Technology Innovation News Survey

Entries for February 1-15, 2024

Market/Commercialization Information

F -- NTCRA OF CONTAMINATED SOIL AT VIRGIN ISLANDS NP (PRESOL)

U.S. Department of Interior National Park Service, PWR OLYM MABO, Port Angeles, WA
Contract Opportunities on SAM.gov 140P2124R0023, 2024

When this solicitation is released on or about March 26, 2024, it will be competed as a total small business set-aside under NAICS code 562910. The U.S. Department of Interior National Park Service requires a contractor to implement a Non-Time Critical Removal Action (NTCRA) work plan at Caneel Bay Resort in Virgin Islands National Park. The work includes removing approximately 13,000 bank cubic yards (BCY) of contaminated soil and landfill refuse and approximately 40 loose CY of contaminated sediment, transporting it to appropriate disposal facilities on the mainland, and performing limited site restoration, such as spreading and compaction of clean fill and/or stockpiled soil, grading, preparation of topsoil, seeding. The estimated removal quantities are based on previous site investigations. The contract will use unit-priced items subject to the variation in quantity clause in conjunction with an established ceiling and notification requirements. A group site visit is scheduled on Wednesday, April 3, 2024, at 9:00 AM AT. No access will be granted to Caneel Bay Resort for parties unable to attend the formal group site visit; requests for individual site visits will not be honored. There is no solicitation at this time. https://sam.gov/opp/8a42c248ea054007bb37896aa64a1ce3/view

F -- FUSRAP REMEDIATION SERVICES (SOL)

U.S. Army Corps of Engineers, North Atlantic Division, Philadelphia District, Philadelphia, PA
Contract Opportunities on SAM.gov W912BU24R0017, 2024

This is a total small business set-aside under NAICS code 562910. The U.S. Army Corps of Engineers (USACE) seeks firms to remediate the Formerly Utilized Sites Remedial Action Program site located at the Former DuPont Chambers Works site in Deepwater, New Jersey. The Scope of Work for the SATOC includes the removal of radioactively contaminated soil and ancillary groundwater from Areas of Concern at the Chambers Works property in accordance with the Record of Decision and Explanation of Significant Differences. Remediation services may also include other identified contaminated areas at the DuPont Site as a result of ongoing investigation work. Constituents of concern are uranium, thorium, and radium, specifically, U-234, U-235, U-238, Th-230, and Ra-226. The award will be a five-year Indefinite Delivery/Indefinite Quantity (IDIQ) single-award task order contract. Offers are due by 3:00 PM EDT on April 4, 2024. https://sam.gov/opp/1dc6fc00e2c24cb2b7356760ffce201f/view

$35M SDVOSB RAPID RESPONSE SATOC

U.S. Army Corps of Engineers, Northwestern Division, Omaha District, Omaha, NE
Contract Opportunities on SAM.gov W9128F24R0058_Solicitation, 2024

This solicitation will be competed as a service-disabled veteran-owned small business (SDVOSB) set-aside under NAICS code 562910. The contract awarded under this solicitation will be an Indefinite Delivery/Indefinite Quantity (IDIQ) Single Award Task Order Contract (SATOC) for RapidResponse/Immediate Response/Emergency Response (RR/IR/ER), Environmental Remediation (ERS) Services, and Other Mission Related SupportServices under NAICS Code 562910, in support of the US Army Corps of Engineers (USACE) and its customers CONUS (Continental United States), including Alaska and Hawaii, and outlying areas within South Atlantic Division(SAD) Areas of Responsibilities (AORs). The contract awarded will include bothcost reimbursement and firm fixed price task orders, for response actions andremediation of various hazardous waste sites. Offers are due by 2:00 PM CT on April 13, 2024. https://sam.gov/opp/5c4e0153dbaa4274b12e1ac0b33aae71/view

Cleanup News

MANAGING THE REMEDIATION STRATEGY OF CONTAMINATED MEGASITES USING FIELD-SCALE CALIBRATION OF GEO-ELECTRICAL IMAGING WITH CHEMICAL MONITORING

Levy, L., T.S. Bording, G. Fiandaca, A.V. Christiansen, L.M. Madsen, L.F. Bennedsen, T.H. Jorgensen, L. MacKinnon, and J.F. Christensen.
Science of The Total Environment 920:171013(2024)

Source zone remediation at the Kaergard Plantation megasite in Denmark was monitored using high-resolution cross-borehole electrical resistivity tomography (XB-ERT) imaging calibrated by chemical analyses of groundwater samples. Remediation of high levels of toxic NAPL was conducted using in situ chemical oxidation with activated persulfate. It may take numerous injection points with extensive injection campaigns to distribute reagents, which requires an understanding of how reagents may be transported within the aquifer. A geophysical (XB-ERT) monitoring network of unprecedented size was installed to identify untreated zones and help manage the remediation strategy. The combination of spatially continuous geophysical information with discrete but precise chemical information allowed detailed monitoring of sulfate distribution, produced during persulfate activation. Untreated zones identified in the first remediation campaign were resolved in the second campaign. Monitoring allowed for adjusting the number of injection screens and the injection strategy from one campaign to the next, resulting in better persulfate distribution and contaminant degradation in the second campaign. Geophysical transects repeated during the remediation campaign allowed high-resolution time-lapse imaging of reagent transport, which can improve the predictability of transport models compared to only using *a priori* assumptions of the hydraulic conductivity field.

SUPERCRITICAL WATER OXIDATION FOR PFAS DESTRUCTION IN VARIOUS MATRICES

Deshusses, M., S. McKnight, and S. Viswanathan. | 2023 Bioremediation Symposium Proceedings, 8-11 May, Austin, TX, 18 slides, 2023

This presentation describes the containerized AirSCWO™ 6 system, its specifications, and its capabilities in terms of treating various matrices (aqueous solutions and slurries of GAX and IX), and how the system can be integrated with various remediation activities (AFFF replacement, GAC/IX treatment, etc.). PFAS destruction was investigated in supercritical water oxidation (SCWO) systems at different scales, including a continuous pilot SCWO system that can treat up to 1 ton of waste per day, including PFAS rinsates, landfill leachate, AFFF dilutions, spent GAC and IX, and a bench-scale SCWO apparatus for kinetic determinations, organofluorine fate, and fluorine balance closure. Construction of the first commercial AirSCWO system, which has a capacity of 6 wet tons/day, can treat 0.5 to 1.5 ton per day of dry material such as GAC or IX resin. Detailed treatment data for selected PFAS wastes are presented, including large-scale treatment of rinsates and various waste matrices containing PFAS with concentrations up to 1 g/L. Generally, elimination of > 99% or higher of total influent PFAS was observed, often yielding non-detect PFAS concentrations in the treated effluent. Notably, transformation of high molecular weight PFAS into lower molecular weight PFAS or volatile species, was not evident. Test runs conducted with spent GAC and IX demonstrated that these could be treated with very high PFAS elimination efficiencies. Generally, PFCAs were eliminated to a greater degree than PFSAs or precursors, and elimination of short-chain (<C6) PFAS was lower than long-chain PFAS. Elimination could be tailored to achieve a specific degree of destruction by adjusting reaction time and temperature. The focus of lab SCWO determinations was on kinetic determinations and closing of the fluorine balance. Specific rate constants were obtained for individual PFAS, confirming the reactivity trend.
Slides: https://www.battelle.org/docs/default-source/hidden/2023-bio-symp-presentations/track-b/b5_1210_194_desbusses.pptx.pdf?sfvrsn=6b0c5231_3
Longer abstract: https://www.battelle.org/docs/default-source/hidden/2023-bio-symp-abstracts/194.pdf?sfvrsn=e282c613_3
See YouTube video of AirSCWO process: https://www.youtube.com/watch?v=2jVyIQ98ZV8

CONTAINMENT OF A 1,4-DIOXANE PLUME USING TREEWELL® PHYTOREMEDIATION TECHNOLOGIES

Gale, C. and F. Volkering. | 2023 Bioremediation Symposium Proceedings, 8-11 May, Austin, TX, poster, 2023

A remedial alternative utilizing a TreeWell system was designed based on site hydrologic calculations, site lithology, and accounting for the space available for planting at an active chemical plant. Historical operations resulted in elevated concentrations of 1,4-dioxane in groundwater, with concentrations as high as 1,500 mg/L, migrating towards a nearby surface water body. The system was installed to target groundwater impacts from 5 to 11 meters bgs. A total of 240 TreeWell units were installed and planted with poplars. The system was designed for the trees to consume 1,4-dioxane-impacted groundwater and transpire the 1,4-dioxane to the atmosphere where it would ultimately be photodegraded in the atmosphere, thus preventing the 1,4-dioxane-impacted groundwater from reaching the nearby surface water body. Groundwater monitoring results since the trees were planted in 2014 demonstrate that the TreeWell units actively draw the groundwater plume into the phytoremediation area during the active growing season, providing the desired containment. Evaluations of the 1,4-dioxane mass being transpired by the trees indicated that < 0.1% of the mass being drawn into the phytoremediation area was being transpired into the atmosphere. Additional investigations proved that 1,4-dioxane-degrading activity is present in soil from within the TreeWell units. The occurrence of 1,4-dioxane biodegradation was supported by the detection of genes encoding for dioxane monooxygenase and aldehyde dehydrogenase, enzymes associated with 1,4-dioxane biodegradation. The data indicates the efficacy of a TreeWell based alternative for addressing 1,4-dioxane in groundwater.
Poster: https://www.battelle.org/docs/default-source/hidden/2023-bio-symp-posters/b10_248_poster_gale.pdf?sfvrsn=20710c10_3
Longer abstract: https://www.battelle.org/docs/default-source/hidden/2023-bio-symp-abstracts/248.pdf?sfvrsn=3ae09124_3

Demonstrations / Feasibility Studies

A COMPREHENSIVE TRIAL ON PFAS REMEDIATION: HEMP PHYTOEXTRACTION AND PFAS DEGRADATION IN HARVESTED PLANTS

Nason, S.L., S. Thomas, C. Stanley, R. Silliboy, M. Blumenthal, W.L. Zhang, Y.N. Liang, J.P. Jones, N. Zuverza-Mena, J.C. White, C.L. Haynes, V. Vasiliou, M.P. Timko, and B.W. Berger.
Environmental Science: Advances 3:304-313(2024)

The Mi'kmaq Nation, Upland Grassroots, and researchers at several institutions participated in a collaborative project that involved phytoremediation field trials using hemp to remove PFAS from soil at the former Loring Air Force Base. PFAS were analyzed in paired hemp and soil samples using targeted and non-targeted analytical approaches. Hydrothermal liquefaction (HTL) degraded PFAS in the harvested hemp tissue. The study identified 28 PFAS in soil and found that hemp had removed 10 of these PFAS via uptake. Hemp exhibited greater bioconcentration for carboxylic acids and shorter-chain compounds compared to sulfonic acids and longer-chain. In total, ~1.4 mg of PFAS was removed from the soil and into hemp stems and leaves, with a ~2% maximum PFAS removed from the soil in the most successful area. PFAS degradation by HTL was ~100% for carboxylic acids, though some sulfonic acids remained. HTL decreased precursor PFAS and extractable organic fluorine. While hemp phytoremediation is not a comprehensive solution for PFAS-contaminated soil, the project effectively reduced PFAS levels at the Loring site and underscores the importance of involving community members in research to remediate their lands. https://pubs.rsc.org/en/content/articlepdf/2024/va/d3va00340j *Also see article from iScience on the project:* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8324804/pdf/main.pdf

INTERPRETATION OF LARGE-SCALE, LONG-TERM ELECTRICAL GEOPHYSICAL MONITORING GUIDED BY A PROCESS SIMULATION

Robinson, J., T. Johnson, J. Thomle, J. Cambeiro, K. Peta, P. Jaysaval, and R. Mackley.
Vadose Zone Journal 23(2):e20303(2024)

The BC Cribs and Trenches (BCCT) site at Hanford contains 20 disposal trenches and 6 disposal cribs. Wastes include a large inventory of ^{99}Tc and large masses of nitrate and 238U. Surface electrical resistivity tomography (ERT) was used to monitor vadose zone changes in electrical properties as a proxy for contaminant flux over 17 years. ERT data were collected along 41 profiles in 2005 to characterize regions of elevated bulk electrical conductivity (BEC) associated with past liquid waste discharges. Previous analyses performed on samples from four boreholes showed a high correlation between nitrate concentration and BEC. In 2022, ERT data were re-collected along the same profiles and six additional profiles in an area not previously surveyed. Compared to background uncontaminated areas, BEC was higher in contaminated areas at the waste sites. Given the correlation between nitrate concentration and BEC at this site, ERT images show the spatial distribution and relative ionic concentration of vadose zone contaminants at BCCT. Between 2005-2022, ERT difference images showed a decrease in BEC surrounding most waste sites except where there were known anthropogenic surface changes. Evaluating recharge-driven nitrate migration using synthetic flow and transport simulations showed that downward migration causes a decrease in BEC from the decrease in ionic strength at the trailing end of the plume where contaminants migrated downward. ERT difference images were interpreted as showing the predominant regions of downward ion flux. https://acsess.onlinelibrary.wiley.com/doi/epdf/10.1002/vzj2.20303

HIGH-RESOLUTION PASSIVE PROFILING TO MONITOR CONTAMINATED SEDIMENTS IN SUPPORT OF REMEDIATION EVALUATION AND RISK CHARACTERIZATION

Jackson, A., ESTCP Project ER-201734, 360 pp, 2022

The overall objective of this project was to demonstrate a sediment High-Resolution Passive Profiler (sHRPP) capable of evaluating the bioavailable distribution of contaminants (metals and organics) in sediments via passive sampling at cm vertical resolution while simultaneously evaluating dominant redox processes at the same resolution, key gene/microbial densities, and pore water velocity. The sHRPP is driven into the sediment and can sample depths as deep as ~80cm. The sHRPP can evaluate at fine-scale: (1) contaminant types and concentrations using either equilibration cell water (e.g., metals, cVOCs, VQCs) or by incorporating solid-phase microextraction fibers for HOCs (e.g., PCBs, PAHs, DDX); (2) the concentrations of biogeochemical species

(e.g. DOC, Cl, NO_3^-, NO_2^-, Fe^{+2}, FeT, SO_4^{-2}, S^{-2}, CH_4, etc.); (3) pore water velocity; and (4) the composition of relevant microbial communities via qPCR analysis of Bio-Sep beads. The ability of the sHRPP to improve the measurement of the occurrence, fate, and transport of contaminants in sediment was demonstrated at four sites. The sHRPP was able to measure key contaminant concentrations at equal or greater sensitivity than comparable traditional technologies. It produced high-resolution concentration profiles of geochemical species and measured pore water velocities with depth, providing increased model resolution and reliability and increased statistical power to evaluate the impact of remedial efforts. The technology required less cost, time, and effort to evaluate sites and produced data not obtainable by traditional methods.
https://serdp-estcp-storage.s3.us-gov-west-1.amazonaws.com/s3fs-public/2023-11/ER-201734%20Final%20Report.pdf?VersionId=QYDJ4SWTaITwGAVzln1qp1UQ..gPtiUm
See YouTube video on assembly: https://www.youtube.com/watch?v=xRPQ3k3TAkc
See YouTube video on design and application: https://www.youtube.com/watch?v=n1u9ftT-xZM
See Executive Summary of Project:
https://serdp-estcp-storage.s3.us-gov-west-1.amazonaws.com/s3fs-public/2023-11/ER-201734%20Executive%20Summary.pdf?VersionId=4Qj4_HIZGG54_ZLYrWCnoBVantMKNf9U

UPTAKE AND TRANSFORMATION OF HEXACHLOROCYCLOHEXANE ISOMERS (HCHS) IN TREE GROWTH RINGS AT A CONTAMINATED FIELD SITE
Liu, X., S. Kummel, S. Trapp, and H.H. Richnow.
Environmental Science & Technology 57(23):8776-8784(2023)

A field study investigated the fate of hexachlorocyclohexane isomer (HCH), particularly α-HCH, in tree trunks using multielement compound-specific isotope analysis (ME-CSIA) and enantiomer fractionation. Results indicate that α-HCH was transformed, as evidenced by higher $\delta^{13}C$ and $\delta^{37}Cl$ values detected across different growth ring sections and in the bark compared to those in muck and soil. Notably, $\delta^{13}C$ values of HCH in the middle growth ring section, were only marginally higher or comparable to those in muck, whereas $\delta^{37}Cl$ values were higher than those of the muck, indicating a different transformation mechanism. The $\delta^{37}Cl$ values of β-HCH also increased in the tree trunks compared to those in soil and muck, implying a transformation of β-HCH. Dual-element isotope analysis revealed different transformation mechanisms between the middle growth rings and other sections. Findings suggest that the transformation of HCHs in trunks can bias quantitative phytoscreening approaches; however, ME-CISA offers an option to estimate the degradation extent.

Research

MECHANISTIC INSIGHTS INTO THE SELECTIVITY FOR ARSENIC OVER PHOSPHATE ADSORPTION BY Fe^{3+} -CROSS-LINKED CHITOSAN USING DFT
Nwokonkwo, O. and C. Muhich. | The Journal of Physical Chemistry B 128(7):1689-1699(2024)

A study employed ab initio calculations to compare the competitive binding of As(V), P(V), and As(III) to neat chitosan and Fe^{3+}-chitosan. Neat chitosan failed to selectively bind As oxyanions, as all three oxyanions bound similarly via weak hydrogen bonds with preferences of P(V) = As(V) > As(III). Conversely, Fe^{3+}-chitosan selectively bound As(V) over As(III) and P(V) with binding energies of -1.9, -1, and -1.8 eV for As(V), As(III), and P(V), respectively. The preferences were due to varying Fe^{3+}-oxyanion donor-acceptor characteristics, forming covalent bonds with distinct strengths (Fe-O bond ICOHP values: - 4.9 eV/bond for As(V), - 4.7 eV/bond for P(V), and -3.5 eV/bond for As(III)). Differences in p K_a between As(V)/P(V) and As(III) precluded any preference for As(III) under typical environmental pH conditions. Calculations suggest that the binding selectivity of Fe^{3+}-chitosan is pH-dependent. The findings enhance understanding of the Fe^{3+}-oxyanion interaction crucial for preferential oxyanion binding using Fe^{3+}-chitosan and provide a lens for further exploration into alternative transition-metal-chitosan combinations and coordination chemistries for applications in selective separations.

GREEN-ENGINEERED CLAY- AND CARBON-BASED COMPOSITE MATERIALS FOR THE ADSORPTION OF BENZENE FROM AIR
Rivenbark, K.J., K. Lilly, M. Wang, P. Tamamis, and T.D. Phillips.
Journal of Environmental Chemical Engineering 12(1):111836(2024)

In this study, composites derived from natural clay minerals and activated carbon were individually green-engineered with chlorophylls, attached to the surface of filter materials, and then assessed for benzene adsorption from air using in vitro and in silico methods. Isothermal, thermodynamic, and kinetic experiments indicated that all green-engineered composites had improved binding profiles for benzene, as demonstrated by increased binding affinities ($K_f \geq 900$ vs 472) and lower values of Gibbs free energy (ΔG = -16.8 vs -15.2) compared to activated carbon. Adsorption of benzene to all composites was achieved quickly (< 30 min), and the green-engineered composites also showed low levels of desorption (≤ 25%). While free chlorophyll is known to be photosensitive, chlorophylls in the green-engineered composites showed photostability and maintained high binding rates (≥70%). In silico simulations demonstrated the significant chlorophyll contribution to the overall binding of benzene in clay systems and that chlorophyll could contribute to benzene binding in the carbon-based systems.

BENCH-SCALE TESTING OF A NOVEL SOIL PFAS TREATMENT TRAIN FOR INFORMED REMEDIAL PLANNING AND DECISION-MAKING
Nguyen, D., C.E. Schaefer, J.T. Bamer, H.A. Lanza, D. Wintle, K.G. Maynard, P. Murphy, R.H. Anderson. | Remediation 33(4):309-321(2023)

A novel treatment train coupling soil washing to treat PFAS-impacted soil/sediment with foam fractionation, to treat the wash water (WW) generated during soil washing, and electrochemical oxidation (ECO) to treat the foam fractionate generated during foam fractionation was evaluated at bench scale using site-specific materials from Schriever Space Force Base. AFFF-impacted sandy soils with low organic content were amenable to treatment via soil washing. However, removing hydrophobic PFAS, such as PFOS, from the organic-rich sediments was challenging. Results from batch desorption experiments were within a factor of 2 of those generated by soil washing bench studies, suggesting that simple batch tests can potentially be used to reasonably predict the treatment efficacy of soil washing. Long-chained PFAAs within the WW were removed more effectively in the foam fractionation studies than short-chain PFAAs. Adding a surfactant, such as cetrimonium bromide, enhanced foaming but only marginally improved the treatment of short-chained PFAAs and, in some cases, inhibited PFOS removal. ECO reduced PFAS concentrations in the foam fractionate generated during foam fractionation by several orders of magnitude. However, generating unwanted byproducts may warrant further treatment and/or disposal. Overall, results provide a novel data set highlighting the site-dependent nature of the PFAS remedial technologies and how simple, low-cost bench tests can be reliably leveraged for informed decision-making during PFAS remedial planning.

STABILIZATION AND SOLIDIFICATION OF A CLAY SOIL CONTAMINATED WITH MTBE BY USING MGO AND HYDRATED LIME
Estabragh, A.R., A. Ansar Shourijeh, K. Rezaei, A.A. Javadi, and M. Amini.
Soil and Sediment Contamination: An International Journal 33(2):175-194(2024)

A study was conducted on the effect of MgO and hydrated lime on the remediation of clayey soil contaminated with MTBE. Soil was artificially contaminated by adding 2.25g MTBE/kg soil. Different percentages of MgO (0.125, 0.25, 0.5, 5, 10, and 20%) and lime (2.5, 5, and 10%) were added to the natural and contaminated soil. Results showed that by increasing the percentage of MgO or lime and curing time, the strength of natural and contaminated soil improved. Leaching test results showed that adding 5, 10, or 20% MgO removed the existing MTBE in the soil samples. There was a decrease in MTBE concentrations over time for the smaller percentages of MgO (0.125, 0.25, and 0.5%). Leaching test results also revealed that the hydrated lime effectively reduced MTBE concentrations. The reduction in MTBE concentration depended on the percentage of MgO or hydrated lime. Comparing the results of the two binders showed that MgO was more effective than hydrated lime in removing MTBE.

IN-SITU CO-REMEDIATION OF PAHS CONTAMINATED AGRICULTURAL SOIL USING BLOOD MEAL AND CELERY: AN AGRICULTURAL GREENHOUSE FIELD STUDY
Wu, H., H. Wang, T.R. Walke, X. Wang, Y. Wang, and L. Sun.
Soil and Sediment Contamination: An International Journal 32(7):878-892(2023)

An in situ co-remediation of PAH-contaminated soil using blood meal and celery was assessed in an agricultural greenhouse to develop a cost-effective remediation technique to degrade PAH in the soil without disturbing crop production. Results showed PAH dissipation rates increased significantly in agricultural soil when co-remediated by blood meal and celery. Planting celery and the addition of 5 g/kg blood meal removed 53.13% of PAHs within three months. Residual PAH concentrations in plant tissue were much lower than China's Standard food limits. Results indicated that the ability of celery to enhance the bioavailability of PAHs and create favorable conditions for microbial rather than direct plant uptake played a vital role in PAH degradation. The optimal addition of blood meal (5 g/kg) significantly enhanced soil enzyme activity and increased PAH degrading bacterial activity, acting as the main remediation pathway to co-remediate PAHs.

A PROBABILISTIC ASSESSMENT OF SURFACE WATER-GROUNDWATER EXCHANGE FLUX AT A PCE CONTAMINATED SITE USING GROUNDWATER MODELLING
Hoglund, N.B., C. Sparrenbom, and R. Hugman. | Frontiers in Earth Science 11:1168609(2023)

A groundwater numerical decision-support model was developed at a site in Sweden to help formulate targeted remediation strategies to mitigate the discharge of groundwater contaminated with chlorinated solvents to a stream. To facilitate reproducibility, the modeling workflow was scripted. The model was designed to quantify and reduce the uncertainty of surface water-groundwater (SW-GW) exchange fluxes from 2016 to 2020 through history-matching. In addition to classical observations, thermal anomalies detected in fiber optic distributed temperature sensing measurements were used to inform the model of groundwater discharge. After assessing SW-GW exchange fluxes, measurements of surface water chemistry were used to provide a probabilistic estimation of mass influx and spatiotemporal distributions of contaminated groundwater discharge. Results show that 1) SW-GW exchange fluxes are likely to be significantly larger than previously estimated, and 2) prior estimations of mass influx are located near the center of the posterior probability distribution. Based on these results, decision-makers should focus remediation action on specific stream segments. https://www.frontiersin.org/articles/10.3389/feart.2023.1168609/pdf?isPublishedV2=False

SUPERCRITICAL WATER OXIDATION FOR THE DESTRUCTION OF SPENT MEDIA WASTES GENERATED FROM PFAS TREATMENT
Chiang, S.-Y.D., M. Saba, M. Leighton, D. Ballenghien, D. Hatler, J. Gal, and M.A. Deshusses.
Journal of Hazardous Materials 460:132264(2023)

A project studied using supercritical water oxidation (SCWO) to destroy both the spent media (granular activated carbon [GAC] and anion exchange resin [AIX]) and the PFAS adsorbed onto it. A sample of spent GAC and spent AIX were collected from full-scale groundwater remediation systems treating PFAS. A second spent AIX sample was collected from a mobile PFAS treatment unit. The total PFAS concentrations reported in the GAC, AIX and second AIX feedstock slurries were 0.21, 1.3, and 0.9 mg/kg, respectively. Each feedstock was processed in a 1 wet metric ton/day tubular reactor SCWO system. SCWO was very effective; spent media were completely mineralized to water, CO2, and a negligible amount of residual minerals. Total target PFAS compound concentrations in the SCWO system effluents after treating spent GAC, AIX, and second AIX feedstocks were 548, 77, and 796 ng/L, respectively. Results indicated that the percentage elimination of PFCAs was better than that of PFSAs, and long-chain PFAS elimination was better than short-chain PFAS.

General News

INTRODUCTION TO SUSTAINABLE REMEDIATION
CL:AIRE SuRF (Sustainable Remediation Forum UK) bulletin, 5 pp, October 2023

This bulletin introduces the concept of sustainable remediation and some of the main guidance and tools available on this subject. It is prepared for those interested in applying sustainability principles to land contamination risk management. Topics covered include: 1) What is sustainable remediation? 2) Why should we be considering sustainable remediation? 3) Approach to sustainable remediation. 4) Sustainability indicators. 5) Other things to consider for sustainable remediation. 6) Overlaps with other initiatives, including the United Nations Sustainable Development Goals. https://www.claire.co.uk/component/phocadownload/category/16-surf-uk-bulletins?download=963:introduction-to-sustainable-remediation-2023

GREEN AND SUSTAINABLE REMEDIATION
Hussey, E. Long Island Association of Professional Geologists webinar, 66 minutes, December 2023

This presentation describes the New York Department of Environmental Conservation's policies and goals on green and sustainable remediation. Green and sustainable remediation can be integrated throughout the remedial process to minimize cleanup action environmental footprints. Sustainable practices and technologies were promoted to give the audience simple and effective methods to apply at other sites. Highlighted concepts included utilizing local resources, material reuse, consolidating site visits, generating on-site renewable energy, and reporting/tracking metrics with several site-specific case studies acting as real-world examples. A tutorial of internal guidance for green and sustainable remediation provided the audience with an external tool and additional resources to implement sustainable practices in their work. https://www.youtube.com/watch?v=h8MkvpXsFIs

MULTIDISCIPLINARY MONITORING OF AN IN-SITU REMEDIATION TEST OF CHLORINATED SOLVENTS

Nivorlis, A., C. Sparrenbom, M. Rossi, S. Akesson, and T. Dahlin.
Science of The Total Environment 922:170942(2024)

A methodology for monitoring the changes following an in situ remediation treatment of a chlorinated solvent-contaminated site is presented. The methodology consists of two different methods, direct current resistivity and time-domain induced polarization, which were used to acquire daily data and geochemical analyses on water samples collected every three months. The geophysical results provide insights into how the injected fluids are spreading and assist in acquiring a better understanding of the geological and hydrogeological systems. The research highlights the challenges of monitoring in situ bioremediation experiments in complex environments and where pollutants are situated in low hydraulic conductivity formations. The joint interpretation of the data shows the importance of an interdisciplinary approach to understand complex systems.

BIOREMEDIATION OF CONTAMINATED SOIL AND GROUNDWATER BY IN SITU BIOSTIMULATION

Romantschuk, M., K. Lahti-Leikas, M. Kontro, P. Galitskaya, H. Talvenmaki, S. Simpanen, J.A. Allen, and A. Sinkkonen. Frontiers in Microbiology 14:1258148(2023)

This review evaluates the in situ bioremediation performance of indigenous microbial degraders. Identifying and removing biodegradation bottlenecks for degradation of organic pollutants is essential. Limiting factors commonly include lack of oxygen or alternative electron acceptors, low temperature, and lack of essential nutrients. Additional factors are the bioavailability of the contaminating compound, pH, distribution of the contaminant, soil structure and moisture, and in some cases, lack of degradation potential, which may be amended with bioaugmentation. Methods to remove these limitations are discussed. The review also suggests tools for assessing sustainability, life cycle assessment, and risk assessment. To help entrepreneurs, decision-makers, and method developers in the future, creating a database for otherwise seldom-reported unsuccessful interventions and the potential for artificial intelligence to assist in site evaluation and decision-making is recommended. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10658714/pdf/fmicb-14-1258148.pdf

FROM THEORY TO PRACTICE: LEVERAGING CHEMICAL PRINCIPLES TO IMPROVE THE PERFORMANCE OF PEROXYDISULFATE-BASED IN SITU CHEMICAL OXIDATION OF ORGANIC CONTAMINANTS

McGachy, L. and D.L. Sedlak.
Environmental Science & Technology 58(1):17-32(2024)

This review provides insights into the chemistry of peroxydisulfate-based ISCO that can enable more efficient operation of these systems and identifies research needed to improve understanding of system performance. Gaining a deeper understanding of the underlying chemistry of these complex systems may improve the design and operation of peroxydisulfate-based ISCO remediation systems. https://pubs.acs.org/doi/epdf/10.1021/acs.est.3c07409

INNOVATIVE REMEDIATION STRATEGIES FOR PERSISTENT ORGANIC POLLUTANTS IN SOIL AND WATER: A COMPREHENSIVE REVIEW

Devendrapandi, G., X. Liu, R. Balu, R. Ayyamperumal, M.V. Arasu, M. Lavanya, V.R.M. Reddy, W.K. Kim, and P.C. Karthika. | Environmental Research 249:118404(2024)

This article critically evaluates the most recent advancements in POP cleanup technology for soil and water, encompassing a wide range of techniques, such as nanotechnology, phytoremediation, enhanced oxidation processes, and bioremediation. It assesses the effectiveness, cost-effectiveness, and environmental sustainability of each method. It addresses new developments in POP regulation and monitoring, highlighting the need for all-encompassing approaches, including risk assessment and management. Case studies from different parts of the world show the difficulties and effective uses of these novel techniques. The integration of diverse remediation strategies, hybrid approaches, and the function of natural attenuation are also examined to combat POP pollution. *See introduction and section snippets at* https://www.sciencedirect.com/science/article/abs/pii/S0013935124003086

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