≥98.7% PFOS, ≥99.7% PFOA, and ≥98.8% PFHxS from the feed stream, including partial/significant removal of other PFAS species, without using absorbent media or chemical amendment consumables. The removal percentages were constrained by the limit of reporting of analytical testing of the treated stream; the actual removal percentages could be higher as detailed by a single sampling event. The mean concentrations of the treated stream were ≤2.34 ng/L PFOS, ≤1.28 ng/L PFOA, and ≤1.00 ng/L PFHxS. The study extends previous analyses to show that removal percentages fall to ~0 at an adsorption coefficient of 0.02 µm with a functional form of a sigmoid on semi-log axes.

IN SITU REMEDIATION OF ARSENIC-CONTAMINATED GROUNDWATER BY INJECTING AN IRON OXIDE NANOPARTICLE-BASED ADSORPTION BARRIER
Mohammadian, S., H. Tabani, Z. Boosalik, A.A. Rad, B. Krok, A. Fritzsche, K. Khodaei, and R.U. Meckenstock. | Water 14(13):1998(2022)

Lab- and field-scale pilot tests assessed and validated in situ remediation of arsenic contamination in groundwater resources using permeable reactive barriers (PRBs) made of injectable, colloidal iron oxide nanoparticles. Sand-packed flow-through column studies assessed the sorption behavior of the iron oxide nanoparticles using sand and groundwater in the lab. Breakthrough curves were analyzed using a reactive transport model considering linear and nonlinear adsorption isotherms and were fitted best with a chemical nonequilibrium consideration. Results were used to design a pilot-scale field test. The injected 28 m^3 of iron oxide was successfully delivered to the aquifer via an injection well. No mobile iron was detected downstream, confirming the formation of a stable in situ barrier that did not move with groundwater flow. Arsenic concentrations in groundwater were reduced to 50% of the background value, despite the relatively short contact time between arsenic and the barrier due to a 1.21 m/day high-flow velocity. Results show that the single-parameter models based on retardation factor and/or adsorption capacity failed to predict the longevity of the barrier and the evolution of arsenic breakthrough with time, most likely because they do not consider the chemical nonequilibrium effects. Upscaling lab findings to field design should be carried out with care and be coupled with detailed reactive transport models. https://www.mdpi.com/2073-4441/14/13/1998/pdf?version=1655978853

FIELD-SCALE TREATABILITY STUDY - SOIL WASHING OF PFAS-CONTAMINATED SOILS, PETERSON AIR FORCE BASE, COLORADO
Becker, S. and P. Newman. | Remediation Technologies Symposium East, 1-3 June, Niagara Falls, Ontario, 24 slides, 2022

A field-scale treatability study evaluated the effectiveness of soil washing to remove PFAS from soils derived from aqueous film-forming foam (AFFF) release sites at Peterson Air Force Base. The study also generated site-specific treatment system design and operational parameters to optimize PFAS removal. Initially, ~500 yd^3 of contaminated soil excavated from a former AFFF spray test area was homogenized to ensure relatively uniform particle size distribution and PFAS concentrations for processing through the soil washing plant. An Incremental Sampling Methodology established pretreatment concentrations of PFAS as a baseline to assess treatment effectiveness. A mobile lab monitored PFAS concentrations in process water at multiple points within the treatment train and in the various system outputs, including organics, gravels, sands, and fines. Ten batches of soil were treated through a patented water-based, closed-loop treatment process that uses particle size and particle density segregation techniques to 'wash' PFAS from the various soil fractions and capture the mobilized PFAS in an effluent stream that was pretreated using settling and flocculation, followed by PFAS treatment with ECT2's regenerable ion exchange resin. Three batches of sediment were dredged and successfully treated from the base stormwater system, demonstrating the ability of the process to treat finer grain size and high-organic matter materials. The soil washing treatment methodology achieved PFAS removal efficiencies between 93 to >99% for the coarse soil fraction and between 82 and 89% for the fine soil fraction. Soil washing liquids with initial PFOS concentrations of 490 µg/L were effectively treated using regenerable IX media to https://esaa.org/wp-content/uploads/2022/06/RTE22Newman.pdf

Research

RESEARCH BRIEF 332: IMPROVING HOW MICROBES BREAK DOWN PFAS
National Institute of Environmental Health Sciences, Superfund Research Program (SRP), August 2022

Researchers demonstrated a method to break down PFAS into smaller, non-toxic molecules using defluorination. The team explored how microorganisms can break the carbon-fluorine bonds to potentially transform them into non-toxic products in anaerobic environments. Their study included 16 different fluorinated carboxylic acids (FCAs), a relatively new group of PFAS. Unsaturated FCAs, which have at least one double bond between their carbon atoms with a fluorine atom attached to the double carbon bond, were more vulnerable to defluorination under anaerobic conditions. Perfluorinated FCAs had higher defluorination degrees than polyfluorinated ones. Researchers observed that the location of the fluorine atoms is important. For example, MeU-C6b, which has no fluorine atoms linked to the carbons with double bonds, had a low defluorination degree compared to the other unsaturated chemicals. The researchers tested an aerobic remediation approach in which microorganisms in activated sludge from a local wastewater treatment plant use oxygen to degrade FCAs. Aerobic conditions enhanced the defluorination of the polyfluorinated FCAs, which showed low removal and defluorination under anaerobic conditions. U-C5c, which did not degrade in anaerobic remediation, exhibited an 80% defluorination rate under aerobic conditions. Activated sludge did not affect perfluorinated FCAs.
https://tools.niehs.nih.gov/srp/1/ResearchBriefs/pdfs/SRP_ResearchBrief_332_508.pdf

PROMOTED OXIDATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN SOILS BY DUAL PERSULFATE/CALCIUM PEROXIDE SYSTEM
Wang, J., X. Zhang, X. Zhou, M.G. Waigi, F.O. Gudda, C. Zhang, and W. Ling.
Science of The Total Environment 758:143680(2021)

An ISCO technology was developed to remediate soils contaminated with PAHs using a dual calcium peroxide (CP)/persulfate (PS) oxidant system activated by oxalic acid (OA)-chelating Fe^{2+}. The single-factor experiment studied the effects of CP dosage, PS dosage, Fe^{2+} dosage, OA concentration, and soil/water ratio on PAH degradation. The response surface method was introduced to obtain the optimized CP dosage, PS dosage, and OA concentration conditions of the dual peroxide system. The dual peroxide system achieved the maximum PAH degradation efficiency (70.8%) under optimal conditions of 8.89 g/kg PS dosage, 0.18 mol/L CP concentration, and a ¼:0.62 Fe^{2+}/PS ratio under neutral soil conditions.

DESULFONATION AND DEFLUORINATION OF 6:2 FLUOROTELOMER SULFONIC ACID (6:2 FTSA) BY RHODOCOCCUS JOSTII RHA1: CARBON AND SULFUR SOURCES, ENZYMES, AND PATHWAYS
Yang, S., Y. Shi, M. Strynar, and K. Chu.
Journal of Hazardous Materials 423(Part A)127052(2022)

A study elucidated the effects of carbon and sulfur sources on the gene expression of *Rhodococcus jostii* RHA1, responsible for the 6:2 FTSA biotransformation. While alkane monooxygenase and cytochrome P450 were highly expressed in ethanol-, 1-butanol-, and n-octane-grown RHA1 in a sulfur-rich medium, the cultures defluorinated 6:2 fluorotelomer alcohol but not 6:2 FTSA, suggesting that the sulfonate group in 6:2 FTSA hinders enzymatic defluorination. In sulfur-free growth media, alkanesulfonate monooxygenase was linked to desulfonation of 6:2 FTSA, while alkane monooxygenase, haloacid dehalogenase, and cytochrome P450 were linked to defluorination of 6:2 FTSA. The desulfonation and defluorination ability of these enzymes toward 6:2 FTSA were validated through heterologous gene expression and in vitro assays. Four degradation metabolites were confirmed, with one identified as a tentative metabolite. Results provide a new understanding of 6:2 FTSA biotransformation by RHA1. The genes encoding the desulfonating- and defluorinating-enzymes are potential markers to assess 6:2 FTSA biotransformation in the environment.

APPLICABILITY OF GROUND SOURCE HEAT PUMPS AS A BIOREMEDIATION-ENHANCING TECHNOLOGY FOR MONOAROMATIC HYDROCARBON CONTAMINANTS
Roohidehkordi, I. and M.M. Krol. | Science of The Total Environment 778:146235(2021)

A study used FEFLOW software to simulate heat and mass transport of a vertical closed-loop ground source heat pump (GSHP) system. Transient flow and heat transport results for a multiple borehole system indicated long-term effects on subsurface temperature. The study also examined the impact of temperature change in a contaminated granular porous subsurface during remediation applications. As subsurface temperatures are elevated due to geothermal heating, sorption will decrease, and biodegradation rates will increase. These effects were examined in the context of contaminant transport to evaluate potentially utilizing geothermal heating as a remediation strategy. Temperature changes caused by GSHP operation significantly enhanced hydrocarbon contaminant biodegradation. Elevated subsurface temperature resulted in a 97% reduction in benzene total mass after one year of GSHP operation for a typical office building.

LONG-TERM ASSESSMENT OF PETROLEUM HYDROCARBON ATTENUATION AT PETROLEUM RELEASE SITES IN CALIFORNIA

Groundwater Monitoring & Remediation [Published online 1 March 2022 before print]

Data from GeoTracker and California Department of Public Health databases provided more than 15 years of groundwater monitoring results for tens of thousands of monitoring wells and public water supply wells in California. The study determined first-order maximum concentration attenuation rate constants (kc-max) for sites with 5 or more years of monitoring data from 2002 to 2017. Kc-max values varied by constituent. Across more than 5,000 sites, the median kc-max value ranged from 0.30-1 yr for methyl tert-butyl ether (half-life of 2.3 yrs) to 0.076 -1 yr for naphthalene (half-life of 9.1 yrs). A focused evaluation of remediation technologies at 50 petroleum release sites indicates that dissolved contaminant attenuation typically increased during remediation. Analyses indicate that remediation and natural biodegradation contribute to site remediation. These attenuation processes have been sufficient to prevent widespread impacts on public water supply wells.

PILOT-SCALE CONTINUOUS FOAM FRACTIONATION FOR THE REMOVAL OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) FROM LANDFILL LEACHATE
Smith, S.J., K. Wiberg, P. McCleaf, and L. Ahrens. | ACS ES&T Water 2(5):841-851(2022)

A pilot-scale foam fractionation setup was tested to remove PFAS from natural landfill leachate in a novel continuous operating mode. A benchmark batch test was also performed to compare treatment efficiency. The ∑PFAS removal efficiency plateaued around 60% and

ENHANCED DELIVERY OF AMENDMENTS IN FRACTURED CLAY SITES BASED ON MULTI-POINT INJECTION: AN ANALYTICAL STUDY

The work provides some guidelines for designing a multi-point injection in the fracturing low-permeability sites to enhance the remediation of contaminated soil.

CHARACTERIZING AND TREATING PFAS-IMPACTED SOURCE ZONES

EVALUATION OF THE PRESENCE OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) ACROSS AQUATIC SPECIES

LESSONS LEARNED DURING A QUARTER CENTURY OF FRACTURING: ILLUSTRATED

DEVELOPMENT OF A FORENSICS-BASED APPROACH TO EVALUATING IMPACTS OF PFAS

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 or

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