Technology Innovation News Survey

Entries for December 16-31, 2019

Market/Commercialization Information

LBNL BUILDINGS 7 AND 7C DEMOLITION, OLD TOWN PHASE VII PROJECT
Department of Energy, Berkeley National Lab - DOE Contractor, Berkeley, CA.
Contract Opportunities on Beta.Sam.gov, Solicitation MF12-2019, 2020

This procurement is full and open under NAICS code 562910 (Remediation Services), size standard $22M or 750 employees. Lawrence Berkeley National Laboratory, Berkeley, CA 94720, requires the demolition of buildings 7 and 7C for its Old Town Phase VII project. Building 7 is a 21,400 gsf two-story wood-framed structure built in 1942. Building 7C is an ~480 gsf (40 ft x 12 ft) mobile office trailer on a concrete foundation north of building 7. Estimated project magnitude is $6M to $8M over a project term of 9 to 12 months. Abatement of any hazardous materials associated with both B7 and B7C is required to allow for open-air demolition. Materials associated with B7 are assumed to be radiologically contaminated. Asbestos in roofing, flooring, and interior wall and ceiling materials will also require abatement, as will PCBs detectable at levels above EPA action levels. Offers are due by 5:00 PM PT on February 19, 2020. https://beta.sam.gov/opp/00cc15d1a3474b10b819790da0a29be3/view

CHEMICAL, PHYSICAL AND/OR BIOLOGICAL ANALYSES IN VARIOUS ENVIRONMENTAL MATRICES
U.S. Army Corps of Engineers, Engineering Research & Development Center, Vicksburg, MS.
Contract Opportunities on Beta.Sam.gov, Solicitation W912HZ-20-T-W81EWF93081798--W81EWF93081801, 2020

This request for information/sources sought constitutes market research to gain knowledge of potential small and large qualified sources and their size classifications relative to NAICS Code 541380, small business size standard $15M. No solicitation is available at this time. The contractor shall be a full-service laboratory able to furnish all labor, bottles, materials, waste disposal, and supplies to accomplish the chemical, physical, and biological analyses listed in the files attached to the notice at beta.SAM. Typical analyses and standard method numbers to be performed are shown in Appendix 1.docx. Responses are due by 1:00 PM ET on February 14, 2020. https://beta.sam.gov/opp/b9f3ee66a94e433598f29b2adab83fed/view

THE COMBINED EPA ANALYTICAL SERVICES CONTRACTS
U.S. Environmental Protection Agency, Washington, DC.
Contract Opportunities on Beta.Sam.gov, Solicitation 68HERH19R0010, 2019

This procurement is a partial small business set-aside under NAICS code 541380 (Testing Laboratories). The U.S. EPA Contract Laboratory Program (CLP) provides analytical data through its Combined Analytical Services Contract (CASC) in support of investigation and cleanup activities under CERCLA and SARA. CASC provides a contractual framework for laboratories to perform CLP analytical methods for the isolation, detection, and quantitative measurement of target analytes identified in two statements of work: the Superfund Analytical Methods (Multi-Media, Multi-Concentration) SFAM01.0 (May 2019), and the High Resolution Superfund Methods (Multi-Media, Multi-Concentration) HRSM02.0 (May 2019). For details, go to FedConnect at https://www.fedconnect.net/FedConnect/?doc=68HERH19R0010&agency=EPA. Contractor shall utilize the prescribed analytical methods, quality control procedures, and submit analytical data in a defined standardized format. Responses are due by 4:30 PM ET on February 24, 2020 https://beta.sam.gov/opp/36d2014fda6847669ad7202d70d241b6/view

FY 2020 SBIR/STTR PHASE I RELEASE 2
Department of Energy, Office of Science, Funding Opportunity DE-FOA-0002146, 2020

Among the topics listed under DOE's current funding opportunity, the Office of Environmental Management seeks new on-site and field monitoring tools and sensors. As part of its current initiative to develop a process to close pump-and-treat systems effectively, DOE will need new methods of long-term monitoring. On-site and field monitoring tools and sensors that are part of a broad, spatially integrated monitoring system would reduce lab analysis costs significantly. Example desirable technologies include field analysis sensors, deployed sensors, geophysical monitoring tools, screening tools, and other concepts to reduce the number of lab-based analyses or to reduce sampling costs. SBIR Phase I applications for grants of up to $200,000 will be accepted until February 24, 2020. https://www.grants.gov/web/grants/view-opportunity.html?oppId=322870 Additional information: https://science.osti.gov/sbir/Funding-Opportunities.

UNEXPLODED ORDINANCE - UXO CLEARANCE
Army Mission & Installation Contracting Command, W6QM MICC Ft. McCoy (RC), WI.
Contract Opportunities on Beta.Sam.gov, Solicitation W911SA-20-Q-3045, 2020

This requirement is a service-disabled veteran-owned small business (SDVOSB) set-aside under NAICS code 562910 for unexploded ordinance services at Fort McCoy, WI. A period of performance from May 1, 2020, to April 30, 2021, plus four one-year option periods and a six-month option to extend services is anticipated for this IDIQ contract. A site visit is scheduled for 10:00 AM CT on Wednesday, February 12, 2020, at 2954 W. 14th Street, Fort McCoy, WI 54656. Interested firms should use the beta.sam search interface -- https://beta.sam.gov/search?index=opp -- to locate amendments and associated documents. [NOTE: Beta.sam assigns a new URL EVERY TIME a notice is updated, so future changes will not be reflected at the URL given here. To monitor for updates, either enter the SOL into the beta.sam search interface or use the "Follow" icon (if a registered user).] Offers are due by 10:00 AM CT on February 27, 2020. https://beta.sam.gov/opp/210191f5406140dfa74a68f08dd2f266/view

STRATEGIC ENVIRONMENTAL RESEARCH AND DEVELOPMENT PROGRAM (SERDP) EXPLORATORY DEVELOPMENT (SEED)
U.S. Army Corps of Engineers, USACE HEC, Ft. Belvoir, Alexandria, VA.
Contract Opportunities on Beta.Sam.gov, Solicitation W912HQ20S0003, 2019

DoD's SERDP Office is interested in receiving proposals from businesses both large and small for innovative research within SERDP's Exploratory Development (SEED) program: MRSEED-21-S1 - Detection, Classification, and Remediation of Military Munitions Underwater. Projects will be funded with firm-fixed-price contracts not to exceed $250,000 in total costs and no more than one year in duration. See the complete submittal instructions at https://www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations/SEED-SONs. To be eligible for consideration, submit a proposal by 2:00 PM ET on March 5, 2020. https://beta.sam.gov/opp/a20a47308137a35ef044290628aa6aef/view

Cleanup News

LONG-TERM EVALUATION OF MULCH BIOWALL PERFORMANCE TO TREAT CHLORINATED SOLVENTS
Walker Jr., K.L., T.M. McGuire, D.T. Adamson, R.H. Anderson.
Groundwater Monitoring & Remediation [Published online 9 January 2020 prior to print]

Ten years after the installation of seven mulch biowalls at Altus Air Force Base, soil and groundwater sampling showed long-term efficacy

for CVOC degradation. TCE was not detected in five of seven groundwater samples collected from the biowall despite upgradient detections above federal drinking water standards. Microbial sampling indicated high reducing conditions within the biowalls and favorable conditions for CVOC destruction via microbial reductive dechlorination. High cellulose content (>79%) of the mulch, elevated total organic carbon (TOC) content in groundwater and elevated potentially bioavailable organic carbon (PBOC) measurements in soil samples further supports an ongoing, long-lived source of carbon. In addition, concentrations of bacteria, TOC, PBOC, and other geochemical parameters suggest a modest impact of the biowalls downgradient. The continued presence of CVOCs downgradient may be attributable to back-diffusion from low-permeability shale. However, the biowalls continue to provide benefits by removing CVOCs in groundwater, thus reducing further CVOC loading to the downgradient, low-permeability strata.

FINAL THIRD FIVE-YEAR REVIEW REPORT FORMER NEBRASKA ORDNANCE PLANT OPERABLE UNIT NO. 2 (GROUNDWATER) MEAD, NEBRASKA
U.S. Army Corps of Engineers, 56 pp, 2019

The remedy performance at the former Nebraska Ordnance Plant Operable Unit 2 was evaluated in this five year review which spanned from 2013-2017. Since 2013, groundwater contaminated with RDX at the site has been treated at the wellhead with ultraviolet (UV) photolysis systems. The UV systems on four extraction wells and two focused extraction wells (FEW) treat RDX with a removal efficiency of 71-99%. A total of 36 lbs RDX were removed. The wellhead systems allowed the main GTP to shut down in 2014 resulting in an annual savings of 120,000 lbs of carbon. Groundwater at one UV-equipped FEW is also contaminated with TCE which is treated at the advanced oxidative process (AOP) groundwater treatment plant using a HiPOx™ reactor. The reactor removed 14,000 lbs of TCE by chemically oxidizing 1.1 billion gals of water through a mixture of hydrogen peroxide and ozone. A groundwater extraction well pumping and reinjecting groundwater at 20 gpm aids in TCE removal. Treated water is beneficially reused or discharged to onsite creeks.
https://usace.contentdm.oclc.org/utils/getfile/collection/p16021coll7/id/11729 [Note it may be necessary to copy and paste the URL]
More information: https://www.nwk.usace.army.mil/Missions/Environmental/Environmental-Projects/NOP/

RAPID ASSESSMENT AND REMEDIATION OF A REFINED PRODUCT RELEASE TO SOIL AND GROUNDWATER (PORT ARTHUR, TEXAS)
Neupane, A., E.W. James, and D. Schneider.
26th International Petroleum Environmental Conference, 7-9 October, San Antonio, TX, 33 slides, 2019

A refined product pipeline release led to the rapid assessment of impacted soil and groundwater using a combination of hydro punch and mobile gas chromatography lab. Once adequately assessed, impacted soil was remediated primarily by mass removal. Residual soil was treated with a combination of in situ chemical oxidation (ISCO) and enhanced bioremediation, leading to reductions below protective concentration levels and regulatory closure for soil issues. However, concentrations of up to 8.55 mg/L of benzene remained in groundwater. Following a bench-scale treatability test, full-scale ISCO application targeting three impacted areas was completed with a network of 31 injection and 13 extraction wells and resulted in significant reductions in total petroleum hydrocarbon-gasoline and benzene in the source area. Attenuation via natural source zone depletion and/or enhanced biostimulation/bioaugmentation is planned at the site to address the dissolved phased concentrations that still exceed regulatory levels.
https://cese.utulsa.edu/wp-content/uploads/2019/10/IPEC.final-A.-Neupane-Rapid-Assessment-Remediation-Soil-and-Groundwater.pdf

REMEDIATING PETROLEUM-CONTAMINATED GROUNDWATER WITH AN AERATED, DIRECT-PUSH, OXIDANT DELIVERY SYSTEM
Christenson, M., J. Reece, A. Kambhu, Y. Li, C. Harris, and S. Comfort.
26th International Petroleum Environmental Conference, 7-9 October, San Antonio, TX, 42 slides, 2019

An aerated, slow-release oxidant delivery system (oxidant candle) was installed by direct-push equipment to remediate TCE or BTEX at three sites in Nebraska. The system continuously bubbles air beneath oxidant candles in situ to facilitate oxidant spreading as the candle slowly dissolves. The aeration rate controls the outward flow of oxidant from the outer screen in all directions and the radius of influence around each drive point is largely a function of the outward velocity of the oxidant exiting the screen and the advection rate opposing the upgradient and lateral spreading of the oxidant. Field results from the three sites show downgradient contaminant concentrations typically decrease 50-99% within 6-9 months after installation.
https://cese.utulsa.edu/wp-content/uploads/2019/10/IPEC-2019-S.-Comfort-Comfort_AirLift_-2019.pdf *More information on the Cozad Landfill using Oxidant Candles:* https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1332&context=natrespapers

Demonstrations / Feasibility Studies

FIELD STUDY OF SOIL VAPOR EXTRACTION FOR REDUCING OFF-SITE VAPOR INTRUSION
Stewart, L., C. Lutes, R. Truesdale, B. Schumacher, J.H. Zimmerman, and R. Connell.
Groundwater Monitoring & Remediation [Published online 14 January 2020 prior to print]

A series of alternating extraction (soil vapor extraction [SVE] on) and rebound (SVE off) periods were run to determine if SVE could provide VI mitigation over a wide area encompassing multiple buildings, city streets, and subsurface utilities and eliminate the need for individual sub-slab depressurization systems in a commercial/light-industrial setting. SVE effectively mitigated offsite VI by intercepting or diluting contaminant vapors that would otherwise enter buildings through foundation slabs. Data indicated a measurable (5 Pa) influence of SVE on sub-slab/indoor pressure differential may occur but is not essential for effective VI mitigation. Indoor air quality improvements were evident in buildings 100-200 ft from SVE including those without a measurable reversal of differential pressure across the slab or substantial reductions in sub-slab VOC concentration. These cases also demonstrated mitigation effects across a four-lane avenue with subsurface utilities. These findings suggest that SVE affects distant VI entry points with little observable impact on differential pressures and without relying on sub-slab VOC concentration reductions.

INNOVATIVE CONTAMINANT MASS FLUX MONITORING IN AN AQUIFER SUBJECT TO TIDAL EFFECTS
Jamin, P., F. Cosme, P. Briers, P. Orban, K. De Greene, and S. Brouyere.
Groundwater Monitoring & Remediation [Published online 14 January 2020 prior to print]

Finite volume point dilution method (FVPDM) tests were undertaken continuously for more than 48 hours at 6 groundwater monitoring wells to evaluate groundwater flow dynamics and characterize highly transient groundwater flows and contaminant mass fluxes within a coastal groundwater flow system during several tide cycles. Contaminant concentrations were measured simultaneously to calculate contaminant mass fluxes. The study highlighted the importance of the aquifer heterogeneity, with groundwater fluxes ranging from 10^{-7} to 10^{-3} m/s. Groundwater flux monitoring enabled a significant refinement of the conceptual site model, including the observation that inversion of groundwater fluxes was not observed at high tide. Results indicated that contaminant mass fluxes were particularly higher at a specific monitoring well by more than 3 orders of magnitude than at other wells of the investigated aquifer. This study provided crucial information for optimizing further field investigations and risk mitigation measures

BIOSPARGE PILOT SYSTEM FOR AEROBIC DEGRADATION OF SULFOLANE
Harder, J., J. Mitton, S. Hains, E. Bergeron, and D. Jouen.
RemTech 2019: Remediation Technologies Symposium, 16-18 October, Banff, 26 slides, 2019

Enhanced attenuation via biosparging was pilot-tested at a former gas plant in Alberta to increase the aerobic biodegradation capacity of sulfolane in groundwater. The biosparging system was designed, constructed, optimized and operated in fractured bedrock to augment the groundwater with oxygen (via air injection) to enhance the growth of sulfolane-degrading microorganisms and sulfolane degradation rates The project was deemed a success in all three areas of evaluation: the mechanical performance of the system, the delivery of oxygen to the and sulfolane-degrader concentration. The mechanical system performance targets were all met which facilitated the delivery and maintenance of dissolved oxygen concentrations to the desired level (>2 mg/L). Sulfolane concentrations decreased and dissolved carbon dioxide and dissolved sulfate concentrations increased within and downgradient of the sparging zone. Putative sulfolane-degrading isolates contained reported sulfolane-degraders. Analysis of plate counts and next-generation sequencing data showed increases in the relative abundance of colonies and operational taxonomic units closely related to putative sulfolane-degraders

after biosparging began, within and downgradient of the sparging zone. Some challenges encountered included operating in winter conditions, associated aerobic nitrification, and nutrient supply. https://www.esaa.org/wp-content/uploads/2019/10/19-Harder.pdf
Longer abstract: https://www.esaa.org/wp-content/uploads/2019/09/72-RT-2019-Abstract.pdf

IN-SITU REDUCTIVE DEGRADATION OF CHLORINATED DNAPLS IN CONTAMINATED GROUNDWATER USING POLYETHYLENEIMINE-MODIFIED ZERO-VALENT IRON NANOPARTICLES

Mdlovu, N.V., K.S. Lin, C.Y. Chen, F.A. Mavuso, S.C. Kunene, and M.J. Carrera Espinoza.
Chemosphere 224: 816-826(2019)

Direct injection of polyethyleneimine-coated zero-valent iron nanoparticles (PEI-ZVIN) was field-tested to facilitate the reduction of TCE, PCE, and 1,2-DCE DNAPL contaminants in low-permeability media in situ. The test was conducted at a petrochemical company situated in the Miaoli County of Northern Taiwan that discharged significant amounts of DNAPLs. After in-situ injection and one-day of reaction with groundwater contaminants, ZVIN was further characterized to examine its efficacy in the reduction of pollutants. After the direct injection of PEI-ZVIN, a notable reduction in the concentration of DNAPLs was recorded with the conversion from toxic to non-toxic substances. The use of resistivity image profiling technique suggested similar conductivity data for the PEI-ZVIN suspension and groundwater samples. X-ray absorption near-edge structure and X-ray absorption fine structure studies depicted that the oxidation of ZVIN and PEI-ZVIN was occurring after the reductive reaction with contaminated groundwater. The reacted samples had bond distance values of 1.98, 2.00, 1.96, and 1.94 Å.

Research

SMOULDERING COMBUSTION FOR THE MANAGEMENT OF PFAS-IMPACTED SOILS AT BROWNFIELDS REDEVELOPMENT SITES IN CANADA

Scholes, G., G. Grant, D. Major, J. Gerhard, A. Duchesne, J. Brown, K. Weber, and D. Patch.
RemTech 2019: Remediation Technologies Symposium, 16-18 October, Banff, 31 slides, 2019

Recent work demonstrated that granular activated carbon (GAC) can be used to support in situ Self-sustaining Treatment for Active Remediation (STAR) and ex situ STAR (STARx) smoldering combustion techniques to achieve temperatures that destroy PFAS when added to soils at ~40 to 60 g/kg. Post-treatment concentrations of PFAS in the remaining sand, soil, and ash were below the 0.05 µg/k detection limit. Initial emission analyses indicate that over 82% of the available fluorine was captured as HF with only small amounts of PFAS emitted which could be subsequently captured by GAC and treated. Results to date are promising, suggesting the technique may provide an effective remediation technique for PFAS-impacted soils. https://www.esaa.org/wp-content/uploads/2019/10/19-Scholes.pdf
Longer abstract: https://www.esaa.org/wp-content/uploads/2019/09/6-RT-2019-Abstract.pdf

REMEDIATION OF PHENANTHRENE-CONTAMINATED SOIL BY ELECTROKINETICS COUPLED WITH IRON/CARBON PERMEABLE REACTIVE BARRIER

Ren, D., S. Li, J. Wu, L. Fu, X. Zhang, and S. Zhang.
Environmental Engineering Science 36(9):1224-1235

Seven sets of tests were conducted to investigate the combined performance of surfactant-enhanced electrokinesis (EK) coupled with Fe/C-filled permeable reactive barriers (PRBs) to treat phenanthrene (PHE)-contaminated soil. Tween 80, a nonionic surfactant, was selected as the solubility-enhancing agent. The tests also investigated the impact of potential gradient and surfactants on the soil remediation. Scanning electron microscopy, X-ray diffraction, and X-ray photoelectron spectroscopy were used to characterize Fe in the PRB and analyze the effect of EK on the micro-electrolysis in PRB. Results showed that PHE migrated toward the cathode under the driving force of the electro-osmotic flow and reacted with the Fe/C-PRB. After 5 days of repair, the removal efficiency of PHE in the test group with the potential gradient of 1 V/cm and the Fe/C mass ratio of 4:1 was 3.5 times as high as that in the control group in which only EK was applied. The removal efficiency of PHE in the test group and control group were 14.4% and 4.11%, respectively. The addition of Tween 80 also improved desorption and mobility of PHE in the soil. When the potential gradient was increased from 1 to 2 V/cm, the removal efficiency of PHE was increased by 42.3% (26.9% vs. 18.9%).

DEGRADATION OF PERFLUOROOCTANESULFONATE BY REACTIVE ELECTROCHEMICAL MEMBRANE COMPOSED OF MAGNELI PHASE TITANIUM SUBOXIDE

Shi, H., Y. Wang, C. Li, R. Pierce, S. Gao, and Q. Huang.
Environmental Science & Technology 53(24):14528-14537(2019)

PFOS degradation by a reactive electrochemical membrane (REM) system utilizing a porous Magneli phase titanium suboxide ceramic membrane that served simultaneously as an anode was tested. The system removed ~98.3% of PFOS under a cross-flow filtration mode at the anodic potential of 3.15 V versus a standard hydrogen electrode. PFOS removal efficiency during the REM operation was higher than that of the batch operation mode under the same anodic potential. A systematic reaction rate analysis in combination with electrochemical characterizations quantitatively elucidated enhanced PFOS removal in REM operation in relation to the increased electroactive surface area and improved interphase mass transfer. PFOS appeared to undergo rapid mineralization to CO_2 and F^-, with only trace levels of PFCAs (C4-C8) identified as intermediate products. Density functional theory simulations and experiments involving free radical scavengers indicated that PFOS degradation was initiated by direct electron transfer on the anode to yield PFOS free radicals, which further reacted with hydroxyl radicals that were generated by water oxidation and adsorbed on the anode surface.

LAB-SCALE REMOVAL OF PAHS IN CONTAMINATED SOIL USING ELECTRICAL RESISTANCE HEATING: REMOVAL EFFICIENCY AND ALTERATION OF SOIL PROPERTIES

Han, Z., W. Jiao, Y. Tian, J. Hu, and D. Han.
Chemosphere 239:124496(2020)

This study used a lab-scale electrical resistance heating (ERH) equipment to investigate the influence factors of ERH, PAH removal efficiency, and changes in soil properties through the treatment process. Results suggested that moisture and salinity were basic factors affecting electric conductive capability; heating 15 g of soil to the target temperature required at least 4 g solution of 0.1% salt. Higher electric strength ensured heating efficiency and maximum temperature. The removal efficiency of PAHs was significantly affected by its benzene rings and bond structure; during 90 min ERH treatment, more than 40% of the pollutants were removed synchronously with the evaporation of water. Co-boiling with water was confirmed to be the primary mechanism of ERH. The influence of the treatment on soil properties (organic matter, particle size, fertility, enzymatic activity) was limited, suggesting that soil functionality can be retained by ERH.

CONFIRMING IN-SITU BENZENE BIODEGRADATION UNDER ANAEROBIC CONDITIONS USING STABLE ISOTOPE PROBING

Sublette, K., D. Taggart, and K. Clark.
26th International Petroleum Environmental Conference, 7-9 October, San Antonio, TX, 24 slides, 2019

Statistical analyses were conducted on results of stable isotope probing (SIP) from 300 field samples collected from benzene sites around the world, including the United States, Australia, Canada, China, Saudi Arabia, and the United Kingdom. SIP is a biological tool that can provide conclusive proof of in situ anaerobic biodegradation. The samples included in the current analysis were Bio-Traps amended with a specially synthesized form of benzene-containing 13C. Following in-well deployment, the Bio-Traps were analyzed for ^{13}C enrichment in dissolved inorganic carbon (DIC) and microbial phospholipid fatty acids. ^{13}C incorporation into DIC conclusively demonstrated benzene mineralization during the deployment period. 13C incorporation into specific fatty acids associated with anaerobic microbial groups indicated that anaerobes were actively involved in the degradation of the ^{13}C-labeled benzene or one of its metabolites.

https://cese.utulsa.edu/wp-content/uploads/2019/11/IPEC-2019-K.-Sublette-Benzene.pdf

IMPROVING BIOTREATABILITY OF HAZARDOUS EFFLUENTS COMBINING ZVI, ELECTROLYSIS, AND PHOTOLYSIS
Ferreira, M.B., M. Munoz-Morales, C. Saez, P.Canizares, C.A. Martinez-Huitle, et al.
Science of The Total Environment 713:136647(2020)

Three advanced oxidation and three zero-valent iron (AOP-ZVI) processes were combined into nine different tests to determine which demonstrated potential as pretreatment for the biological degradation processes of organochlorinated pollutants. To do this, the changes undergone in the respirometric behavior, toxicity, and short-term biodegradability were compared. The three AOPs studied were anodic oxidation with mixed metal oxides anodes, with boron-doped diamond (BDD) anodes, and photolysis. They were evaluated in three different modes: without any addition of ZVI, with ZVI-dehalogenation as pre-treatment, and with ZVI-dehalogenation simultaneous to the AOP treatment. Clopyralid was used as a chlorinated hydrocarbon pollutant. Results show that the technologies could successfully treat wastes polluted with clopyralid. Lower toxicity was achieved using ZVI dehalogenation, and BDD-electrolysis improved the biodegradability of the effluents. The biological characteristics of the waste were significantly modified by dehalogenating the waste with ZVI, either previously to the treatment or simultaneously to the treatment.

CAN BIOCHAR AND DESIGNER BIOCHAR BE USED TO REMEDIATE PER- AND POLYFLUORINATED ALKYL SUBSTANCES (PFAS) AND LEAD AND ANTIMONY CONTAMINATED SOILS?
Silvani, L., G. Cornelissen, A. B. Smebye, Y. Zhang, G. Okkenhaug, et al.
Science of The Total Environment 694:133693(2019)

Contaminated soils were amended with either waste timber biochar (BC), coconut shell activated biochar (aBC) or a wood shrub iron-enriched designer biochar (Fe-BC) and were compared to determine their ability to remediate PFAS or heavy metals. Two PFAS-contaminated soils with total organic carbon (TOC) contents of 1.6 and 34.2% were amended with six doses of BC and aBC. Two Pb- and Sb-contaminated shooting range soils (TOC 5.2 and 10.2%) were amended with four doses of BC and Fe-BC. An amendment of 20% BC reduced the PFOS leachate concentration by 86% for the low TOC soil but was not effective for the high TOC soil. An amendment of 1% aBC reduced PFOS leachate concentrations by over >96% for both soils. For the low TOC shooting range soil, a 20% amendment of BC reduced Pb and Sb leaching by 61% and 12%, respectively. An amendment of 20% Fe-BC to soil with low TOC reduced Pb and Sb leaching by 99% and 40%, respectively. The need for designer biochars using processes such as iron enrichment or activation should be considered depending on the TOC of the soil, the type of contaminants and remediation goals.

General News

REMEDIATION OF MERCURY CONTAMINATED SOIL, WATER, AND AIR: A REVIEW OF EMERGING MATERIALS AND INNOVATIVE TECHNOLOGIES
Wang, L., D. Hou, Y. Cao, Y.S. Ok, F.M.G. Tack, J. Rinklebe, and D. O'Connor.
Environment International 134:105281(2019)

Recent developments in technological approaches to remediate Hg-contaminated soil, water, and air, are evaluated with a focus on emerging materials and innovative technologies. Extensive research on various nanomaterials for mercury removal is examined as well as characteristics of emerging materials, including graphene, biochar, metal organic frameworks, covalent organic frameworks, layered double hydroxides, clay minerals, and manganese oxides. The review also examines the performance of technologies with the aid of these materials as well as technologies involving organisms.

TREATMENT TRAIN APPROACHES FOR THE REMEDIATION OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS): A CRITICAL REVIEW
Lu, D., S. Sha, J. Luo, Z. Huang, and X.Z. Jackie.
Journal of Hazardous Materials 386:121963(2020)

Since 2015, treatment train processes have been used to effectively achieve in situ remediation of PFAS. This review provides new insight into recently reported treatment train studies selected from ~150 different publications on PFAS remediation and discusses their innovative designs, remediation performances, present limits, and possible improvements. A new design is proposed that consists of three individual technologies, nanofiltration, electrochemical anodic oxidation, and electro-Fenton degradation, to maximize the economic and environmental benefits of PFAS remedial measures.

EBC EMERGING CONTAMINANTS PROGRAM: PFAS REMEDIATION AND DISPOSAL - PFAS DETECTED, WHAT'S NEXT?
Environmental Business Council of New England Emerging Contaminants Program, 24 July, Reading, MA, 130 slides, 2019

The Environmental Business Council Emerging Contaminants Program explored current and future options for treatment and destruction for PFAS materials. Presentation topics included ongoing treatment projects; technologies currently employed for water treatment, destruction, and disposal of PFAS; and developing technologies for soil treatment. The technologies are applicable to drinking water, groundwater, industrial wastewater, sludges, spent media and soils.
https://ebcne.org/wp-content/uploads/2019/07/07-24-19-MASTER-PFAS-Detected-What-Next.pdf *Agenda*
https://ebcne.org/wp-content/uploads/2019/06/07-24-19-Final-Agenda-PFAS-Remediation-and-Disposal.pdf

BIO-BASED REMEDIATION OF PETROLEUM-CONTAMINATED SALINE SOILS: CHALLENGES, THE CURRENT STATE-OF-THE-ART, AND FUTURE PROSPECTS
Sima, N.A.K., A. Ebadi, N. Reiahisamani, and B. Rasekh.
Journal of Environmental Management 250:109476(2019)

This review focuses on the management of petroleum hydrocarbon (PHC)-contaminated saline soils and the potential of halophytes acting in concert with synergistic microbes to degrade PHCs. The goals were to identify optimal combinations of halophyte(s) and the bacteria present as endophytes and/or associated with the rhizosphere and determine what factors most strongly affect their viability.

WORLDWIDE TRENDS IN TRACING POLY- AND PERFLUOROALKYL SUBSTANCES (PFAS) IN THE ENVIRONMENT
Nakayama, S.F., M. Yoshikane, Y. Onoda, Y. Nishihama, M. Iwai-Shimada, M. Takagi, et al.
TrAC Trends in Analytical Chemistry 121:115410(2020)

Recent analytical methods developed to detect PFAS in air, water, abiotic solid matrices, and biological matrices are reviewed in this article. It also addresses non-target approaches. Various methods are covered including sampling, pre-treatment and instrumental analysis, and their applications, advantages, shortcomings and future needs.

AOPS-BASED REMEDIATION OF PETROLEUM HYDROCARBONS-CONTAMINATED SOILS: EFFICIENCY, INFLUENCING FACTORS AND ENVIRONMENTAL IMPACTS
Zhang, T., Y. Liu, S. Zhong, and L. Zhang. | Chemosphere 246:125726(2020)

This review presents an updated overview of the efficiency, influencing factors and environmental implications of advanced oxidation processes (AOPs). Key findings include 1) cyclodextrin and its derivatives can be used to synthesize targeting reagents; 2) soil organic

matter (SOM), glucose and cement can activate persulfate; 3) SOM affects redox circumstance in soil and could be further developed for enhancing the catalysis effect of transition metals; 4) non-thermal plasma and wet oxidation are promising methods of AOPs to remove petroleum hydrocarbons from soil; 5) the occurrence, fate, and transformation of intermediates during the degradation of petroleum hydrocarbons in soil should be considered. The review suggests an urgent need to develop cost-effective remedial strategies for petroleum hydrocarbons contaminated soils and to advance our knowledge on the generation, transport and propagation of radicals in soils.

PERSPECTIVES ON ARSENIC TOXICITY, CARCINOGENICITY AND ITS SYSTEMIC REMEDIATION STRATEGIES

Sodhi, K.K., M. Kumar, P.K. Agrawal, and D.K. Singh.
Environmental Technology & Innovation 16:100462(2019)

The current knowledge about the toxicity, carcinogenicity, and remediation strategies for arsenic removal from the environmental systems was reviewed to provide insight into arsenic removal by physicochemical processes and discuss the feasibility of using biological methods and its potential for sustainable use and environmental compatibility.

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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