Technology Innovation News Survey

Entries for January 1-15, 2023

Market/Commercialization Information

ENVIRONMENTAL REMEDIATION DREDGING OF TIDAL FLATS IN HOUSATONIC RIVER ADJACENT TO STRATFORD ARMY ENGINE PLANT (SNOTE)

U.S. Army Corps of Engineers, New England District, Concord, MA
Contract Opportunities on SAM.gov, no solicitation number, 2023

The U.S. Army Corps of Engineers, New England District (CENAE) is issuing this Special Notice Announcement for Environmental Remediation Dredging of tidal flats in the Housatonic River adjacent to the Stratford Army Engine Plant, Stratford, Connecticut under NAICS code 562910. The Army is remediating the site under the Base Realignment and Closure (BRAC) Program, consistent with CERCLA and the Connecticut Department of Energy and Environmental Protection. The February 2021 Decision Document selected sediment removal as the remedy. The purpose of this announcement is to solicit input from industry as to the construction means and methods as well as anticipated construction durations for the proposed work. CENAE plans to award this project using a best-value design-bid-build approach. CENAE anticipates issuing the Request for Proposal (RFP) on or about January 2024, with the award anticipated by July 2024. A Solicitation is not available at this time. This special notice does not constitute a commitment by the Government. Responses to this special notice are due by 1:00 PM EST on March 3, 2023.
https://sam.gov/opp/09b20e5238d649d89251b2edc9a03ccc/view

UMIAT AFS FORMERLY USED DEFENSE SITE (F10AK0243) FUDS, REMEDIAL ACTION (SOL)

U.S. Army Corps of Engineers, Alaska District, Anchorage, AK
Contract Opportunities on SAM.gov, Solicitation W911KB23R0002, 2023

This is an 8(A) set-aside under NAICS code 562910. The U.S. Army Corps of Engineers, Alaska District, plans to issue a Single-Award Task Order Contract (SATOC) for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation of the Umiat Landfill Formerly Used Defense Site (FUDS), located in remote Umiat, Alaska. POA's Umiat FUDS Landfill is a large unpermitted landfill created by the military services during the development of military assets in the north slope of Alaska in the late 1940s and 1950s. It is a complex contaminated site in a highly remote location. It threatens to contaminate the adjacent Colville River and the traditional food sources of the native Alaskans in the region. POA requires a single-industry partner that can perform a robust portfolio of tasks to design the Hazardous, Toxic, and Radioactive Waste (HTRW) remedy and infrastructure improvements, mobilize heavy equipment and technical specialists to the site, perform the necessary site improvements conduct environmental sampling and studies, backhaul contaminated material, manage an onsite treatment system for non-hazardous contaminants, design, construct, install maintain hydraulic flood mitigation of the adjacent river, and conduct public meetings and stakeholder engagements. Offers are due by 12:00 PM AKST on March 9, 2023. https://sam.gov/opp/b6f576518db84a19b340c08a1018c42e/view

AIRCRAFT MISHAP SITE CLEANUP/ REMEDIATION (SRCSGT)

U.S. Department of the Army, National Guard Bureau, Wisconsin Air National Guard, Madison, WI
Contract Opportunities on SAM.gov, Solicitation W50S9F-23-Q-0009, 2023

This is a sources sought notice for marketing research purposes only under NAICS code 562910. The Wisconsin Air National Guard seeks to identify small business contractors who are qualified to provide remediation services to clean up and restore a specific site within the area of the Hiawatha National Forest located in Delta County, Michigan Upper Peninsula. The contractor will be responsible for all materials, services, labor, tools, equipment, mobilization, and the like to perform the work. Work will include bore soil sampling, analysis, excavation, and removal of ~700 yd3 of contaminated compacted soil, replacement of removed soil with clean new like material, and site restoration. The purpose of this work is for the government to obtain a "Certificate of Completion" or a "No Further Action" response from the Michigan Department of Environment, Great Lakes and Energy (MI-EGLE) and restore the site to natural conditions to the satisfaction of the United States Forest Service (USFS). Responses to this sources sought notice will assist the Government in the development of its acquisition strategy for a possible Request for Quote (RFQ), to be issued at a later date, and in determining whether any type of small business set-aside is possible for this procurement or whether full and open competitive procedures should be utilized. There is no solicitation at this time. Responses are due by 1:00 PM CST on February 21, 2023.
https://sam.gov/opp/18e90aa17eb84991a5740ea8386ba831/view

REMEDIAL INVESTIGATIONS FOR PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) IMPACTED AREAS AT FOUR ARMY INSTALLATIONS (SRCSGT)
U.S. Army Corps of Engineers, North Atlantic Division, Baltimore District, Baltimore, MD
Contract Opportunities on SAM.gov, Solicitation W912DR23R0024, 2023

This is a sources sought notice for marketing research purposes only under NAICS code 562910. The U.S. Army Corps of Engineers (USACE), Baltimore District, is seeking sources with current relevant qualifications, experience, personnel, and capabilities for remedial investigation (RI) services for PFAS-impacted areas at the following Army installations: Joint Base Myer-Henderson Hall, Virginia; United States Military Academy at West Point, New York; United States Army Carlisle Barracks, Pennsylvania; and Scranton Army Ammunition Plant, Pennsylvania. The intent of this anticipated contract is to support USACE and its customer in conducting Remedial Investigations, with the option to conduct Feasibility Studies, at sites located at the four aforementioned installations with areas where AFFF or other PFAS releases have occurred. Specific performance objectives of the contract may include Project Management Plans (PMP), Remedial Investigation Work Plans with Uniform Federal Policy Quality Assurance Project Plans (UFP-QAPP), Remedial Investigations and Feasibility Studies, Community Relations Support, and providing and alternative water supply. The work under this contract shall be performed in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, the National Contingency Plan (NCP) (40 CFR Part 300), and in compliance with the United States Army Requirements and Guidance for field investigations including specific requirements for sampling for PFAS. The contract is anticipated to be awarded in the 4th quarter of FY23 with an eight-year period of performance. There is no solicitation at this time. Responses are due by 4:30 PM EST on February 24, 2023. https://sam.gov/opp/3a13a78dfba747ae9c16eb5620e32230/view

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Cleanup News

REMEDIATION OF AN ARSENIC GROUNDWATER CONTAMINATION BY AN INNOVATIVE IN-SITU MOBILIZATION TECHNIQUE

Najem, S.A. | Remedy for Contaminated Sites Conference, 28 September, Warsaw, Poland17 minutes, 2022

A fertilizer plant contaminated soil and groundwater in a residential area with arsenic, dioxins, furans, and heavy metals. Excavation over nine years removed ~190,000 tons of contaminated soil, including ~50 tons of arsenic. A pump and treat system reduced >99% of contaminant availability and captured a groundwater plume, however, arsenic concentrations within the contamination center were not reduced. An optimization investigation was conducted to develop a 3D mass transport model of available arsenic in the contamination center. Then, an innovative mobilization technique was developed in lab experiments (batch and column experiments) using phosphate as a mobilization agent to optimize groundwater remediation. The mobilization technique was customized onsite (bench scale) and implemented at a large-scale for 2.5 years. Following optimization, arsenic removal levels tripled compared to the original pump and treat system.
https://www.youtube.com/watch?v=zdNjUsL5n7o

BIOREMEDIATION - ELIMINATING THE ENTIRE SPECTRUM OF HYDROCARBONS THROUGH A ONE-TIME APPLICATION
Ethier, M. REMTECH 2022: The Remediation Technologies Symposium, Banff, AB, Canada, 11-14 October. Environmental Services Association of Alberta, Edmonton, AB (Canada), 26 slides, 2022

A bioremediation technology, Bio-Reclaim™ was developed to transform hydrocarbon contaminants into water and a minute amount of carbon dioxide using a 100% environmentally sustainable and safe process. The technology provides an environmentally sustainable solution for shorter- and longer-chain hydrocarbons. Biosurf™, the delivery agent for Bio-Reclaim, decreases the surface tension, allowing microbe delivery into soil contamination pockets. The presentation includes case studies demonstrating use of the technologies to remediate petroleum hydrocarbons. In the first case study, Bio-Reclaim was used to treat an ~ 8,000 m^3 plume located in seven different subsites at a former fuel station. Hydrocarbons from all four fractions were detected in differing concentrations throughout the site, in addition to BTEX and miscellaneous aromatic compounds. Injection of Bio-Reclaim was conducted in July 2021, and subsequent sampling indicated a significant reduction in petroleum hydrocarbons. In the second case study, petroleum hydrocarbons were detected in two areas in soil and groundwater at a retail fuel station and commercial site in Olds, Alberta. Area 1 was treated with 800 L of inoculated Bio-Reclaim mixed with a water solution using direct push drilling equipment. Area 2 was treated with 1,750 L of solution using the same methods. The treatment successfully reduced ethylbenzene, xylenes and PHC F2 concentrations to within guidelines in both areas.
Slides: https://esaa.org/wp-content/uploads/2022/11/RT22Ethier.pdf
Longer abstract: https://esaa.org/wp-content/uploads/2022/09/RT2022-program-Abstracts-6.pdf

(THE) SUCCESSFUL IN-SITU TREATMENT OF A TCE PLUME USING A COMBINATION OF REDUCTION, SORPTION, AND ANAEROBIC BIOREMEDIATION
McGregor, R. REMTECH 2022: The Remediation Technologies Symposium, Banff, AB, Canada, 11-14 October. Environmental Services Association of Alberta, Edmonton, AB (Canada), 28 slides, 2022

A former industrial facility impacted by TCE, cis-1,2 DCE, and VC plumes that extended onto neighboring properties created potential human health and liability risks. As part of the risk mitigation program, a permeable reactive zone (PRZ) was installed on the downgradient portion of the site to treat dissolved phase ethenes. An injected PRZ was designed and implemented using a combination of chemical reduction, sorption, and anaerobic bioremediation approaches. TCE, *cis*-1,2 DCE, and VC concentrations ranged up to 2,560 µg/L, 4,300 µg/L, and 460 µg/L, respectively, in groundwater flowing into the PRZ. Using a dense vertical and lateral injection grid consisting of 69

locations along a 90 m long PRZ, 2,700 kg of colloidal activated carbon and 1,130 kg of micro-sulfidated zero-valent iron were injected to form a PRZ. Using activated carbon and zero-valent iron provided smaller particle formats allowing for easier injection and better distribution than larger particle formats while increasing reagent reactivity. Monitoring results indicated that the groundwater exiting the PRZ met the regulatory objectives within three months of PRZ installation and met objectives for >24 months post-injection. Detailed geochemical and microbiological groundwater sampling indicated that strong reductive dechlorination conditions were maintained within the impacted aquifer while key microorganisms increased by three to four orders of magnitude. Detailed sampling of the aquifer solids pre- and post-injection revealed that the horizontal hydraulic conductivity of the aquifer was unaffected by the injection of the remedial reagents, with no meaningful change measured in the hydraulic conductivity. Sampling and analyses of the aquifer solids for iron and activated carbon suggest that the two remedial reagents were present within >99% of the samples collected at concentrations >700% of their pre-injection levels.
Slides: https://esaa.org/wp-content/uploads/2022/11/RT22McGregor.pdf
Longer abstract: https://esaa.org/wp-content/uploads/2022/09/RT2022-program-Abstracts-29.pdf

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Demonstrations / Feasibility Studies

FIELD DEMONSTRATION OF BIOSTIMULATION WITH WINE POMACE EXTRACT AT A CHLOROETHENE CONTAMINATED SITE

Ohashi, T., K. Sugimoto, Y. Sasaki, and M. Hisamoto.
Bioresource Technology Reports 21:101322(2023)

A pilot study evaluated the effectiveness of wine pomace extract (WPE) as a hydrogen donor to anaerobically bioremediate chloroethenes in TCE-contaminated soil. WPE was extracted from organic acids and other substances from grape pomace generated during winemaking. Injecting WPE into the soil created a reducing environment, decreased the concentration of chloroethenes, and increased the number of Dehalococcoides spp. Before WPE injection, microbiota in groundwater and soil was dominated by dechlorinating bacteria. After the injection, the number of co-metabolizing microorganisms increased. WPE can be used at contaminated sites to activate various bacteria involved in the degradation of chloroethenes.

BIOCHAR-SUPPORTED NANO-SCALE ZERO-VALENT IRON ACTIVATED PERSULFATE FOR REMEDIATION OF AROMATIC HYDROCARBON-CONTAMINATED SOIL: AN IN-SITU PILOT-SCALE STUDY

Zeng, Y., T. Li, Y. Ding, G. Fang, X. Wang, B. Ye, L. Ge, J. Gao, Y. Wang, and D. Zhou.
Biochar 4:64(2022)

A facile ball-milling method was developed to mass-produce biochar-supported nano-scale zero-valent iron (nZVI/BC), which was then applied to activate persulfate to remediate polluted organic soil in situ at pilot scale. An in situ high-pressure injection device was used to inject nZVI/BC suspension and persulfate solution into soil at 0-70 cm depth. The removal efficiency of target pollutants such as 2-ethylnitrobenzene (ENB, 1.47-1.56 mg/kg), biphenyl (BP, 0.19-0.21 mg/kg), 4-(methylsulfonyl) toluene (MST, 0.32-0.43 mg/kg), and 4-phenylphenol (PP, 1.70-2.46 mg/kg) at different soil depths was 99.7%, 99.1%, 99.9%, and 99.7%, respectively, after 360 days of remediation. Applying nZVI/BC increased contaminant degradation rates by 11-322%, ascribed to its relatively higher efficiency in generating free radicals than the control groups. nZVI/BC-PS inhibited soil urease and sucrase enzyme activities by 1-61% within 55 days due to the oxidative stress for

microbes induced by free radicals. However, these inhibition effects disappeared with prolonged remediation time (> 127 days).
https://link.springer.com/content/pdf/10.1007/s42773-022-00188-5.pdf?pdf=button%20sticky

COMPARATIVE INVESTIGATION OF PFAS ADSORPTION ONTO ACTIVATED CARBON AND ANION EXCHANGE RESINS DURING LONG-TERM OPERATION OF A PILOT TREATMENT PLANT
Chow, S.J., H.C. Croll, N. Ojeda, J. Klamerus, R. Capelle, J. Oppenheimer, J.G. Jacangelo, K.J. Schwab, and C, Prasse. | Water Research 226:119198(2022)

A pilot-scale study compared PFAS adsorption behaviors in granular activated carbon (GAC) and two strong-base gel anion exchange resin (AER) columns operated in parallel over 441 days to treat groundwater contaminated with short-chain PFCAs. Adsorption trends were elucidated by measuring highly resolved breakthrough profiles of homologous series of 2-8 CF2 PFCA and PFSA, including ultrashort-chain compounds and branched isomers. Sample ports at intermediate bed depths predicted 50% breakthrough of compounds on an accelerated basis, but lower empty bed contact times led to conservative estimates of initial breakthrough. Homologous PFAS series displayed linear (GAC) and log-linear (AER) relationships between chain length and breakthrough independent of initial concentration. AERs generally outperformed GAC on a normalized bed volume basis, and the advantage widened with increasing PFAS chain length. As designed, all treatments would have short full-scale service times (≤142 days for GAC; ≤61 days for AERs) before the initial breakthrough of short-chain (2-4 CF2) PFCA. However, AER displayed far longer breakthrough times for PFSA than GAC (>3× treatment time), and breakthrough was not observed for PFSA with >4 CF2 in AERs. GAC had a finite molar adsorption capacity for total PFAS, leading to a stoichiometric replacement of short-chain PFCA by PFSA and longer-chain PFCA over time. AERs quickly reached a finite adsorption capacity for PFCA but showed substantially greater selectivity for PFSA whose capacity was not reached during the test. Breakthrough characteristics of keto- and unsaturated-PFSA identified in the groundwater by suspect screening were also evaluated without using reference standards. Modified PFAS structures (branched, keto-, unsaturated-) broke through faster than linear and unmodified perfluorinated structures with equal degrees of fluorination; effects were more pronounced in GAC compared to AERs. Results highlight that robust PFAS treatment systems design should consider facets beyond current PFAS targets, including operational complexities and impacts of unregulated and unmonitored co-contaminants.

SUPERCRITICAL WATER OXIDATION AS AN INNOVATIVE TECHNOLOGY FOR PFAS DESTRUCTION
Krause, M.J., E. Thoma. E. Sahle-Damesessie, B. Crone, A. Whitehill, E. Shields, and B. Gullett. Journal of Environmental Engineering 148(2)(2022)

Three supercritical water oxidation (SCWO) technology providers were contracted to test the efficacy of SCWO systems to reduce PFAS concentrations in solutions of dilute AFFF. Results of all three demonstration studies showed a >99% reduction of total PFAS identified in a targeted compound analysis, including PFOS and PFOA. PFOS was reduced from 26.2 mg/L to 240 µg/L (Aquarden), 30.4 mg/L to 0.310 µg/L (Battelle), and 190 mg/L to 8.57 µg/L (374Water). Similarly, PFOA was reduced from 930 to 0.14 µg/L, 883 to 0.102 µg/L, and 3,100 µg/L to ND. The chemical oxygen demand of the dilute AFFF was reduced from 4,750 to 5.17 mg/L after treatment, indicating significant organic compound destruction. In one demonstration, a mass balance of the influent and effluent found that the targeted compounds accounted for only 27% of the generated fluoride, suggesting that more PFAS were destroyed than measured and emphasizing the limitations of targeted analysis alone. As a destructive technology, SCWO may be an alternative to incineration and

could be a permanent solution for PFAS-laden wastewater rather than disposal by deep well injection or landfilling. *See presentation from the 3rd National PFAS Conference:* https://pfasmeeting.wordpress.ncsu.edu/files/2022/07/Day3_Krause.pdf

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Research

PFAS IN DRINKING WATER AND SERUM OF THE PEOPLE OF A SOUTHEAST ALASKA COMMUNITY: A PILOT STUDY

Babayev, M., S.L. Capozzi, P. Miller, K.R. McLaughlin, S.S. Medina, S. Byrne, G. Zheng, and A. Salamovag. | Environmental Pollution 305:119246(2022)

A study focused on assessing PFAS exposure in Gustavus, a small Alaska community located near significant PFAS sources, including an airport and fire training sites. Residential water (n = 25) and serum (n = 40) samples were collected from residents and analyzed for 39 PFAS compounds. Also, two water samples were collected from previously identified PFAS sources near the community. Fourteen distinct PFAS were detected in Gustavus water samples, including 6 PFCAs, 7 PFSAs, and 1 FTS. ∑PFAS concentrations in residential drinking water ranged from ND to 120 ng/L. High ∑PFAS levels were detected in two source samples collected from the Gustavus Department of Transportation (14,600 ng/L) and the Gustavus Airport (228 ng/L), confirming these two locations as nearby major sources of PFAS contamination. Seventeen PFAS were detected in serum, and ΣPFAS concentrations ranged from 0.0170-13.1 ng/mL (median 0.0823 ng/mL). PFOS and PFHxS were the most abundant PFAS in both water and serum samples, comprising up to 70% of ∑PFAS concentrations. Spearman's correlation analysis revealed that PFAS concentrations in water and serum were significantly and positively correlated ($r = 0.495$; $p = 0.0192$). Results suggest that contaminated drinking water from private wells contributes to the overall PFAS body burden in Gustavus residents.

THERMORESPONSIVE CATIONIC POLYMERS: PFAS BINDING PERFORMANCE UNDER VARIABLE PH, TEMPERATURE AND COMONOMER COMPOSITION.

Frazar E.M., A. Smith, T. Dziubla T, and J.Z. Hilt. | Gels 8(10):668(2022)

Thermoresponsive cationic multifunctional poly(N-isopropylacrylamide) systems functionalized with cationic monomers N-[3-(dimethylamino)propyl]acrylamide (DMAPA) and (3-acrylamidopropyl) trimethylammonium chloride (DMAPAQ) were examined for swelling capacity behavior and PFOA binding potential when exposed to aqueous environments with varying pH and temperature. Comonomer loading percentages had the most significant effect on polymer swelling behavior and temperature responsiveness when compared to aqueous pH. PFOA removal efficiency was greatly improved by adding DMAPA and DMAPAQ monomers. Aqueous pH and buffer selection were important factors when examining the binding potential of the polymers, as buffered aqueous environments drastically altered polymer PFOA removal. The role of temperature on binding potential had no discernible effect on the ability of DMAPAQ polymers to remove PFOA. The cationic systems show interesting swelling behavior and significant PFOA removal results that can be explored further for potential environmental remediation applications

THE EFFECT OF BACTERIAL GROWTH STRATEGIES ON PLASMID TRANSFER AND NAPHTHALENE DEGRADATION FOR BIOREMEDIATION

Varner, P.M., M.N. Allemann, J.K. Michener, and C.K. Gunsch
Environmental Technology & Innovation 28:102910(2022)

A study explored the effect of the ecological growth strategies of plasmid donors and recipients on conjugation and naphthalene degradation of two PAH-degrading plasmids, pNL1 and NAH7. Both pNL1 and NAH7 showed conjugation preferences towards a slow-growing ecological growth strategy, except when NAH7 was in a mixed synthetic community. A combination of growth strategy, GC content, and phylogenetic relatedness partially described the conjugation preferences. Naphthalene removal via plasmid-mediated degradation was consistently higher in a community consisting of recipients with a slow-growing ecological growth strategy compared to a mixed community or a community consisting of a fast-growing ecological growth strategy. Understanding plasmid conjugation and degradative preferences can influence future remediation technology design and may have broad implications in biomedical, environmental, and health fields.

HYDROLYTICALLY STABLE IONIC FLUOROGELS FOR HIGH-PERFORMANCE REMEDIATION OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) FROM NATURAL WATER
Manning, I.M., N. Guan Pin Chew, H.P. Macdonald, K.E. Miller, M.J. Strynar, O. Coronell, and F.A. Leibfarth | Angewandte Chemie International Edition 61:e202208150(2022)

A class of polymer networks with a synergistic combination of ionic and fluorous components that serve as granular materials to remove anionic PFAS from water is reported in this article. A library of Ionic Fluorogels (IFs) with systematic variation in charge density and polymer network architecture was synthesized from hydrolytically stable fluorous building blocks. The IFs were effective sorbents in removing 21 legacy and emerging PFAS from natural water and were regenerable over multiple cycles of reuse. Comparison of one IF to a commercial ion exchange resin in mini-rapid small-scale column tests demonstrated superior performance in removing short-chain PFAS from natural water under operationally relevant conditions.
https://onlinelibrary.wiley.com/doi/epdf/10.1002/anie.202208150

REMOVING PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) IN WATER BY FOAM FRACTIONATION
Wang, Y., Y. Ji, V. Tishchenko, and Q. Huang. | Chemosphere 311(Part 2):137004(2023)

A systematic study of PFAS removal by foam fractionation (FF) is presented. Experiments were conducted on both laboratory-spiked and environmental water samples containing PFAS. Higher airflow, greater ionic strength, and the addition of thickener boosted PFAS removal in the defoamed bottom solutions and intensified enrichment in the collected foam. FF treatments of landfill leachate, groundwater contaminated by AFFFs, and a wastewater treatment plant effluent sample were evaluated. The removal rate was > 70% for most monitored PFAS, except short-chain PFAS. PFAS concentrations in the final collected foams were up to 30x than in the original samples. Analysis using high-resolution mass spectrometry revealed enrichment of non-target PFAS by FF. Results demonstrate the effectiveness of FF in removing most PFAS from waters, producing low-volume, highly concentrated solutions of PFAS in all environmental samples.

SOURCES OF POLYCHLORINATED BIPHENYLS TO UPPER HUDSON RIVER FISH POST-DREDGING
Capozzi, S.L., K.L. Francisco, B.L. Stahl, M. Al Hello, M.S. Meixler, and L.A. Rodenburg.
Chemosphere 310:136742(2023)

Portions of the Upper Hudson River were dredged from 2009-2015 to address PCBs, the dominant contaminant from General Electric (GE) plant discharges. In 2017, the first post-dredging survey of yearling feeder fish and sediment PCB contamination was conducted to establish a baseline for the river's recovery. Analysis of the sediment data indicated that 2% of the PCBs in the surface sediment were higher in molecular weight than the formulation used by GE and therefore arose from non-GE sources. Fish PCB data from the 2017 survey were analyzed using Positive Matrix Factorization. Empirical Bayesian Kriging was used to estimate PCB concentrations in sediment at fish sampling locations. Results suggest that PCB byproducts from microbial dechlorination bioaccumulated in the fish, representing 7% of the PCB mass in the fish data set. Further, results suggest that ~13% of the PCBs in the fish may have come from non-GE sources. This is higher than the percentage of non-GE PCBs in the sediment but can be explained by the higher molecular weight of the non-GE mixture, which causes it to bioaccumulate more effectively than GE PCBs. Concentrations of the non-GE PCBs averaged ~ 240 ppb wet weight (whole body) in yearling feeder fish. The remedial goals range from 50 to 400 ppb ww in fillet for fish, including piscivorous species that are likely to have higher PCB concentrations than feeder fish.

UNDERSTANDING THE EVOLUTION OF GROUNDWATER-CONTAMINANT PLUME CHEMISTRY EMANATING FROM LEGACY CONTAMINANT SOURCES: AN EXAMPLE FROM A LONG-TERM CRUDE OIL SPILL
Cozzarelli, I.M., M.J. Baedecker, A.C. Mumford, J.B. Jaeschke, and T.A. Spencer.
Groundwater Monitoring & Remediation 42(4):30-42(2022)

A study that investigated plume changes at the site of a 1979 crude-oil pipeline spill served as the first comprehensive look at groundwater chemistry associated with residual hydrocarbon source zones in different stages of aging. The data show a direct relationship between concentrations of benzene and naphthalene in the residual oil and those measured in water samples collected below the oil. Groundwater associated with oil near the spill site had different chemical composition compared with water associated with oil downgradient from the spill zone, indicating a shift in biodegradation reactions. Results emphasize that source zone processes are spatially and temporally heterogeneous and should be accounted for in natural attenuation studies where residual source zones persist.
https://ngwa.onlinelibrary.wiley.com/doi/epdf/10.1111/gwmr.12536

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General News

SUPERFUND REMEDY REPORT 17TH EDITION
EPA Office of Land and Emergency Management, EPA-542-R-23-001, 66 p, 2023

The 17th edition of the Superfund Remedy Report focuses on analyzing Superfund remedial actions selected in fiscal years 2018, 2019, and 2020. The report includes an analysis of remedies selected in 379 decision documents (Records of Decision [RODs], ROD amendments, and Explanations of Significant Differences with changes to remedy components) signed in the three-year period. Data are compiled on overall remedy selection and remedies for source materials (soil and sediment), surface water, groundwater, and air (i.e., vapor intrusion).
https://www.epa.gov/system/files/documents/2023-01/100003149.pdf

FATE & TRANSPORT OF VINYL CHLORIDE IN SOIL VAPOR
Eklund, B., R. Rago, G. Plantz, E. Haddad, M. Miesfeldt, and R. Volpi.
Remediation 32(4):273-279(2022)

This paper sets forth a conceptual model for understanding vapor intrusion results for VC and summarizes data from several field sites to illustrate the concepts. Data from multiple field sites are presented to illustrate the fate and transport of VC. At sites drawn from various regions of the U.S. covering a range of conditions, VC was detected at relatively high concentrations in groundwater. It may also have been detected in deeper soil gas but generally was fully attenuated before reaching shallow soil depths. Indoor air results were consistently non-detect. VC behavior is also discussed for sites with very shallow groundwater, where VC was found in some sub-slab soil gas samples but not in the overlying indoor air. https://onlinelibrary.wiley.com/doi/epdf/10.1002/rem.21732

REVIEW OF THE HYDRAULIC PERFORMANCE OF PERMEABLE REACTIVE BARRIERS BASED ON GRANULAR ZERO VALENT IRON
Bilardi, S., P.S. Calabro, and N. Moraci. | Water 15(1):200(2023)

An overview of the long-term hydraulic behavior of permeable reactive barriers (PRBs) composed of zero-valent iron (ZVI) mixed with other reactive or inert materials is provided in this paper. The literature on the hydraulic performance of ZVI-based PRBs in full-scale applications, long-term laboratory testing, and related mathematical modeling was thoroughly analyzed. The outcomes of this review include an in-depth analysis of factors influencing the long-term behavior of ZVI-based PRBs (i.e., reactive medium, contamination, and the aquifer's geotechnical, geochemical, and hydrogeological characteristics) and a critical revision of the lab procedures aimed at investigating their hydraulic performance. The analysis shows that admixing ZVI with non-expansive granular materials is the most suitable choice for obtaining a long-term hydraulically efficient PRB. Finally, the paper summarizes a procedure for the correct hydraulic design of ZVI-based PRBs and outlines that research should aim at developing numerical models to couple the hydraulic and reactive behaviors of PRBs. *This article is **Open Access** at*https://www.mdpi.com/2073-4441/15/1/200.

CONTAMINANT BACK DIFFUSION FROM LOW-CONDUCTIVITY MATRICES: CASE STUDIES OF REMEDIAL STRATEGIES
Blue, J., T. Boving, M.E. Tuccillo, J. Koplos, J. Rose, M. Brooks, and D. Burden.
Water 15(3):570(2023)

Four sites were selected as case studies after a review of the available literature on remediation of plume persistence due to back diffusion. Remediation methods at the sites included pump and treat, enhanced bioremediation, and thermal treatment. The review highlights that a relatively small number of sites have been studied in sufficient detail to fully evaluate remediation of back diffusion; however, three general conclusions can be made based on the review. First, it is difficult to assess the significance of back diffusion without sufficient data to distinguish between multiple factors contributing to contaminant rebound and plume persistence. Second, high-resolution vertical samples are decidedly valuable for back diffusion assessment but are generally lacking in post-treatment assessments. Third, complete contaminant mass removal from back diffusion sources may not always be possible. Partial contaminant mass removal may nonetheless have potential benefits, similar to partial mass removal from primary DNAPL source zones. *This article is **Open Access** at* https://www.mdpi.com/2073-4441/15/3/570.

MONITORING TECHNIQUES-GRAB AND PASSIVE SAMPLING

Hawker, D.W., J. Clokey, S.G. Gorji, R. Verhagen, and S.L. Kaserzon.
Emerging Freshwater Pollutants Analysis, Fate and Regulations, Chapter 3:25-48, 2022

This book chapter compares passive and conventional grab sampling techniques for pollutants (pharmaceuticals, pesticides, metals, and nutrients) and emerging pollutants (glyphosate and PFAS), highlighting the techniques' relative advantages, disadvantages, and challenges. For example, spot grab sampling is unsuitable for situations where pollutant concentrations are subject to fluctuation, whereas passive sampling can provide a time-weighted pollutant concentration. The application of these sampling techniques to current water quality guidelines from different countries is described. Approaches such as non-target analysis and improved techniques such as using novel passive sampling sorbents are suggested to address the growing list of emerging freshwater pollutants. A better theoretical understanding of how they operate and more calibration data, especially for emerging pollutants, is needed to enable wider use of passive samplers.

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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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