

Entries for April 1-15, 2019

ADVANCE NOTIFICATION OF UPCOMING SOLICITATION - BAYVIEW PARCEL 1 CLEANUP AND SITE PREP

This future acquisition will be issued as a total small business set-aside. Subcontractor shall perform all work for the Bayview Parcel 1 Cleanup project to include removal of the legacy structures, site features, and potential residual impacted soils from the footprint of the former Bevatron Utilities Tunnel Demolition and in the potential mercury-contaminated area in accordance with the Subcontract SOW. This presolicitation notice provides numerous draft documents as files attached to the FedBizOpps notice to provide background information and help interested offers prepare for the forthcoming solicitation. Release of the solicitation is anticipated on May 22, and the notice cites June 7, 2019, as the current proposal due date. https://www.fbo.gov/spa/DOF/LBNL/LB/AdvNtr_BvvpwP1C-SP/Listing.html

OPTIMIZED REMEDIATION CONTRACT. JB ELMENDORF-RICHARDSON, ALASKA

The USACE Alaska District is conducting market research to facilitate determination of an acquisition strategy, and this Sources Sought is open to all qualified prime contractor firms (i.e., large and small businesses under NAICS code 562910). The contractor will be required to have sufficient staff, flexibility, and capability to conduct environmental remediation activities ranging from routine to complex at about 90 IBER Installation Restoration Program and Military Munitions Response Program Sites. Regulatory oversight will be provided by the U.S. EPA Region 10 and the Alaska DEC. Responses must be received by 2:00 PM Alaska Standard Time on June 10, 2019. <https://www.fbo.gov/spo/USACE/DAAC85/W911KB-19-R-0031-SS/listing.html>

ANNUAL BROAD AGENCY ANNOUNCEMENT (BAA) - FY19 ENVIRONMENTAL INITIATIVES FOR NAVFAC EXPEDITIONARY WARFARE CENTER (NAVFAC EXWC)

This funding opportunity is open until March 25, 2020. NAVFAC EXWC is interested in environmental technologies and methodologies that are either new, innovative, advance the state-of-the-art, or increase knowledge or understanding of a technology or methodology in the following topic areas: (1) Environmental assessment, restoration and cleanup. (2) Conservation of natural resources. (3) Unexploded ordnance. (4) Technologies and methodologies addressing emerging contaminants (e.g., PFASs, pharmaceuticals, pesticides, herbicides, endocrine-disrupting compounds, etc.). (5) Environmental compliance. (6) Resilient infrastructure crucial for enduring environmental protection. (7) Remote sensing and web-based data processing and reporting of environmental data. The request is for abstracts/white papers only, which may be submitted at any time during the open period. Use the abstract form and instructions located at http://www.navfac.navy.mil/navfac_worldwide/specialty_centers/exwc/products_and_services/ev/ec/baa.html for submissions. Full proposals may be submitted only as invited by the NEXWC contracting office.

NATURAL RESOURCE DAMAGE ASSESSMENT AND RESTORATION PROGRAM

Responsible Parties historically discharged a variety of hazardous wastes, including Hg, PCBs, PAHs, and chlorinated benzenes into Onondaga Lake, its tributaries, and other wetland and upland areas. These releases contributed to injuries to natural resources. The settlement of the natural resource damage claim with the Responsible Parties provides for a suite of ecological restoration projects designed to compensate for damage to natural resources. Fish and Wildlife Ecological Services will use the information applicants provide to conduct a competitive review and select projects for funding. The restoration projects are to be safe and cost-effective; address injured resources; consider actual and anticipated conditions; have a reasonable likelihood of success; and be consistent with applicable laws and policies. For this round of funding, about \$1M will be available to as many as 10 qualifying projects. The closing date for applications is July 30, 2019. The NRDA Program is authorized by the Federal Water Pollution Control Act; Oil Pollution Act; CERCLA; and Fish and Wildlife Act.

<https://www.grants.gov/web/grants/view-opportunity.html?oppId=314750>

SMALL BUSINESS EVENT: EPA OFFICE OF AIR AND RADIATION VENDOR DAY

OPA's Office of Air and Radiation (OAR) plans to hold a Vendor Day on Wednesday, June 19, 2019, from 8:30 AM to 3:00 PM. Participation will be limited to the first 150 registrants, and only one person from each company will be permitted to attend. OAR's mission areas include indoor and outdoor air quality, industrial air pollution, pollution from vehicles and engines, radon, acid rain, stratospheric ozone depletion, pollution prevention and energy efficiency, and radiation protection. The OAR program offices plan to provide an overview of program portfolios and requirements to attendees while gaining insight into the technical capabilities of participating vendors. Registration at <https://www.surveymonkey.com/r/OAR19> ends at 11:59 PM ET on June 3, 2019. <https://www.fbo.gov/notices/4bcb48d533854232313783327d65702>

SMALL BUSINESS EVENT: BUSINESS OPPORTUNITIES OPEN HOUSE

The USACE Buffalo District office is hosting its first annual Business Opportunities Open House event on Thursday, June 13, 2019, from 9:30 AM to Noon at the Buffalo Central Library, Central Meeting Room, 2nd Floor Lafayette Square, Buffalo, NY 14202. All companies are welcome to attend and the event is free, though pre-registration by 11:59 PM ET on June 10, 2019 is required via <https://www.usace.army.mil/portal/centralmeetingroom/booh2019>. Women-owned, veteran-owned, HUBZone, small disadvantaged, and service-disabled veteran-owned small businesses doing work in remediation and environmental services; marine, heavy, and civil construction; engineering; and dredging are especially encouraged to attend to meet District leadership, program managers, and project engineers to find out about upcoming projects and other business opportunities. <https://www.fbp.gov/sps/ISA/COE/DAC/W49/W912P4-19-SB-0001/listing.html>

LIBBY GROUNDWATER SITE, LIBBY, MONTANA: FOCUSED FEASIBILITY STUDY FOR THE UPPER AQUIFER, REVISION 2

The International Paper Company (Memphis, TN) comanated this feasibility study to develop and evaluate alternatives to remediate contaminants in the Upper Aquifer at the Libby Groundwater Site, a former lumber mill and wood treater. Prior remedial efforts at the site have been unsuccessful in meeting cleanup goals in certain portions of the Upper Aquifer that contain DNAPL (coal tar creosote). This report addresses portions of the Upper Aquifer affected by both creosote and LNAPL. An in situ bioparging (ISB) pilot-scale test was conducted in 2014-2017 in the Upper Aquifer soil and groundwater. A source area treatment system removed ~40,546 gal of NAPL from the Upper Aquifer (1991-2016) and currently consists of 3 extraction wells, 2 oil/water separators, 2 air strippers, 2 activated carbon filters, 2 ozonation systems, and 2 ozonation basins. The system is designed to effectively treat creosote and LNAPL using oxidation processes and support remediation timeframe estimates (2016-2018). Establishment of a Controlled Groundwater Area is currently being considered to consolidate existing institutional controls and provide a comprehensive and consistent way to address future potential groundwater consumption and plume stability until full cleanup occurs. http://link.springer.com/10.1007/978-1-4939-9125-1_18 http://www.epa.gov/epaosopr/remediation/groundwater/groundwaterdocuments/final_FES/Response%20to%20Comments%20-%202018.pdf A potential bio-oxidation treatment for creosote contaminated groundwater is being evaluated. The objective of this study is to determine the feasibility of using bio-oxidation to remediate creosote-contaminated groundwater. Creosote, "one of 4 presentations at <http://unf.edu/pan-box.com/s/pan339wld9w/4wrcnsc39a5vax33s5u/fil/35812171452D>. Use the mid-page arrow to move among the 4 presentations.

VINELAND CHEMICAL CO. INC., VINELAND, NJ: CLEANUP ACTIVITIES

The Vineland Chemical Company operated from 1949 to 1994 and produced arsenical herbicides and fungicides. The company stored by-product arsenic salts in open piles, lagoons and chicken coops, which led to contamination of groundwater, surface water, sediment, and soil throughout the area. To address arsenic-contaminated soil (OU1), EPA constructed an innovative soil washing facility that processed 70 tons of soil per hour. The facility processed over 400,000 tons of arsenic-contaminated soil and sediments until completion of the remedy in 2014. A pump-and-treat operation captures the flow of arsenic-contaminated groundwater from the plant site (OU2). Certain areas of exposed sediment/soil of the Blackwater Branch floodplain (OU3) became recontaminated with arsenic due to contaminated groundwater reaching the sediment/soil during ongoing implementation of the OU2 remedy. A ROD Amendment for the site was signed in September 2016 at <https://semspub.epa.gov/scrd/document.cfm?id=393184>, that modified the original OU3 remedial action to include in situ treatment, hot spot excavation, and the construction of a new, larger, pile-scale arsenic storage system. This system is installed at OU3 to effect treatment by injecting oxygen into the ground, causing a reaction with the arsenic that makes it immobile and insoluble. The new pilot system was tested in 2016 in one portion of the plume and expanded to an adjacent area in 2017. The pilot system is described in slides at <https://www.epa.com/unloadings/insights/NSRP/2016-DiMcarrillo-Vineland.pdf>.

Demonstrations / Feasibility Studies

FULL-SCALE FIXED-BED BIOLOGICAL PERCHLORATE DESTRUCTION DEMONSTRATION: CONSTRUCTION OF A FIXED-BED BIOREACTOR WELLHEAD TREATMENT SYSTEM

The efficacy of a 2-stage, fixed-bed biological treatment (FXB) system to address perchlorate-contaminated groundwater was evaluated at a facility in Rialto, Calif., alongside a fluidized bed bioreactor to enable comparison of the performance of the two biological treatment systems. Operation of the full-scale FXB system began on November 9, 2017, demonstrating successful removal of perchlorate (plus complete and consistent removal of 1.85 µg/L of TCE) and producing water that met all performance goals and water quality objectives. This report presents key findings and lessons learned from the project, including optimal chemical dose, backwash frequency, and plant hydraulics to be incorporated in future designs and operations.

<https://www.serris-estcn.org/content/download/49129/468610/file/FR-20169%20Final%20Report.pdf>

NANOREMEDIATION AND LONG-TERM MONITORING OF BROWNFIELD SOIL HIGHLY POLLUTED WITH AS AND HG

The capacity of NZVI for reducing the availability of As and Hg in brownfield soils was evaluated at pilot scale to determine the immobilization stability of As and Hg over a 32-month period. Two sub-areas (A and B) that differed in pollution load were selected, and a 5 m² plot was treated with 2.5% NZVI (Nanofer 25S or NanoIron by weight) in each case. In sub-area A, which had a greater degree of pollution, a second application was performed 8 months after the first application. Overall, the treatment significantly reduced the availability of both As and Hg, after only

72 h, although treatment effectiveness was highly dependent on the degree of initial contamination. Concentrations of As and Hg in sub-area A decreased in TCLP extracts by 65% and 50%, respectively, whereas in sub-area B (with a lower level of pollution) As and Hg decreased by 70% and 80%, respectively. NZVI application at a dose of 2.5% appears to be an effective approach for the remediation of soils at this brownfield site, especially in sub-area B.

NANOREMEDIATION AND LONG-TERM MONITORING OF BROWNFIELD SOIL HIGHLY POLLUTED WITH AS AND HG

Gil-Diaz, M., E. Rodriguez-Valdes, J. Alonso, D. Baragano, J.R. Gallego, and M.C. Lobo.
Science of the Total Environment 675:165-175(2019)

The capacity of NZVI for reducing the availability of As and Hg in brownfield soils was evaluated at pilot scale to determine the immobilization stability of As and Hg over a 32-month period. Two sub-areas (A and B) that differed in pollution load were selected, and a 5 m² plot was treated with 2.5% NZVI (Nanofor 25S or Nanoflon by weight) in each case. In sub-area A, which had a greater degree of pollution, a second application was performed 8 months after the first application. Overall, the treatment significantly reduced the availability of both As and Hg, after only 72 h, although treatment effectiveness was highly dependent on the degree of initial contamination. Concentrations of As and Hg in sub-area A decreased in TCLP extracts by 65% and 50%, respectively, whereas in sub-area B (with a lower level of pollution) As and Hg decreased by 70% and 80%, respectively. NZVI application at a dose of 2.5% appears to be an effective approach for the remediation of soils at this brownfield site, especially in sub-area B.

LOW CARBON HEATING AND COOLING BY COMBINING VARIOUS TECHNOLOGIES WITH AQUIFER THERMAL ENERGY STORAGE

Pellegrini, M., M. Bloemendal, N. Hoekstra, G. Spaak, A.A. Gallego, J.R. Comins, et al.
Science of the Total Environment 665:1-10(2019)

Adoption of aquifer thermal energy storage (ATES) varies strongly across Europe because of both technical and organizational barriers, e.g., differences in climatic/subsurface conditions and legislation, respectively. Six ATES pilot systems were installed in five different EU countries to show how such barriers can be overcome. This paper presents an analysis of barriers to use and pilot plants results. Two pilots show how ATES can be successfully used to redevelopment contaminated sites by combining ATES with soil remediation. Two other pilots show the added value of ATES because its storage capacity enables the utilization of solar heat in combination with solar power production. The last two pilots were realized in countries with legal barriers where ATES systems have not previously been applied at all. *Additional information:*

<https://www.deltareg.nl/app/uploads/2018/11/Soil-energy-as-smart-low-carbon-technology-for-cost-effective-climate-mitigation-AquaConSoil-2019.pdf>

EMULSIFIED POLYCOLLOID SUBSTRATE BIOBARRIER FOR BENZENE AND PETROLEUM-HYDROCARBON PLUME CONTAINMENT AND MIGRATION CONTROL: A FIELD-SCALE STUDY

Lee, T.H., W.Z. Cao, D.C. Cao, Y.T. Tsang, Y.T. Sheu, K.F. Shia, and C.M. Kao.
Science of the Total Environment 666:839-848(2019)

Benzene served as the target compound in a field-scale biobarrier study at an abandoned petrochemical manufacturing facility site where a leaking storage tank released benzene and other petroleum products. The biobarrier's emulsified polycolloid substrate (EPS), consisting of cane molasses, soybean oil, and surfactants, was pressure-injected into three remediation wells. Groundwater monitoring showed that EPS injection increased total organic carbon concentrations (up to 786 mg/L) in groundwater, which also resulted in the formation of anaerobic conditions. An abrupt drop in benzene concentration (from 6.9 mg/L to < 0.04 mg/L) was observed after EPS supplementation in the remediation wells (RWs) due to both sorption and biodegradation mechanisms. The first-order decay rate in RW1 increased from 0.003 to 0.023/d after EPS application. Results demonstrated the efficacy of the EPS biobarrier in containing the petroleum-hydrocarbon plume and preventing its migration downgradient.

MANIPULATING REDOX CONDITIONS TO ENHANCE IN SITU BIOREMEDIATION OF RDX IN GROUNDWATER AT A CONTAMINATED SITE

Jugnia, L.-B., D. Manno, S. Dodard, C.W. Greer, and M. Hendry.
Science of the Total Environment 676:368-377(2019)

Surficial application of waste glycerol (WG) for enhanced bioremediation was tested in situ at an old military range site to address RDX-contaminated groundwater. The treatment was effective in inducing strong reducing conditions (range: -4 to -205 mV) and increasing the concentrations of organic carbon (from 10 to 729 mg/L) and fatty acids (from 0 to 940 mg/L) concomitantly with a decrease in RDX concentrations (range: 17 to 143 µg/L) to below detection limits (0.1 µg/L) in 2 of the 3 monitoring wells evaluated. None of these changes were observed in the control well. RDX disappeared without the detection of any common anaerobic nitroso degradation intermediates, with the exception of one well where the organics concentration did not increase significantly (range: 10 to 20 mg/L), suggesting the conditions were not favorable for biodegradation. Ecotoxicological analysis indicated potential WG dose-related deleterious effects on different soil and aquatic receptors. Overall results at the site show that the WG treatment can provide an effective long-term, semi-passive remediation option for RDX-contaminated groundwater.

Research

NEW ELECTROCHEMICAL METHOD DETECTS PFOS AND PFOA: BUBBLE NUCLEATION IS THE BASIS FOR RAPID AND COST-EFFECTIVE ANALYSIS

Holski, E.
Chemical & Engineering News, 2019

Researchers have developed an electrochemistry-based method to detect surfactants, specifically PFOS and PFOA, with high sensitivity and specificity (Analytical Chemistry 2019, <https://pubs.acs.org/doi/10.1021/acs.analchem.9b01060>). The most commonly used detection method uses HPLC-MS/MS, which requires complex instrumentation and can cost up to \$300 per sample. The new method is based on a phenomenon known as electrochemical bubble nucleation. Applying electric potential to an electrode in an aqueous solution splits water into hydrogen gas and oxygen. Increasing current increases the gas concentration near the electrode until a bubble forms, blocking the electrode surface and causing the current to drop. Surfactants reduce surface tension and make it easier for such bubbles to form, meaning the amount of current required to form those bubbles is inversely related to surfactant concentration. The method could detect PFOS and PFOA concentrations as low as 80 µg/L and 30 µg/L, respectively. Preconcentrating samples using solid-phase extraction allows detection limits > 70 ng/L, the health advisory level for drinking water set by U.S. EPA. The ultimate goal is to create a handheld device for testing water in streams and other field sites—not just drinking water. <https://cen.acs.org/environment/persistent-pollutants/New-electrochemical-method-detects-PFOS-and-PFOA/97/web/2019/05>

PERFORMANCE ASSESSMENTS OF A NOVEL WELL DESIGN FOR REDUCING EXPOSURE TO BEDROCK-DERIVED ARSENIC

Winston, R.B. and J.D. Ayotte.
Groundwater 56(5):762-769(2018)

Arsenic in groundwater is a serious problem in New England, particularly for domestic well owners drawing water from bedrock aquifers. The overlying glacial aquifer generally has waters with low As concentrations but is less used because of frequent loss of well water during dry periods and the vulnerability to surface-sourced bacterial contamination. An alternative, novel design for shallow wells in glacial aquifers is intended to draw water primarily from unconsolidated glacial deposits, while being resistant to drought conditions and surface contamination. Its use could greatly reduce exposure to As through drinking water from domestic wells. See the well design patent at <https://patents.google.com/patent/US9689235B1/en>

THE APPLICABILITY OF SOIL FLUSHING TECHNOLOGY IN A METALLURGICAL PLANT

Manca, P.P., P. Caredda, and G. Orru.
International Journal of Coal Science & Technology 5(1):70-77(2018)

Successful application of in situ soil flushing depends on the leachability of the pollutants and the environmental compatibility and total volumes of the solutions used. This paper discusses feasibility testing for the applicability of soil flushing for different heavy metal contents and pH conditions of the flushing solution. <https://link.springer.com/article/10.1007/s40789-018-0190-9>

ENVIRONMENTAL RISK OR BENEFIT? COMPREHENSIVE RISK ASSESSMENT OF GROUNDWATER TREATED WITH NANO Fe⁰-BASED CARBO-IRON®

Weil, M., K. Mackenzie, K. Foit, D. Kuehnelt, W. Busch, M. Bundschuh, R. Schulz, and K. Duis.
Science of the Total Environment 677:156-166(2019)

Carbo-Iron® is a composite of zero-valent nano-iron and active carbon. In a study of the environmental risk of the in situ remediation agent, existing ecotoxicity data were complemented by studies with *Daphnia magna* (Crustacea), *Scenedesmus vacuolatus* (Algae), *Chironomus riparius* (Insecta), and nitrifying soil microorganisms. The predicted no-effect concentration of 0.1 mg/L (derived from acute and chronic ecotoxicity studies) was compared to environmental concentrations measured and modeled in a field study of Carbo-Iron applied in a groundwater contaminated with chlorohydrocarbons, and risk ratios were derived. The study data showed about a 50% decrease in the total environmental risk in the heavily contaminated zones after Carbo-Iron application, which suggests the benefit of remediation with Carbo-Iron outweighs its negative effects on the environment.

TREATMENT OF DE-ICING CONTAMINATED SURFACE WATER RUNOFF ALONG AN AIRPORT RUNWAY USING IN-SITU SOIL ENRICHED WITH STRUCTURAL FILTER MATERIALS

Pressl, A., B. Pucher, B. Scharf, and G. Langergraber.
Science of the Total Environment 660:321-328(2019)

Column experiments at temperatures between 3-5°C were carried out to evaluate the potential of in situ soil and a soil-based filter containing zeolite and perlite as additional filter media to degrade high concentrations of pavement de-icing fluids in surface water runoff. The study aimed to determine degradation potential when using 50% in situ soil mixed with zeolite and perlite. Due to the low temperatures, available nutrients were a key factor for the total organic carbon (TOC)-degrading microorganisms. Overall TOC reduction rates were found from 76% up to 98%, with TOC effluent concentrations in the range of 18-870 mg/L, depending on the influent concentration. The experimental results indicate good potential for the use of a soil-based filter as a passive solution for the treatment of de-icing runoff.

REMEDICATION OF CHLORINATED ETHENES IN FRACTURED SANDSTONE BY NATURAL AND ENHANCED BIOTIC AND ABIOTIC PROCESSES: A CRUSHED ROCK MICROCOSM STUDY

Yu, R., R.G. Andrachek, L.G. Lehmiche, and D.L. Freedman.
Science of the Total Environment 626:497-506(2018)

Most of the mass of TCE and cis-DCE at a fractured sandstone aquifer resides within the rock matrix. Strategies to restore groundwater to pre-existing conditions are severely limited by back diffusion. A microcosm study using crushed rock and groundwater from the site was performed to assess biostimulation and natural attenuation. Lactate, hydrogen release compound® (HRC), and emulsified vegetable oil (EVO) significantly increased the rate of TCE reduction to cis-DCE. Lactate also stimulated dechlorination of cis-DCE to VC and ethene, suggesting the presence of indigenous *Dehalococcoides*. Illumina sequencing and qPCR analyses suggest that reductive dechlorination of TCE to cis-DCE is mediated by *Geobacter* spp. while *Dehalococcoides* spp. perform reduction of cis-DCE to VC and ethene. The rate of VC reduction to ethene was much slower than the reduction of TCE to cis-DCE and cis-DCE to VC, indicating the indigenous *Dehalococcoides* perform the final step cometabolically and confirmed in enrichment cultures fed with only VC. Abiotic transformation of TCE and cis-DCE was observed based on accumulation of ¹⁴C-labeled products from ¹⁴C-TCE and ¹⁴C-cis-DCE. Based on accumulation rates for ¹⁴C-products in unamended microcosms, pseudo-first-order rates for abiotic transformation were 0.038/yr for TCE and 0.044/yr for cis-DCE, rates potentially sufficient to support natural attenuation in this diffusion-controlled system. See more on this study in R. Yu's dissertation at https://tigerprints.clemson.edu/all_dissertations/2019/

COMBINED IN SITU BIOREMEDIATION TREATMENT FOR PERCHLORATE POLLUTION IN THE VADOSE ZONE AND GROUNDWATER

Levakov, I., Z. Ronen, and O. Dahan.
Journal of Hazardous Materials 369:439-447(2019)

In Israel, perchlorate has been found at high concentrations in the vadose zone (up to 30,000 mg/L) and groundwater (up to 800 mg/L) underlying former industrial waste ponds. A proposed perchlorate reduction method that utilizes the high degradation potential of shallow soil and the high mobility of perchlorate across the deep unsaturated zone combines recurrent pumping and application of contaminated groundwater amended with an electron donor to the shallow soil layers. As a result, perchlorate biodegrades in the upper soil and the treated water drains through the unsaturated zone, flushing the pollutant toward the water table, where it is immediately pumped back to the surface for further treatment through a cyclic process. This treatment approach was implemented in a one-yr full-scale unsaturated zone (40 m) pilot study. Results showed a daily reduction in perchlorate concentration from 800 mg/L to practically zero. A total of ~330 kg of perchlorate was reduced during the experiment. Competitive reduction (iron and sulfate) and soil acidification were found to be limiting factors.

ASSESSMENT OF THE POTENTIAL OF VETIVER GRASS IN MITIGATION OF DIOXIN AND ARSENIC IN CONTAMINATED SOILS AT BIEN HOA AIRBASE

Dinh, N.Q., N.T.T. Huong, and N.T. Thanh Thao.
VNU Journal of Science: Earth and Environmental Sciences 34(3):(2018)

A field study was carried out to assess the potential use of Monto vetiver (*Chrysopogon zizanioides* L.) in mitigating dioxin contamination and the treatment of arsenic contaminated soils. The study area consisted of 3 lots of 100 m² each. The Monto genotype, known to be a noninvasive type of vetiver grass, was planted on November 25, 2014, in two groups, lots 1 and 2, in soils with initial dioxin levels of ~1000-1800 ppt TEQ and arsenic at about 25-30 mg/kg dry soil. Group 1 (G1) received DECOM 1, a soil supplement to promote the growth of indigenous microorganisms in the rhizosphere; Group 2 (G2) served without supplement as a control; and Group 3 was left unvegetated. Results showed that vetiver grass was able to absorb dioxin into grass roots and then to grass shoots. Dioxin in soil declined significantly in both G1 and G2, though somewhat more in G1 than in G2. The correlation between dioxin content in soil samples and root samples showed a tight relationship. Results also showed that vetiver roots can take up As and transport it to the shoots. This project receives support in part from the National Academies of Sciences: http://sites.nationalacademies.org/PGA/PFER/PFERscience/PGA_181433

PHYTOREMEDIATION POTENTIAL OF VETIVER GRASS IRRIGATED WITH WASTEWATER FOR TREATMENT OF METAL CONTAMINATED SOIL

Kafil, M., S. Boroomand Nasab, H. Moazed, and A. Bhatnagar.
International Journal of Phytoremediation 21(2):92-100(2019)

A field experiment was conducted to understand the potential of vetiver grass (*Vetiveria zizanioides*) in heavy metal uptake from the soil and wastewater. Four main irrigation treatments were applied: T1 (treated industrial wastewater), T2 (1:1 ratio of municipal:industrial wastewater), T3 (treated municipal wastewater), and T4 (fresh water). The effect of arbuscular mycorrhizal fungus, *Glomus mosseae*, on plant growth and heavy metal concentration was also evaluated. Three main criteria—bioconcentration factor, translocation factor, and heavy metal uptake—were applied to assess the potential of vetiver grass in accumulation and translocation of heavy metals to aerial parts. The highest concentration of heavy metals was found in plants and soils irrigated with T1 treatment followed by T2, T3, and T4 (lowest concentrations). Irrigation with treated municipal wastewater led to a significant increase in plant biomass and heavy metal uptake compared to other treatments. In T1 treatment (industrial wastewater), a significant decrease in Zn, Fe, Cu, Cd, and Pb concentrations was observed in vetiver-planted soil as compared to no-plant treatment. <https://www.tandfonline.com/eprint/bvTMrbvA7Zymwew9cvZ/full>

OPTIMISING THE TRANSPORT PROPERTIES AND REACTIVITY OF MICROBially SYNTHESISED MAGNETITE FOR IN SITU REMEDIATION

Joshi, N., F. Liu, M.P. Watts, H. Williams, V.S. Coker, D. Schmid, T. Hofmann, and J.R. Lloyd.
Scientific Reports 8:4246 (2018)

Microbially synthesized nanoscale magnetite, prepared from Fe(III) oxides by subsurface Fe(III)-reducing bacteria, offers a scalable biosynthesis route to a nanoscale remediation reagent. Batch and column experiments were conducted to assess and optimize the transport and reactivity of the particles in porous media. Collectively, the experiments showed that non-toxic, low-cost coatings such as guar gum and salts of humic acid can be used to enhance the mobility of the nanomaterial while maintaining reactivity against target contaminants. Bionanomagnetite (BNM) reactivity also was enhanced by the addition of surface coatings of nano-Pd, which extended the operational lifetime of the BNM in the presence of a simple electron donor, such as hydrogen or formate. <https://www.nature.com/articles/s41598-018-21733-y>

IN SITU ELECTROKINETIC REMEDIATION OF TOXIC METAL-CONTAMINATED SOIL DRIVEN BY SOLID PHASE MICROBIAL FUEL CELLS WITH A WHEAT STRAW ADDITION

Song, T.-S., J. Zhang, S. Hou, H. Wang, D. Zhang, S. Li, and J. Xie.
Journal of Chemical Technology & Biotechnology 93(10):2860-2867(2018)

This preliminary study illustrates how a solid-phase microbial fuel cell (SMFC) can drive the in situ electrokinetic (EK) remediation of toxic metal-contaminated soil. SMFCs with different concentrations of wheat straw, used in several configurations, were tested and compared. The SMFCs were used to drive the electromigration of Pb and Zn in contaminated soil, and their removal efficiency gradually increased with the straw ratio. After operating for 100 days, the removal efficiencies for Pb and Zn were 37.2% and 15.1%, respectively, in the anode region of the SMFC with 3% straw. Analysis of Pb and Zn fractions after the SMFC treatments using a sequential extraction method illuminated different distributions of the Pb and Zn fractions in the soil, indicating variations in removal efficiency.

DECONTAMINATION OF PETROLEUM-CONTAMINATED SOILS USING THE ELECTROCHEMICAL TECHNIQUE: REMEDIATION DEGREE AND ENERGY CONSUMPTION

Streche, C., D.M. Cocarta, I.-A. Istrate, and A.A. Badea.
Scientific Reports 8:3272(2018)

Two types of electrochemical treatment experiments were conducted using soils artificially contaminated with diesel fuel at the same level of contamination. The experimental conditions considered for each experiment were different amounts of contaminated soils (6 kg and 18 kg, respectively), the same current intensity level (0.25A and 0.5A), three different contamination degrees (1%, 2.5% and 5%) and the same application duration of the electrochemical treatment. The remediation degree concerning the removal of petroleum hydrocarbons from soil increased over time by ~20% over 7 days. With regard to energy consumption, results revealed that with about a triple increase in the quantity of treated soil, the specific energy consumption decreased from 2.94 kWh/kg of treated soil to 1.64 kWh/kg of treated soil. <https://www.nature.com/articles/s41598-018-21606-4>

DEEP VADOSE ZONE TREATABILITY TEST OF URANIUM REACTIVE GAS SEQUESTRATION FOR THE HANFORD CENTRAL PLATEAU

Truex, M.J., J.E. Szecsody, C.E. Strickland, D.A. St. John, M.M. Snyder, C.T. Resch, et al.
PNL-27773, 249 pp, 2018

A uranium reactive gas sequestration (URGS) test was conducted as a potential remedy to decrease the mobility of uranium in the vadose zone as a mechanism to protect groundwater at DOE's Hanford facility. The URGS technology is based on a series of geochemical reactions that occur when ammonia vapor is injected into uranium-contaminated vadose zone sediments. Lab tests with site sediments were conducted concurrently with the field test design and construction to evaluate treatment effectiveness. When lab results demonstrated that interferences affected the ammonia treatment, the field test was not conducted. This treatability test report compiles the technology information gained from lab testing during technology development and describes the field injection and monitoring equipment design and associated design calculations. Collectively, this information will enable evaluation of the ammonia gas technology for applicability at other sites. http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-27773.pdf

General News

INDEPENDENT ASSESSMENT OF SCIENCE AND TECHNOLOGY FOR THE DEPARTMENT OF ENERGY'S DEFENSE ENVIRONMENTAL CLEANUP PROGRAM

National Academies of Sciences, Engineering, and Medicine.
The National Academies Press, Washington, DC. ISBN: 13: 978-0-309-48775-7, 122 pp, 2019

This report identifies seven technology areas and alternative approaches that have the potential to substantially reduce long-term cleanup costs; accelerate cleanup schedules; mitigate uncertainties, vulnerabilities, or risks; or otherwise significantly improve DOE's Defense Environmental Cleanup Program for former nuclear weapons sites. The committee's recommendations address the following areas:

1. Waste chemistry at bulk and interfacial scales to facilitate treatment and disposal.
2. Nuclear properties of waste to facilitate treatment and disposal.
3. Human involvement in cleanup activities to increase cleanup efficiencies and reduce worker risks.
4. Interrogation approaches to characterize wastes and monitor cleanup remedies and environmental impacts.
5. Modeling and visualization approaches to manage large cleanup-related data sets and improve predictive capabilities.
6. Disposal pathways to increase waste disposition options.
7. Decision-making approaches to improve the quality and durability of cleanup decisions.

<https://www.nap.edu/catalog/25338/independent-assessment-of-science-and-technology-for-the-department-of-energy-s-defense-environmental-cleanup-program>

UPDATE FOR CHAPTER 3 OF THE EXPOSURE FACTORS HANDBOOK: INGESTION OF WATER AND OTHER SELECT LIQUIDS

EPA 600-R-18-259F, 157 pp, 2019

This update of the *Exposure Factors Handbook: 2011 Edition* contains new information on nonchemical-specific information used to assess human exposure to environmental contaminants. The intake data for water and select liquids can be used in assessing exposure and risk from contaminants in water for the general population, pregnant and lactating women, and formula-fed infants. http://ofmpub.epa.gov/eims/eimscmm.getfile?p_download_id=538153. See also the errata sheet: http://ofmpub.epa.gov/eims/eimscmm.getfile?p_download_id=538154

RECOGNIZING REDEVELOPMENT SUCCESSES: AWARD PROGRAMS CELEBRATING EXCELLENCE IN SITE REUSE

U.S. EPA, Office of Site Remediation and Technology Innovation, Superfund Redevelopment Initiative. EPA 520-R-18-001, 20 pp, 2018

U.S. EPA has established several award programs to recognize state, tribal, and local community partners who have worked collaboratively with EPA and gone the extra mile to support the redevelopment of Superfund sites in ways that are compatible with cleanups and are beneficial to communities. <https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P100W3X7.txt>

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.

Mention of non-EPA documents, presentations, or papers does not constitute a U.S. EPA endorsement of their contents, only an acknowledgment that they exist and may be relevant to the Technology Innovation News Survey audience.