Technology Innovation News Survey

Entries for May 1-15, 2019

Market/Commercialization Information

SFAAP MUNITION AND EXPLOSIVES OF CONCERN REMOVAL AND ENVIRONMENTAL REMEDIATION, DESOTO, KANSAS

Department of the Army, U.S. Army Corps of Engineers, USACE District, Kansas City.
Federal Business Opportunities, Solicitation W912DQ-19-R-3008, 2019

This solicitation is a total small business set-aside acquisition for the award of a cost-plus-fixed-fee contract for construction and remediation services in support of the Former Sunflower Army Ammunition Plant, DeSoto, Kansas. The USACE Kansas City District requires removal and decontamination of 9 separate areas of underground infrastructure and sewers containing potentially explosive material, to include investigation and cleanup of environmental contamination beneath the sewers after the in-sewer explosive hazards have been removed and soil certified as safe. The NAICS code is 562910 (Remediation Services), size standard 750 employees. The selected contractor must have the ability to work in multiple remediation areas concurrently and adapt to changing requirements. The total duration of this contract, including the exercise of any options, is not to exceed 5 years and 6 months from date award. Offers must be received by 2:00 PM CT on July 8, 2019. https://www.fbo.gov/spg/USA/COE/DACA41/W912DQ-19-R-3008/listing.html

ANALYTICAL LABORATORY TESTING

Army Contracting Command, MICC - Joint Base Lewis-McChord, WA.
Federal Business Opportunities, Solicitation PANMCC-19-P-000-017371, 2019

This requirement is a total small business set-aside, NAICS code 541380, for analytical services support for the Joint Base Lewis McChord (JBLM). JBLM has need for an analytical laboratory to provide timely chemical analysis of soil/sludge, water, and biosolids for analytes such as diesel-range organics, semivolatiles, heavy metals, PCBs, and other compounds that might fall within federal or Washington State criteria. The objective of this contract is to obtain chemical data that are technically valid, of known quality, legally defensible, and that will meet or exceed the required project-specific DQOs. The Government anticipates issuing a firm-fixed-price indefinite delivery order contract for a period not to exceed one year. Due to short hold times for some analyses, the contractor laboratory must be located within 90 miles of the JBLM Main Gate to allow JBLM to drop off samples within the analytical hold time. The Contractor shall maintain ELAP accreditation. Offers must be received by 5:00 PM PT on July 5, 2019. https://www.fbo.gov/notices/7ce3ea175f947f137ae1ebc7a401197e

REMEDIAL ACTION OPERATIONS (RA-O) AND LONG-TERM MANAGEMENT (LTM) FOR LAUGHLIN, DYESS, GOODFELLOW, AND SHEPPARD AFBS, TEXAS

Department of the Air Force, AFICA - CONUS, Wright-Patterson AFB, OH.
Federal Business Opportunities, Solicitation FA8903-19-R-0074, 2019

This RFP is a total small business set-aside under NAICS 562910, size standard 750 employee. The Government anticipates awarding a competitive firm-fixed-price contract to acquire services for conducting RA-O and LTM for Laughlin, Dyess, Goodfellow, and Sheppard AFBs, Texas. The period of performance will be 18 months from date of award. See the performance work statement attached to the FedBizOpps notice for details. Proposals must be received by 2:00 PM CT on July 8, 2019. https://www.fbo.gov/notices/4c527120c05a1626963dd45b4cd6e97c

IDIQ COMPREHENSIVE ENVIRONMENTAL SERVICES AMC

U.S. Army Corps of Engineers, USACE District, Mobile, AL.
Federal Business Opportunities, Solicitation W9127819R0049, 2019

This requirement is issued as a competitive 8(a) set-aside under NAICS code 562910 for services in providing diversely skilled expertise in the implementation and application of environmental laws, statues, and regulations, such as the Clean Air Act, Clean Water Act, Endangered Species Act, CERCLA, National Historic Preservation Act, National Environmental Policy Act, OSHA, RCRA, Noise Control Act, Asbestos Hazardous Emergency Response Act, International Standard for Organization 14001, and Executive Orders involving the environment, occupational health, and safety. Proposals are due by 2:00 PM CT on July 9, 2019. [NOTE: SAM validation is required to access the locked bid package.]
https://www.fbo.gov/spg/USA/COE/DACA01/W9127819R0049/listing.html

ENVIRONMENTAL RESTORATION STUDIES AND MONITORING; ENVIRONMENTAL PLANNING; CERCLA AND RCRA ANALYSES, STUDIES, AND INVESTIGATIONS

Naval Facilities Engineering Command, NAVFAC Southeast, Jacksonville, FL.
Federal Business Opportunities, Solicitation N6945019S0610, 2019

The proposed contract is being considered for certified 8(a) businesses, NAICS code 562910. The Naval Facilities Engineering Command Southeast intends to award one IDIQ environmental technical services contract for environmental restoration projects, contract not to exceed 5 years or $4M. All interested firms should answer the Market Research Questionnaire posted at https://www.neco.navy.mil/synopsis_file/N6945019S0610_N6945019S0610_QUESTIONAIRE.docx by 5:00 PM ET on June 25, 2019.
https://www.fbo.gov/notices/4ea3d57323af85b1091e2f6a698ed955

PROJECT MANAGEMENT (SUPERFUND ADAPTIVE MANAGEMENT)

Environmental Protection Agency, Office of Acquisition Solutions, Region V, Chicago, IL.
Federal Business Opportunities, Solicitation 68HE0519R0006, 2019

EPA's Office of Superfund Remediation and Technology Innovation seeks to determine the availability of large and small businesses (small disadvantaged, 8(a), HubZone, woman-owned, veteran-owned, and service-disabled veteran-owned small businesses), NAICS code 541620, small business size standard $15M, able to perform the activities in the draft Statement of Work posted on FedConnect at https://www.fedconnect.net/FedConnect/?doc=68HE0519R0006&agency=EPA [Note: It might be necessary to copy and paste the URL into your browser for direct access]. The EPA Adaptive Management (AM) Task Force Workgroup requests contractor project management support/expertise to help develop the AM Site Management Plan for the 10th Street Site and the Baytown Township Groundwater Plume and an AM Project Management Plan for the Keyport OU1 of the Naval Undersea Warfare Center Division Site. These plans will focus on groundwater remedy completion strategies for the project/site that comply with CERCLA policy and guidance. Responses are due by 4:30 PM ET on June 26, 2019. [NOTE: Two different times are given for responses due on FedConnect, and the earlier time is given here.] https://www.fbo.gov/spg/EPA/OAM/MMC-101/68HE0519R0006/listing.html

Cleanup News

VOLUNTARY REMEDIATION PROGRAM COMPLIANCE STATUS REPORT: FORMER TRANSCO RAILCAR FACILITY, MACON, GEORGIA

Georgia Environmental Protection Division, 286 pp, 2019

The facility supported the railroad industry from 1889 to 1991. Environmental assessment activities identified lead and PCBs in soil and VOCs in groundwater. Remediation consisted of excavation of contaminated soils. During sampling, LNAPL was discovered in ~3 feet of well casing in monitoring well 2. This led to the installation of a free-phase LNAPL skimmer unit and continuous hydrophobic belt skimmer unit, selected based on their capability to extract LNAPL from a well casing with minimal water withdrawal (thus minimizing waste generation) and to extract LNAPL at its natural recovery rate at five extraction well points. LNAPL remediation was completed in 2018. The groundwater VOC plume was delineated and will continue to be monitored. https://epd.georgia.gov/sites/epd.georgia.gov/files/TranscoCSR.pdf

INNOVATIVE APPLICATIONS OF SUBGRADE BIOGEOCHEMICAL REACTORS: THREE CASE STUDIES

Gamlin, J., J. Cox, and A. Castor
Remediation 29(2):33-43(2019)

Three case studies are presented describing innovative subgrade biogeochemical reactors (SBGR) configurations recently developed and tested. The first case study addresses a site with groundwater deeper than 30 ft where an SBGR column configuration reduced TCE groundwater concentration from 9,900 µg/L to 97% within about 1 year. New SBGR configurations that are planned for treatment of additional classes of contaminants are summarized as well as a discussion describing research being conducted to further understand and optimize treatment mechanisms within SBGRs. *This article is* ***Open Access*** *at* https://onlinelibrary.wiley.com/doi/epdf/10.1002/rem.21586.

CASE STUDY: HOW TO AVOID FAILURES IN THE DESIGN AND INSTALLATION OF PERMEABLE REACTIVE BARRIERS

French, K. | SustainTech, 21 March, Saskatoon, Saskatchewan, 2019, 46 slides.

This presentation discusses a case study using a permeable reactive barrier (PRB) to remediate groundwater contaminated with chlorinated VOCs under a parking lot. Bench-scale studies and high-resolution site characterization were used to finalize the PRB design, which consisted of 30% zero-valent iron (ZVI) in a 0.9 m-thick PRB. The PRB was installed over 6 days and consisted of course sand and ZVI mixed in a cement truck before placement. Post-placement monitoring from 2012-2017 showed that all contaminant concentrations met site goals.
https://www.seima.sk.ca/resources/Documents/SustainTech%202019%20Presentations/SustainTech%20Kevin%20French%20presentation%202019%20(2).pdf

Demonstrations / Feasibility Studies

ACTIVELY FACILITATED PERMEABLE REACTIVE BARRIER FOR REMEDIATION OF TCE FROM A LOW PERMEABILITY AQUIFER: FIELD APPLICATION

Bekele, D.N., J. Du, L.G. de Freitas, M. Mallavarapu, S. Chadalavada, and R. Naidu.
Journal of Hydrogeology 572:592-602(2019).

Researchers developed a technique to remediate groundwater in a low-permeability and low water-bearing aquifer contaminated with TCE. The remediation technique introduced coupling of large-diameter permeable reactive barrier (PRB) wells with extraction wells in a highly impacted plume and re-injection wells at the fringe of the plume. The authors discuss approaches for coupling technologies to increase technical and economic feasibility. Extraction and reinjection wells of treated groundwater at the fringe of the plume promoted a positive hydraulic gradient, facilitated groundwater transport through the reactive media, and contained the plume. Detailed geospatial and statistical analysis with over 10 years' monitoring data showed that the dissolved TCE plume delineation shrank. Concentration continues to decline and is projected to meet the demands of remediation compliance regulations in the next few years.

CASE STUDIES: OVERCOMING ANNOYING CONTAMINANT REBOUND USING ADSORPTIVE TECHNOLOGIES

French, K. | SustainTech, 21 March, Saskatoon, Saskatchewan, 2019, 59 slides.

This presentation discusses two case studies demonstrating the Trap & Treat® Technology as an adsorptive tool that can prevent contaminant rebound during remediation. The first case study was conducted on the neighboring property to a former dry cleaner contaminated with a plume of VOCs. About 450 kg BOS 100®, which combines carbon adsorption using activated carbon (AC) pores and chemical reduction using zero-valent iron to trap contamination , was injected through 17 points over 2 days. After 3 months, VOC concentration fell 35.6% in test plot 1 and 99.1% in test plot 2. The second case study was conducted on a former underground storage tank contaminated with petroleum hydrocarbons. About 2,000 kg BOS 200 ®, which combines AC, nutrients, and microbes to trap PHC in pores; and 800 kg gypsum mixed in 10,000 L of slurry was injected through 40 points over 3 days. PHC concentrations in some wells were non-detect 8 days after injection. https://www.seima.sk.ca/resources/Documents/SustainTech%202019%20Presentations/SustainTech%20Kevin%20French%202%20presentation.pdf

Research

ADVANCES IN ANAEROBIC BIOREMEDIATION OF BENZENE

Dennis, P. | 2019 SMART Remediation, Toronto, Canada, 2019, 19 slides.

Several benzene degrading cultures have been identified, including a methanogenic benzene enrichment culture (DGG-B), developed at the University of Toronto. Recent research efforts have been undertaken to determine 1) whether bioaugmentation with the DGG-B culture is an effective remedy for benzene contaminated sites; 2) if the presence of benzene degrading biomarkers can be correlated to in situ biodegradation activity; and 3) if scale-up of the culture to volumes sufficient for field pilot testing application is feasible. Numerous anaerobic treatability studies have been conducted using site materials impacted with petroleum hydrocarbons ranging from 8 to 14 months. Degradation of BTEX was monitored with and without DGG-B bioaugmentation and under various electron acceptor conditions. The results to date indicate that bioaugmentation with the DGG-B culture was able to accelerate benzene degradation under methanogenic or sulfate-reducing conditions, while in one case no benzene degradation was observed despite bioaugmentation. Results from ongoing treatability studies provide insights into the performance of the DGG-B bioaugmentation culture at a range of petroleum hydrocarbon contaminated sites, as well as into the correlation between the presence of benzene degradation molecular biomarkers and in situ biodegradation. https://2ziaphmm3zh1x23mj335vjxt-wpengine.netdna-ssl.com/wp-content/uploads/2018/03/SMART-Remediation-Toronto-2019-Phil-Dennis.pdf

REMOVAL OF TOTAL PETROLEUM HYDROCARBONS FROM CONTAMINATED SOILS BY ELECTROCHEMICAL METHOD

Cocarta, D.M., I.A. Istrate, C. Streche, and D.M. Dumitru.
International Journal of Environmental and Ecological Engineering 11(5):479-483(2017)

This paper presents results to assess electrochemical treatment as an option for the remediation of total petroleum hydrocarbons (TPHs) from contaminated soils. The electrochemical method was applied in an experimental setup with the next dimensions: 450 mm x 150 mm x 150 mm. The setup length was devised in three electrochemical cells that were connected at two power supplies. The power supplies configuration was provided in such a manner that each cell has a cathode and an anode without overlapping. The initial value of TPH concentration in soil was of 1420.28 mg/kg dry weight. Twenty-one days of application resulted in removal efficiency of 31%, with better results in the anode area respect to the cathode one (33% respect to 27%). The energy consumption registered after the development of the experiment was 10.6 kWh for exterior power supply and 16.1 kWh for the interior one.
https://waset.org/publications/10007754/removal-of-total-petroleum-hydrocarbons-from-contaminated-soils-by-electrochemical-method.

FIELD TRIALS OF CHAOTIC ADVECTION TO ENHANCE REAGENT DELIVERY

Cho, M.S., F. Solano, N.R. Thomson, M.G. Trefry, D.R. Lester, and G. Metcalfe.
Groundwater Monitoring and Remediation [Published online 23 May 2019 prior to print]

of a circular array of wells followed by either mixing using an engineered RPM flow system to invoke chaotic advection, or by natural processes as the control. Pressure fluctuations from the mixing tests using the RPM flow system suggested that the target hydraulic behaviors were achieved with the time-dependent flow field. The tracer breakthrough responses showed that the desired RPM flow was generated. Results from several quantitative metrics adopted to demonstrate field-scale evidence of chaotic advection showed that mixing led to improved lateral tracer spreading and close to uniform concentrations across the monitoring network. The multiple lines of evidence assembled in this proof-of-concept study conclusively demonstrated that chaotic advection can be engineered at field scale.

ENHANCED ADSORPTION OF PERFLUORO ALKYL SUBSTANCES IN GROUNDWATER: DEVELOPMENT OF A NOVEL IN-SITU GROUNDWATER REMEDIATION METHOD

Aly, Y.H., Ph.D. dissertation, University of Minnesota, 117 pp, 2019

This thesis explores the amendment of natural soil by two cationic coagulants (polydiallyldimethylammonium chloride [PDM] and poly (epichlorohydrin-dimethyl) amine [PA]) in order to increase adsorption and retention of PFAS in groundwater. PFAS adsorption onto natural soil was increased significantly based on batch and column tests. ^{19}Fluorine-NMR spectra and PFOS ion-specific electrode analysis indicated that perfluoro carboxylates (PFCAs) were strongly bound in a solution of PA and PDM. There was little release detected, indicating that PFAS are strongly bound in solution and that this binding interaction potentially reduces bioavailability of enhancers when bound with PFAS. https://conservancy.umn.edu/handle/11299/202916

METHODS FOR ACTIVATED CARBON-BASED SEDIMENT REMEDIATION: APPLICABILITY, REMEDIATION POTENTIAL AND ADVERSE EFFECTS OF CONVENTIONAL AND NOVEL SORBENT MATERIALS UNDER FIELD AND LABORATORY CONDITIONS

Abel, S., Ph.D. dissertation, University of Eastern Finland, 61 pp, 2019

This thesis studied different activated carbon (AC) amendments for their remediation efficiency and adverse effects to allow a balanced view of the potential and risks of the method. A 14-month pilot-scale field study was conducted in a hydrophobic organic contaminant (PCB)-contaminated lake in Finland and complemented by laboratory trials. Field study results revealed several shortcomings of AC-based sediment remediation, including poor retention of the AC cap on site and ongoing recontamination with sediment from adjacent, untreated sites during storm events. A novel, low-buoyancy AC-based material (ACC-G) was developed to improve the sorbent's applicability from the water surface and increase its resistance to water turbulence. Initial laboratory tests showed high contaminant-binding capabilities of the novel material. Adverse effects were reduced compared to powdered ACs by granulating the ACC-G. This prevents the ingestion of AC particles by organisms, which has been suggested to be one of the major causes of AC-induced adverse effects.
http://epublications.uef.fi/pub/urn_isbn_978-952-61-3001-9/urn_isbn_978-952-61-3001-9.pdf

AN APPROACH FOR PASSIVE REMOVAL OF RESIDUAL LNAPL FROM GROUNDWATER

Svitana, K. and J. South.
Groundwater Monitoring and Remediation 39(2):64-70(2019)

This paper presents a passive approach for recovering persistent LNAPLs using nonwoven hydrophobic oil absorbing cloth. Lab trials assessed the physical properties of the cloth, including sorptive capacity and rate, buoyancy, and LNAPL wicking. It was determined that the cloth could be rolled and secured with cable ties for placement in the wells/sumps. Two placement designs were developed, one where rolled sorbent freely floated on the well/sump fluid surface and a second where the sorbent roll was placed in the fluid column at a fixed depth. Sorbents were then used at two manufacturing facilities where LNAPLs persisted for decades. In both instances, many wells/sumps were reduced to thicknesses below the action level in

REMEDIATION OF PERFLUOROOCTYLSULFONATE CONTAMINATION BY IN SITU SEQUESTRATION: DIRECT MONITORING OF PFOS BINDING TO POLYQUATERNIUM POLYMERS

Anderson, E.L., M.P.S. Mousavi, Y.H. Aly, X.V. Chen, M.F. Simcik, and P. Buhlmann.
ACS Omega 4:1068-1076(2019)

This paper aimed to calculate the stoichiometry and strength of PFOS when bound to polyquaternium polymers, which have been shown in laboratory studies to immobilize and concentrate PFOS in situ. Fluorous-phase ion-selective electrodes (ISEs) were used to determine the equilibrium constants characterizing binding of PFOS to poly-(dimethylamine-co-epichlorohydrin) and poly-(diallyldimethylammonium) in simulated groundwater and in soil suspensions. A new method is introduced to interpret potentiometric data for surfactant binding to the charged repeat unit of these polyions by combining a 1:1 binding model with the ISE response model. Data fit the binding model for poly (diallyldimethylammonium) and poly(dimethylamine-co-epichlorohydrin) chloride in soil-free conditions and in the presence of soil from Tinker Air Force Base. When the total PFOS concentration in a soil system is known, knowledge of these PFOS binding characteristics permits quantitative prediction of the mobile (free) and polymer-bound fractions of PFOS as a function of the concentrations of the polyquaternium polymer.
https://pubs.acs.org/doi/pdf/10.1021/acsomega.8b03275

COUPLED THERMALLY-ENHANCED BIOREMEDIATION AND RENEWABLE ENERGY STORAGE SYSTEM: CONCEPTUAL FRAMEWORK AND MODELING INVESTIGATION

Moradi, A., K.M. Smits, and J.O. Sharp.
Water 10(10):1288(2018)

This paper presents a novel method to couple an environmental bioremediation system with a subsurface renewable energy storage system. This method involves treating unsaturated contaminated soil using in situ thermally enhanced bioremediation; the thermal system is powered by renewable energy. After remediation goals are achieved, the thermal system can then be used to store renewable energy in the form of heat in the subsurface for later use. This method can be used for enhanced treatment of environmental pollutants for which temperature is considered a limiting factor. For instance, this system can be used at a wide variety of petroleum-related sites that are likely contaminated with hydrocarbons, such as oil refineries and facilities with above- and underground storage tanks. In this paper, a case-study example was analyzed using a previously developed numerical model of heat transfer in unsaturated soil. Results demonstrate that coupling energy storage and thermally enhanced bioremediation systems offer an efficient and sustainable way to achieve desired temperature-moisture distribution in soil that will ultimately enhance the microbial activity. *This paper is* ***Open Access*** *at* https://www.mdpi.com/2073-4441/10/10/1288/htm.

EVALUATING THE LONGEVITY OF A PFAS IN SITU COLLOIDAL ACTIVATED CARBON REMEDY

Carey, G.R., R. McGregor, A.L.-T. Pham, B. Sleep, and S.G. Hakimabadi.
Remediation 29:17-31(2019)

The remediation of per- and polyfluoroalkyl substances (PFAS) by injection of colloidal activated carbon (CAC) at a contaminated site in Central Canada was evaluated using various visualization and modeling methods. Radial diagrams were used to illustrate spatial and temporal trends in perfluoroalkyl acid (PFAA) concentrations, as well as various redox indicators. To assess the CAC adsorption capacity for PFOS, laboratory Freundlich isotherms were derived for PFOS mixed with CAC in two solutions: (1) PFOS in a pH 7.5 synthetic water that was buffered by 1 mM NaHCO3; and (2) a groundwater sample (pH = 7.4) containing PFAS from a former fire-training area in the United States. A mass balance approach was derived to facilitate the numerical modeling of mass redistribution after CAC injection, when mass transitions from a two-phase system (aqueous and sorbed to organic matter) to a three-phase system that also includes mass sorbed to CAC. An equilibrium mixing model of mass accumulation over time was developed using a finite-difference solution and was verified by intermodel comparison for prediction of CAC longevity in the center of a source area. A 3D reactive transport model (ISR-MT3DMS) was used to indicate that the CAC remedy implemented at the site is likely to be effective for PFOS remediation for decades. *This paper is* ***Open Access*** *at* https://onlinelibrary.wiley.com/doi/10.1002/rem.21593.

BIOCHAR AS AN EFFECTIVE MATERIAL ON SEDIMENT REMEDIATION FOR POLYCYCLIC AROMATIC HYDROCARBONS CONTAMINATION

Chen, Z., J. Chen, X. Yang, C. Chen, S. Huang, and H. Lu.
IOP Conference Series: Earth and Environmental Science 281:012016(2019)

This paper investigates the mechanism of biochar as capping material on PAHs removal in river sediments. When biochar was amended, pyrene was decreased through strengthened aging effects, which was attributed to high adsorption capacity of the biochar. While biochar did not alter the main microbial community, it provided a stable niche for PAHs degradation microorganisms, attributed to the porosity and biological affinity of biochar. According to the results, biochar increased the opportunity for PAH-degraders to contact PAHs in sediments. When electron acceptors were available, the pyrene-degraders in biochar pores degraded the adsorbed pyrene rapidly. https://iopscience.iop.org/article/10.1088/1755-1315/281/1/012016/pdf.

General News

ABSTRACT BOOK: SETAC EUROPE 29TH ANNUAL MEETING

Society of Environmental Toxicology and Chemistry Europe, 432 pp, 2019

The theme of the 29th annual SETAC meeting, held 26-30 May 2019 in Helsinki, Finland, was "One Environment. One Health. Sustainable Societies." This book comprises the abstracts of the presentations for the platform and poster sessions of the 2019 meeting. https://helsinki.setac.org/wp-content/uploads/2019/05/SETAC-Helsinki-Abstract-Book-2019.pdf

EPA SUPERFUND OPTIMIZATION PROGRAM

Pachon, C. and K. Biggs.
Naval Facilities Engineering Command (NAVFAC) Open Environmental Restoration Resources Webinar Series, March 21, 2019

This webinar presented an overview of the EPA Superfund Optimization Program. It presented the basic optimization components, reviewed the OSRTI optimization process and summarized the optimization accomplishments spread over the last 20 years. The presentation reviewed key COCs and treatment options with respect to remedy selection and optimization results for presumptive and innovative remedial strategies. Finally, the presentation highlighted key conclusions and offered a way forward for optimization within the Superfund Remedial Acquisition Framework. https://www.navfac.navy.mil/navfac_worldwide/specialty_centers/exwc/products_and_services/ev/erb/oer2.html#past_topics

PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) REMEDIATION WORKSHOP

Marley, M., E. Moyer, and R.G. Ball.
AEHS Foundation 34th Annual International Conference on Soils, Sediments, Water and Energy, 15-18 October 2018. 126 pp, 2018

This workshop presents recent information about remediating PFAS using physical, chemical, and biological technologies. Cutting edge technologies using advanced carbon, synthetic resins, alternative natural adsorbents, and advanced oxidation, among others, are explained. The presenters suggest key site data relevant to viable or promising PFAS remedial technologies that can be collected during site characterization. Treatability study methods, benefits, and limitations for PFAS remediation are discussed. Case studies at the bench and field scale illustrate both long- and short-chain PFAS remediation effectiveness. Case studies include a comparison of carbon and ion-exchange resin treatment, and chemical oxidation of PFAS intermixed with chlorinated solvents at an Air Force base, among others. http://www.xdd-llc.com/wp-content/uploads/2018/10/PFAS-Workshop-2018-Amherst-Final-Website.pdf

AN INTRODUCTION TO NATURAL SOURCE ZONE DEPLETION AT LNAPL SITES

Technical Bulletin 20. CL:AIRE (Contaminated Land: Applications in Real Environments), London, UK. TB1, 7 pp, June 2019

The purposes of this bulletin introducing natural source zone depletion (NSZD) at LNAPL sites are to introduce and raise awareness of NSZD and outline its potential significance; outline the key processes controlling NSZD rates and recent research advances; outline recent approaches to measuring NSZD, particularly the gaseous component; consider the varied roles of emerging NSZD technology use in the remediation life cycle; and review the challenges and needs yet to be overcome. *See the bottom of the page at* https://www.claire.co.uk/component/phocadownload/category/17-technical-bulletins.

THE DEVELOPMENT AND USE OF SUSTAINABILITY CRITERIA IN SURF-UK'S SUSTAINABLE REMEDIATION FRAMEWORK

Bardos, R.P., H.F. Thomas, J.W.N. Smith, N.D. Harries, F. Evans, R. Boyle, T. Howard, et al.
Sustainability 10(6):1781(2018).

The Sustainable Remediation Forum for the UK (SuRF-UK) published guidance on sustainability criteria for consideration in drawing up (or framing) assessments, organized across 15 "headline" categories: five for the environmental element of sustainability, five for the social, and five for the economic. This paper describes how the SuRF-UK indicator guidance was developed and the rationale behind its structure and approach. It describes its use in remediation option appraisal in the UK and reviews the international papers that have applied or reviewed it. It then reviews the lessons learned from its initial use and the opinions and findings of international commentators and concludes with recommendations on how the indicator categories might be further refined in the future. *This paper is* ***Open Access*** *at* https://www.mdpi.com/2071-1050/10/6/1781/htm.

INTEGRATED REMEDIATION PROCESSES TOWARD HEAVY METAL REMOVAL/RECOVERY FROM VARIOUS ENVIRONMENTS: A REVIEW

Selvi, A., A. Rajasekar, J. Theerthagiri, A. Ananthaselvam, K. Sathishkumar, et al.
Frontiers in Environmental Science 7:Article 66(2019)

This review summarizes various integrated processes for heavy metal removal from environmental matrices. It discusses the advantages and disadvantages of each integrated process, with a special mention of the few methods that needs more research attention. The review concludes that integrated processes consisting of two different methods to achieve a synergistic and an effective effort to remove heavy metals are viable remedial options. However, more research focus on the process is needed to challenge the in situ operative conditions. https://researchportal.port.ac.uk/portal/files/14116018/Integrated_Remediation_Processes_published.pdf

NANOTECHNOLOGY FOR ENVIRONMENTAL REMEDIATION: MATERIALS AND APPLICATIONS

Guerra, F.D., M.F. Attia, D.C. Whitehead, and F. Alexis.
Molecules 23(7):1760(2018)

This review provides an overview of three main categories of nanomaterials used for environmental remediation: inorganic, carbon-based, and polymeric-based materials. The use of these nanomaterials for the remediation of different environmental contaminants is reviewed. Various recent examples are extensively highlighted focusing on the materials and their applications. *This paper is* ***Open Access*** *at* https://www.mdpi.com/1420-3049/23/7/1760.

PRIORITIZATION APPROACHES FOR SUBSTANCES OF EMERGING CONCERN IN GROUNDWATER: A CRITICAL REVIEW

Gaston, L., D.J. Lapworth, M. Stuart, and J. Arnscheidt
Environmental Science and Technology 53(11):6107-6122

A systematic review of prioritization approaches for selecting emerging contaminants (ECs) that may pose a risk in groundwater was conducted using online databases searches for prioritization approaches of ECs in the aquatic environment. Searching standardized key word combinations resulted in 672 studies, 33 of which met the eligibility criteria. Results revealed a lack of groundwater-specific contaminant prioritization methodology in spite of widely recognized differences between groundwater and surface water environments with regard to pathways to receptors. The findings highlight a lack of adequate evaluation of methodologies for predicting the likelihood of an EC entering groundwater and knowledge gaps regarding the occurrence and fate of ECs in this environment. The review concludes with a proposal for a prioritization framework for ECs in groundwater monitoring that enables priority lists to be updated as new information becomes available for substances with regard to their usage, physicochemical properties, and hazards.

MULTI-CRITERIA DECISION ANALYSIS FOR ENVIRONMENTAL REMEDIATION: BENEFITS, CHALLENGES, AND RECOMMENDED PRACTICES

Havranek, T.J. | Remediation 29:93-108(2019)

This paper describes the potential benefits of multi-criteria decision analysis (MCDA) to the environmental remediation industry, the factors that may limit its use in this industry, and the MCDA process in general. The MCDA process description includes recommended practices for including stakeholder values and objectives and for performing stochastic MCDA. Lastly, the paper includes recommendations for enhancing stakeholder communications within the MCDA process. https://onlinelibrary.wiley.com/doi/epdf/10.1002/rem.21589

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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