Technology Innovation News Survey

Entries for December 1-15, 2023

Market/Commercialization Information

F -- DEPARTMENT OF ENERGY (DOE) ENVIRONMENTAL MANAGEMENT (EM) WEST VALLEY DEMONSTRATION (SNOTE)
U.S Department of Energy, Environmental Management Consolidated Business Center, Cincinnati, OH
Contract Opportunities on SAM.gov 89303324REM000122, 2024

The U.S. Department of Energy (DOE) anticipates the issuance of a Final Request for Proposal (RFP) for the WVDP Phase 1B procurement no earlier than January 2024 under NAICS code 562910. The WVDP Phase 1B Contractor will be responsible for achieving a significant reduction in financial liability and environmental risk that provides the best overall optimal solution to site accelerated completion and closure. The major elements of scope for Phase 1B include: the demolition of remaining near-grade and below-grade components of the Main Plant Process Building; additional facility deactivation and demolition; contaminated soils excavation and remediation; waste management and legacy waste disposition; safeguards and security; environmental monitoring; surveillance and maintenance; and program support activities. The Final RFP will promote contractor community commitment and engagement, to include a requirement for the WVDP Phase 1B Contractor to submit a community commitment plan to DOE. The new contract resulting from this acquisition will replace the contract currently being performed by CH2M Hill -- BWXT West Valley, LLC., which will expire in 2025.
https://sam.gov/opp/88a60b07806c41feb6afb839aa481837/view

F -- REMEDIAL ACTION CONTRACT TO PROVIDE OPERATIONS AND MAINTENANCE AND LONG-TERM MONITORING SERVICES AT JOINT BASE CAPE COD IN CAPE COD, MASSACHUSETTS (SOL)
U.S. Army Corps of Engineers, New England District, Concord, MA
Contract Opportunities on SAM.gov W912WJ24R0004, 2024

This is a total 8(A) small business set-aside under NAICS code 562910. The U.S. Army Corps of Engineers New England District seeks An 8(a) contractor to perform Environmental Remediation Services at Joint Base Cape Cod (JBCC) in Cape Cod, Massachusetts. JBCC is located in the western portion of Cape Cod in Barnstable County, Massachusetts, approximately 60 miles south of Boston and immediately southeast of the Cape Cod Canal. It occupies ~22,000 acres within the towns of Bourne, Falmouth, Mashpee, and Sandwich. Work will include but not be limited to: Operations and Maintenance of groundwater treatment facilities; Long-Term Monitoring of groundwater; Aquifer hydraulic monitoring; Exploratory soil drilling and well installation; Military Munitions and Explosives of Concern (MEC) clearance supporting exploratory soil drilling and well installation; Laboratory analysis, data validation, and environmental database entry; Reporting (e.g., periodic data reports; five-year review); and miscellaneous building and road maintenance. Services provided under this contract will be specified in subsequently issued Firm-Fixed Price task orders for a wide range of environmental services at various known or suspected Hazardous, Toxic, and Radioactive Waste sites, and MEC sites. Offers are due by 1:00 PM EST on February 14, 2024. https://sam.gov/opp/4a6f5be6fdb84af4ab2849485181860b/view

F -- FORMAL SOLICITATION AND REQUEST FOR PROPOSALS (RFP) FOR ERRS VI: EMERGENCY RESPONSE AND REMOVAL SERVICES (SOL)
U.S. Environmental Protection Agency, Region 9 Contracting Office, San Francisco, CA
Contract Opportunities on SAM.gov 68HE0923R0006, 2024

This is a total small business set-aside under NAICS code 562910. EPA Region 9 seeks a contractor to provide rapid and responsive environmental cleanup services for releases of hazardous substances, wastes, pollutants and contaminant materials, and oil and petroleum products for EPA Region 9. Environmental cleanup in response to natural and manmade disasters, terrorist activities, weapons of mass destruction, and nuclear, biological, or chemical incidents may also be required under this contract. A regional "cross-over", a response in another EPA region, may be requested under this contract. It is also anticipated that, under rare circumstances, international and transboundary responses may be required. Contractor personnel require specialized training in National Incident Management System (NIMS) and Incident Command System (ICS) tenets. To comply with the NIMS requirements, non-government first responder personnel and disaster workers must take NIMS, NRP, and ICS training. The process for award will be a two-step advisory down-selected process with a basic technical offer due first for review as to whether the competitor will be a viable contender for award. BASIC Technical offers are due by 4:00 PM PST on January 25, 2024. https://sam.gov/opp/3f55bc10f83a474c811e5f1fa81710c1/view

F -- SITE WALK REMEDIATION SERVICES AT OTTAWA RADIATION (SOL)
U.S. Environmental Protection Agency, Region 5 Contracting Office, Chicago, IL
Contract Opportunities on SAM.gov 68HE0523R0050, 2024

This is a total hubzone business set-aside under NAICS code 562910. EPA Region 5 seeks a contractor to complete the remediation of the Ottawa Radiation Areas National Priorities List (NPL)-8 Site, utilizing the 2007 Remedial Design, with updated site condition information found in the supplemental design investigation, remedial action report for the Frontage Property, 2020 and 2021 Auto Dealership Investigation Reports. The NPL-8 site consists of four parcels of land that include both the Frontage Property (one parcel -- 4 acres), the Landfill (two parcels, 17 acres), and portions of an adjacent auto dealership property (one parcel). Access to NPL-8 is via the Frontage property, located at 1820 East Norris Drive in Ottawa, Illinois. Please note East Norris Drive is also known as US Route 6 and SR-71. The period of performance for the contract is four years from the date of award. Actual field work is anticipated to last no more than three field seasons. It is anticipated that six (6) months are needed prior to fieldwork for planning, generation, and approval of site plans, and mobilization; another six months are anticipated after fieldwork for completing remedial action reporting and invoicing. Offers are due by 4:00 PM https://sam.gov/opp/64108?ccf3f34ed9a23d89e1d951309 5/view

Cleanup News

CLOSED LOOP PFAS TREATMENT CASE STUDY: SEPARATION, CONCENTRATION, DESTRUCTION
Pierce, Z., K. Sorenson, and A. Punsoni. I AEHS 39th Annual International Conference on Soils, Sediments, Water and Energy, 16-19 October, Amherst, MA, 24 slides, 2023

This presentation describes the first ever closed-loop PFAS treatment case studies to validate Surface Active Foam Fractionation® (SAFF®), an engineered system that separates and concentrates PFAS into a liquid waste without absorption media. By combining DE-FLUORO™, a PFAS destruction technology that uses a Reactive Electrochemical Membrane (REM) Reactor to destroy PFAS with SAFF, a complete onsite treatment of PFAS contamination in water via a separation, concentration, and destruction strategy can be achieved. Case study results from ongoing projects treating groundwater in Minnesota and surface water at a Massachusetts Air Force Base using these technologies are shared. Results were compared to three specific objectives: 1) full separation and concentration of regulated PFAS from contaminated water; 2) closed loop destruction of PFAS concentrate by DE-FLUORO; and 3) comparison of cost-effectiveness and sustainability of the separation, concentration, and destruction strategy to alternative onsite separation technologies (carbon adsorption using granular activated carbon or ion exchange resin). SAFF comprises two foam fractionation stages in series that operate in semi-batch mode to separate and concentrate PFAS. Previous studies have shown 98-100% removal of regulated PFAS using SAFF, meeting the strict standards in New England states. The concentrate represents a low-volume, high-density PFAS matrix ideal for onsite destruction. DE-FLUORO destroys PFAS by breaking carbon-fluorine bonds, resulting in benign carbon dioxide and fluoride residues. DE-FLUORO has achieved destruction of >90% of total PFAS mass within 24 hours. Water after PFAS destruction is recycled to SAFF, such that the only inputs to the system are PFAS-impacted water, air, and electricity, and the only output is PFAS-free effluent with no PFAS waste by-product.
https://s3.amazonaws.com/amz_xcdsystem.com/A51108D5-FA2F-2B6D-01D92AC0E42DCF3B_abstract_File23333/Handout_154_1014070555.pdf
See ESTCP project page for more information: https://serdp-estcp.mil/projects/details/263f9b50-8665-4ecc-81bd-d96b74445ca2/surface-active-foam-fractionationr-for-pfas-treatment

HEAT ENHANCED REDUCTIVE BIOREMEDIATION
Birk, G. and D. Alden. I AEHS 39th Annual International Conference on Soils, Sediments, Water and Energy, 16-19 October, Amherst, MA, 38 slides, 2023

This presentation discusses methods of heating an amendment mixture and injecting hot water to enhance in situ alcoholysis reactions. Applying heat enhances the transesterification reaction and the degradation rates. Using hot water also offers several advantages. In general, hot water dissolves fewer gases (like oxygen or carbon dioxide) but more solids (sugars) than cold water. Temperature modeling results show that the injection of water heated to 90°C into three injection wells at a flow rate of 150 m ^{3}/d maintained temperatures of >30°C for 10 days in the vicinity of the injection wells. Remediation results showing the benefits of the approach are shared. https://s3.amazonaws.com/amz_xcdsystem.com/A51108D5-FA2F-2B6D-01D92AC0E42DCF3B_abstract_File23333/Handout_169_1015090715.pdf

OPTIMIZING REMEDIATION IN FRACTURED AND WEATHERED BEDROCK: LESSONS FROM SUCCESSFUL INJECTION PROJECTS
Dombrowski, P.M. I AEHS 39th Annual International Conference on Soils, Sediments, Water and Energy, 16-19 October, Amherst, MA, 20 slides, 2023

A series of case studies of successful in situ remediation of contaminated bedrock zones are the focus of this presentation, with an evaluation of project-specific objectives, remedial design, reagent selection, and injection methods. Particular attention was applied to the weathered bedrock zone between the overburden and competent bedrock and approaches for applying remediation into this zone where contaminant transport may be high. The discussion also includes strategies to enhance contaminant reduction in deeper competent bedrock. Case studies highlight enhanced in situ dechlorination (EISD) and ISCO applied at sites impacted by cVOCs and petroleum hydrocarbons. Supporting examples include cases where multiple amendments in sequence were applied into contaminated bedrock to provide short-term aggressive contaminant destruction and persistent treatment to achieve extended contaminant reduction and/or distribution of reagents post-injection.
https://s3.amazonaws.com/amz_xcdsystem.com/A51108D5-FA2F-2B6D-01D92AC0E42DCF3B_abstract_File23333/Handout_218_1024100957.pdf

MATERIALS AND METHODS FOR THE RAPID AND COMPLETE IN-SITU REMEDIATION OF SOURCE ZONE CONTAMINANTS
Freim, J. I AEHS 39th Annual International Conference on Soils, Sediments, Water and Energy, 16-19 October, Amherst, MA, 33 slides, 2023

This presentation provides the results of column studies showing that a mixture of sulfidated iron (SZVI) and organic bioremediation amendments substantially lessens the quantity and persistence of daughter products that can accumulate in the source zone or migrate downgradient when addressing source zone contamination. Those that are produced are rapidly degraded to ethene or ethane. The results of case studies demonstrating the performance of a low-viscosity mixture of SZVI, organic emulsion, and anaerobic microbes at sites with high contaminant concentrations are also provided. At these locations, the degradation patterns generally followed the aforementioned mechanism, resulting in the rapid and near complete elimination of parent and daughter products.
https://s3.amazonaws.com/amz_xcdsystem.com/A51108D5-FA2F-2B6D-01D92AC0E42DCF3B_abstract_File23333/Handout_132_1024045540.pdf

Demonstrations / Feasibility Studies

DO SIMPLE ANALYTICAL MODELS CAPTURE COMPLEX FRACTURED BEDROCK HYDRAULICS? OSCILLATORY FLOW TESTS SUGGEST NOT
Patterson, J.R. and M. Cardiff. I Groundwater 61(6):816-833(2023)

A study applied oscillatory flow testing across a range of frequencies and inter-well spacings on a fracture embedded in poorly cemented sedimentary bedrock with considerable primary porosity at the Field Site for Research in Fractured Sedimentary Rock in Madison, Wisconsin. Consistent with previous studies, results show an apparent period-dependence in returned flow parameters, with hydraulic diffusivity decreasing and storativity increasing with increasing oscillation period, when assuming an idealized fracture conceptual model. Simple analyses was used to examine non-Darcian flow and borehole storage effects as potential test design artifacts and a simple analytical model that examines fluid leakage to the surrounding host rock as a potential hydraulic mechanism that might contribute to the period-dependent flow parameters. The analyses represent a range of conceptual assumptions about fracture behavior during hydraulic testing, none of which account for the measured responses during oscillatory flow testing, likely indicating that other hydraulic processes (e.g., aperture heterogeneity and/or fracture hydromechanics) are necessary to accurately represent pressure propagation through fractured sedimentary bedrock. https://ngwa.onlinelibrary.wiley.com/doi/epdf/10.1111/gwat.13297

DRONE-BASED PHYTOREMEDIATION RECONNAISSANCE USING NDVI/NIR MULTISPECTRAL IMAGERY AT A HISTORICAL WASTE STORAGE LANDFILL
Austin, C., A. Martin, and D. Gray
2023 Bioremediation Symposium Proceedings, 8-11 May, Austin, TX, 19 slides, 2023

The health of ~500 hybrid poplar trees (*Populus deltoids* x *Populus nigra*) installed for leachate mitigation and water removal at a historical waste containment landfill was evaluated by combining drone aerial reconnaissance and ground-based tree assessment techniques. Project objectives were to develop and implement a cost-effective approach to map the tree plot within ~2.5 acres (1 hectare) of land and determine reasons for tree dieback and mortality. The drone payload consisted of a MicaSense RedEdge-M sensor array equipped with red-edge/RGB/near-infrared (NIR) spectral sensitivity at 1280 x 960 sensor resolution. The average density of data acquisition was ~0.01 points/US survey foot. Data were processed using Pix4D drone mapping software and georeferenced to a local state plane coordinate system. Reflectance maps of the terrain, trees, and ground cover were generated for visual RGB, red-edge, and NIR outputs. A Normalized Difference Vegetative Index (NDVI) map was also developed based on ratios of NIR to red wavelengths. Based on a review of the drone mapping results, a field visit focused on individual tree health, including indicators for chlorosis, epinasty (leaf curling), twig dieback, bark sloughing, insect predation and bacterial and fungal lesions. Based on a review of drone imagery and field inspections, polygon classifications for tree health were assigned in a final tree health map. The visible RGB, NIR, and red-edge drone-acquired imagery was helpful in quickly identifying healthy trees and canopy-chlorophyll signatures at sub-meter resolution. The NDVI data and resulting maps were less helpful in identifying stressed trees or evidence of tree morbidity and mortality. Drone-based aerial reconnaissance is a cost-effective, and alternative approach for quickly delineating and mapping stressed and damaged phytoremediation plots.
Slides: https://www.battelle.org/docs/default-source/hidden/2023-bio-symp-presentations/track-e/e3_1325_364_austin.pptx.pdf?sfvrsn=7e911f5f_3
Longer abstract: https://www.battelle.org/docs/default-source/hidden/2023-bio-symp-abstracts/364.pdf?sfvrsn=bc9b4d80_3

FOAM FRACTIONATION COUPLED WITH HYDROTHERMAL ALKALINE TREATMENT FOR PFAS SEPARATION AND DESTRUCTION
Pinkard, B. I 2023 Great Lakes PFAS Summit, 5-7 December, virtual, 40 minutes, 2023

This presentation demonstrates the coupling of foam fractionation with hydrothermal alkaline treatment (HALT) to enable PFAS separation and destruction in a single treatment train. Foam fractionates from three vendors were tested on fire-training pond water and landfill leachate. Destruction performance and general guidance on the applicability of the two technologies are discussed.
https://us06web.zoom.us/rec/play/VxlvV2uwjHd65jrCX1LRo_COewwLLpUwIDu7WYPQMdkHWhgkW_6MnJmGxtIr8eKtUAcHgz_8r3xp9Xt1.S3rQkkGq9IE_uy4y?canPlayFromShare=true&from=share_recording_detail&continueMode=true&componentNa

LONG-TERM EFFECTIVENESS AND SUSTAINABILITY OF EHC REMEDIATION IN CARBON TETRACHLORIDE-CONTAMINATED GROUNDWATER: MECHANISTIC UNDERSTANDING AND PRACTICAL APPLICATIONS
Ling, L., Y. Wei, H. Niu, H. Zhao, Y. Chen, D. Qu, M. Gao, and J. Chen.
Journal of Cleaner Production 435:140510(2023)

A series of lab tests were conducted to determine the most efficient types and concentrations of electron donors for degrading VOCs (e.g, carbon tetrachloride and chloroform) for a pilot test. The ZVI-biological stimulation coupling remediation field test was conducted using a high-pressure rotary jet injection method to inject the EHC™ remedial agent into a chlorinated hydrocarbon-contaminated aquifer in Shandong Province, China. It was observed that indicators such as alkalinity and SO_4^{2-} can signify biological reduction, with ZVI significantly shortening the beginning time of biological action within the EHC treatment area. The pilot test results revealed that the initial four days following the injection of the EHC witnessed only chemical reduction, with chemical and biological reduction coexisting from day 4 to day 45. After 45 days, contaminant removal relied solely on biological reduction. Data collected from the pilot test support the synergistic application of EHC remedial agent with high-pressure rotary injection to effectively remediate chlorinated contaminants within a relatively brief timeframe.

Research

PYROLYSIS TEMPERATURE AND BIOCHAR REDOX ACTIVITY ON ARSENIC AVAILABILITY AND SPECIATION IN A SEDIMENT
Soares, M.B., O.W. Duckworth, M. Styblo, P.H. Cable and L.R.F. Alleoni.
Journal of Hazardous Materials 460:132308(2023)

A study investigated the effect of pyrolysis temperature and biochar application on As release and transformations in contaminated sediments subjected to redox fluctuations. Biochar application and pyrolysis temperature were important in As species availability, As methylation, and dissolved organic carbon concentration. Successive flooding cycles that induced reductive conditions in sediments increased the As content in the solution by up to seven times. Applying biochar and the flooding cycle altered the spatial distribution and speciation of carbon, Fe, and As in the solid phase. In general, biochar application decreased the reduction of Fe(III) and As(V) after the first cycle of flooding. Results demonstrate that the flooding cycle plays an important role in the reoxidation of biochar to the point of enhancing the immobilization of As.

DEVELOPMENT OF POLY(ACRYLAMIDE)-BASED HYDROGEL COMPOSITES WITH POWDERED ACTIVATED CARBON FOR CONTROLLED SORPTION OF PFOA AND PFOS IN AQUEOUS SYSTEMS.
Klaus, M.V.X., A.M. Gutierrez, and J.Z. Hilt. I Polymers (Basel) 15(22):4384(2023)

Acrylamide-based hydrogel composites were synthesized with powdered activated carbon (PAC) and characterized to determine their PFAS affinity. Physicochemical characterization included Fourier-Transform infrared spectroscopy (FTIR) to identify the chemical composition, thermogravimetric analysis (TGA) to confirm PAC loading %, and aqueous swelling studies to measure the effect of crosslinking density. FTIR showed successful conversion of carbonyl and amine groups, and TGA analysis confirmed PAC presence within the network. Surface characterization also confirmed carbon-rich areas within composite networks, and the swelling ratio decreased with increasing crosslinking density. PFAS sorption was detected via LC-MS/MS, with removal efficiencies of up to 98% for PFOS and 96% for PFOA. The developed hydrogel composites exhibited great potential as advanced materials with tunable levers that can increase affinity towards specific compounds in water.

GENOME-RESOLVED METAGENOMICS AND METATRANSCRIPTOMICS REVEAL INSIGHTS INTO THE ECOLOGY AND METABOLISM OF ANAEROBIC MICROBIAL COMMUNITIES IN PCB-CONTAMINATED SEDIMENTS
Dang, H., J.M. Ewald and T.E. Mattes.
Environmental Science & Technology 57(43):16386-16398(2023)

To evaluate naturally occurring interactions between Dehalococcoides and key supporting microorganisms (e.g., production of H_2, acetate, and corrinoids) in PCB-contaminated sediments, metagenomic and metatranscriptomic sequencing was conducted on DNA and RNA extracted from sediment microcosms, showing evidence of both *Dehalococcoides* growth and PCB dechlorination. Using a genome-resolved approach, 160 metagenome-assembled genomes (MAGs), including three

Dehalococcoides MAGs, were recovered. A novel reductive dehalogenase gene was significantly expressed, which was distantly related to the chlorophenol dehalogenase gene cprA (pairwise amino acid identity: 23.75%). Using MAG gene expression data, 112 MAGs were assigned functional roles (e.g., corrinoid producers, acetate/H_2 producers, etc.). A network coexpression analysis of all 160 MAGs revealed correlations between 39 MAGs and the *Dehalococcoides* MAGs. It also showed that MAGs assigned with functional roles that support *Dehalococcoides* growth (e.g., corrinoid assembly and production of intermediates required for corrinoid synthesis) displayed significant coexpression correlations with *Dehalococcoides* MAGs. The work demonstrates the power of genome-resolved metagenomic and metatranscriptomic analyses, which unify taxonomy and function, in investigating the ecology of dehalogenating microbial communities.
https://pubs.acs.org/doi/epdf/10.1021/acs.est.3c05439

USING ^{19}F NMR TO INVESTIGATE CATIONIC CARBON DOT ASSOCIATION WITH PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)
Lewis, R.E., C.H. Huang, J.C. White, and C.L. Haynes.
ACS Nanoscience Au 3:408-417(2023)

A study determined whether nanoscale polymeric carbon dots are a viable PFAS sorbent material and developed fluorine nuclear magnetic resonance spectroscopy (^{19}F NMR) methods to probe interactions between carbon dots and PFAS at the molecular scale. Positively charged carbon dots (PEI-CDs) were synthesized using branched polyethyleneimine to target anionic PFAS by promoting electrostatic interactions. PEI-CDs were exposed to PFOA to assess their potential to sorb PFAS. After PFOA exposure, the average size of the PEI-CDs increased (1.6±0.5 to 7.8±1.8 nm), and the surface charge decreased ($^{+}$38.6±1.1 to $^{+}$26.4±0.8 mV), both of which are consistent with contaminant sorption. ^{19}F NMR methods were developed to gain further insight into PEI-CD affinity toward PFAS without complex sample preparation. PFOA peak intensity and chemical shift changes were monitored at various PEI-CD concentrations to establish binding curves and determine the chemical exchange regime. ^{19}F NMR spectral analysis indicates slow-intermediate chemical exchange between PFOA and CDs, demonstrating a high-affinity interaction. The alpha-fluorine had the greatest change in chemical shift and highest affinity, suggesting electrostatic interactions are the dominant sorption mechanism. PEI-CDs demonstrated an affinity for a wide range of analytes when exposed to a mixture of 24 PFAS, with a slight preference toward PFSAs.
https://pubs.acs.org/doi/epdf/10.1021/acsnanoscienceau.3c00022

FACTORS AFFECTING THE ADSORPTION OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) BY COLLOIDAL ACTIVATED CARBON
Hakimabadi, S.G., A. Taylor, and A.L.-T. Pham.
Water Research 242:120212(2023)

The adsorption of seven PFAS on a polymer-stabilized colloidal activated carbon (CAC, i.e., PlumeStop®) and a polymer-free CAC was investigated in batch experiments. The adsorption affinity of PFAS to CAC was PFOS>6:2 FTS>PFHxS>PFOA>PFBS>PFPeA>PFBA. Hydrophobic interaction was the predominant adsorption mechanism and that hydrophilic compounds such as PFBA and PFPeA will break through CAC barriers first. The partition coefficient K_d for PFAS adsorption on the polymer-stabilized CAC was 1.3-3.5 times smaller than the K_d for PFAS adsorption on the polymer-free CAC, suggesting that the polymers decreased the adsorption, presumably due to competitive sorption. PFAS adsorption capacity of PlumeStop CAC barriers is expected to increase once the polymers are biodegraded and/or washed away. PFOA and PFOS affinity to CAC increased when the ionic strength of the solution increased from 1 to 100 mM or when the concentration of Ca^{2+} increased from 0-2 mM. Less PFOS and PFOA were adsorbed in the presence of 1 - 20 mgC/L Suwannee River Fulvic Acid, which represented dissolved organic carbon, or in the presence of 10 - 100 mg/L diethylene glycol butyl ether, which is an important component in some AFFF formulations. The presence of 0.5 - 4.8 mg/L benzene or 0.5 - 8 mg/L TCE, co-contaminants that may comingle with PFAS at AFFF-impacted sites, diminished PFOS adsorption but had no effect or even slightly enhanced PFOA adsorption. When the initial concentration of TCE was 8 mg/L, the K_d (514 ± 240 L/g) for PFOS adsorption was ~20 times lower than that in the TCE-free system (K_d = 9,579 ± 829 L/g). Results provided insights into some key factors that may affect the adsorption of PFAS in in situ CAC barriers. *See the introduction and section snippets at* https://doi.org/10.1016/j.watres.2023.120212

BUILDING RELIABLE GROUNDWATER TRANSPORT MODELS AT CONTAMINATED SITES USING CROSS-BOREHOLE ELECTRICAL MONITORING
Levy, L., L. Lelimouzin, C. Delbet, L.M. Madsen, T. Gunther, P.L. Bjerg, and N. Tuxen.
The Remplex Virtual Global Summit, 14-16 November, 20 slides, 2023

In this study, different approaches to evaluate transport properties were compared based on cross-borehole electrical tomography for characterization and monitoring, as well as on chemical monitoring and sediment analyses. The first approach uses cross-borehole-induced polarization data for inverting the permeability field before remediation occurs. The second approach relies on inverting preferential pathways as discrete 1D elements, "fractures," based on time-lapse cross-borehole resistivity monitoring of the injection. The third method is a coupled hydrogeophysical inversion of the permeability field, using a stochastic optimization of the permeability distribution that includes misfit calculation with both concentration data and resistivity data at different time steps. The three approaches are tested on the same dataset collected during a remediation experiment at a contaminated site in Farum, Denmark.
https://www.pnnl.gov/sites/default/files/media/file/Pres_PNNL_nov2023_LeaLevy_light_0.pdf

TIME-LAPSE ELECTRICAL RESISTIVITY TOMOGRAPHY (ERT) MONITORING OF USED ENGINE OIL CONTAMINATION IN LABORATORY SETTING
Nazifi, H.M., L Gulen, E. Gurbuz, and E. Peksen.
Journal of Applied Geophysics 197:104531(2023)

The migration of used engine oil (UEO) was monitored to investigate the electrical characteristics of UEO as viscous LNAPL within a tank aquifer system using time-lapse ERT. The ERT data were collected using 24 electrodes arranged as a miniature resistivity array. The contaminant was injected into the tank aquifer system, and the electrical changes of the contaminant were monitored for 80 days. The time-lapse results revealed vertical and lateral migration of the contaminant, with the lateral migration dominating. Results also revealed an increase in electrical resistivity values from day 1 until day 35, then a drastic decrease to day 50, then a slight increase to day 60, followed by a decrease until day 80. Based on the odor change in the contaminated region from a used engine oil odor to a slightly rotten odor and relevant published research, it was interpreted that the decrease in electrical resistivity was associated with UEO degradation that may be caused by microbial activity. *See the introduction and section snippets at* https://www.sciencedirect.com/science/article/abs/pii/S0926985122000027

General News

ELECTROKINETIC-ENHANCED IN SITU REMEDIATION FACT SHEET
Naval Facilities Engineering Command, 4 pp, 2023

This fact sheet discusses how EK delivery methods work and explores two EK case studies for bioremediation and ISCO. Lessons learned and key considerations for applying and implementing EK technologies are also summarized. An EK-enhanced delivery method can achieve a more uniform distribution of amendments into the target treatment zone at low-permeability sites compared to hydraulic-based methods. EK can be used to implement in situ bioremediation, in situ chemical oxidation (ISCO), and in situ chemical reduction. https://exwc.navfac.navy.mil/Portals/88/Documents/EXWC/Restoration/er_pdfs/e/NAVFAC%20EK_FactSheet__9_27_23.pdf?ver=cQkrUYX7EWNDkrCQkKcdgQ%3d%3d

ADVANCES IN PFAS LEACHING MODELS AND LONG-TERM MONITORING
Guo, B. and L. Beckley. SERDP & ESTCP Webinar Series, January 2024

This SERDP and ESTCP webinar focuses on DoD-funded research efforts to develop tools for contaminant source tracking and monitoring. Specifically, investigators will discuss modeling platforms used to predict PFAS leaching in source zones and optimize groundwater monitoring. https://serdp-estcp.mil/webinars/details/a1bf1083-ca3c-4fef-bb01-51e0d3c1003d/advances-in-pfas-leaching-models-and-long-term-monitoring

CONTAMINANTS OF EMERGING CONCERN
Interstate Technology and Regulatory Council (ITRC) Website, cec-1, 2023

CEC are defined in this resource as "substances and microorganisms including physical, chemical, biological, or radiological materials known or anticipated in the environment, that may pose newly identified risks to human health or the environment." CEC require a clear technical approach on how to identify and evaluate them while acknowledging uncertainties in their environmental fate and transport, receptor exposure, and/or toxicity. Such an approach can be conducive to improved allocation of regulatory response resources and provide a foundation for communicating potential risk to stakeholders. The ITRC CEC Framework is comprised of a white paper and four associated fact sheets. These materials were developed to help environmental regulatory agencies and other stakeholders identify examples of CEC monitoring programs, evaluate potential hazards by systematically applying key CEC characteristics, communicate real and perceived risks from CEC to the public, and understand how lab analytical methods can be used in the identification process. https://cec-1.itrcweb.org/

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. 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 long-screened wells and open boreholes.
https://ngwa.onlinelibrary.wiley.com/doi/epdf/10.1111/gwat.13300

INNOVATIVE IN-SITU REMEDIATION APPROACHES FOR TREATING PFAS
Tunnicliffe, B. I RemTech 2023: Remediation Technologies Symposium 2023, 11-13 October, Banff, Alberta, Canada, 40 slides, 2023

This presentation summarizes the current state of PFAS remediation and introduces an innovative, new method for in situ treatment of PFAS. Data is presented from multiple studies (bench and field) where adsorbent materials have been utilized to treat PFAS contamination in groundwater. Significant efforts to optimize and apply these existing adsorptive technologies to enhance their reliability, lifespan, and overall effectiveness in treating PFAS-contaminated groundwater plumes are also discussed. Various in situ amendment materials, including activated carbon and clay-based materials, are reviewed. The presentation also offers recommendations and insights into the potential for future effective in situ PFAS treatment methods.
Slides: https://esaa.org/wp-content/uploads/2023/10/RT2023Tunnicliffe.pdf
Longer abstract: https://esaa.org/wp-content/uploads/2023/09/RT2023-Abstracts-52.pdf

NOVEL GEOMATERIALS FOR THE REMEDIATION OF TOXIC POLLUTANTS: A REVIEW
Sreenivasan S. and B. Kandasubramanian. I Hybrid Advances 3:100057(2023)

This scientometric assessment aimed to properly comprehend and evaluate the potential remediation of integrated effluents from wastewater thoroughly through various techniques such as adsorption, immobilization, and encapsulation using geopolymer-based materials. Advanced fabrication techniques like 3D printing, spin-coating, and phase inversion, the detailed mechanism of adsorption, the introduction of various isotherms and kinetic models, and regeneration ability are also explained.

COMETABOLISM OF CHLORINATED VOLATILE ORGANIC COMPOUNDS AND 1,4-DIOXANE IN GROUNDWATER
Clark, C. and L.K. Rhea. I Water 15(22):3952(2023)

This article provides an overview of the bioremediation of groundwater plumes containing admixtures of CVOCs and 1,4-dioxane. Topics covered include biodegradation pathways, biodegradation kinetics, substrate delivery and quality, inhibitory and stimulatory factors, and monitoring. *This article is* ***Open Access*** *at* https://www.mdpi.com/2073-4441/15/22/3952

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