Technology Innovation News Survey

Entries for November 1-15, 2023

Market/Commercialization Information

FOREST SERVICE, REGION 1 - AE MINE REMEDIATION SERVICES - SOURCES SOUGHT (SRCSGT)
U.S. Department of Agriculture Forest Service, CSA Intermountain 9, Ogden, UT
Contract Opportunities on SAM.gov 1240LU24R0005, 2023

This is a sources sought notice for marketing research purposes only. The U.S. Forest Service, Region 1 -- Northern Region is requesting information from qualified vendors interested in providing support to the Forest Service under NAICS code 562910 for CERCLA Project at the Barker-Hughesville Mining District, the Beal Mountain Mine, and the New World Mine Complex in Montana, and the Riley Uranium Mine Site in South Dakota to investigate, model, design, operate, and monitor mining contaminated properties. General activities include technical evaluations, investigations, studies, reports, and response actions as specified in the National Contingency Plan found in 40 CFR 300. The contractor will be requested to work in support of various CERCLA activities currently underway and to be completed in the future at each site. The Government plans to award a single Indefinite Delivery Indefinite Quantity Contract with a one-year base period and up to four one-year extensions periods. There is no solicitation at this time. Capability statements are due by 12:00 PM MST on January 4, 2023.https://sam.gov/opp/0d49193d9b8d4f7db2b514e267e96d93/view

ENVIRONMENTAL REMEDIATION IN KOTZEBUE, ALASKA (COMBINE)
U.S. Department of the Interior, Bureau of Indian Affairs, Pacific Region, Sacramento, CA
Contract Opportunities on SAM.gov 140A0524Q0001, 2023

This is a total small business set-aside under NAICS code 562910. The Bureau of Indian Affairs requires contaminated soil removal, groundwater sampling, and laboratory analysis within the Village of Kotzebue. The purpose of this contract is to remove ~200 cubic yards of soil contaminated with diesel range organics and characterize the contamination of groundwater on the site and its environmental impacts on the community. The scope of work includes research of historic documents, site reconnaissance, identification of contamination, geotechnical investigation, risk evaluation, permitting, fieldwork, sampling, analysis, data evaluation, and additional activities to determine the quantity and quality of known contaminants present at the site. The scope of the investigation shall provide information sufficient to identify the risk associated with environmental and public health considerations concerning the property. In addition, the groundwater monitoring will allow managers to plan further investigations, if required, to determine cleanup requirements and design a cleanup action in accordance with the AK Department of Environmental Conservation, and federal and tribal laws and regulations. The Government contemplates the award of a firm-fixed-price services contract with a one-year period of performance. Quotes are due by 9:00 AM PST on January 8, 2024. https://sam.gov/opp/e718691a1f134480a7e52f1288b9702e/view

ENVIRONMENTAL REMEDIATION IN NAPASKIAK, ALASKA (COMBINE)
U.S. Department of the Interior, Bureau of Indian Affairs, Pacific Region, Sacramento, CA
Contract Opportunities on SAM.gov 140A0524Q0002, 2023

This is a total small business set-aside under NAICS code 562910. The Bureau of Indian Affairs requires a contractor to perform a preliminary investigation/ site assessment of soil and groundwater contamination within the Village of Napaskiak, Alaska. The purpose of this contract is to conduct a preliminary investigation/ assessment and remediation at the old school site within the Village of Napaskiak to characterize the contamination and design a remediation plan. The scope of work includes research of historic documents, site reconnaissance, identification of contamination, geotechnical investigation, risk evaluation, permitting, fieldwork, sampling, analysis, data evaluation, and additional activities to determine the quantity and quality of contaminants present at the site. The scope of the investigation shall provide information sufficient to identify potential liability and risk associated with environmental and public health considerations concerning the property. In addition, the site characterization will allow managers to plan further investigations, if required, to determine cleanup requirements and design a cleanup action in accordance with the Alaska Department of Environmental Conservation, federal and tribal laws and regulations. The Government contemplates the award of a firm-fixed-price contract with a one-year period of performance. Quotes are due by 9:00 AM PST on January 8, 2024. https://sam.gov/opp/176d8b992533f0cb143e33104d47e7b/view

NTCRA AT FORMER WASTE DUMP, KINGS CANYON NP, CA (SOL)
U.S. Department of the Interior, National Park Service, Washington Contracting Office, Lakewood, CO
Contract Opportunities on SAM.gov 140P2124R0002, 2023

This is an indian small business economic enterprise (isbee) set-aside under NAICS code 562910. The U.S. National Park Service requires a contractor to implement a Non-Time Critical Removal Action work plan to clean up the Grant Grove Former Waste Disposal Area in Kings Canyon National Park in Fresno County, CA. The work includes removing ~9,988 tons of non-hazardous, non-RCRA hazardous, and/or RCRA hazardous soil and debris, transporting it to appropriate disposal facilities, collecting and analyzing post-removal confirmation samples, limited reconditioning of the site, and preparing a Response Action Completion Report. The work includes lab analyses of soil samples in addition to the preparation of reports and other documentation required for this type of CERCLA action. All work will be performed under a single firm-fixed-price construction contract. The estimated magnitude of this project is between $1,000,000 and $5,000,000. Offers are due by 1:00 PM PST on January 9, 2024. https://sam.gov/opp/f4953ddcf1484855b903df64171ba3cb/view

Cleanup News

USING GEOCHEMICAL DATA TO TROUBLE SHOOT VARIABLE PERFORMANCE FOLLOWING ISCO
Smith, B. I AEHS 39th Annual International Conference on Soils, Sediments, Water and Energy, 16-19 October, Amherst, MA, 25 slides, 2023

This presentation reviews performance data from various ISCO project sites and discusses performance relative to geochemical response. Direct measurements of key geochemical parameters to assess persulfate applications included persulfate, electric conductivity (EC), sodium or potassium, sulfate, pH, and oxidation-reduction potential. The timing of the geochemical response was used to evaluate whether a monitoring location was immediately impacted by the persulfate injections or impacted over time, either by persulfate or its breakdown products, which were compared to the dose rates applied to validate substrate distribution and longevity. By reviewing the variation in treatment performance relative to changes in geochemical parameters, it was often possible to determine the underlying cause of the mixed results. The disappearance of a geochemical footprint (persulfate indicators) over time suggested that new, untreated groundwater migrated into the area, in some cases recontaminating the groundwater. Conversely, a rebound in contaminant concentrations occurring while EC and sodium remained elevated suggested a true rebound where sorbed mass reequilibrated into the groundwater phase after the persulfate was spent. This distinction helped guide the next action, whether a second application was recommended (in the case of a true rebound) or an expansion of the treatment area to address the source (in the case of recontamination) from inflowing.
https://s3.amazonaws.com/amz.xcdsystem.com/A51108D5-EA2E-2B6D-01D92AC0E42DCE3B_abstract_File23333/Handout_176_1019010435.pdf

PREDICTIVE GROUNDWATER MODELING TO DEVELOP PFAS SOURCE REMEDIATION PRIORITIES
Johnson, J., J. Wang, and S. Tucker. I AEHS 39th Annual International Conference on Soils, Sediments, Water and Energy, 16-19 October, Amherst, MA, 13 slides, 2023

Site-specific distribution coefficients and groundwater source concentrations were calibrated for PFOA, PFOS, PFNA, and longer chain PFAS compounds by fitting a model to several rounds of site groundwater monitoring data and influent data from an onsite treatment system. The calibrated site-specific distribution coefficients were at the low end or below the range of reviewed literature values. The modeling approach was used to successfully prioritize source remediation at an AFFF site with leaking stormwater infrastructure, resulting in multiple locations of soil and/or groundwater impacts and relatively minor PFAS impacts in other areas. Source areas were identified based on history of AFFF use and contaminant distribution. Each source modeled included a different combination of PFAS compounds based on groundwater monitoring data. An onsite treatment system previously constructed to address other COCs consists of two primary extraction wells with combined discharge to a treatment plant. Predictive contaminant transport simulations were run to simulate PFAS transport from the beginning of AFFF use to 30 years into the future as a baseline. Each source area was assigned a 50% reduction of mass flux in the model to quantify the impact of remedial actions at individual source areas as measured by the changes observed in the influent of the treatment system. Along the stormwater infrastructure, shorter-chain PFAS sources closer to the extraction wells had the largest and earliest impact on concentration reduction at the treatment plant. However, the treatment plant did not reduce concentrations for several years. The magnitude of the impact at the treatment plant was primarily related to the amount of mass reduction at the source, though the timing of the impact was related to the distance from the extraction well and the site-specific distribution coefficient for the PFAS compound.
https://s3.amazonaws.com/amz.xcdsystem.com/A51108D5-EA2E-2B6D-01D92AC0E42DCE3B_abstract_File23333/Handout_202_1027092731.pdf

DIFFERENTIATING CVOCS IN BEDROCK AND ALTERNATE REMEDIATION CRITERIA RATIONALE AND REGULATORY CONCURRENCE
Hutnick, D.C. and N.A. Stevens. I AEHS 39th Annual International Conference on Soils, Sediments, Water and Energy, 16-19 October, Amherst, MA, 20 slides, 2023

CVOCs migrated by advection in groundwater from an industrial drycleaning facility located northeast and along a bedrock strike of a petroleum facility to the southwest. Transport of CVOCs to the petroleum facility occurred via fracture flow enhanced by a pumping water supply well. Bedrock structure consists of fractures and joints with bedding planes that strike northeast and dip northwest with a shallow dip angle (5 to 12°). Combined with a weathered bedrock zone to ~60 ft-bgs, the bedding planes are significant conduits for groundwater flow and contaminant transport. A forensic assessment and conceptual site model demonstrated that most CVOCs in bedrock, particularly along the defined transport pathway, were attributable to offsite sources. TCE exhibited the greatest concentration difference between offsite (2,710 µg/L) and onsite (147 µg/L) bedrock groundwater relative to a regulatory standard of 1 µg/L. The remediation goal for TCE was to reduce concentrations by 146 µg/L. An alternative approach was used to develop site-specific alternative remediation goals for up to 27 individual CVOCs. Through engagement, technical demonstration, and documentation, the state regulatory agency accepted the approach.
https://s3.amazonaws.com/amz.xcdsystem.com/A51108D5-EA2E-2B6D-01D92AC0E42DCE3B_abstract_File23333/Handout_152_1015124833.pdf

Demonstrations / Feasibility Studies

SOLID PHASE COLLOIDAL ORGANIC AMENDMENTS PROMOTE SUSTAINED BIODEGRADATION IN PERMEABLE REACTIVE BARRIERS
J. Freim I Florida Remediation Conference, 1-3 November, Orlando, FL, abstract only, 2023

This presentation describes the development and field demonstration of a novel plant-based, sub-micron fermentable amendment that can be co- injected with activated carbon at low pressures to promote sustained in situ bioremediation in permeable reactive barriers. Investigations were conducted on several plant-based products to identify a material that could be reduced to ~1 µm in size and slowly degrade to support bioremediation. To inhibit the agglomeration that naturally occurs, several food-grade dispersants were investigated to inhibit the naturally occurring agglomeration in small particle-size suspensions. Experiments were then conducted to optimize the particle size to produce a material that could be co-applied with similarly sized colloidal activated carbon. Particle transport through sand was verified using column studies. The ability to promote biodegradation was studied using closed bottle treatability studies with chlorinated ethenes. A pilot study was then performed using direct-push technology injection at low pressures with and without activated carbon. Monitoring well data was used to measure degradation rates and degradation pathways of chlorinated ethenes, geochemical parameters, and the generation of gaseous reaction products such as ethane and methane. After numerous iterations, a stable colloidal suspension of a biodegradable plant-based material with a median particle size of ~ 1 µm (99% of the particles were See presentation from 2023 Bioremediation Symposium: https://www.battelle.org/docs/default-source/bidden/2023-bio-symp-presentations/track-a/a1_0850_78_erickson.pptx.pdf?sfvrsn=55220_3

HYDROGEOLOGICAL CHARACTERIZATION OF CRYSTALLINE BEDROCK USING BOREHOLE MAGNETIC RESONANCE
Eeva, S., A. Karjalainen, E. Koivisto, K. Korkka-Niemi, A. Rautio, O. Raisanen, R, Gee, and B. Birt. I Groundwater 61(6):793-815(2023)

A borehole magnetic resonance (BMR) method was tested to determine the hydraulic parameters (porosity, permeability, and hydraulic conductivity) required for hydrogeological modeling in two distinct crystalline rock environments. The sites comprise Proterozoic basement rocks of different compositions: mafic rocks at the Sakatti mining development site in northern Finland and felsic rocks at the Olkiluoto Island nuclear repository site in southwest Finland. While BMR is widely used for determining storage and hydraulic properties in sedimentary environments, few studies have examined crystalline bedrocks. Results indicate that BMR is a suitable tool for studying lithologically and hydrogeologically heterogeneous fractured crystalline bedrocks. It can produce continuous data from hydraulic properties of bedrock in addition to more time-consuming methods, such as flowmeter and packer tests, and guide where to focus additional flow measurements. The intervals display fracture and reduced matrix porosity characteristics, which can be enhanced or reduced locally by chemical alteration and tectonic processes. Flow parameters vary significantly throughout the studied intervals; independently from the lithological composition, these intervals locally display relatively high porosities and may be correlated to the more intensely fractured and/or brecciated zones. However, due to the heterogeneity in mineralogy, grain/pore arrangement, and the variability of fracture flow-driven transport in each borehole, the challenge remains in finding a unique set of permeability constants for these crystalline rock types.
https://ngwa.onlinelibrary.wiley.com/doi/10.1111/gwat.13290

USE OF CENSORED MULTIPLE REGRESSION TO INTERPRET TEMPORAL ENVIRONMENTAL DATA AND ASSESS REMEDY PROGRESS
DiFilippo, E., M. Tonkin, and W. Huber. I Groundwater 61(6): 846-864(2023)

Multiple regression using maximum likelihood estimation (or censored multiple regression) was demonstrated at the U.S. Department of Energy Hanford site, where analyte concentrations in groundwater samples are negatively correlated with the stage of the nearby Columbia River. Incorporating a time-lagged stage variable in the regression analysis of these data provides more reliable estimates of future concentrations, reducing the uncertainty in evaluating the progress of remediation toward remedial action objectives. Censored multiple regression can identify significant changes over time, project when maxima and minima of interest are likely to occur, estimate average values and their confidence limits over time periods relevant to regulatory compliance and improve the management of remedial action monitoring programs.

FOAM FRACTIONATION FOR REMOVAL OF PER- AND POLYFLUOROALKYL SUBSTANCES: TOWARDS CLOSING THE MASS BALANCE
Smith. S.J., J. Lewis, K. Wilberg, E. Wall, and L. Ahrens.
Science of The Total Environment 871:162050(2023)

A study verified the high treatment efficiency of a pilot-scale foam fractionation system to remove PFAS from industrial water contaminated with AFFF. ΣPFAS removal reached up to 84% and PFOS removal up to 97%, but the short chain perfluorobutanoic acid was only removed with a mean efficiency of 1.5%. Mobile short-chain PFAS were generally removed less efficiently when the perfluorocarbon chain length was below six for carboxylic acids and below five for sulfonic acids. Treatment efficiency fluctuations due to natural variations in the chemistry of the influent water were minor, confirming the robustness of the technology. However, significant positive correlations were observed between PFAS removal and influent metal concentration and conductivity. The mass balance closure did not differ significantly from 100% in all experiments. PFAS sorption to the reactor's walls and high PFAS emissions by the air exiting the reactor were measured. PFAS emissions in aerosols correlated positively with mass balance closure. The elevated aerial PFAS concentrations measured in the experimental facility have implications for worker safety and prevention of PFAS emissions to the atmosphere and demonstrate the importance of installing appropriate filters on the air outlet of foam fractionation systems.

Research

PYRO-CATALYTIC DEGRADATION OF PYRENE BY BENTONITE-SUPPORTED TRANSITION METALS: MECHANISTIC INSIGHTS AND TRADE-OFFS WITH LOW PYROLYSIS TEMPERATURE
Denison, S.B., P.X. Jin, P.D. Da Silva, C. Chu, B. Moorthy, T.P. Senftle, K. Zygourakis and P.J.J. Alvarez. I Environmental Science & Technology 57(38):14373-14383(2023)

A study demonstrated that transition metals in clay can catalyze pyrolytic reactions at relatively low temperatures to decrease the energy and contact times required to meet cleanup standards. Transition metal catalysts can significantly enhance the pyrolytic remediation of PAH-contaminated soil. Significantly higher pyrene removal efficiency was observed after the pyrolytic treatment of Fe-enriched bentonite (1.8% wt ion-exchanged content) relative to natural bentonite or soil (i.e., 93% versus 48% and 4%) at 150°C with a 15 min treatment time. Density-functional theory calculations showed that bentonite surfaces with Fe^{2+} or Cu^{2+} adsorb pyrene stronger than surfaces with Zn^{2+} or Na^{+}. Enhanced pyrene adsorption results from increased charge transfer from its aromatic p-bonds to the cation site, destabilizing pyrene and allowing faster degradation at lower temperatures. UV-vis and GC-MS analyses revealed pyrene decomposition products in extracts of samples treated at 150°C, including small aromatic compounds. Product distribution shifted from extractable compounds to char coating the residue particles as the pyrolysis temperature increased above 200°C. No extractable byproducts were detected after treatment at 400°C, indicating that char was the final product of pyrene decomposition. Tests with human lung cells showed that extracts of samples pyrolyzed at 150°C were toxic, indicating that high removal efficiency by pyrolytic treatment does not guarantee detoxification. No cytotoxicity was observed for extracts from Fe-bentonite samples treated at 300°C, inferring that char is an appropriate treatment endpoint.

SUBSTANTIAL DEFLUORINATION OF POLYCHLOROFLUOROCARBOXYLIC ACIDS TRIGGERED BY ANAEROBIC MICROBIAL HYDROLYTIC DECHLORINATION
Jin, B., H. Liu, S. Che, J. Gao, Y. Yu, J. Liu Y. and Men. I Nature Water 1: 451-461(2023)

This study reports the substantial defluorination of chlorinated polyfluorocarboxylic acids (Cl-PFCAs) by an anaerobic microbial community via novel pathways triggered by anaerobic microbial dechlorination. Cl-PFCAs first underwent microbial reductive, hydrolytic, and eliminative dechlorination. Hydrolytic dechlorination led to the highest spontaneous defluorination, which was favored with increased Cl substitutions. An isolated, highly enriched, anaerobic defluorinating culture was dominated by two genomes most similar to those of *Desulfovibrio aminophilus* and *Sporomusa sphaeroides*, both of which exhibited defluorination activity towards chlorotrifluoroethylene tetramer acid. Results imply that anaerobic non-respiratory hydrolytic dechlorination plays a critical role in the fate of chlorinated polyfluoro chemicals in natural and engineered water environments. The greatly enhanced biodegradability by Cl substitution also sheds light on the design of cost-effective treatment biotechnologies and alternative polyfluoroalkyl substances that are readily biodegradable and less toxic.

MINERALIZATION OF A FULLY HALOGENATED ORGANIC COMPOUND BY PERSULFATE UNDER CONDITIONS RELEVANT TO IN SITU REDUCTION AND OXIDATION: REDUCTION OF HEXACHLOROETHANE BY ETHANOL ADDITION FOLLOWED BY OXIDATION

Kim, T.K. and D.L. Sedlak. Environmental Science & Technology 57(36):13691-13698(2023)

A two-phase process was employed to dehalogenate and oxidize a representative halogenated compound (i.e., hexachloroethane) using persulfate ($S_2O_8^{2-}$)-based ISCO. A relatively high ethanol concentration (1.8 M) was added in the first phase, along with $S_2O_8^{2-}$ concentrations typically used for ISCO (i.e., 450 mM). Hexachloroethane underwent rapid dehalogenation when carbon-centered radicals, produced by the reaction of ethanol and radicals formed during $S_2O_8^{2-}$ decomposition, reacted with carbon-halogen bonds. Unlike conventional ISCO treatment, hexachloroethane transformation and $S_2O_8^{2-}$ decomposition took place in a matter of days without external heating or base addition. The presence of O_2, Cl^-, and NO_3^- delayed the onset of hexachloroethane transformation when low $S_2O_8^{2-}$ concentrations (10 mM) were used, but the solutes had negligible effects when $S_2O_8^{2-}$ was present at concentrations typical of in situ remediation (450 mM). The second phase of the reaction was initiated after most of the ethanol had been depleted when thermolytic $S_2O_8^{2-}$ decomposition resulted in SO_4sup>•- production, which oxidized the partially dehalogenated transformation products.

CRITICAL ROLE OF SEMIQUINONES IN REDUCTIVE DEHALOGENATION

Lokesh, S., M.L. Lard, R.L. Cook and Y. Yang.
Environmental Science & Technology 57(38):14218-14225(2023)

A study focused on the reductive dehalogenation of triclosan, a model organohalogen, by 1,4-benzohydroquinone (H_2Q). In the presence of H_2Q only, triclosan degradation did not occur within the experimental period of 288 h. it occurred in the presence of H_2Q and $FeCl_3$ under anoxic conditions at pH 5 and 7 (above the pK_a of SQ = 4.1) only to be halted in the presence of dissolved oxygen. Kinetic simulation and thermodynamic calculations indicated that benzosemiquinone ($SQ^{\bullet-}$) is responsible for the reductive degradation of triclosan, with a fitted rate constant for the reaction between $SQ^{\bullet-}$ and triclosan of 317/M2/h. The critical role of semiquinones in reductive dehalogenation can be relevant to a wide range of quinones in natural and engineering systems based on the reported oxidation-reduction potentials of quinones/semiquinones and semiquinones/hydroquinones and supported by experiments with additional model hydroquinones.

FUNCTIONALIZED FERROCENE ENABLES SELECTIVE ELECTROSORPTION OF ARSENIC OXYANIONS OVER PHOSPHATE—A DFT EXAMINATION OF THE EFFECTS OF SUBSTITUTIONAL MOIETIES, PH, AND OXIDATION STATE

Nwokonkwo, O., Y. Pelletier, M. Broud and C. Muhich.
The Journal of Physical Chemistry A 127(37):7727-7738(2023)

Ab initio calculations were used to examine the competitive binding of As(V), P(V), and As(III) to ferrocene (Fc)/ferrocenium (Fc^+) with and without functional substitutions (OH, SH, NH_2, COOH, CH_3, C_2H_5, NO_2, and Cl). The study aimed to understand factors that induce the selective binding of toxic arsenic over phosphate. Neat Fc could not distinguish the three oxyanions because physical forces (electrostatics and dispersion) dominate the Fc-oxyanion interactions. Combined oxidation and substitution effects enable selectivity for As(V) over P(V). Oxidation of Fc to Fc^+ allows the formation of Fc+-oxyanion covalent bonds with varying donor-acceptor character depending on the oxyanion. Additionally, NH_2 and SH groups that donate charge to the base Fc^+ molecule and H-bond to oxyanion induce an energetic preference for As(V) over P(V) by -0.23 and -0.13 eV, respectively. Differences in pKa between As(V)/P(V) and As(III) preclude any preference for As(III) over the other anions. Calculated energetics were used to predict the pH-dependent binding selectivity of functionalized ferrocenium. Findings demonstrate the challenges of Fc/ Fc^+-oxyanion interaction for selective binding and provide a path for identifying other molecules and substituents for efficient metallocene adsorbent design.

POTENTIAL IMPACT OF BACTERIA ON THE TRANSPORT OF PFAS IN POROUS MEDIA

Dai, M., N. Yan and M.L. Brusseau. I Water Research 243:120350(2023)

A study focused on the retention and transport of PFAS. First, a critical review of prior studies was conducted to delineate observed PFAS-bacteria interactions and summarize the mechanisms of PFAS sorption and retention by bacteria. The second part of the study involved batch and miscible-displacement experiments to investigate the influence of bacteria on the retention and transport of PFAS. Batch experiments were conducted using Gram-negative *Pseudomonas aeruginosa* and Gram-positive *Bacillus subtilis* to quantify PFOS sorption. Results indicated that both bacteria showed strong adsorption of PFOS, with no significant difference in adsorption capacity. Miscible-displacement experiments examined the retention and transport of PFOS in both untreated sand and sand inoculated with *Pseudomonas aeruginosa* or *Bacillus subtilis* for 1 and 3 days. PFOS transport exhibited greater retardation for the experiments with inoculated sand. Enhanced sorption was greater for the 3-day inoculation than the 1-day, indicating that biomass is an important factor affecting PFOS transport. A mathematical model representing transport with nonlinear and rate-limited sorption simulated the observed PFOS transport.

SPATIAL AND TEMPORAL TRENDS OF PERSISTENT ORGANIC POLLUTANTS ACROSS EUROPE AFTER 15 YEARS OF MONET PASSIVE AIR SAMPLING

White, K.B., J. Kalina, M. Scheringer, P. Pribylova, P. Kukucka, J. Kohoutek, R. Prokes, and J. Klanova. I Environmental Science & Technology 57(31):11583-11594(2023)

After 15 years of passive air monitoring (2003-2019) by the Global Monitoring Plan of the Stockholm Convention on Persistent Organic Pollutants (POPs), sufficient data was produced to analyze long-term concentrations of 20 POPs at 32 sites in 27 European countries. As of January 1, 2019, the concentration ranges (pg/m^3) were 1.1-52.8 (Σ_6PCB), 0.3-8.5 (Σ_{12}dl-PCB), 0.007-0.175 (Σ_{17}PCDD/F), 0.02-2.2 (Σ_9PBDE), 0.4-24.7 (BDE 209), 0.5-247 (Σ_6DDT), 1.7-818 Σ_4HCH), 15.8-74.7 (HCB), and 5.9-21.5 (PeCB). Temporal trends indicate that concentrations of most POPs have declined significantly over the past 15 years, with median annual decreases ranging from -8.0 to -11.5% (halving times of 6-8 years) for Σ_6PCB, Σ_{17}PCDD/F, HCB, PeCB, and Σ_9PBDE. No statistically significant differences were observed in either the trends or the concentrations of specific POPs at sites in Western Europe compared to sites in Central and Eastern Europe, which suggests relatively uniform compound-specific distribution and removal at the continental scale.

General News

CONDUCTING CLIMATE VULNERABILITY ASSESSMENTS AT SUPERFUND SITES

Technical Support Project, Engineering Forum, EPA 542-R-23-002, 22 pp, 2023

The Engineering Forum, developed this issue paper to document lessons learned in conducting climate vulnerability assessments (CVAs) at sites on the National Priorities List. The goals of a CVA are to assess future changes in climate conditions at a site so they may be factored into site decision-making, determine whether adaptation measures are necessary to improve remedy resilience, and ensure remedy protectiveness is maintained under future changes in climate. The issue paper explains the three components of a CVA (exposure, sensitivity, and adaptive capacity) and details six steps in the CVA process implemented by EPA for Superfund sites. A CVA may be performed by federal or state authorities or potentially responsible parties for any type of Superfund site at various stages of remediation. The CVA process described in the issue paper may also be adapted for application at contaminated sites in other cleanup programs.
https://clu-in.org/conf/tio/cva/Climate_Vulnerability_Assessments_Issue_Paper.pdf

BENEFITS OF THE ENVIRONMENT, REVITALIZATION, AND ENVIRONMENTAL CLEANUP WEBINAR

Yee, S. and T. Newcomer Johnson. EPA Healthy and Resilient Communities Research Webinar Series: Benefits of the Environment and Environmental Cleanup and Revitalization for Communities, 75 minutes, 2023

This webinar highlights approaches to assess the benefits of ecosystem services of restored biological conditions to support goal setting, inspire action, and communicate and track relevant outcomes. Case studies illustrate a transferable and adaptable framework to 1) identify relevant benefits of environmental restoration to communities, 2) identify relevant metrics and indicators of ecosystem services, 3) apply quantitative models to link changing biological conditions to ecosystem services, and 4) compare and evaluate management options. https://www.youtube.com/watch?v=bSJEKR_pA5A

DEVELOPING A ROBUST BIOVENTING MODEL

Soureshjani, M.K. and R.G. Zytner. I Mathematical and Computational Applications 28:76(2023)

A comprehensive review evaluated and compared the advantages and disadvantages of various bioventing models regarding the different numerical methods used to solve relevant bioventing equations. After investigating the various assumptions and methods from the literature, an improved foundational bioventing model was developed that characterizes gas flow in unsaturated zones where water and NAPL are present and immobile, accounting for interphase mass transfer and biodegradation, and incorporating soil properties through a rate constant correlation. The proposed model was solved using the finite volume method in OpenFOAM, an independent dimensional open-source coding toolbox. Preliminary simulation results of a simple case indicate good agreement with the exact analytical solution of the same equations. The improved bioventing model has the potential to enhance predictions of the remediation process and support the development of efficient remediation strategies for petroleum hydrocarbon-contaminated soil. *This article is* ***Open Access*** *at* https://www.mdpi.com/2297-8747/28/3/76.

PHOTOCATALYSTS FOR CHEMICAL-FREE PFOA DEGRADATION – WHAT WE KNOW AND WHERE WE GO FROM HERE?

Arana Juve, J., J. Donoso Reece, M. Wong, Z. Wei, and M. Ateia.
Journal of Hazardous Materials 462:132651(2023)

This review classifies the state-of-the-art of chemical-free photocatalysts for PFOA degradation in families of materials (Ti, Fe, In, Ga, Bi, Si, and BN); describes the evolution of catalysts, identifies and discusses the strategies to enhance their performance; proposes a simplified cost evaluation tool for simple techno-economical analysis of the materials; compares the features of the catalysts expanding the classic degradation focus to other essential parameters; and identifies current research gaps and future research opportunities to enhance the photocatalyst performance. The review aims to assist researchers and practitioners in developing rational photocatalyst designs and identify research gaps for green and effective PFAS degradation.

USING SURFACE-AREA WEIGHTED AVERAGE CONCENTRATIONS (SWACS) TO OPTIMIZE SEDIMENT AND SOIL REMEDIES

White, P. NAVFAC Remediation Innovative Technology Seminar, 59 slides, 2023

This presentation highlights how SWACs can be developed and used to estimate exposure point concentrations, develop remediation target areas, and provide data for long-term monitoring. Planning and monitoring remedies for contaminated sediment and soil sites typically requires comparing contaminant data collected over different temporal and spatial scales to remediation goals. SWACs can be used to estimate mean contaminant concentrations over a specified area. The presentation also reviews SWAC guidance and provides several case studies.
https://exwc.navfac.navy.mil/Portals/88/Documents/EXWC/Restoration/er_pdfs/rits/2023%20RITS%20SWAC%20presentation_final_PAO.pptx?ver=YYf0fG9WRaQ_rg2ExShomg%3d%3d

BEST PRACTICES FOR PFAS SAMPLING AND DATA EVALUATION

Andrzejczyk, N., J. Kornuc, and R. Iery. NAVFAC Remediation Innovative Technology Seminar, 57 slides, 2023

This presentation provides the most appropriate procedures that should be followed when sampling for PFAS in different matrices, including drinking water, groundwater, soil, sediment, surface water, and tissue. Information on collecting control samples, which materials to use to ensure PFAS sampling integrity, and additional considerations for proper data analysis during the development of Site Investigation and Remedial Investigation reports are presented. PFAS guidance updates from DOD and Assistant Secretary of the Navy are also covered.
https://exwc.navfac.navy.mil/Portals/88/Documents/EXWC/Restoration/er_pdfs/rits/2023%20RITS%20PFAS%20Sampling_final_JV_7172023.pdf?ver=Fe6sB33Y2qidFbAU2BmCCg%3d%3d

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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