Technology Innovation News Survey

Entries for December 1-15, 2017

Market/Commercialization Information

ESTCP FY19 BROAD AGENCY ANNOUNCEMENT (BAA)

Environmental Security Technology Certification Program (ESTCP), 2018

ESTCP is soliciting proposals for demonstrations of environmental and installation energy technologies. Areas of Environmental Restoration and Munitions Response interest include the following topics: (1) Innovative technology transfer approaches; (2) Long-term management of contaminated aquatic sediments; (3) Management of contaminated groundwater; and (4) Detection, classification, and remediation of military munitions in underwater environments. ESTCP has previously supported development of technologies under the above topics; duplication of previous efforts should be avoided. Proposed technologies should be well past the lab phase, although site-specific treatability work prior to the field demonstration is acceptable. Demonstrations should address technical and/or regulatory issues that inhibit the widespread use of the proposed approach across DoD. ESTCP supports demonstrations at a scale sufficient to determine the operational performance of the remediation technology and to estimate its expected full-scale costs. Pre-proposals must be delivered via the SERDP/ESTCP Management System (SEMS) by 2:00 PM ET on March 8, 2018. More information at https://serdp-estcp.org/Funding-Opportunities/ESTCP-Solicitations.

LABORATORY TESTING

Department of the Interior, Bureau of Reclamation, Denver, CO.
Federal Business Opportunities, FBO-5895, Solicitation 140R8118Q0040, 2018

This requirement is a total small business set-aside. The U.S. Bureau of Reclamation's Advanced Water Treatment Priority Area is undertaking a project to investigate biochar as water treatment filtration media for adsorption and biological reduction of dissolved metals and fluoride (FA352). The project will focus on three case studies in the Mid-Pacific and Great Plains regions and the use of biochar for treating waters contaminated by selenium, metals, and fluoride. Lab services are required to analyze source and treated waters for total and dissolved concentrations of metals by ICP-MS or AAS, and for fluoride and sulfate by EPA method 300.0 (ion chromatography). The period of performance is February 2018 to August 2019. The lab must be certified by the Colorado Department of Health and Environment for drinking water analyses. Responses to this notice are due by 5:00 PM MT on January 26, 2018.
https://www.fbo.gov/notices/6b9ae776ee2c9a9d91f5b25d54f00cf4

AN IDIQ BASE CONTRACT FOR SMALL BUSINESS A-E ENVIRONMENTAL SERVICES

Department of the Army, U.S. Army Corps of Engineers, USACE District, Louisville, KY.
Federal Business Opportunities, FBO-5896, Solicitation W912QR-AE(Environmental), 2018

A market survey is underway to investigate the availability of interested and qualified small business (SB), certified HUBZone, 8(a), woman-owned SB, or service-disabled veteran-owned SB contractors for A-E services to provide environmental support to the federal Government. Firms must be capable of performing work on a wide variety of hazardous, toxic, and radiological (HTRW) sites and other contaminated sites in compliance with all applicable regulations and within required timeframes at federal/military and civil works projects throughout the world. A-E services required under this contract include but are not limited to performing environmental studies, designs, and general support of environmental issues under RCRA, CERCLA, SARA, TSCA, the Clean Water Act, and other federal programs. [See the FedBizOpps notice for a detailed list of support activities.] Base IDIQ contract awards potentially would be awarded to multiple small businesses and set-asides. The contract duration for each award is estimated to be a 3-year base with a 2-year optional extension. The estimated capacity for each award is $8M. Small business firms operating under NAICS code 541330 are encouraged to respond to this survey by email by 2:00 PM ET on January 26, 2018.
https://www.fbo.gov/spg/USA/COE/DACA27/W912QR-AE(Environmental)/listing.html

SUPPORT FOR SERDP AND ESTCP

Department of the Army, U.S. Army Corps of Engineers, USACE HEC, Ft. Belvoir, VA.
Federal Business Opportunities, FBO-5894, Solicitation W912HQ-18-SN-0007, 2018

No award will be made as a result of this market survey. The U.S. Army Corps of Engineers - Humphreys Engineer Center Support Activity contemplates solicitation and award of a single-award task-order contract (SATOC) for program support for the Strategic Environmental Research and Development Program (SERDP) and the Environmental Security Technology Certification Program (ESTCP). The required services are expected to break out roughly as technical review of proposals and documents (35%); direct support to program areas (30%); administrative and financial (15%); meeting planning, logistics, and support (10%); and outreach (10%). The proposed SATOC is expected to be firm-fixed-price with a total estimated ceiling of $25M over three years (base year plus two options). Interested vendors under NAICS code 541690, 541620, or 541611 are encouraged to submit a capability package relevant to work described in the Performance Work Statement. Submit responses by 5:00 PM ET on January 31, 2018.
https://www.fbo.gov/spg/USA/COE/DACA72/W912HQ-18-SN-0007/listing.html

DOE EM NEVADA ENVIRONMENTAL PROGRAM SERVICES (EPS)

Department of Energy, Cincinnati, OH.
Federal Business Opportunities, FBO-5893, Solicitation 89303318REM000014, 2018

DOE's Office of Environmental Management Consolidated Business Center (EMCBC) EM Nevada Program is currently in the acquisition planning phase for potential upcoming environmental program services procurement at the Nevada National Security Site (NNSS), the Nevada Support Facility, and the Nevada Test and Training Range, including the Tonopah Test Range. The contract with the current contractor, Navarro Research and Engineering Inc., expires January 31, 2020. The purpose of this RFI is to solicit input via capability statements from interested businesses both large and small with the specialized capabilities necessary to meet all or part of the major elements of scope for the upcoming competitive procurement(s) for the EM NV EPS requirement. DOE seeks to determine whether any part of the requirement can be set aside for small business-type firms. The NAICS code for this requirement is 562910 (Environmental Remediation Services), small business size standard 750 employees. All capability statements (15 pages max) and questions pertaining to this announcement must be received by 3:00 PM ET on February 2, 2018, at EMNevadaEPS@emcbc.doe.gov. Watch for updates at https://www.emcbc.doe.gov/SEB/EMNevadaEPS/, the DOE EMCBC procurement page.
https://www.fbo.gov/spg/DOE/PAM/HQ/89303318REM000014/listing.html

Cleanup News

SOIL VAPOR EXTRACTION OF WET GASOLINE-CONTAMINATED SOIL MADE POSSIBLE BY ELECTROOSMOTIC DEWATERING: LAB SIMULATIONS APPLIED AT A FIELD SITE

Simpanen, S., D. Yu, R. Makela, H. Talvenmaki, A. Sinkkonen, H. Silvennoinen, and M. Romantschuk.
Journal of Soils and Sediments [Published online 4 May 2017 prior to print]

Aged oil-contaminated soil at a former fuel station in Finland was treated in situ using different methods sequentially. Following implementation of soil vapor extraction (SVE) and biostimulation with electrokinetic pumping, the dense original portion of the soil located beneath the gasoline pump (~100 m^3) was still contaminated with petroleum-derived VOCs at concentrations of nearly 10,000 mg/kg at some hot spots. After a period of electroosmotic water circulation, the electrical field (0.5 V/cm DC) was kept connected for 6 months without addition of water, leading to dewatering and warming of the soil. When SVE was renewed using perforated tubing installed horizontally at ~1 m depth in the dewatered soil, the treatment was effective, and soil decontamination was achieved in 5 months. The final VOC concentrations were on average 190 mg/kg (n = 13) with the highest value of 700 mg/kg at one hot spot. After risk evaluation, the site was found to be sufficiently clean for industrial use. *This paper is* ***Open Access*** *at* https://link.springer.com/article/10.1007/s11368-017-1717-1.

FIRST SEMIANNUAL 2017 GROUNDWATER AND SOIL VAPOR MONITORING & WASTE DISCHARGE REQUIREMENTS REPORT, DYMALLY HIGH SCHOOL/SOUTH REGION HIGH SCHOOL #12, 8800 SOUTH SAN PEDRO STREET, LOS ANGELES, CALIFORNIA

California State Water Resources Control Board, 584 pp, 2017

This report summarizes the field activities conducted at the site (an active high school) during the first half of calendar year 2017 and presents the results of groundwater and soil vapor monitoring and sampling. The groundwater results are discussed in the context of groundwater remediation implemented using sodium permanganate for in situ chemical oxidation (ISCO) of TCE and cDCE. ISCO implementation commenced in 2009 with one pilot injection followed in 2010 by two more injections. Results indicated only partial effectiveness—specifically, limited distribution in the treatment area. Evaluation of the lagging performance of the ISCO remedy led to design and implementation of a recirculation test to evaluate whether injection-extraction well pairs could enhance the distribution of previously injected permanganate. Monitoring data indicated permanganate was redistributed as recirculation gradients were induced between the recirculation wells. Owing to scaling and electrical issues, however, the recirculation pumps were removed in 2014. Full-scale injections were conducted in December 2011, comprising ~59,000 gal 3% w/w $NaMnO_4$ into 22 injection wells, followed by ~71,000 gal chase water. A 32-hr high-vacuum dual-phase extraction pilot conducted in 2015 was found to be an infeasible technology owing to the high cost of installing wells large enough to achieve sufficient drawdown and of disposing of full-scale volumes of extracted water. Monitoring data now show that chlorinated VOCs are rebounding in the groundwater and volatilizing into soil vapor. Additional groundwater treatment technologies will be evaluated.
http://geotracker.waterboards.ca.gov/esi/uploads/geo_report/6839286506/WDR100001088.PDF *See additional site information at* http://geotracker.waterboards.ca.gov/profile_report?global_id=WDR100001088.

Demonstrations / Feasibility Studies

REMEDIATION OF TRICHLOROETHENE (TCE)-CONTAMINATED GROUNDWATER BY PERSULFATE OXIDATION: A FIELD-SCALE STUDY

Chang, Y.-C., T.-Y. Chen, Y.-P. Tsai, and K.-F. Chen.
RSC Advances 8:2433-2440(2018)

The main objectives of the field project at an industrial park in Taiwan were to (1) evaluate the efficacy of TCE treatment using persulfate with different injection strategies; (2) determine the persistence of persulfate in the aquifer; (3) determine the persulfate radius of influence and transport distance; and (4) determine the impact of persulfate on indigenous microorganisms during remediation. Prior to persulfate injection, TCE concentrations were 0.26 mg/L in well P143 and 0.361 mg/L in well P146, and the microbial numbers were 6.1 x 103 CFU/mL in P143 and 4.4 x 104 CFU/mL in P146. Persulfate eliminated 100% of TCE in P146 and 95% in P143. A single injection of a total amount of 275 kg of 5% persulfate produced better TCE removal than two half persulfate injections in sequence. The compound persisted in the aquifer for 14 days, and transport distance ranged from 3.6 to 4.5 m. Following persulfate injection, total bacterial counts decreased slightly to 2.4 x 103 CFU/mL in P143 and 1.8 x 103 CFU/mL in P146. As persulfate was consumed, total bacterial counts increased, but there was a reduction in the diversity within the microbial community. Results show that sequential injections of a large amount of persulfate are suggested to maintain good long-term performance for TCE treatment. *This paper is* ***Open Access*** *at* http://pubs.rsc.org/en/content/articlehtml/2018/ra/c7ra10860e.

PILOT TEST REPORT: BIOACTIVE GRANULAR ACTIVATED CARBON (BIOGAC) WITH AEROBIC OXIDATION FOR EX SITU TREATMENT OF VINYL CHLORIDE IN GROUNDWATER, KNAPHOLM SITE, HERLEV, DENMARK

Region Hovedstaden, Center for Regional Udvikling, Grundvand, 57 pp, 2017

An aerobic bioactive granular activated carbon (BioGAC) pilot test was performed in an existing pump-and-treat (P&T) system for removal of chlorinated solvents in groundwater at the Knapholm site in Herlev, Denmark. The purpose of the pilot was to assess whether BioGAC can be used to extend the bed life of GAC in a P&T system, thereby reducing the frequency of replacing GAC in the reactors. The pilot test evaluated BioGAC performance using aeration and nutrient amendment between October 2015 and October 2016. The site is in an old industrial area with multiple potential sources of contamination from companies that historically used chlorinated solvents during operation, and contaminants in the groundwater include TCE, cDCE, VC. Backflush cycles are not commonly performed on typical GAC vessels but were performed during this BioGAC pilot test to mitigate the impacts of biofouling. Although increased resistance was observed in the BioGAC vessel, it did not limit P&T performance over the duration of the test, a period of 356 days. At the end of the test, VC concentrations remained relatively low while cDCE concentrations increased, indicating that perhaps with the influence of biological activity, treatment of VC in the process water was successful, whereas cDCE became the primary chlorinated ethene compound contributing chlorinated ethene mass loading to the carbon bed. Results suggest that while the BioGAC pilot might have extended GAC bed life with respect to VC, it did not succeed in extending the GAC bed life overall with respect to total chlorinated ethenes. http://danishsoil.org/media/projects/198/documents/Knapholm_BioGAC_Final_Rpt.pdf

Research

SULFIDATION OF IRON-BASED MATERIALS: A REVIEW OF PROCESSES AND IMPLICATIONS FOR WATER TREATMENT AND REMEDIATION

Fan, D., Y. Lan, P.G. Tratnyek, R.L. Johnson, J. Filip, D.M. O'Carroll, A. Nunez Garcia, & A. Agrawal.
Environmental Science & Technology 51(22):13070-13085(2017)

Iron-based materials used in water treatment and groundwater remediation—especially micro- and nanosized zero-valent iron—can be more effective when "sulfidated," i.e., modified with lower-valent forms of sulfur. Material characterization shows that varying sulfidation protocols (e.g., concerted or sequential) and key operational variables (e.g., S/Fe ratio and sulfidation duration) result in materials with structures and morphologies ranging from core-shell to multiphase. A meta-analysis of available kinetic data for dechlorination under anoxic conditions shows that sulfidation usually increases dechlorination rates, and simultaneously hydrogen production is suppressed. Sulfidation thus can greatly improve the efficiency of utilization of reducing equivalents for contaminant removal, likely due to inhibited corrosion as a result of sulfidation. Sulfidation may also favor desirable pathways of contaminant removal, such as (i) dechlorination by reductive elimination rather than hydrogenolysis and (ii) sequestration of metals as sulfides that could be resistant to reoxidation. Under oxic conditions, sulfidation is shown to enhance heterogeneous catalytic oxidation of contaminants. These net effects of sulfidation on contaminant removal by iron-based materials may substantially improve their practical utility for water treatment and remediation of contaminated groundwater. *This paper is* ***Open Access*** *at* http://pubs.acs.org/doi/abs/10.1021/acs.est.7b04177.

MECHANOCHEMICALLY SULFIDATED MICROSCALE ZERO VALENT IRON: PATHWAYS, KINETICS, MECHANISM, AND EFFICIENCY OF TRICHLOROETHYLENE DECHLORINATION

Gu, Y., B. Wang, F. He, M.J. Bradley, and P.G. Tratnyek.
Environmental Science & Technology 51(21):12653-12662(2017)

In water treatment processes that involve contaminant reduction by zero-valent iron (ZVI), reduction of water to dihydrogen is a competing reaction that must be minimized to maximize the efficiency of electron utilization from the ZVI. Sulfidation has been shown to decrease H_2 formation significantly, such that the overall electron efficiency of (or selectivity for) contaminant reduction can be greatly increased. This paper describes the development of a process for sulfidation of microscale ZVI by ball milling ZVI with elemental sulfur. The resulting material (S-mZVIbm) exhibits reduced aggregation, relatively homogeneous distribution of Fe and S throughout the particle (not core-shell structure), enhanced reactivity with TCE, less H_2 formation, and greatly improved electron efficiency of TCE dechlorination. The major products from TCE degradation by S-mZVIbm were acetylene, ethene, and ethane, consistent with dechlorination by beta-elimination as is typical of ZVI, iron oxides, and/or sulfides. *This paper is **Open Access** at* http://pubs.acs.org/doi/abs/10.1021/acs.est.7b03604?src=recsys.

MACROPOROUS CARBON SUPPORTED ZEROVALENT IRON FOR REMEDIATION OF TRICHLOROETHYLENE

Lawrinenko, M., Z. Wang, R. Horton, D. Mendivelso-Perez, E.A. Smith, T.E. Webster, D.A. Laird and J. van Leeuwen.
ACS Sustainable Chemistry and Engineering 5:1586-1593(2017)

A method is presented to produce zero-valent iron (ZVI) supported on macroporous carbon using only lignin and magnetite. Biochar-ZVI (BC-ZVI) produced by this method exhibits a broad pore size distribution with micrometer-sized ZVI phases dispersed throughout a carbon matrix. X-ray diffraction revealed that pyrolysis at 900°C of a 50/50 lignin-magnetite mixture resulted in almost complete reduction of magnetite to ZVI and that compression molding promoted iron reduction in pyrolysis due to mixing of starting materials. High-temperature pyrolysis of lignin yields some graphite in BC-ZVI due to reduction of carbonaceous gases on iron oxides. TCE was removed from water as it passed through a column packed with BC-ZVI at flow rates representative of average and high groundwater flow. One-dimensional convection-dispersion modeling revealed that adsorption by biochar influences TCE transport and that BC-ZVI facilitated removal of TCE from contaminated water by both adsorption and degradation.
http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1115&context=ccee_pubs

ACETYLENE FUELS TCE REDUCTIVE DECHLORINATION BY DEFINED *DEHALOCOCCOIDES/PELOBACTER* CONSORTIA

Mao, X., R.S. Oremland, T. Liu, S. Gushgari, A.A. Landers, S.M. Baesman, and L. Alvarez-Cohen.
Environmental Science & Technology 51(4):2366-2372(2017)

Acetylene (C_2H_2) can be generated in contaminated groundwater sites as a consequence of chemical degradation of TCE by in situ minerals. C_2H_2 is known to inhibit bacterial dechlorination. Researchers found that while high C_2H_2 (1.3 mM) concentrations reversibly inhibited reductive dechlorination of TCE by *Dehalococcoides mccartyi* isolates as well as enrichment cultures containing *D. mccartyi* sp., low C_2H_2 (0.4 mM) concentrations did not inhibit growth or metabolism of *D. mccartyi*. Cocultures of *Pelobacter* SFB93, a C_2H_2-fermenting bacterium, with *D. mccartyi* strain 195 or BAV1 were actively sustained by providing acetylene as the electron donor and carbon source, while TCE or cis-DCE served as the electron acceptor. Inhibition by acetylene of reductive dechlorination and methanogenesis in the enrichment culture ANAS was observed, and the inhibition was removed by adding *Pelobacter* SFB93 into the consortium. Transcriptomic analysis of *D. mccartyi* strain 195 showed genes encoding for reductive dehalogenases were not affected during C_2H_2 inhibition, while genes encoding for ATP synthase, biosynthesis, and Hym hydrogenase were down-regulated during C_2H_2 inhibition, consistent with the physiological observation of lower cell yields and reduced dechlorination rates in strain 195. These results will help facilitate the optimization of TCE bioremediation at contaminated sites containing both TCE and acetylene.

LABORATORY EVALUATION OF BIOSTIMULATION TO TREAT CHLORINATED ETHENES IN THE CHATSWORTH FORMATION, SANTA SUSANA FIELD LABORATORY, VENTURA COUNTY, CALIFORNIA

Freedman, D.L. and R. Yu.
California Environmental Protection Agency, Department of Toxic Substances Control, 292 pp, 2017

The purpose of this project was to perform two stages of testing at lab scale to provide information for evaluating biostimulation technology in the RCRA Corrective Measures Study for groundwater for potential deployment at the Santa Susana Field Laboratory (SSFL). The main objectives were to 1) determine the effect of biostimulation on the rate of TCE reduction; 2) determine if biostimulation enhances transformation of TCE and cDCE via pathways other than reductive dechlorination; and 3) assess the effect of biostimulation on transformation of TCE and cDCE within the rock matrix. Objectives 1 and 2 were addressed in Phase I, using microcosms prepared with samples of crushed rock and groundwater from SSFL. Objective 3 was addressed in Phase II, using novel intact rock core microcosms prepared with rock and groundwater from SSFL.
http://www.dtsc-ssfl.com/files/lib_feasibilitystudy/TreatabilityReports/67565_2017.07.10_Biostimulation_TS_w_Boeing_Xmittal.pdf
See additional information in R. Yu's dissertation at
http://tigerprints.clemson.edu/cgi/viewcontent.cgi?article=3022&context=all_dissertations

EVALUATION OF DIFFERENT AMENDMENTS AND FOLIAR FERTILIZER FOR IMMOBILIZATION OF HEAVY METALS IN CONTAMINATED SOILS

Guo, G., M. Lei, T. Chen, and J. Yang.
Journal of Soils and Sediments 18(1):239-247(2018)

A field experiment was conducted in soils contaminated with Cd and Pb to evaluate the effect of four amendments—sepiolite (SE), single superphosphate (SSP), triple super phosphate (TSP), and calcium magnesium phosphate (CMP) in combination with one foliar fertilizer (ZnSO4)—to reduce contaminant bioavailability in the calcareous soils. Amongst these treatments, the addition of SE + SSP and SE + CMP had the greatest effect in reducing Cd and Pb availability, respectively, in the soil. *This paper is **Open Access** at* https://link.springer.com/article/10.1007/s11368-017-1752-y.

SCALE-UP ON ELECTROKINETIC REMEDIATION: ENGINEERING AND TECHNOLOGICAL PARAMETERS

Lopez-Vizcaino, R., V. Navarro, M.J. Leon, C. Risco, M.A. Rodrigo, C. Saez, and P. Canizares.
Journal of Hazardous Materials 315:135-143(2016)

In a study of the effect of the scale-up of electrokinetic remediation processes in natural soils, a compacting process was employed to prepare soils with moisture content and density similar to those found in real field soils. Using soil obtained from a region with a high agrarian activity (Mora, Spain), the scale-up study was performed in two installations at different scales: a pilot-scale mockup (0.175 m^3) and a prototype at a scale similar to a real application (16 m^3). The electrode configuration consisted of rows of graphite electrodes facing each other located in electrolyte wells. The discharge of 20 mg of 2,4-dichlorophenoxyacetic acid [2,4-D] per kg of dry soil was treated by applying an electric potential gradient of 1 V/cm. Increase in scale was observed to directly influence the amount of energy supplied to the soil being treated. As a result, electroosmotic and electromigration flows and electric heating were more intense than in smaller-scale tests. Potential leaks were evaluated via a water-tightness test and evaporation losses quantification. *Manuscript version at* https://ruidera.uclm.es/xmlui/bitstream/handle/10578/11834/fi_1466159426-nm%202016%20jhm%20scale%20ekr.pdf

ELECTRO-KINETIC REMEDIATION OF CHROMIUM-CONTAMINATED SOIL BY A THREE-DIMENSIONAL ELECTRODE COUPLED WITH A PERMEABLE REACTIVE BARRIER

Xue, F., Y. Yan, M. Xia, F. Muhammad, L. Yu, F. Xu, Y.-C. Shiau, D. Li, and B. Jiao.
RSC Advances 7:54797(2017)

3D electrokinetic (EK) remediation of Cr-contaminated soil was investigated by coupling a 2D electrode with a permeable reactive barrier (PRB) and using a graphite electrode as the third electrode. The PRB contained a mixture of zero-valent iron and zeolite. The investigation encompassed three experimental conditions: 2D EK with and without PRB and 3D EK with PRB. Results were evaluated based on the removal rate and leaching efficiency in both the pre- and post-experiments. Comparison of the three conditions showed that 3D EK with PRB had a better effect on both leaching efficiency and soil contaminant removal rate. Single and multifactor experiments were designed to explore the optimum conditions on the basis of 3D remediation. Graphite particles with a 5% dosage resulting from the single-factor experiments were used in the multi-factor experiments. The best remediation efficiencies were achieved after 12 d using 0.05 mol/L citric acid and a voltage gradient of 1.5 V/cm in 3D EK remediation coupled with a PRB. *This paper is* ***Open Access*** *at* http://pubs.rsc.org/en/content/articlehtml/2017/ra/c7ra10913j.

REMEDIATION OF COPPER CONTAMINATED KAOLIN BY ELECTROKINETICS COUPLED WITH PERMEABLE REACTIVE BARRIER

Zhao, S., L. Fan, M. Zhou, X. Zhu, and X. Li.
Procedia Environmental Sciences 31:274-279(2016)

Electrokinetics (EK) is an in situ soil remediation technique by which the flow direction of contaminants can be controlled and low-permeability soil can be treated. In an investigation of remediation of copper-contaminated kaolin by electrokinetic process coupled with an activated carbon permeable reactive barrier (PRB), experimental results showed that integration of the PRB with EK successfully removed copper from kaolin with pH control of the catholyte. Average removal rate was highest at 96.6% when the initial Cu^{2+} concentration was 2000 mg/kg. *This paper is* ***Open Access*** *at* http://www.sciencedirect.com/science/article/pii/S1878029616000372.

ELECTROKINETIC REMEDIATION OF COPPER CONTAMINATED SOILS USING EDTA

Dasgupta, R., K. Venkatesh, and R.P. Tiwari.
International Journal of Innovative Studies in Sciences and Engineering Technology 2(6):18-23(2016)

Electrokinetic (EK) remediation for soil decontamination can demonstrate high removal efficiencies for metal ions. An investigation of the effect of initial Cu concentration and applied voltage on transport and Cu removal from typical clayey soil by EK remediation also examined Cu removal efficiency under various experimental conditions, such as process enhancement using purging solution at the anode end. Laboratory 1D tests were performed on typical clayey soil under the influence of a direct current electric field. The purging fluids, EDTA, and zero-valent iron powder were used in a reactive barrier, which enhanced EK remediation by increasing Cu removal from 66.55% to 74.85%. http://ijisset.org/wp-content/uploads/2016/06/IJISSET-020616.pdf

ENHANCED REMOVAL OF AS(V) FROM AQUEOUS SOLUTION USING MODIFIED HYDROUS FERRIC OXIDE NANOPARTICLES

Huo, L., X. Zeng, S. Su, L. Bai, and Y. Wang.
Scientific Reports 7:#40765(2017)

Hydrous ferric oxide (HFO) nanoparticles with carboxymethyl cellulose (CMC) or starch as modifier was synthesized to improve its stability for removing As(V) from water. Comparatively, CMC might be the optimum stabilizer for HFO nanoparticles given its effective physical and chemical stability. The large-pore structure, high surface specific area, and the non-aggregated nature of CMC-HFO lead to increased adsorption sites and thus high adsorption capacities of As(V) without pre-treatment (355 mg/g), much greater than reported in previous studies. Second-order equation and a dual-mode isotherm model could be used successfully to interpret the sorption kinetics and isotherms of As(V), respectively. FTIR, XPS, and XRD analyses suggested that precipitation and surface complexation were primary mechanisms for As(V) removal by CMC-modified HFO nanoparticles. A surface complexation model was used to simulate As adsorption over pH 2.5-10.4. The predominant adsorbed arsenate species were modeled as bidentate binuclear surface complexes at low pH and as monodentate complexes at high pH. The immobilized As remained stable when aging for 270 d at room temperature.
https://www.nature.com/articles/srep40765

CELLULOSE NANOCRYSTAL ZERO-VALENT IRON NANOCOMPOSITES FOR GROUNDWATER REMEDIATION

Bossa, N., A.W. Carpenter, N. Kumar, C. de Lannoy, and M.R. Wiesner.
Environmental Science: Nano 4:1294-1303(2017)

This paper reports the synthesis of nanoscale zero-valent iron (NZVI) particles stabilized by cellulose nanocrystal (CNC) rigid nanomaterials (CNC-NZVI; Fe/CNC = 1 w/w) with two different CNC functional surfaces (-OH and -COOH) using a classic sodium borohydride synthesis pathway. The final nanocomposites were thoroughly characterized and the reactivity of CNC-NZVI was assessed by their methyl orange (MO) dye degradation potential. The mobility of nanocomposites was determined in (sand/glass bead) porous media by utilizing a series of flowthrough transport column experiments. The synthesized CNC-NZVI provided a stable colloidal suspension and demonstrated high mobility in porous media with an attachment efficiency value < 0.23. In addition, reactivity toward MO increased up to 25% compared to bare ZVI. The use of CNC as a delivery vehicle shows promising potential to further improve the capability and applicability of NZVI for in situ groundwater remediation.

USER'S GUIDE FOR BIODEGRADATION REACTIONS IN TMVOCBIO

Jung, Y. and J. Battistelli.
LBNL-1005179, 45 pp, 2016

TMVOCBio is an extended version of the TMVOC numerical reservoir simulator, with the capability of simulating multiple biodegradation reactions mediated by different microbial populations or based on different redox reactions, thus involving different electron acceptors. This modeling feature is implemented within the existing TMVOC module in iTOUGH2. TMVOCBio uses a general modified form of the Monod kinetic rate equation to simulate biodegradation reactions, which effectively simulates the uptake of a substrate while accounting for various limiting factors (i.e., limitation by substrate, electron acceptor, or nutrients). Two approaches are included: 1) a multiple Monod kinetic rate equation, which assumes all the limiting factors simultaneously affect the substrate uptake rate, and 2) a minimum Monod model, which assumes that the substrate uptake rate is controlled by the most limiting factor among those acting on the specific substrate. Limiting factors include biomass growth inhibition, toxicity effects, and competitive and non-competitive inhibition effects. The temperature and moisture dependence of biodegradation reactions is also considered. This report provides mathematical formulations and describes the assumptions used for modeling the biodegradation reactions as well as additional modeling capabilities. A detailed description of the input format for biodegradation reactions is presented along with sample problems.
https://www.osti.gov/scitech/biblio/1377850-users-guide-biodegradation-reactions-tmvocbio

General News

FAQs REGARDING PFASs ASSOCIATED WITH AFFF USE AT U.S. MILITARY SITES

Field, J., C. Higgins, R. Deeb, and J. Conder.
ESTCP Project 201574-T2, 35 pp, 2017

This brief report summarizes the state of knowledge regarding per- and polyfluoroalkyl substances (PFASs) as related to the use and release of aqueous film forming foams (AFFFs) at U.S. military sites. The document addresses eight frequently asked questions about PFASs and provides citations from the literature that offer more detailed information. In addition to describing the unique structural attributes and uses of PFASs in AFFFs, the report identifies other sources of human and environmental exposure, the environmental media in which PFASs are found, and the factors that control PFASs fate and transport. An overview of currently available characterization and remedial tools is provided in addition to information on the pathways of human and ecological health effects. https://www.serdp-estcp.org/content/download/46353/431598/file/FAQ%20ER-201574%20September%202017.pdf

BOTTLE SELECTION AND OTHER SAMPLING CONSIDERATIONS WHEN SAMPLING FOR PER- AND POLY-FLUOROALKYL SUBSTANCES (PFAS) - REVISION 1.2

DoD Environmental Data Quality Workgroup, 2 pp, 2017

During sample collection, the use of products that contain PFASs could contaminate the samples. While written for a DoD practitioner audience, the information is useful for a broader audience, but is not an EPA guidance document. To prevent accidental contamination of samples, this fact sheet identifies materials to use and materials to avoid.
http://www.denix.osd.mil/edqw/home/what-s-new/unassigned/edqw-pfas-sampling-factsheet-rev-1-2-july-2017

CHARACTERIZATION AND REMEDIATION OF FRACTURED ROCK

Interstate Technology and Regulatory Council (ITRC), FracRx-1, 2017

Contaminated fractured rock sites have often been considered too complex to be remediated, so site managers default to simply containing the contamination. This web-based document provides an introduction to the unique puzzle faced when investigating and remediating fractured rock sites. The guide explains the processes controlling contaminant fate and transport in fractured rock; addresses significant advances in skills, tools, and lessons learned in understanding contaminant flow and transport in fractured rock environments; describes how to develop a useful conceptual site model; and discusses how to identify strategies to remediate contamination in fractured rock. http://fracturedrx-1.itrcweb.org/

SEDIMENT SITE RECONTAMINATION: LEVERAGING NATIONAL POLICIES AND CROSS-PROGRAM COORDINATION STRATEGIES

ASTSWMO Sediments Focus Group.
Association of State and Territorial Solid Waste Management Officials (ASTSWMO), 29 pp, 2017

The purpose of this document was to evaluate efforts coordinated across CERCLA and CWA authorities that were, or could have been, better aimed at preventing sediment recontamination. Several case studies are presented of CERCLA sites that involve a component of sediment remediation through which to explore the application of collaborative recommendations jointly developed by several EPA offices. http://astswmo.org/files/Resources/CERCLA_and_Brownfields/Sediment-Site-Recontamination-Paper-Final.pdf

INTERIM RECORDS OF DECISION PAPER

ASTSWMO Remedial Action Focus Group.
Association of State and Territorial Solid Waste Management Officials (ASTSWMO), 17 pp, 2017

Based on feedback ASTSWMO has received from the states, numerous and varied criteria are identified for consideration when deciding if Interim Remedial Action is appropriate at a given site:

1. Risk: Will the Interim ROD address/prioritize an immediate or ongoing risk? How will the Interim ROD contribute to the overall risk reduction once the final remedy is implemented?
2. Cost: Will the cost of an Interim ROD reduce or potentially increase the long-term cost of site remediation? Will an Interim ROD result in ongoing costs, and is the state prepared to pay those costs and for how long?
3. Effectiveness: How will the Interim ROD be incorporated into the final remedy at the site? Could it potentially reduce the need for additional action?
4. Compliance with ARARs: What impacts could the Interim ROD have on final ARARs? Are these impacts understood by all stakeholders?

The use of an Interim ROD is an option that can expedite Remedial Actions to address immediate threats to human health and the environment or achieve other near-term goals, but when an Interim ROD is proposed, its benefits, drawbacks, and impacts should be evaluated and considered before determining if it is the best approach for a site.
http://astswmo.org/files/Resources/CERCLA_and_Brownfields/Interim-Records-of-Decision-Paper.pdf

ENERGETIC COMPOUNDS ON MILITARY TRAINING RANGES

Taylor, S.
ESTCP Project ER-201571-T2, Web-Based Resource, 2017

Information, images, videos, and data derived from over two decades of research at Engineer Research and Development Center labs, primarily the Cold Regions Research and Engineering Laboratory, have been compiled in a web-based resource. To make knowledge gained from past and currently funded projects more accessible to many potential stakeholders, ESTCP developed a repository that contains key knowledge on theory, methods, best practices, and data for assessing energetic contaminants on training ranges. Information is provided in the form of easy-to-follow annotated photo and video demonstrations collected from previous and ongoing funded projects. In addition, the project uses data from the Donnelly Training Area as a model framework for making energetics contamination data available in the form of tables that are sortable by range-relevant parameters such as munition type. The data are also available in the form of a GIS web app. This repository serves as a primary knowledge source for range managers, regulatory agency representatives, acquisition program managers, and contractors on the risk posed by energetic contaminants and the best practices for their assessment. https://energetics.erdc.dren.mil/