Technology Innovation News Survey

Entries for March 16-31, 2023

Market/Commercialization Information

ENVIRONMENTAL REMEDIAL ACTION CONTRACT (PRESOL)

Naval Facilities Engineering Systems Command (NAVFAC) Atlantic, Norfolk, VA
Contract Opportunities on SAM.gov, Solicitation N62470-22-R-9014, 2023

When the solicitation is released on or about April 20, 2023, it will be competed as a total small business set-aside under NAICS code 562910. NAVFAC Atlantic intends to award a Cost-Plus-Award-Fee, ID/IQ Multiple Award Contract with a one-year base period and four one-year option periods totaling a maximum value of $240,000,000 for all contracts inclusive of the base year and all options. Work will be issued through task orders. The work will primarily support the remediation of sites ranked on the Superfund NPL and non-NPL sites regulated under CERCLA, RCRA, the Underground Storage Tanks regulations, state-specific regulations, and other sites, which might require remedial action. Work will be performed primarily in AL, AR, CT, DE, FL, GA, IL, IN, KS, KY, LA, ME, MD, MA, MI, MS, MO, NH, NJ, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WV, WI, DC areas, and Puerto Rico. Work could also include Base Realignment and Closure Program and Non-CERCLA sites throughout NAVFAC Atlantic's area of responsibility. Although principal sites are identified for the contract, the contractor may be required to perform work at any Naval or Marine Corps activity in areas of responsibility covered by NAVFAC Atlantic and anywhere outside of NAVFAC Atlantic's area of responsibility, as required by the Government. The general scope of work will be to provide all aspects of environmental remediation services to return various sites to safe and acceptable levels of contamination. Services may include but are not limited to contaminants identified and regulated under RCRA; CERCLA; TSCA; SWDA; petroleum, oils, and lubricants (POL); munitions constituents (MCs); and munitions and explosives of concern (MEC). Several sites may require remediation of radiological media. Contaminants are predominately solvents, POL, inorganics, acids, bases, radiological, MCs, PAHs, PCBs, PFAS, MEC (including all discarded military munitions and unexploded ordnance), emerging contaminants, and pesticides. Contaminants may be present in soils, marine or freshwater sediments, groundwater, air, sludge, surface water, and man-made structures in landfills, hazardous waste treatment storage and disposal facilities, tanks, lagoons, firefighting training areas, or other facilities. This notice does not constitute a request for proposal. https://sam.gov/opp/11f209536aaa400dabdaeb83c01aa897/view

ENVIRONMENTAL REMEDIATION (ERMA23 IDIQ RFP) (SOL)

U.S. Department of the Army, Army Contracting Command, Mission and Installation Contracting Command, FDO Sam Houston, TX
Contract Opportunities on SAM.gov, Solicitation W9124J-22-R-0005, 2023

This is a full and open competition under NAICS code 562910. The United States Army Environmental Command needs to re-procure a performance-based Multiple Award Indefinite Delivery/Indefinite Quantity contract, which shall consist of a small business (SB) suite and an unrestricted business suite to provide a broad spectrum of environmental remediation services at various Installations/locations throughout the contiguous U.S. to include Puerto Rico, Hawaii, Alaska and United States territories. The anticipated work will include a wide range of evaluation, investigation, and other remediation services required for sites involving hazardous/toxic waste. The work to be performed includes munitions response activities that may involve the remediation and the disposition of munitions and explosives of concern, which includes unexploded ordnance, discarded military munitions, and munitions constituents. In addition, the contractor shall perform Operational Range Assessments on operations ranges to provide information on potential migration of munitions constituents of concern of operational ranges (necessary to support continuity of training and testing). The work shall not include chemical warfare material work; however, the contractor shall be familiar with and be able to recognize CWM to be able to stop work and notify the Army of these potential hazards. All questions in response to the RFP must be submitted no later than May 17, 2023. A two-day site visit is scheduled on May 3 and 4, 2023. Offers are due by 1:00 PM CDT on May 31, 2023. https://sam.gov/opp/d18f61233aab4ee7a2e12e7a9e9503ad/view

F--CERCLA TCRA AT BURN SITES IN ROCKY MTN NP, CO

U.S. Department of the Interior, National Park Service, Washington Contracting Office, Lakewood, CO
Contract Opportunities on SAM.gov, Solicitation 140P2123R0008, 2023

When the solicitation is released on or about April 24, it will be competed as a total small business set-aside under NAICS code 562910. The U.S. National Park Service seeks a contractor to perform a response action under CERCLA at up to twenty-two burn sites at four locations within Rocky Mountain National Park in north-central Colorado that burned in the East Troublesome wildfire in October 2020. Limited prior investigations have analyzed the contaminants, characterized the hazards, and established a framework for the removal action at this site in accordance with the CERCLA process. The debris to be removed varies from site to site and includes vegetation, ash, wood, contaminated soil, remnant concrete/stone/masonry structures, concrete, metal articles, trees that prohibit work performance, stumps, presumed PCB-containing light ballasts, chemical containers, aerosol cans, fire extinguishers, compressed gas cylinders, electronic waste, small-motorized equipment (generators, chain saws, etc.), white goods (washers, dryers, refrigerators, etc.). Ash, debris, metal, and concrete at all locations may contain or be contaminated by friable asbestos. The Contractor shall perform confirmation sampling and analysis in accordance with a previously prepared Sampling and Analysis Plan (SAP). In addition to the base items, the anticipated RFP will include options for the cleanup of additional burned sites at two locations; risk assessments; and additional sampling and analyses. This anticipated contract is expected to be awarded as a best value negotiated procurement. There will be no site visit because the burn sites are inaccessible due to snow or seasonal road closures. Photos and maps will be included in the RFP and prospective offerors are encouraged to research the park and sites using publicly-available information.
https://sam.gov/opp/87b545f77d3c4a2396c5258acc531b2e/view

Cleanup News

INVESTIGATION AND REMEDIATION STRATEGY FOR A FAST-MOVING 1,4-DIOXANE PLUME AT A MILITARY SITE

Gopinath, S., T. Eiber, G. Geckeler, and P. Dombrowski. I AEHS Foundation 32nd Annual International Conference on Soil, Water, Energy and Air, 20-23 March, San Diego, CA, 18 slides, 2023

An in situ chemical oxidation (ISCO) pilot study demonstrated that ISCO could successfully remediate a large 1,4-dioxane groundwater plume migrating downgradient. An investigation was performed to verify the source area and extent of full-scale treatment. Additional investigations and full-scale ISCO were conducted during the same field season in 2021 due to the rapid groundwater flow rates that could result in the treatment misaligning with the moving contaminant mass. This strategy required rapid design, review, approval, and implementation to treat the 1,4-dioxane before significant migration occurred. In July 2021, 300 gals of Modified Fenton's Reagent (200 g 8% H_2O_2 and 100 g catalyst) were injected into 235 points, and activated sodium persulfate (8% with NAOH and carbohydrate activator) was injected into 35 points. One year of monitoring showed a 21-36% reduction in 1,4-dioxane concentrations, similar to the efficiency achieved during the pilot test.
https://s3.amazonaws.com/amz.xcdsystem.com/A51108D5-EA2F-2B6D-01D92AC0F42DCF3B_abstract_File22921/PDFforhandouttoattendeesopt_219_0317123904.pdf

SURFACTANT ENHANCED VAPOR, SORBED, AND NAPL PHASE REMEDIATION OF PETROLEUM AND CHLORINATED SOLVENTS AT BROWNFIELDS

Ivey, G. I AEHS Foundation 32nd Annual International Conference on Soil, Water, Energy and Air, 20-23 March, San Diego, CA, poster, 2023

This poster presentation visually explains three primary hydrogeochemical factors that limit the availability of vapor, sorbed, globule (ganglia), and NAPL contamination for physical, biological, and chemical remediation at brownfield sites. The poster also demonstrates how coupling surfactant-enhanced remediation with multiphase extraction (MPE), bioremediation, and chemical methods can reliably improve in situ soil, bedrock, and groundwater remediation with more sustainable time and cost savings. The brownfield case study sites feature surfactant-enhanced physical, biological, and chemical remediation, including a manufactured gas plant, a Superfund site, and an upstream pipeline spill site. Contaminants of concern (COC) include VOCs, petroleum hydrocarbons, chlorinated solvents, and comingled COC plumes. The presentation is supported by literature references, tables, graphics, statistics, and 3D animations of the in situ remediation techniques applied.
https://s3.amazonaws.com/amz.xcdsystem.com/A51108D5-EA2F-2B6D-01D92AC0F42DCF3B_abstract_File22919/PresentationPoster_105_0314111223.pdf

ENDOPHYTE ASSISTED PHYTOREMEDIATION A SUSTAINABLE AND RESILIENT NATURE BASED SOLUTION

Murphy, R. and G. O'Toole. I Sustainable Remediation Forum (SURF) webinar, 58 minutes, 2023

This presentation focuses on the use of endophytic microbes as a phytoremediation tool targeted to specific classes of contaminants and specialized tree cultivars. Plant-microbe symbiotic systems expand the range of sites available for phytoremediation and provide increased degradation for the targeted classes of contaminants. The content provides technical background, applications, and lessons learned from full-scale deployment on Superfund and military sites, petroleum transfer stations, and manufacturing sites. Remediation benefits include:

- Faster establishment and healthier trees and plants.
- Increased rhizosphere activity and natural source zone depletion rates.
- Lower costs for installation and maintenance with fewer tree replacements.
- Ability to install phytoremediation systems in higher-concentration zones.
- System resilience to brackish groundwater and mixed-waste sites.
- Complete degradation of chlorinated solvents.

https://www.youtube.com/watch?v=r0bmrcqp1is

EFFECTIVENESS OF EARLY ACTIONS IN ACCELERATING A HARBOR-WIDE MONITORED NATURAL RECOVERY REMEDY IN ESQUIMALT HARBOUR

Thomas, R., K. Ritchot, and A. Corp. I REMTECH 2022: The Remediation Technologies Symposium, Banff, AB, Canada, 11-14 October. Environmental Services Association of Alberta, Edmonton, AB (Canada), 21 slides, 2022

Esquimalt Harbor is a large working harbor located on Vancouver Island, British Columbia that houses the RCN Pacific Fleet, necessitating that remedial objectives align with harbor operations. The remedial strategy included a phased approach of early remedial actions, with monitored natural recovery (MNR) of most of the harbor. Eleven early remedial actions conducted over the past seven years were completed as part of the first phase of the harbor-wide cleanup. Comprehensive data were collected during all phases to confirm remedy effectiveness and identify potential ongoing sources of recontamination. Multiple studies were conducted throughout the harbor to identify trends and early indications of natural recovery processes, including sediment sampling and deployment of sediment traps to characterize deposition and resuspension and coring to assess vertical trends. Tissue sampling and analysis were also conducted during all phases. Multiple lines of evidence confirmed that exposure concentrations are declining or maintained at levels below risk thresholds. Surface sediment in remediated areas is equilibrating to harbor background levels, consistent with recontamination modeling and sediment trap results. Based on findings to date, MNR is a viable strategy for the remediation of most of the harbor, with a potential need for additional source control and/or supplemental remediation in limited areas. https://esaa.org/wp-content/uploads/2022/11/RT22Thomas.pdf

Demonstrations / Feasibility Studies

IN-SITU APPLICATION OF COLLOIDAL ACTIVATED CARBON FOR PFAS-CONTAMINATED SOIL AND GROUNDWATER: A SWEDISH CASE STUDY

Niarchos, G., L. Ahrens, D.B. Kleja, G. Leonard, J. Forde, J. Bergman, E. Ribeli, M. Schutz, and F. Fagerlund. I Remediation 33(2):101-110(2023)

A pilot-scale study was carried out to investigate the potential of colloidal activated carbon (CAC) to stabilize soil by entrapping PFAS and preventing leaching into groundwater. Monitoring revealed the presence of two potential sources of PFAS contamination at concentrations up to 23 µg/L for ∑11PFAS in groundwater. After CAC application, initial results indicated a 76% reduction of ∑11PFAS and high removal rates for long-chain PFAS, such as PFOS and PFOA. Concentration spikes showed a plume rebound and a reduced treatment effectiveness (52%) six months after CAC injection. Concentration rebounds were attributed to the plume bypassing the barrier due to the presence of high conductivity zones, which likely occurred because of seasonal changes in groundwater flow directions or the CAC application. This demonstrates the need for a detailed and accurate hydrogeological understanding of contaminated sites before designing and applying stabilization techniques, especially at sites with high geologic and hydrologic complexity.
https://onlinelibrary.wiley.com/doi/epdf/10.1002/rem.21746

COMBINING ISCR & ANTIMETHANOGENIC REAGENTS TO ACHIEVE SUBSTANTIAL CVOC REDUCTIONS

Moody, W. and T. Lizer. I AEHS Foundation 32nd Annual International Conference on Soil, Water, Energy and Air, 20-23 March, San Diego, CA, abstract only, 2023

Combining antimethanogenic reagents (AMRs) with conventional remedial technologies allows for more rapid reductions in chlorinated VOCs and more efficient use of the amendments due to inhibition of methanogen population growth, thereby reducing safety hazards associated with excess methane. Adding AMRs to solid in situ chemical reduction (ISCR) amendments can suppress methanogen populations while allowing other

microbial species to flourish, thus creating more rapid reductions in VOC concentrations and predictable changes in geochemistry without excess methane production. Pre- and post-application data is presented from various field scale applications, showing reductions in VOCs and predictable changes in geochemistry data, showcasing the avoidance of the potential consequences of excess methane production. *See presentation from AESAS II Conference in 2022:* https://www.youtube.com/watch?v=Kbdi6qg0MS8

ELECTROCHEMICAL OXIDATION FOR TREATMENT OF PFAS IN CONTAMINATED WATER AND FRACTIONATED FOAM-A PILOT-SCALE STUDY

Smith, S.J., M. Lauria, L. Ahrens, P. McCleaf, P. Hollman, S.B. Seroka, T. Hamers, H.P.H. Arp, and K. Wiberg. I ACS ES&T Water 3(4):1201-1211(2023)

A practical treatment train that combines foam fractionation to concentrate PFAS from groundwater and landfill leachate, followed by an electrochemical oxidation (EO) step to degrade the PFAS was demonstrated in a pilot-scale study. The study combined an up-scaled experimental approach with thorough characterization strategies, including target analysis, PFAS sum parameters, and toxicity testing. A newly developed coupled numerical model successfully reproduced EO kinetics. The mean total PFAS degradation over the designed treatment train reached 50%, with long- and short-chain PFAS degrading up to 86 and 31%, respectively. Treatment decreased the toxic potency of the water, as assessed by transthyretin binding and bacterial bioluminescence bioassays. Moreover, the extractable organofluorine concentration of the water decreased by up to 44%.

TREATMENT BY THERMAL DESORPTION OF DIOXIN-CONTAMINATED SOILS AND VAPOR AT BIEN HOA AIRBASE, VIETNAM

Haemers, J., A. Vandekerckhove, and M. Stumbaugh I AEHS Foundation 32nd Annual International Conference on Soil, Water, Energy and Air, 20-23 March, San Diego, CA, 43 slides, 2023

A pilot study is being conducted to demonstrate the effectiveness of the Smart Burners treatment technology and design to meet site-specific target levels for dioxins and furans at the Bien Hoa Airbase, where thousands of barrels of Agent Orange were stored. Although the project started in early 2020, it was interrupted due to the COVID pandemic and resumed in December 2021. The pilot was restarted in February 2022 to treat the most contaminated materials in the area. After 40 days of treatment, the target temperature of 335°C was reached in the thermal pile and the temperature was maintained for at least five days. The presentation covers the treatment system design, operation, challenges, and results.
https://s3.amazonaws.com/amz.xcdsystem.com/A51108D5-EA2F-2B6D-01D92AC0F42DCE3B_abstract_File22921/PDFforhandouttoattendeesopt_202_0319085347.pdf

ANAEROBIC BENZENE, TOLUENE AND XYLENE BIODEGRADATION: FROM THE LAB TO THE FIELD

Dennis, P. I SMART Remediation 26 January, Ottawa, 19 slides, 2023

Lan treatability study results demonstrated enhanced benzene, toluene and oxylene biodegradation rates with DGG-Plus™ bioaugmentation and provided information to aid in designing a field pilot test. One field pilot-test performed at a site in Saskatchewan included three injection points, two of which received up to 10 L of the DGGB culture, with four more being added a few months later. Benzene degradation rates are anticipated to accelerate in situ through bioaugmentation as observed in corresponding treatability studies. Additional field applications in Ontario and the US where DGG-Plus were bioaugmented are also being monitored. These first-to-field projects will establish a better understanding of dosing requirements, timeframes for obtaining results and ranges of conditions over which the cultures are effective. The presentation summarizes data from lab treatability studies and shows how they aided in field design. Data from regulatory approvals and the first field applications are also shared.
https://smartremediation.com/wp-content/uploads/2023/02/SMART-Remediation-Ottawa-Phil-Dennis-February-2-2023.pdf

Research

PFAS IN SAN FRANCISCO BAY WATER

Mendez, M., M. Trinh, E. Miller, D. Lin, and R. Sutton. San Francisco Estuary Institute Contribution No. 1094, 37 pp, 2022

A study analyzed ambient surface water in San Francisco Bay for 40 PFAS to discern the occurrence, fate, and potential ecological and human health risks. Eleven of 40 PFAS were detected in ambient surface water collected from 22 sites. Seven PFAS (PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, and PFOS), were found in at least 50% of samples. PFHxA (86%) and PFOA (77%) were the most frequently detected analytes. PFPeA and PFHxA were generally found at the highest concentrations across sites, with median and maximum concentrations of 1.6 and 4.8 ng/L and 1.5 and 5.7 ng/L, respectively. Pairwise Spearman's correlations revealed strong positive correlations ($p < 0.001$; $r > 0.77$) among the seven PFAS detected in at least 50% of sites, suggesting significant similarities between their sources, pathways, and/or fate in the environment. PFBA, PFNA, PFDA, and 6:2 FTS were found at a limited number of sites. 6:2 FTS was detected at a site at 14 ng/L, the highest concentration of any individual PFAS. The sums of detected PFAS for all sites had median and maximum concentrations of 10 and 29 ng/L, respectively.
https://www.sfei.org/sites/default/files/biblio_files/PFASinBayWater2022_Final.pdf

EVALUATION OF TREATMENT OF MGP-IMPACTED SOILS AND GROUNDWATER COMINGLED WITH PFAS USING ISCO

Prasad Kakarla, Y. Chin, and W. Caldicott. I AEHS Foundation 32nd Annual International Conference On Soil, Water, Energy And Air, 20-23 March, San Diego, CA, 19 slides, 2023

A two-phase treatability study was conducted to evaluate the effect of ISCO to treat groundwater impacted with benzene and naphthalene comingled with PFAS and PFOS at a former manufactured gas plant. Significant regulatory concerns existed with applying ISCO to remediate MGP-related compounds, as the site lies adjacent to a river. The treatment effectiveness of modified Fenton's reagent (MFR) and carbohydrate-activated sodium persulfate (CHASP) was evaluated on groundwater samples in Phase I. Both oxidants effectively treated VOCs, but only MFR effectively treated PAHs. Standard PFAS analyses showed that fluctuations in individual PFAS compounds were possible; increases appeared to be within anticipated variations under lab conditions. Total oxidizable precursor (TOP) assay results showed that TOP concentrations decreased following the application of MFR, with slight decreases also noted using CHASP. During Phase II, experiments were conducted on soil slurries using MFR and MFR+CHASP. MFR was applied as a first step to promote initial desorption and degradation. MFR increased PFAS concentrations initially, but MFR+CHASP showed a significant decrease. TOP assay PFAS compounds showed an average 43% decrease, with PFOA and PFOS showing an average 67% decrease compared to baseline, indicating that the MFR+CHASP can achieve quantifiable reduction of PFAS compounds. A field pilot test program was developed for regulatory approval.
https://s3.amazonaws.com/amz.xcdsystem.com/A51108D5-EA2F-2B6D-01D92AC0F42DCE3B_abstract_File22921/PDFforhandouttoattendeesopt_226_0317110012.pdf

CYCLIC SOLUBILIZATION AND RELEASE OF POLYCYCLIC AROMATIC HYDROCARBONS (PAHS) USING GEMINI PHOTOSENSITIVE SURFACTANT COMBINED WITH MICRO-NANO BUBBLES: A PROMISING ENHANCEMENT TECHNOLOGY FOR GROUNDWATER REMEDIATION

Dai, C., Y. Han, Y. Zhang, Y. Duan, W. Tong, S. Liu, Y. Tu, J. Hu, and J. Li.
Separation and Purification Technology 309:123042(2023)

A study showed that combining micro-nano bubbles (MNBs) with the gemini photosensitive surfactant N1, N2-bis[4-[4-[(4-butylphenyl) azo] phenoxy] butyl]-N1, N2-tetramethylethane-1,2-diammonium bromide (AzoPBT) significantly enhanced phenanthrene (Phe) solubilization and surfactant cycling efficiency. The presence of MNBs was conducive to Phe dissolution and release by reducing the CMC and γ of *trans*-AzoPBT (from 0.52 mmol/L and 28.94 mN/m to 0.39 mmol/L and 27.88 mN/m) and increasing the difference of interfacial properties between trans and cis-AzoPBT due to electrostatic interaction. Groundwater chemical parameters (ions, pH and organic matter) affected the solubilization ability of trans-AzoPBT. Mg^{2+} and Ca^{2+} inhibited solubilization while SO42- promoted solubilization, depending on their radius, electronic quantity, and solution pH. Changes in humic acid levels up to 8 mg/L negatively affected the solubilization ability. A high release rate (69.39%) of *cis*-AzoPBT for Phe and a high recovery rate (89.37%) for tans-AzoPBT were obtained in the AzoPBT/MNBs mixed aqueous solution. AzoPBT/MNBs mixed aqueous solution exhibited better synergistic solubilization performance, and the apparent solubility of Phe increased from 26.74% to 31.61% compared to MNBs combined with conventional cationic surfactants.

UPTAKE OF PER- AND POLYFLUOROALKYL SUBSTANCES BY FISH, MUSSEL, AND PASSIVE SAMPLERS IN MOBILE-LABORATORY EXPOSURES USING GROUNDWATER FROM A CONTAMINATION PLUME AT A HISTORICAL FIRE TRAINING AREA, CAPE COD, MASSACHUSETTS

Barber, L.B., H.M. Pickard, D.A. Alvarez, J. Becanova, S.H. Keefe, D.R. LeBlanc, R. Lohmann, J.A. Steevens, and A.M. Vajda I Environmental Science & Technology 57(14):5544-5557(2023)

The potential for PFAS bioconcentration from exposure to PFAS-contaminated groundwater discharging to surface water bodies was assessed using groundwater from the contamination plume and a nearby reference location at Joint Base Cape Cod. The onsite continuous-flow 21-day exposures used male and female fathead minnows, freshwater mussels, polar organic chemical integrative samplers (POCIS), and polyethylene tube samplers (PETS) to evaluate biotic and abiotic uptake. Composition of the PFAS-contaminated groundwater was complex; 9 PFAS were detected in the reference groundwater (summed concentration of 120-140 ng/L), and 17 PFAS were detected in the contaminated groundwater (summed concentration of 6,100-15,000 ng/L). Biotic concentration factors (CF_B) for individual PFAS were species-, sex-, source-, and compound-specific, ranging from 2.9 to 1,000 L/kg in whole-body male fish exposed to contaminated groundwater for 21 days. The fish and mussel CF_B generally increased with increasing fluorocarbon chain length and were greater for sulfonates than carboxylates. The exception was PFHxS which deviated from the linear trend and had a 10-fold difference in CF_B between sites, possibly due to biotransformation of precursors, such as perfluorohexane sulfonamide. Uptake for most PFAS in male fish was linear over time, whereas female fish showed bilinear uptake indicated by an initial increase in tissue concentrations followed by a decrease. PFAS uptake was less for mussels (maximum $CF_B = 200$) than for fish; mussel uptake of most PFAS also was bilinear. Although abiotic concentration factors were greater than CFb, and values for POCIS were greater than for PETS, passive samplers were useful to assess PFAS that potentially bioconcentrate in fish but are present at concentrations below method quantitation limits in water. Passive samplers also accumulate short-chain PFAS that are not bioconcentrated.

ENHANCED NATURAL ATTENUATION OF GROUNDWATER CR(VI) POLLUTION USING ELECTRON DONORS: YEAST EXTRACT VS. POLYHYDROXYBUTYRATE

Tumolo, M., A. Volpe, N. Leone, P. Cotugno, D. De Paola, D. Losacco, V. Locaputo, M. Concetta de Pinto, V. Felice Uricchio, and V. Ancona.
International Journal of Environmental Research and Public Health 19:9622(2022)

A bioremediation test was carried out using viable microcosms set with groundwater and deep soil (4:1) collected from the saturated zone of an industrial site in Southern Italy contaminated with Cr(VI) (~130 µg/L). Conditions simulating natural attenuation were compared to enhanced natural attenuation induced by supplying yeast extract or polyhydroxybutyrate. Sterile controls were set up to study possible Cr(VI) abiotic reduction. No pollution attenuation was detected in the unamended viable reactors, whereas yeast extract provided complete Cr(VI) removal in seven days. Polyhydroxybutyrate allowed ~70% pollutant removal after 21 days. Incomplete abiotic Cr(VI) removal was observed in sterile reactors amended with yeast extract, suggesting the essential role of native bacteria in Cr(VI) remediation. This agreed with the results of Pearson's coefficient test, which revealed that Cr(VI) removal was positively correlated with microbial proliferation ($n = 0.724$), and also negatively correlated with pH ($n = -0.646$), dissolved oxygen ($n = -0.828$) and nitrate ($n = -0.940$). The relationships between the Cr(VI) removal and other monitored parameters were investigated by principal component analysis, which explained 76.71% of the total variance.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9367865/pdf/ijerph-19-09622.pdf

PASSIVE OZONE INJECTION THROUGH GAS-PERMEABLE MEMBRANES FOR ADVANCED IN SITU GROUNDWATER REMEDIATION

Dawas, A., Y. Yecheskel, E. Bein, U. Hubner, and I. Zucker.
ACS ES&T Engineering [Published online 16 February 2023 before print]

A study examined an alternative ozone delivery method using permeable membranes to remediate groundwater. A cylindrical polydimethylsiloxane (PDMS) membrane was used for passive ozone injection in a 2D system simulating in situ groundwater treatment. Liquid velocity and the presence of ozone consumers (e.g., nitrite) were found to regulate the ozone diffusion rate through the membrane and the resultant dissolved ozone concentration. A higher liquid velocity (examined in a 340-920 cm/d range) increased ozone diffusion rates (up to 2 µmol/s/m²) and decreased dissolved ozone concentration due to a dilution effect. Similarly, increasing the nitrite concentration from 0.5 to 25 mM enhanced the ozone diffusion rate by up to 5.64 µmol/s/m². Carbamazepine was used as a fast-reacting model pollutant to examine membrane performance. Up to 80% carbamazepine removal was obtained for the lowest liquid velocity examined, which is also relevant for typical groundwater velocities. However, a low ratio of carbamazepine-removed to ozone-delivered was obtained, which was associated with reactions occurring close to the membrane surface that may enable additional reactions of ozone with carbamazepine transformation products.

General News

POLYFLUOROALKYL SUBSTANCES REQUIRING A RENEWED FOCUS ON GROUNDWATER-SURFACE WATER INTERACTIONS

Divine, C., A. Wadhawan, V. Pulikkal, P. Khambhammettu, and J. Erickson.
Groundwater Monitoring & Remediation 43(1):14-31(2023)

The rapid rise in the emphasis on the PFAS contaminant class is one of the most dramatic and important trends in groundwater remediation research and practice. Key factors driving the attention and focus are:

1. The documented widespread presence of PFAS in human blood serum and the environment.
2. The existence of thousands of individual PFAS compounds, a wide range of materials that contain PFAS, and a very large number of potential sites.
3. The very low regulatory standards, which have been established and/or are proposed in many jurisdictions (typically low ppt or ng/L). EPA recently issued lifetime drinking water health advisory levels of 4 and 20 pg/L for PFOA and PFOS.
4. The complex behavior of PFAS in the environment. For example, most PFAS compounds are resistant to biological degradation processes, sorb to sediment and microplastics, exhibit self-assembly behavior, partition into NAPL, and concentrate at air-water interfaces.
5. The number of scenarios where PFASs are released to the environment are notably different and can be more complex than common release scenarios for other groundwater contaminants.

Combining factors c, d, and e result in complex contaminant distributions at sites, with transport across multiple media types, and more opportunities for completed exposure pathways to potential receptors. As a result, it is expected that there will be many sites where contaminant assessment and management of PFAS at the groundwater-surface water interface will be necessary. The article highlights examples where PFAS transport between groundwater and surface water is important and summarizes current practices and developing techniques and technologies for characterizing and managing impacts at the groundwater-surface water interface.

IN SITU AND EX SITU APPROACHES FOR TREATING PFAS-IMPACTED GROUNDWATER

Werth, C. and E. McKenzie. SERDP & ESTCP Webinar Series, April 2023

This webinar features DoD-funded research efforts to treat PFAS-impacted groundwater in situ and ex situ. First, Dr. Charles Werth, University of Texas at Austin, presents his work on the efficacy of particulate carbon amendments in arresting downgradient plume migration. Then, Dr. Erica McKenzie, Temple University, discusses her research on the treatment of PFAS using regenerable ion exchange resin or activated carbon.
https://www.serdp-estcp.org/webinars/details/27e9aa93-da91-42ae-9be8-f787523b0628/in-situ-and-ex-situ-approaches-for-treating-pfas-impacted-groundwater

RECENT ADVANCES IN THE REMEDIATION OF PERFLUOROALKYLATED AND POLYFLUOROALKYLATED CONTAMINATED SITES

Marquinez-Marquinez, A.N., N.S. Loor-Molina, L.S. Quiroz-Fernandez, N.R. Maddela, R. Luque, and J.M. Rodriguez-Diaz. Environmental Research 219:115152(2023)

Advances in remediation of PFAS-contaminated soil and water are presented through a review of current literature. The work addresses the performance and characteristics of each technique. The review found that PFAS elimination studies in soil and water were carried out at lab and, in some cases, pilot-scale. Ball milling, chemical oxidation and thermal desorption are the most efficient techniques to remove PFAS in soil; however, phyto-microbial remediation is under study and may be a promising technique. Electrocoagulation, membrane filtration, ozofractionation, catalysis, oxidation reactions - reduction, thermolysis and destructive treatments with plasma have provided the best results for the remediation of PFAS-contaminated water. Hybrid treatments have proven to be efficient techniques in the removal of PFAS from soil and water matrices.

COMPOUND-SPECIFIC ISOTOPE ANALYSIS AS A FORENSIC TOOL TO DISTINGUISH SOURCES

Birk, G., D. Alden, and J. Sankey. | AEHS Foundation 32nd Annual International Conference on Soil, Water, Energy and Air, 20-23 March, San Diego, CA, 30 slides, 2023

Compound-specific isotope analysis (CSIA) can be used to demonstrate in situ destruction of selected VOCs and for forensic investigations to gain information about potential contaminant sources, the extent of degradation, comingling of contaminant plumes, and the origins of some chemicals. Because several diverse factors govern the synthesis of petroleum hydrocarbons or the manufacturing of chlorinated solvents, different $\delta^{13}C$, $\delta^{37}Cl$ and $\delta^{2}H$ signatures for the same VOC coming from a different synthesis\manufacturing process can be obtained. A substantial advantage of this non-uniformity is that the isotopic ratio can serve as a fingerprint once the product reaches the commercial level. This translates into a tool that can distinguish two sources of the same contaminant at a given site, identify a contaminant coming from an offsite, upgradient source, and establish a link between an observed compound and its potential emitting source. A case study is also presented on distinguishing PCE sources at a brownfields site with multiple responsible parties.
https://s3.amazonaws.com/amz.xcdsystem.com/A51108D5-EA2E-2B6D-01D92AC0E42DCE3B_abstract_File22921/PDEforhandouttoattendeesopt_198_0314013539.pdf

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