Technology Innovation News Survey

Entries for April 16-30, 2024

Market/Commercialization Information

R -- SOURCES SOUGHT | EPA | REPA 7 (SRCSGT)
U.S. Environmental Protection Agency, Region 9 Contracting Office, San Francisco, CA
Contract Opportunities on SAM.gov 68HE0924R0025, 2024

This is a sources sought notice for marketing research purposes only under NAICS code 541620. EPA Region 9, seeks information from potential sources including all socioeconomic categories of Small Businesses and Historically Black Colleges and Universities/Minority Institutions, and members of the underserved communities as defined by Executive Order 13985 titled "Advancing Racial Equity And Support For Underserved Communities Through The Federal Government" for the future EPA RCRA Enforcement, Permitting and Assistance (REPA) procurement. The Government reserves the right to consider a Small, 8(a), Women-owned, Service Disabled Veteran, Economically Disadvantaged Women-owned Small Business or HUBZone business set aside based on responses received. The purpose of the REPA 7 contract is to provide technical support services to the EPA in support of RCRA program goals. REPA 7 intends to be a consolidated procurement, encompassing the environmental services that are currently being performed under multiple EPA contracts. The environmental support services include, but are not limited to, Technical Reviews, Technical Analysis/Assessment Support and Document Preparation, Field Audit/Oversight and Inspections, Data Review (Validation, Evaluation, and Reporting), Site Investigation and Corrective Action, Case Development, General Enforcement Negotiation Support, Expert Witness/Consultant Support, Records Management, Data Management, Training and Conference Support, Public Involvement and Outreach Activities, Sustainable Materials Management, and RCRA authorization. The contractors shall have a detailed knowledge and demonstrated experience of applicable State and Federal statutes and regulations as well as a similar understanding of the Executive Orders and local statutes and regulations governing environmental compliance. The contractor shall remain proficient throughout the life of the contract regarding environmental laws and regulations for the jurisdictions in which they plan to perform services. Potential work locations may include sites in EPA Region 02 (NY, NJ, VI, PR), Region 03 (PA, WV, VA, DE, MD, DC), Region 04 (KY, TN, NC, SC, GA, FL, AL, MS), Region 05 (IL, IN, OH, MI, WI, MN), Region 06 (NM, TX, OK, AR, LA), Region 07 (NE, IA, KS, MO), Region 08 (CO, UT, WY, SD, ND, MT), Region 09 (CA, NV, AZ, HI, Pacific Islands) and Region 10 (OR, WA, ID, AK) as requirements arise. Required services may include long-term day-to-day support or one-time special projects. In addition, services may be required at multiple locations simultaneously. EPA is contemplating awarding IDV contracts to multiple awardees, with an ordering period of at least 5 years, with a potential of up to 10 years, with a potential value of approximately $240M (for a 10-year ordering period). Capability statements are due by 5:00 PM PDT on June 17, 2024. https://sam.gov/opp/9718aecf8e2a4cef9b2394e9b918fb89/view

F -- TANKS AND CONTAMINATED SOIL REMOVAL (SOL)
U.S. Department of the Interior, Bureau of Land Management, Colorado State Office, Lakewood, CO
Contract Opportunities on SAM.gov 140L1724Q0017, 2024

This is an Indian Small Business Economic Enterprise (ISBEE) set-aside (specific to the Department of Interior and Indian Health Services). The Bureau of Land Management's (BLM) Colorado State Office requires the removal of two flat tanks and ~40 ft3 of hydrocarbon-contaminated soil from Orphan Well Federal 1-35 (api 05-107-06062) near Hayden, Colorado. BLM will provide a pre-award site visit on June 11, 2024, at 10:00 AM MDT. Interested contractors must RSVP no later than June 10, 2024, at 4:30 PM MDT to the COR to confirm attendance. BLM reserves the right to cancel the pre-award site visit if no RSVPs are received by the required date. The BLM contemplates issuing a commercial firm-fixed-price purchase order pursuant to FAR 12 and FAR 13 for one-time performance. This solicitation is issued with the award being made subject to the availability of funds. The award will be a firm-fixed-price contract with a 45-day period of performance upon securing funding for this project. Offers are due by 5:00 PM MDT on June 21, 2024. https://sam.gov/opp/09b38bfee7794cc7b1174d66cc035952/view

F -- FUSRAP REMEDIAL ACTION SERVICES AT THE ST. LOUIS SITES (PRESOL)
Contract Opportunities on SAM.gov W912P923R0057, 2024

When this solicitation is released on or about June 4, 2024, it will be competed as a total small business set-aside under NAICS code 562910. The U.S. Army Corps of Engineers intends to issue a solicitation for a Single Award Task Order Contract or the continued support of Hazardous, Toxic and Radioactive Waste investigations and environmental remediation programs and projects managed by the St. Louis District of the U.S. Army Corps of Engineers. The work anticipated under this contract is primarily for, but not limited to, low-level radioactive contaminated material investigation, extent of contamination surveys, environmental assessments, on-site laboratory analysis, radiological support, removal action verification, and environmental monitoring. Radiological contaminants are primarily thorium, radium and uranium, with co-located chemical contamination such as cadmium, and arsenic. Other services requested will be in connection with the performance of administrative recordkeeping and document management, data management, technical/regulatory integration, and project controls necessary for the execution of the St. Louis District FUSRAP. Task Orders issued under this contract will be cost reimbursable Cost Plus Fixed-Fee. https://sam.gov/opp/267125e3342d4ed5a1f1642fd3985758/view

Cleanup News

SOIL REMEDIATION AT FORMER CARNOTITE REDUCTION COMPANY SITE
Nissen, C. I DCHWS West 2023 Fall Symposium, 25-27 October, Denver, CO, 13 slides, 2023

This presentation focuses on the technical and administrative complexities of conducting radiological soil remediation in an urban environment, shares lessons learned, and presents solutions to the issues that developed as the project progressed. Elevated radioactivity from Ra^{226}, Th^{230}, and uranium at the Carnotite Radium Company site required remediation and decommissioning. A site investigation employed 3D site visualization to understand contaminant distribution and determine the magnitude and extent of contamination. The remedial design involved dewatering, water treatment and discharge to the publicly-owned treatment works, the excavation of ~27,000 tons of soil to a max of 20 feet below grade, sewer decommissioning, the transportation and disposal of soil, backfilling, construction of a detention basin and replacement of the sewer system. The site is located very close to Lake Michigan, and its geology consists of beach sand, making dewatering and excavation stability challenging. The footprint of the contaminated area measured ~2 acres in the central portion of the ~7-acre site, presenting logistical challenges for filled bag storage, truck routes, and access to soil for excavation. A site layout was developed to allow the trucks to stay outside the exclusion zone. Bag tracking and storage was a large effort and presented logistical issues, such as trucking and railcar availability challenges, which caused bag accumulation. Bag tracking methods were developed, bag storage pads were added, and a second crane was brought in to facilitate daily bag load out. Soil grids were established, and close communication was necessary to avoid cross-contamination of completed grids. Dust control was highly important, as the site had a zero-dust policy. Lab analyses were required for each bag to characterize the radiological activity and for final remedial verification. A combination of closely calibrated field instruments, an onsite lab, and fixed lab turn-around times helped keep the project on schedule. https://mediaclip.guidebook.com/upload/205632/a2GfS2Sd9aIDhm4ht3mjkYlN9N94gsNSGDDs.pdf
More information at https://www.chicago.gov/city/en/sites/carnotite-remediation/home.html

THE CERTAINTIES AND UNCERTAINTIES OF IN SITU THERMAL TREATMENT IN DOWNTOWN SEATTLE A CASE STUDY: SPIC 'N SPAN CLEANERS
Massey, D. I Northwest Remediation Conference, 2 May, Tacoma, Washington, 18 slides, 2024

Electrical Resistance Heating (ERH) was conducted at a former dry cleaner site in Seattle's International Special Review District, as a treatment that would eliminate most contamination without disturbing the building. Care had to be taken to confirm that the subsurface was appropriate for ERH. Bench-scale testing confirmed ERH effectiveness for site soil and contaminants and provided the basis for the full-scale design. The site was divided into four areas based on depth of contamination, and 52 electrodes spaced 15 ft apart were installed into the shallow subsurface. Over 40 vapor recovery wells and a vapor recovery system were installed to capture and convey the permitted discharge. Over ~ 6 months, the cleanup action removed ~800 pounds of air-phase petroleum hydrocarbons and 42 pounds of perchloroethylene. Following 12 months of post-treatment monitoring, contaminant concentrations detected on the property are below cleanup levels. https://pwremediation.com/wp-content/uploads/1A_Massey.pdf

A CASE STUDY IN MANAGEMENT STRATEGIES: DESIGN AND IMPLEMENTATION OF IN-SITU THERMAL TREATMENT VELSICOL BURN PIT SUPERFUND SITE
Knoepfle, J. I DCHWS East 2024 Spring Symposium, 10-12 April, Philadelphia, PA, 17 slides, 2024

This case study presents the application of in situ thermal treatment to illustrate how comprehensive and collaborative planning among stakeholders promotes action and demonstrable steps toward remediating complex Superfund sites. Between 1936 and 1977, a wide array of industrial chemicals, including solvents, pesticides, and flame retardants, were produced by the Velsicol Chemical Corporation and its predecessors, causing wide-scale contamination of soil, groundwater, and sediment of the Pine River, which flows adjacent to the site. Contaminants attributed to site operations were routinely encountered in the residential areas outside the 52-acre site, prompting remediation of shallow soil on >100 properties over 16 city blocks. The diverse range of chemicals handled, manufactured, and disposed of at the site, and protection of the ecological resources surrounding the site, required the integration of multiple remedial technologies. In situ thermal treatment (ISTT) is critical in the restoration process, particularly to protect previously remediated Pine River sediment from upland DNAPL sources. Thermal treatment of ~3 acres is being performed in accordance with the 2015 Record of Decision. Implementing ISTT on this scale presented unique technical, financial, and logistic challenges for the site cleanup. Adaptive management strategies were integrated to develop a phased approach to site remediation. The first remedial activity of three ISTT phases were recently completed, removing ~239,000 lbs of contamination from a treatment volume of ~35,500 yd ^{3}. Phase 3 operations are currently underway. In completing Phase 1 and Phase 2 ISTT operations, integrating adaptive management strategies significantly benefited project stakeholders and served as a cornerstone for project success. Change happens quickly when source zones are heated, and effective management requires adaptive strategies that can provide technical flexibility and balance contractual requirements. Remedial project elements spanning investigation, design, and operation, including optimizing treatment areas, navigating electric power limitations, and developing performance criteria for ISTT system shutdown are discussed. https://drive.google.com/file/d/1dLmXNPUBss-jNPNKfC_X8H-zWxhrAvTr/view
See YouTube video: https://www.youtube.com/watch?v=UGqrDhC_1cY

Demonstrations / Feasibility Studies

SOLAR-POWERED BEDROCK VAPOR EXTRACTION IN DEEP FRACTURED SANDSTONE
Ehret, E. I DCHWS West 2023 Fall Symposium, 25-27 October, Denver, CO, 15 slides, 2023

This presentation focuses on the results of an innovative pilot study conducted at the Fort Hall Mine Landfill as part of remedial design and remedy optimization. Primary chemicals of concern are PCE and TCE, emanating from an unlined cell. The pump and treat remedy in operation since 2002 does not capture all contamination from the source, resulting in a groundwater plume impacting the public water supply. In spring 2023, an injection pilot study was conducted to evaluate the effectiveness of a combined remedy of in situ bioremediation (ISB) and in situ chemical reduction (ISCR) to treat groundwater in a low permeability formation via hydraulic fracturing with a cased borehole. Cased-borehole injections were performed to prevent borehole sloughing and loss of straddle packers and to successfully emplace 176 metric tons of zero-valent iron into two injection boreholes. https://ntrs.nasa.gov/api/citations/20230014694/downloads/DCHWSWest%20BVE%20Presentation.pptx?attachment=true
See pilot study fact sheet: https://www.bannockcounty.us/wp-content/uploads/2022/11/2022_fort_hall_factsheet_110822.pdf

REMEDIATION OF CHLORINATED ETHENES PLUME IN DENMARK BY RETARDATION AND ENHANCED BIODEGRADATION – LESSONS LEARNED
Tuxen, N., D. Harrekilde, L. Bennedsen, M. Broholm, A.S. Fjordboege, and G. Leonard.
AquaConSoil 2023, Prague, Czech Republic, 12-14 September, 15 slides, 2023

A pilot test of Plumestop coupled with enhanced reductive dechlorination (ERD) was conducted to investigate the feasibility of the technology to mitigate a chlorinated ethene plume under Danish conditions at a site in Denmark. The pilot investigated the distribution of amendments, developing a combined set of documentation methods to distinguish between the different remedial processes initiated in the plume, and amendment efficiency. PlumeStop, donor, and bacteria were injected as a barrier across the contaminant plume at a depth of 12-21 m bgs. Monitoring wells were established in three transects perpendicular to the groundwater flow and one transect following the flow direction. Each well was fitted with three screens (~65 total) and ~25 upgradient screens to describe the baseline and track contamination passing into the treatment zone from the source area. Samples from 12 monitoring events were analyzed for CVOCs, ethene, redox parameters, pH, dissolved organic carbon, microbial parameters, and compound-specific isotopes (CSIA) to help interpret degradation and sorption processes. Results showed that the donor was easier to distribute than PlumeStop and bacteria during the first injection event, which was verified by visual observations of water samples and soil cores from near injection points. Degradation stalled at cis-DCE, therefore, a second injection was performed based on a revised design. Monitoring showed a satisfactory distribution of amendments. A sorption capacity analysis was developed to measure PlumeStop distribution and apply CSIA to document degradation. Sorption and degradation dominated in different areas of the injection zone, while amendment effects were found to be insufficient in other areas. Degradation occurred further downgradient from the injection points, creating a reactive treatment zone rather than a strict barrier. Results showed that the technology is suitable for remediating chlorinated ethene plumes when the injection of amendments is designed to be robust. The investigation exposed the diverse conditions that should be considered during the design, injection, monitoring, and maintenance of the technology. https://aquaconsoil.com/assets/3b2_Nina_Tuxen.pdf

RESULTS FROM A 1,4-DIOXANE BIOGEOCHEMICAL REACTOR FIELD PILOT TEST
Walecka-Hutchison, C. I 2023 Bioremediation Symposium Proceedings, 8-11 May, Austin, TX, 18 slides, 2023

This presentation provides an overview of the results from the first two phases of a pilot test of six above-ground biogeochemical reactors (BGRs) treatment trains at a chemical manufacturing facility to treat 1,4-dioxane and residual CVOCs. The pilot was conducted using a series of microcosm reactors filled with different combinations of treatment media, with and without bioaugmentation. Groundwater was pumped from a nearby monitoring well through the six different treatment trains. Three treatment trains were bioaugmented with CB1190 bacteria culture while the remaining treatment trains relied on native site bacteria only. The first phase was completed in 2020 (Treatment Trains 1, 2, 3, and 4) and a second phase was completed in 2021 (Treatment Trains 2, 5, and 6). During each phase, treatment trains were operated between spring and autumn for at least 6 months to monitor 1,4-dioxane and CVOC reductions. Based on field monitoring and analytical data, all six BGR treatment trains were shown to be effective at reducing 1,4-dioxane and CVOC concentrations. During Phase 2, a reduction up to 95 to 98% in 1,4-dioxane was observed in Treatment Trains 5 and 6. Results are being incorporated into a full-scale design for a subgrade BGR to be constructed at the site. Performance results and lessons learned from the above-ground pilot study phases are presented, including target contaminant analytes, field data monitoring, and microbial analyses.
Slides: https://www.battelle.org/docs/default-source/hidden/2023-bio-symp-presentations/track-b/b10_1300_224_hutchison_aurey.pdf?sfvrsn=68e15526_3
Longer abstract: https://www.battelle.org/docs/default-source/hidden/2023-bio-symp-abstracts/224.pdf?sfvrsn=fca71053_3

Research

THE OPTIMIZATION OF POLY(VINYL)-ALCOHOL-ALGINATE BEADS WITH A SLOW-RELEASE COMPOUND FOR THE AEROBIC COMETABOLISM OF CHLORINATED ALIPHATIC HYDROCARBONS
Harris, C.G., H.K. Gedde, A.A. Davis, L. Semprini, W.E. Rochefort and K.C. Fogg.
RSC Sustainability 2:1101(2024)

Poly(vinyl)-alcohol - alginate (PVA-AG) beads were engineered to immobilize ATCC 21198 with the slow-release compound (tetrabutoxysilane [TBOS]) that produces 1-butanol as a growth substrate for high mechanical strength. PVA and AG concentrations and the crosslinking time were optimized on compressive modulus and oxygen utilization rate for batch incubation experiments between 1 and 30 days using a design of experiments approach. The predictive models generated from the experimental design were then tested by measuring the compressive strength, oxygen utilization, and abiotic hydrolysis rates for a predicted optimal bead formulation. Results generated a hydrogel bead with immobilized *R. rhodochrous* ATCC 21198 and TBOS that exhibited a high compressive modulus on day 1 and day 30, which models accurately predicted. The hydrogel beads exhibited low metabolic activity based on oxygen rates on day 1 and day 30 but were not accurately predicted by the models. The ratio between oxygen utilization and abiotic hydrolysis rates was roughly half of what was expected stoichiometrically. The beads' capability as a bioremediation technology was demonstrated for cDCE, which was significantly reduced after 30 days for all bead formulations. https://pubs.rsc.org/en/content/articlepdf/2024/su/d3su00409k

IN VITRO AND IN VIVO REMEDIATION OF PER- AND POLYFLUOROALKYL SUBSTANCES BY PROCESSED AND AMENDED CLAYS AND ACTIVATED CARBON IN SOIL
Wang, M., K.J. Rivenbark, H. Nikkhah, B. Beykal and T.D. Phillips.
Applied Soil Ecology 196:105285(2024)

The efficacy of processed and amended clays and carbons as soil amendments to sequester PFAS and prevent leaching was assessed in a study using PFAS-contaminated soil and validated using sensitive ecotoxicological bioassays. Quartz sand, clay loam soil, garden soil, and compost were spiked with PFOA, PFOS, GenX, and PFBS at 0.01-0.2 µg/mL and subjected to a 3-step extraction method to quantify PFAS leachability from each matrix. The multistep extraction method showed that PFAS leaching from soil was aligned with the total carbon content in soil, and the recovery depended on PFAS concentration. To prevent PFAS leaching, sorbents, including activated carbon (AC), calcium montmorillonite, acid-processed montmorillonite (APM), and organoclays modified with carnitine, choline, and chlorophyll, were added to the four soil matrices at 0.5-4% w/w. PFAS was extracted using the LEAF method. Total PFAS bioavailability was reduced by 58-97% by all sorbents in a dose-dependent manner, with AC being the most efficient sorbent with a reduction of 73-97%. The water leachates and soil were tested for toxicity using an aquatic plant (*Lemna minor*) and a soil nematode (*Caenorhabditis elegans*) to validate the reduction in PFAS bioavailability. Growth parameters in ecotoxicological models showed a dose-dependent reduction in toxicity with value-added growth promotion from the organoclays due to added nutrients. The kinetic studies at varying time intervals and pHs simulating acidic rain, fresh water, and brackish water suggested a stable PFAS sorption on all sorbents that fit the pseudo-second-order for up to 21 days. Contaminated soil with > 0.1 µg/mL PFAS may require amendment reapplication every 21 days. AC showed the highest total PFAS sorption percentage from in vitro studies, while organoclays delivered higher protection in ecotoxicological models (in vivo). Results suggest that in situ immobilization with soil amendments can reduce PFAS leachates and bioavailability to surrounding organisms. Combining sorbents may facilitate the most effective remediation of complex soil matrices containing PFAS mixtures and prevent leaching and uptake into plants.

REMEDIATION OPTIONS TO REDUCE BIOACCESSIBLE AND BIOAVAILABLE LEAD AND ARSENIC AT A SMELTER IMPACTED SITE - CONSIDERATION OF TREATMENT EFFICACY
Alankarage, D., A. Betts, K.G. Scheckel, C. Herde, M. Cavallaro, A.L. Juhasz. I Environmental Pollution 341:122881(2023)

Smelter-contaminated soil was treated with ferric sulfate [Fe2(SO4)3], triple superphosphate (TSP), or biochar to determine their efficacy to immobilize soil Pb and As. Soil incubated with ferric sulfate (0.6M) reduced gastric phase Pb bioaccessibility from 1.939 ± 17 mg/kg to 245 ± 4.7 mg/kg and intestinal phase bioaccessibility reduced from 194 ± 25 mg/kg to 11.9 ± 3.5 mg/kg, driven by plumbojarosite formation. In TSP-treated soil, there were minor reductions in gastric phase Pb bioaccessibility (1,631 ± 14 mg/kg) at the highest TSP concentration (6,000 mg/kg). Greater reductions were observed in the intestinal phase, with bioaccessibility reduced to 9.3 ± 2.2 mg/kg, primarily driven by chloropyromorphite formation in the intestinal phase following Pb and phosphate solubilization in the low pH gastric fluid. At the highest concentration (10% w/w), biochar-treated soil showed negligible decreases in Pb bioaccessibility in both gastric and intestinal phases. Validation of bioaccessibility outcomes using an in vivo mouse assay led to similar results, with treatment effect ratios of 0.20 ± 0.01, 0.76 ± 0.11, and 1.03 ± 0.10 for ferric sulfate (0.6M), TSP (6,000 mg/kg) and biochar (10% w/w) treatments. In vitro and in vivo assays showed that only ferric sulfate treatments significantly reduced As bioaccessibility and bioavailability with TER at the highest application of 0.06 ± 0.00 and 0.14 ± 0.04, respectively.

DEVELOPMENT OF CERAMIC MEMBRANES WITH CONTROLLABLE PFAS MASS TRANSFER FOR PASSIVE SAMPLING APPLICATIONS

Qiang, Z., X. Min, Y. Wang, and X. Ma.
Chemical Engineering Journal Advances 16:100562(2023)

A study's primary objective was to develop ceramic membranes with controllable PFAS diffusion and mass transfer suitable for PFAS passive sampling applications. PFAS diffusion through ceramic membranes strongly depended on membrane structures and properties, particularly membrane porosity. By controlling membrane fabrication conditions, including particle size, membrane material morphology, sintering temperature, and ceramic membranes with a range of PFAS diffusivities and mass transfer rates were obtained that varied by over two orders of magnitude, which substantially expanded the limits of polyethersulfone membranes. Modifying ceramic membranes with a thin TiO2 layer did not influence PFAS mass transfer. Integrative passive samplers consisting of ceramic membranes and a sorbent receiving phase were then developed and assessed through calibration studies. Passive samplers showed linear PFAS uptake up to 25 days. PFAS sampling rates were affected by both the type of ceramic membranes and the PFAS structures. Results demonstrated the proof-of-concept of using ceramic membranes in PFAS passive sampling applications.
https://www.sciencedirect.com/science/article/pii/S2666821123001199/pdfft?md5=aa71b37916a7ee74f0ce93b0a0f5fbb7&pid=1-s2.0-S2666821123001199-main.pdf

ANALYSIS OF COLLOIDAL ACTIVATED CARBON ALTERNATIVES FOR IN SITU REMEDIATION OF A LARGE PFAS PLUME AND SOURCE AREA

Carey, G.R., R.H. Anderson, P. Van Geel, R. McGregor, K. Soderberg, A. Danko, S. Gilak Hakimabadi, A. Le-Tuan Pham, and M. Rebeiro-Tunstall.
Remediation 34(1):e21772(2024)

A study evaluated optimal locations for in situ PFAS remediation in groundwater with colloidal activated carbon (CAC). New Freundlich isotherms for PFAS adsorption to CAC were estimated to illustrate the effect of competitive adsorption with dissolved organic carbon and other PFAS in a groundwater sample. A hypothetical model scenario was constructed based on source area characteristics similar to an AFFF-impacted site in South Dakota. Modeling indicates that, even with high PFAS concentrations, CAC could maintain concentrations below the proposed maximum contaminant levels in the adsorption zone for at least 30-40 years. 2D areal modeling indicates that future PFAS breakthrough will likely occur in the localized core of the plume and that corresponding future CAC reinjection will only need to be conducted over a smaller portion of the original injection footprint. Source area and mid-plume CAC treatments were ineffective at attenuating PFAS concentrations at the downgradient property boundary within a reasonable timeframe when PFAS travel time was relatively slow. Among the CAC alternatives evaluated, a downgradient CAC permeable reactive barrier showed the best performance in protecting downgradient receptors. https://onlinelibrary.wiley.com/doi/epdf/10.1002/rem.21772

FLUORESCENT DYES AS PARTITIONING TRACERS FOR THE ESTIMATION OF NAPL-MASS SATURATION IN POROUS MEDIA

Visitacion-Carrillo, S., S. Colombano, N. Fatin-Rouge, and D. Davarzani.
Groundwater Monitoring & Remediation 43(4):82-91(2023)

Five fluorescent dyes were assessed as partitioning tracers (PTs) to estimate the octanol and complex mixture saturation of chlorinated organic compounds (COCs) and NAPLs in soil columns. PT experiments required an initial assessment of partitioning (NAPL/water and octanol/water) and linear free-energy relations. Partition coefficient predictability was correlated to the pH of the two-phase fluids for both NAPL/water and octanol/water. The COC-NAPLs were acidic, and some PTs with acid-base properties were easily influenced by pH. Partitioning interwell tracer test experiments were performed in a column packed with glass beads using rhodamine water tracer (WT) as PT due to its specificity for the complex mixture of NAPLs and sodium chloride as the inert tracer. Breakthrough curves of rhodamine WT were examined to estimate the saturation of a NAPL made of a complex mixture of COCs. The DNAPL residual saturation estimation accuracy was sensitive to pH variations and the water velocity. The latter was represented by an exponential function resulting from non-equilibrium measurements, heterogeneous sweeping of the contaminated sample, and redistribution of the NAPL droplets in the medium. https://ngwa.onlinelibrary.wiley.com/doi/epdf/10.1111/gwmr.12591

General News

PANDORA'S PFAS BOX: LIFE CYCLE EXPOSURE CONSIDERATIONS OF TREATMENT OPTIONS FOR PFAS IN GROUNDWATER

L.C. Hall, J.T. Wilson, and J.G.A. Birnstingl l Remediation 34(2):e21775(2024)

This commentary considers four PFAS remediation technologies (granular activated carbon, ion-exchange resin, foam fractionation, and in situ remediation with colloidal activated carbon) and identifies places in the life cycle that have the potential for environmental releases from the handling, transport, disposal, regeneration, and/or destruction of remediation wastes. It also identifies where those releases have the potential to result in human exposure to PFAS, focusing on the long-chain PFAAs and using PFOA and PFOS as examples.
https://onlinelibrary.wiley.com/doi/epdf/10.1002/rem.21775

COMMERCIAL-SCALE REMOVAL OF SHORT-CHAIN PFAS IN A BATCH-WISE ADSORPTIVE BUBBLE SEPARATION PROCESS BY DOSING WITH CATIONIC CO-SURFACTANT

Stevenson, P. And S.I. Karakashev. Remediation 34(1):e21767(2024)

Previous studies demonstrated that surface active foam fractionation (SAFF) effectively removes most PFAS from contaminated groundwater and landfill leachate. However, PFAS species with very low adsorption coefficients to bubble surfaces are difficult to remove, parallel to the difficulties in removing short-chain PFAS in granulated activated carbon beds and other solid media. The adsorption coefficient to bubble surfaces improves in the presence of electrolytes in solution, which has been shown to improve PFAS removal. By developing a correlation for the removal percentage of various PFAS species due to SAFF in commercial-scale processes as a function of the adsorption coefficient, it is possible to obtain a general estimate of the removal percentage of any PFAS. Adding cetrimonium bromide to the feed can significantly further improve the adsorption coefficient and, consequently, materially improve short-chain PFAS removal during SAFF. A method for estimating the improved performance is in qualitative agreement with plant trials of SAFF at a site with a history of groundwater contamination due to AFFF use, but the precise improvements appear to be dependent upon the concentration of the added co-surfactant. The required concentration of co-surfactant is significantly larger than might be expected on charge equivalence considerations, which may be due to its consumption by other species in the feed, including PFAS that have not been accounted for.

BIOREMEDIATION FOR SUSTAINABLE ENVIRONMENTAL CLEANUP

Malik, A. and V.K. Garg. (eds.) CRC Press, Boca Raton. eBook ISBN: 9781003277941, 322 pp, 2024

This book describes the state-of-the-art on emerging bioremediation approaches employed for sustainable environmental cleanup of diverse environmental contaminants such as metal(loid)s, PAHs, dyes, pesticides, and petroleum hydrocarbons, using bacteria, fungi, algae, higher plants, and novel materials like biohybrids, nano-biomaterials, and graphitic carbon nitride (g-C3N4). Different bioremediation strategies such as biosorption, bioprecipitation, bioaccumulation, biodegradation, and biotransformation are described in detail.
TOC: https://www.taylorfrancis.com/books/edit/10.1201/9781003277941/bioremediation-sustainable-environmental-cleanup-anju-malik-vinod-kumar-garg?refId=fc9c1666-23b2-4453-bf64-f8331b2dd356&context=ubx

MODPATH-RW: A RANDOM WALK PARTICLE TRACKING CODE FOR SOLUTE TRANSPORT IN HETEROGENEOUS AQUIFERS

Perez-Illanes, R. and D. Fernandez-Garcia. Groundwater [published online 27 January 2024 before print]

This article presents a solute transport code that implements the random walk particle tracking (RWPT) method by extension of MODPATH, which provides the base infrastructure for interacting with several variants of MODFLOW groundwater flow models. Implementation is achieved by developing a method for determining the exact cell-exit position of a particle undergoing simultaneous advection and dispersion, allowing for the sequential transfer of particles between flow model cells. The program is compatible with rectangular unstructured grids and integrates a module for the smoothed reconstruction of concentrations. In addition, the program incorporates parallel processing of particles using the OpenMP library, enabling faster simulations of solute transport in heterogeneous systems. Numerical test cases involving different applications in hydrogeology benchmark the RWPT model with well-known transport codes.
https://ngwa.onlinelibrary.wiley.com/doi/epdf/10.1111/gwat.13390

A MULTIPLE LINES OF EVIDENCE APPROACH TO DEMONSTRATE EFFECTIVENESS OF PFAS REMEDIATION TECHNOLOGIES

Wanzek, T., E. Hawley, J. Merrill, R. Deeb, D. Sedlak, J. Field, and C. Higgins.
Groundwater Monitoring & Remediation 44(2):30-38((2024)

Significant investments have been made to develop treatment technologies, particularly destructive approaches, for various PFAS present in groundwater, surface water, and other environmental media. Multiple lines of evidence approach was developed to assist regulators, funding agencies, and practitioners to evaluate PFAS treatment technology performance. This article describes three lines of evidence that a technology is effective: (1) a decrease in target PFAS concentrations is observed; (2) PFAS treatment transformation products are identified and quantified; and (3) a treatment mechanism is proposed that is consistent with previous studies and supported by data. Other considerations are also described to inform conclusions about knowledge gaps and priorities for future testing. Collectively, these lines of evidence and other considerations help communicate the complexities of PFAS treatment, strengthen research plans, standardize technology evaluator reviews, and inform realistic expectations of PFAS treatment technologies.

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 (703) 603-9915 with any comments, suggestions, or corrections.

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