Technology Innovation News Survey

Entries for November 1-15, 2016

Market/Commercialization Information

CERCLA RESEARCH COOPERATIVE AGREEMENT
Environmental Protection Agency, Funding Opportunity EPA-OLEM-OSRTI-16-07, 2016

This project will provide support for state participation in developing tools, procedures, and guidance to promote efficient cleanup work by states under the Superfund program. The closing date for proposals is January 20, 2017. Total estimated funding: $1.5M. EPA anticipates selecting one project. http://www.grants.gov/web/grants/view-opportunity.html?oppId=290592

ZORTMAN/LANDUSKY WATER TREATMENT AND RECLAMATION, STATE OFFICE
DOI, Bureau of Land Management, Funding Opportunity L17AS00003, 2016

To protect water quality in streams and aquifers adjacent to the abandoned Zortman and Landusky mines, project objectives include (l) interception and retention of all contaminated seepage and runoff from the mine sites; (2) treatment and discharge of intercepted waters in compliance with Montana water quality standards and the BLM Zortman and Landusky Mines EE/CA; and (3) reduction in the water volume requiring treatment annually. The closing date for applications is January 17, 2017. Estimated funding: $450,000. A single award is anticipated. http://www.grants.gov/web/grants/view-opportunity.html?oppId=290201

TECHNOLOGY REQUIREMENTS FOR ENVIRONMENTAL REMEDIATION SERVICES
Department of the Army, U.S. Army Corps of Engineers, USACE District, Omaha.
Federal Business Opportunities, FBO-5489, Solicitation W9128F-17-S-E002, 2016

The U.S. Army Corps of Engineers, Omaha District is conducting market research to seek information about potential woman-owned small business sources interested and capable of providing environmental remediation services. A green and sustainable technology is sought to remove the full suite of organic compounds and select metals from soils for cleanup to residential standards. The technology should be capable of treating in situ or ex situ all soil contaminants through processes that destroy or otherwise chemically reduce the contaminants and address any by-products, such as acidic gases. Submit capabilities statements by 2:00 PM CT on January 4, 2017.
https://www.fbo.gov/spg/USA/COE/DACA45/W9128F-17-S-E002/listing.html

USACE MEGA: TULSA DISTRICT WILL ISSUE AN RFP FOR ENVIRONMENTAL CONSULTING SERVICES FOR SOUTHWEST DIVISION PROJECTS
Department of the Army, U.S. Army Corps of Engineers, USACE District, Tulsa.
Federal Business Opportunities, FBO-5486, Solicitation W912BV-17-R-0001, 2016

The U.S. Army Corps of Engineers plans to compete this acquisition as an 8(a) set-aside when it issues a solicitation for a firm-fixed-price, indefinite-delivery MATOC for Environmental Consulting Services for work within the geographic boundaries of the Southwest Division and its assigned projects. The solicitation will facilitate award of up to three contracts with a maximum shared capacity of $60M over a base period of three years and one two-year option. Release of the solicitation is expected on or after December 15, 2016, with proposals likely due on or about January 18, 2017. https://www.fbo.gov/spg/USA/COE/DACA56/W912BV-17-R-0001/listing.html

Cleanup News

VOLUNTARY CLEANUP REPORT: CROSS MANUFACTURING, INC., LEWIS, KANSAS
Kansas Dept. of Health and Environment, Bureau of Environmental Remediation, 215 pp, 2015

Past operations at the Cross plant included chrome plating. A voluntary cleanup in situ chromium reduction and fixation remedy was completed at the site between 2012 and 2015 to reduce Cr(VI) to the much less toxic and mobile Cr(III). This report describes the completed in situ Cr reduction and fixation remedy, performance monitoring, and site restoration activities. The remedy was completed by delivering the reducing agent calcium polysulfide through direct injection and amendment infiltration galleries, with treatments performed in October 2014 and May 2015.
Report (May be slow to load): http://kenpas.kdhe.state.ks.us/herisl/getDocument.kdhe_her2documentId=20000000RCG_0VQK4DB8YRWE
16 Slides: http://www.kdheks.gov/sbcs/2016_Environmental_Conference/In_Situ_Reduction_Hexavalent_Chromium_Deep_Vadose_Zone_Soil_Burns_Carlstens_Holum_Law.pdf

COMMUNITY UPDATE INFORMATION SHEET: CTS OF ASHEVILLE, INC. SUPERFUND SITE, ASHEVILLE, BUNCOMBE COUNTY, NORTH CAROLINA
U.S. EPA Region 4, 4 pp, 2015

EPA required CTS Corporation to conduct a removal action at the springs area east of the CTS site to reduce air concentrations of TCE. Air sparging was selected to pump air into the surface water and the subsurface at 7 locations, and the vapors are vacuum-extracted at 12 locations for treatment in carbon canisters. The area was covered with a low-density polyethylene liner to increase operational efficiency. The system has reduced TCE air concentrations effectively and greatly improved the quality of surface water. Prior to system startup, TCE concentrations in the surface water from the springs area were close to 30,000 ppb and now are ~30 ppb, a 99.9% reduction. After 6 months of operation, the system has removed ~42 lb of VOCs. https://www.buncombecounty.org/common/health/cts-community-update-june-2015.pdf See additional information on the cleanup of this site in its 2016 Interim Action Record of Decision, which calls for electrical resistance heating to treat the mixed NAPL and TCE plume in a roughly 1.2-acre area (~47,250 yd³ of saturated material) and in situ chemical oxidation to treat TCE-only contamination in the expanded Northern Area (~1.9 acres).
http://semspub.epa.gov/src/document/04/11015988

A NEW METHODOLOGY FOR THE REMEDIATION OF AN ACID TAR LAGOON IN MONS, BELGIUM
Kahn, A., C. Oger, C. Van Wouwe, P. Perseo, and S. Leroi.
Conference Proceedings: International Conference — Contaminated Sites 2016, pp 105-109, 2016

Acid tar composition is a mixture of sulfuric acid, hydrocarbons, water, and ash. Mercury and arsenic might also be present. Acid tar releases gases of hydrogen sulfide, sulfur dioxide, and BTEX, especially when the waste is handled. A historical accumulation of acid tar in a lagoon at a former industrial site in Mons, Belgium, was neutralized in place prior to excavation and transportation off site to licensed waste treatment facilities. The in situ mixing technique used is not a new technology, but this was its first application in an acid tar lagoon. The neutralizing chemical (Rompetrol, Vega Refinery, Romania) was injected at depth by means of an automated dosing system, thus greatly reducing the acid tar emissions. The pH of the tar was very variable, and the additive quantities needed to neutralize it varied from ~2 to 15% (by weight). After reaching the pH target value, the acid tar was excavated and taken to waste treatment facilities where the most cost-effective treatment method (depending on parameters such as calorific value, sulfur content, and Hg, As, and benzene concentrations) was selected: co-incineration in cement kilns; incineration with energy recovery; thermal treatment by pyrolysis; or thermal desorption. *See* ***pages 105-109*** *in the proceedings at* http://contaminated-sites.sazp.sk/sites/contaminated-sites.sazp.sk/files/prilohy/Conference_Proceedings_ICCS_Final.pdf

WASTE DISCHARGE REQUIREMENTS FOR IN SITU REMEDIATION OF GROUNDWATER IMPACTED BY CHLORINATED SOLVENTS, PERCHLORATE AND HEXAVALENT CHROMIUM ASSOCIATED WITH THE TRIUMPH PROCESSING SITE
State of California, Regional Water Quality Control Board, Santa Ana Region, 25 pp, 16 Sep 2016

The proposed individual waste discharge requirements and associated monitoring and reporting program authorizes Triumph Processing, Embee Division Inc., to conduct in situ injections of chemical amendments to remediate VOCs, perchlorate, and Cr(VI) that are present in groundwater as a result of historical site metal plating and finishing operations. Implementation of in situ bioremediation and reduction as covered by Order No. R8-2016-0049 includes the following activities: (1) Existing Interim Measure Area: Injections in both water-bearing zones (WBZs) of soybean oil, sodium bicarbonate, P&G Dawn Ultra Original (surfactant), Accelerite®, and calcium polysulfide (CPS); (2) Expansion of Interim Measure Area: Injections in both WBZs of soybean oil, sodium bicarbonate, surfactant, Accelerite®, rhodamine tracer, and KB-1 Plus® bioaugmentation agent; and (3) Pilot Study Area: Injections in the second WBZ of soybean oil, sodium bicarbonate, surfactant, Accelerite®, and CPS. http://www.waterboards.ca.gov/santaana/board_info/agendas/2016/09_16/Item_10.pdf

REPORT OF EVO INJECTION, VOLUNTARY CLEANUP PLAN, SMITH COUNTY HIGHWAY DEPARTMENT VOLUNTARY CLEANUP SITE, SMITH CENTER, KANSAS
Kansas Dept. of Health & Environment (KDHE), Topeka. 4 pp, 2016

Emulsified vegetable oil (EVO) injection was a primary task of the Voluntary Cleanup Plan (VCP) for the Smith County Highway Department site. After a pilot injectivity test of the saturated zone demonstrated that chemical injection should be successful at the site, the contractor mobilized to the site on June 27, 2016, to begin chemical injection at 10 locations. Each boring was advanced by Geoprobe unit to 37 ft, and the open-ended rods then were pulled up to 22 ft, as proposed in the VCP. About 20 gal/min of 300 gal of EVO solution (25 gal veg oil/5 gal Nutrimin bacterial supplement/270 gal potable water) was injected into the top of the rods at each boring at a consistent 42 psi. Five borings were injected on June 27 and five more on June 28, introducing a total of 3000 gal of EVO solution into the groundwater zone. Each boring was plugged with bentonite following injection. According to the Annual Site Report (October 10, 2016), the annual sampling event was performed in September to allow the injected EVO several months to affect groundwater contaminant concentrations; results show that overall PCE and TCE concentrations at the site are steadily decreasing.
http://kenpas.kdhe.state.ks.us/herisl/getIdentifiedSiteListing.kdhe_her?projectCode=C6-092-22298&siteName=SMITH%20COUNTY%20HIGHWAY%20DEPARTMENT

RECORD OF DECISION: MONROE ELECTRONICS STATE SUPERFUND PROJECT, LYNDONVILLE, ORLEANS COUNTY, SITE NO. 837013
New York State DEC, Division of Environmental Remediation, 56 pp, 2016

Enhanced in situ bioremediation will be employed to treat CVOCs (mainly TCA, TCE, and daughter compounds) in overburden and bedrock groundwater downgradient of the suspected source area beneath the manufacturing building. Groundwater exhibiting total CVOC concentrations >1,000 µg/L will be targeted. The treatment area will be confirmed during the remedial design investigation. The naturally occurring biological breakdown of contaminants through anaerobic reductive dechlorination will be enhanced by the injection of a controlled-release carbon source (e.g., lactate or emulsified vegetable oil), electron donor (sulfate), and pH buffer to stimulate microbial growth, and then bacterial cultures will be injected into the subsurface to bioaugment the aquifer with microbes appropriate for complete CVOC biodegradation. In situ chemical reduction using zero-valent iron particles in solution will be implemented to supplement the bioremediation groundwater remedy and to further treat CVOCs in overburden and bedrock groundwater. A cover system will be required to allow for commercial use of the site. http://www.dec.ny.gov/docs/remediation_hudson_pdf/837013rod.pdf

TIBBETTS ROAD SITE, BARRINGTON: SITE SUMMARY
New Hampshire Department of Environmental Services, 3 pp, 2016

The Tibbetts Road site is located in a rural residential area. In addition to maintaining a residence at the site, the property owner collected and stored flammable hazardous waste in drums on the property and used the waste to help burn out the interiors of junked automobiles, to be sold for scrap. Site wastes included solvents, automotive fluids, petroleum products, and PCBs. Dioxins and furans were detected in the site soils. A vapor extraction and groundwater recovery (VER) system was built and operated 1995-1998 to remove soil and groundwater contaminants. Phytoremediation using hybrid poplar trees was implemented in spring 1998. The VER system was restarted in 2000 to operate during the warmer months of the year. A pilot test of in situ chemical oxidation (ISCO) using sodium permanganate was performed during fall 2003 with an initial injection of 20% solution into shallow bedrock in three injection/monitoring wells, followed by a second injection in late December 2003. Reductions in VOC concentrations in groundwater in the pilot area were significant, and the treatment was implemented in other portions of the site in November-December 2006. Based upon monitoring results, additional injections were performed in summer 2007 and continued through 2008. Limited soil excavation to remediate remnant source areas in the overburden was conducted in June 2013. Another ISCO pilot test in bedrock was conducted in fall 2013. In 2015, EPA allowed a directed groundwater recirculation pilot test in the contaminated bedrock north of the site for operation in 2016.
http://des.nh.gov/organization/divisions/waste/hwrb/fss/superfund/summaries/documents/tibbetts.pdf

Demonstrations / Feasibility Studies

DIRECT PUSH OPTICAL SCREENING TOOL FOR HIGH-RESOLUTION, REAL-TIME MAPPING OF CHLORINATED SOLVENT DNAPL ARCHITECTURE
Einarson, M., A. Fure, R. St. Germain, S. Chapman, and B. Parker.
ESTCP Project ER-201121, 222 pp, 2016

This report describes the testing of a new direct-push optical screening tool for high-resolution 3D subsurface mapping of chlorinated solvent DNAPLs in unlithified sediments. The tool was field-tested at a formerly used defense facility in Massachusetts in fall 2013 (Geoprobe® delivery) and again in March 2014 (CPT delivery).The new tool, a laser-induced fluorescence (LIF) technology referred to as "DyeLIF™," was developed and validated during this project and is now commercially available. https://www.estcp.com/content/download/40309/386525/file/ER-201121%20Final%20Report.pdf *See also the* ***ESTCP Cost and Performance Report*** at
https://www.estcp.com/content/download/41051/392166/file/ER-201121%20C&P%20Report%20-%20FOR%20POSTING.pdf

PRESSURE-CONTROLLED INJECTION OF GUAR GUM STABILIZED MICROSCALE ZEROVALENT IRON FOR GROUNDWATER REMEDIATION
Luna, M., F. Gastone, T. Tosco, R. Sethi, M. Velimirovic, J. Gemoets, R. Muyshondt, H. Sapion, N. Klaas, and L. Bastiaens. Journal of Contaminant Hydrology 181:46-58(2015)

A pilot injection test of microsized zero-valent iron (MZVI) dispersed in a guar gum shear-thinning solution was performed at a site in Belgium contaminated by PCE and daughter products. The goal was to overcome those critical aspects that hinder MZVI field injection mainly due to the colloidal instability of ZVI-based suspensions. The particles were delivered into the aquifer through an injection well designed for controlled-pressure delivery (~10 bars). Based on preliminary tests, a flow regime at the threshold between permeation and preferential flow was selected for delivery of 5 m^3 MZVI as a compromise between the desired homogeneous distribution of the MZVI around the injection point (ensured by permeation flow) and fast and effective slurry injection (guaranteed by high discharge rates and injection pressure, resulting in the generation of preferential flow paths). The injection generated a reactive zone of about 0.8 m around the injection well, with maximum migration distance of the MZVI particles of 1.7 m. http://www.iws.uni-stuttgart.de/publikationen/vegas/Luna_2015.pdf

A PORTABLE BURN PAN FOR THE DISPOSAL OF EXCESS PROPELLANTS
Walsh, M.R.
ESTCP Project ER-201323, 99 pp, 2016

Open burning of excess propellant charges for munitions can deposit up to 20% of the propellant on the ground as residue. A portable propellant burn pan system designed to enable environmentally safe propellant destruction demonstrated a 99.98% reduction in combustible mass of the charges, https://www.estcp.com/content/download/41144/392898/file/ER-201323%20Final%20Report.pdf *See also the burn pan* ***Field Manual*** *at*
https://www.estcp.com/content/download/39147/377308/file/ER-201323%20Field%20Manual%20SOP_V1%20November%202015.pdf

Research

DEVELOPMENT OF AN IN SITU PASSIVE SAMPLER FOR THE DETECTION AND REMEDIATION OF EXPLOSIVE COMPOUNDS
Vlahos, P.
SERDP Project ER-2539, 45 pp, 2016

Given the abundance of aging unexploded ordnance (UXO) in marine continental margins and nearshore areas, is impractical to retrieve these UXOs in their entirety; however, cost-effective methods are needed to monitor or evaluate areas at risk for leakage and to measure concentrations of energetic compounds derived from UXOs to compare with water quality criteria. In this project, a novel passive sampling approach based on the introduction of samplers coated with ethylene vinyl acetate (EVA) was evaluated to assess the efficacy of the samplers in marine water and porewater monitoring. Initial efforts were dedicated to parameterizations identifying the uptake and depuration rates to confirm sufficient deployment times for testing at known UXO dumping areas in Halifax Harbor and the Baltic Sea. https://www.estcp.com/content/download/41022/392318/file/ER-2539%20Final%20Report.pdf

IN SITU BIOREMEDIATION OF 1,4-DIOXANE BY METHANE OXIDIZING BACTERIA IN COUPLED ANAEROBIC-AEROBIC ZONES
Schaefer, C., P.K. van Groos, and P. Hatzinger.
SERDP Project ER-2306, 43 pp, 2016

The overall goal of this limited-scope SERDP effort was to measure and assess the extent to which 1,4-dioxane can be biodegraded by methane-oxidizing bacteria under conditions representative of a commingled chlorinated solvent plume. Michaelis-Menten kinetic parameters were determined for both 1,4-dioxane and ethane using a mixed culture obtained from the former Myrtle Beach Air Force Base (MBAFB) in South Carolina. Using these regressed parameters and the observed rates of ethane biodegradation in MBAFB soil, the estimated half-life for 1,4-dioxane was ~1.9 years, which agrees with published rates of 1,4-dioxane biodegradation observed in the field. Results from MBAFB in this study show that ethane is present within the 1,4-dioxane plume at concentrations of ~20 µg/L. Results of this research suggest that ethane-oxidizing bacteria, sustained by the presence of ethane at sites with commingled 1,4-dioxane and chlorinated solvent plumes, may be responsible for slow yet sustained 1,4-dioxane biodegradation at some DoD facilities. Further studies are needed to confirm this hypothesis.
https://www.estcp.com/content/download/41073/392328/file/ER-2306%20Final%20Report.pdf

CARBON NANOTUBE BASED GROUNDWATER REMEDIATION: THE CASE OF TRICHLOROETHYLENE
Jha, K.C., Z. Liu, H. Vijwani, M. Nadagouda, S.M. Mukhopadhyay, and M. Tsige.
Molecules 21(7):953(2016)

Adsorption of chlorinated organics on carbon nanotubes (CNTs) has been gaining ground as a remedial platform for groundwater treatment. This paper lays out the nature of competing interactions at play in hybrid, membrane, and pure CNT-based systems and presents results with the perspective of existing gaps in design strategies. First, current remediation approaches to TCE are presented with an examination of forces contributing to adsorption of analogous contaminants at the molecular level. Second, results of TCE adsorption and remediation on pure and hybrid CNT systems are discussed with an emphasis on the specific nature of substrate and molecular architecture that would contribute to competitive adsorption. Delineation of intermolecular interactions that contribute to efficient remediation is needed for custom, scalable field design of purification systems for a wide range of contaminants.
http://corescholar.libraries.wright.edu/mme/259

ELECTROMAGNETIC INDUCTION OF ZEROVALENT IRON (ZVI) POWDER AND NANOSCALE ZEROVALENT IRON (NZVI) PARTICLES ENHANCES DECHLORINATION OF TRICHLOROETHYLENE IN CONTAMINATED GROUNDWATER AND SOIL: PROOF OF CONCEPT
Phenrat, T., T. Thongboot, and G.V. Lowry.
Environmental Science & Technology 50(2):872-880(2016)

A study was conducted to evaluate the concept of using zero-valent iron (ZVI) powder or nanoscale ZVI particles in combination with a low-frequency (150 kHz) AC electromagnetic field (AC EMF) to remove TCE from groundwater and saturated soils. ZVI and NZVI are ferromagnetic, and their induction can induce heat under applied AC EMF, which can increase the rate of dechlorination, according to Arrhenius' equation, and increase the rate of TCE desorption from TCE-sorbed soil. Both dechlorination and TCE desorption enhance the overall TCE removal rate. In lab batch reactors, both ZVI and NZVI induced heat under applied AC EMF up to 120°C in 20 min. Using ZVI and NZVI with AC EMF enhanced dechlorination of dissolved TCE (no soil) up to 4.96-fold. In addition to increasing the temperature, AC EMF increased intrinsic ZVI and NZVI reactivity, ostensibly due to accelerated corrosion, as demonstrated by the increased ORP. In a soil-water-TCE system, NZVI together with AC EMF thermally enhanced desorption of TCE from soil and increased the degradation of TCE up to 5.36-fold compared to the absence of AC EMF.

ASSESSMENT AND COMPARISON OF ELECTROKINETIC AND ELECTROKINETIC-BIOREMEDIATION TECHNIQUES FOR MERCURY CONTAMINATED SOIL
Azhar, A.T.S., A.T.A. Nabila, M.S. Nurshuhaila, E. Zaidi, M.A.M. Azim, and S.M.S. Farhana.
IOP Conf. Series: Materials Science and Engineering 160:012077(2016)

A study was conducted to investigate the ability of isolated bacteria (*Lysinibacillus fusiformis*) to remove mercury from landfill soil. In 5 kg of landfill soil mixed with deionized water to make slurry, EK-Bio was conducted for seven days using 50 V/m of electrical gradient. *L. fusiformis* was applied at the anode reservoir. The slurried landfill soil was positioned at the middle of the reservoir while distilled water was placed at the cathode. Using EK-Bio the lowest Hg concentration occurred at the near cathode compartment. After the seven days of treatment, analysis showed an Hg concentration reduction of up to 78% for the landfill soil.http://iopscience.iop.org/article/10.1088/1757-899X/160/1/012077/pdf

SUSTAINABILITY ASSESSMENT OF ELECTROKINETIC BIOREMEDIATION COMPARED WITH ALTERNATIVE REMEDIATION OPTIONS FOR A PETROLEUM RELEASE SITE
Gill, R.T., S.F. Thornton, M.J. Harbottle, and J.W. Smith.
Journal of Environmental Management 184(Pt 1):120-131(2016)

A framework was developed by the Sustainable Remediation Forum UK to support the implementation of sustainable practices within contaminated land management and decision-making. Researchers applied the framework to the cleanup of a complex site contaminated with unleaded gasoline and its dissolved-phase BTEX and MTBE plume. The pathway is groundwater migration through a chalk aquifer, and the receptor is a water supply borehole. A hydraulic containment system was installed to manage the MTBE plume migration. Overall analysis identified air sparging/soil vapor extraction and electrokinetic-enhanced bioremediation (EK-Bio) to be more sustainable remediation options for this site than pump and treat or monitored natural attenuation. The study included an appraisal of the management decision from each tier of the assessment with the aim to highlight areas for time and cost savings for similar assessments in the future. The researchers observed that EK-BIO performed well against key indicator categories compared to the other intensive treatments and that methods introduced to improve the sustainability of the EK-Bio treatment design (e.g., photovoltaics) had no significant effect in this instance. http://eprints.whiterose.ac.uk/106461/

DEGRADATION OF PHTHALATE ESTERS AND ACETAMINOPHEN IN RIVER SEDIMENTS USING THE ELECTROKINETIC PROCESS INTEGRATED WITH A NOVEL FENTON-LIKE PROCESS CATALYZED BY NANOSCALE SCHWERTMANNITE
Yang, G.C.C., S.-C. Huang, C.-L. Wang, and Y.-S. Jen.
Chemosphere 159:282-292(2016)

Nanoscale schwertmannite (nano-SHM) was first synthesized and then a novel in situ remediation technology coupling the nano-SHM/H_2O_2 process (i.e., a Fenton-like reaction) and an electrokinetic (EK) process was developed for evaluating its performance in removing phthalate esters (PAEs) and acetaminophen from river sediment. This paper describes the performance of the novel oxidation technology in lab studies. http://isi-dl.com/downloadfile/141029

DEGRADATION OF OIL PRODUCTS IN A SOIL FROM A RUSSIAN BARENTS HOT-SPOT DURING ELECTRODIALYTIC REMEDIATION
Pedersen, K.B., T. Lejon, P.E. Jensen, and L.M. Ottosen.
SpringerPlus 5:168(2016)

A highly oil-contaminated soil from Krasnoe in northwest Russia was used to investigate the degradation of organic pollutants during electrodialytic remediation. Removal efficiencies were up to 70% for total hydrocarbons (THC) and up to 65% for PAHs, with greater effects observed on the lighter PAH compounds and THC fractions. Multivariate analysis of the experimental settings and final concentrations in the 12 experiments revealed that the stirring rate of the soil suspension was by far the most important parameter for the remediation of both THC and PAH. Light was the second most important variable for PAH and appeared to influence degradation. Current density and remediation time did not significantly influence organics degradation; however, there is potential for degrading organics during electrodialytic removal of heavy metals if a stirred setup is applied. http://munin.uit.no/bitstream/handle/10037/8574/article.pdf?sequence=3&isAllowed=y

ELECTROKINETIC-ENHANCED MIGRATION OF SOLUTES FOR IMPROVED BIOREMEDIATION IN HETEROGENEOUS GRANULAR POROUS MEDIA
Gill, Richard T., Ph.D. thesis, University of Sheffield, UK. 271 pp, 2016

This thesis investigates the influence of physical heterogeneity on electrokinetics (EK) migration of an amendment designed to enhance bioremediation. Lab apparatus was designed and built to accommodate physical heterogeneity, electrokinetic transport of solutes, and contaminant biodegradation in two types of EK experiments: (1) EK amendment migration under abiotic conditions on different arrangements of physical heterogeneity, and (2) experiments in the same lab setup that introduced contaminant and microbial variables. From these experiments a conceptual framework was developed that describes the influence of physical heterogeneity on the EK transport of an amendment. It relates the spatial change in material properties associated with physical heterogeneity with aspects of EK application, such as the voltage gradient, and observes the implications for amendment transport. Numerous limitations exist to EK-Bio applications in these settings, but many different implementation methods can mitigate these effects. A sustainability assessment compared EK-Bio with conventional remediation technologies against specific criteria for a complex site contaminated with BTEX and MTBE. EK-Bio compared well to other technologies; however, specific site characteristics will determine the potential sustainability benefits of applying EK. http://etheses.whiterose.ac.uk/12712/

EFFECT OF POLARITY-REVERSAL ON ELECTROKINETIC ENHANCED BIOREMEDIATION OF PYRENE CONTAMINATED SOIL
Li, T., Y. Wang, S. Guo, X. Li, Y. Xu, Y. Wang, and X. Li.
Electrochimica Acta 187:567-575(2016)

PAH-contaminated soil was studied under electrokinetic-enhanced biodegradation with polarity reversal. The effects of polarity reversal were investigated with reference to electric current, pH, microbial counts, and the spatial distribution of pyrene biodegradation rate during the application of electro-bioremediation. Three types of treatment were conducted: pyrene-degrading microbial treatment only (Bio), electro-bioremediation without polarity-reversal (EK-Bio), and electro-bioremediation with polarity-reversal at an interval of 2 hours (EK-Bio-PR). After 17 days, the electric current stabilized around 10 mA in EK-Bio-PR, which was 5 times that of EK-Bio. After 42 days, EK-Bio-PR maintained a neutral soil pH (7.20) and relatively stable electric current. Polarity-reversal enhanced microbial counts and improved pyrene degradation. The bacterial counts reached 4.8 x 10^{11} cfu/g, and the best pyrene degradation efficiency was 55.9% in EK-Bio-PR at the end of the experiment. The application of electrokinetics with periodic polarity reversal enhanced microbial growth and biodegradation, which further improved overall PAHs removal.
http://fulltext.study/preview/pdf/183304.pdf

PHOTOBIOLOGICAL TRANSFORMATION OF HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE (RDX) USING *RHODOBACTER SPHAEROIDES*
Millerick, K.A., J.T. Johnston, and K.T. Finneran.
Chemosphere 159:138-144(2016) http://dx.doi.org/10.1016/j.chemosphere.2016.05.056

Bacterial photosynthesis was investigated as a strategy for ex situ groundwater treatment, using light as the primary energy source to facilitate RDX transformation. Photosynthetic *Rhodobacter sphaeroides* (strain ATCC® 17023™) transformed 30 µM RDX within 40 h under light conditions; RDX was not fully transformed in the dark (non-photosynthetic conditions), suggesting that photosynthetic electron transfer was the primary mechanism. Experiments with RDX demonstrated that succinate and malate were the most effective electron donors for photosynthesis, but glycerol was also utilized as a photosynthetic electron donor. RDX was transformed irrespective of the presence of carbon dioxide. When CO_2 was added, the cells generated more biomass, and anthraquinone-2,6-disulfonate had no stimulatory effect. End products indicated that RDX carbon became CO_2, biomass, and a soluble, uncharacterized aqueous metabolite, determined using C-14-labeled RDX. *See additional information in* ***Part 2 of K.A. Millerick's*** *dissertation at* https://oatd.org/oatd/record?record=%22handle%5C%3A2142%2E49615%22

PRODUCTION OF A MICROCAPSULE AGENT OF CHROMATE-REDUCING *LYSINIBACILLUS FUSIFORMIS* ZC1 AND ITS APPLICATION IN REMEDIATION OF CHROMATE-SPIKED SOIL
Huang, J., J. Li, and G. Wang.
SpringerPlus 5:561(2016)

Lysinibacillus fusiformis ZC1 is an efficient Cr(VI)-reducing bacterium that can transform the toxic and soluble Cr(VI) form to the less toxic and precipitated Cr(III) form. The study objective was to prepare a microcapsule agent of strain ZC1 for bioremediation of Cr(VI)-contaminated soil. Using a single-factor orthogonal array design, the optimal fermentation medium was obtained and consisted of 6 g/L corn flour, 12 g/L soybean flour, 8 g/L NH_4Cl, and 6 g/L $CaCl_2$. After enlarged fermentation, the cell and spore densities were 5.9 x 109 and 1.7 x 108 cfu/mL, respectively. The fermentation products were collected and embedded with 1% gum arabic and 1% sorbitol as the microcapsule carriers and then spray-dried. Strain ZC1 exhibited viable cell counts of (3.6 ± 0.44) x 1010 cfu/g dw after 50-d storage at room temperature. In simulated soil bioremediation experiments, 67% of Cr(VI) was reduced in 5 days with the inoculation of this microcapsule agent, and the Cr(VI) concentration was below the soil Cr(VI) standard level. *This paper is* ***Open Access*** *at* https://springerplus.springeropen.com/articles/10.1186/s40064-016-2177-6

COMBINATIONS OF SURFACTANT FLUSHING AND BIOREMEDIATION FOR REMOVING FUEL HYDROCARBONS FROM CONTAMINATED SOILS
Yan, G., W. Ma, C. Chen, Q. Wang, S. Guo, and J. Ma.
Clean Soil Air Water 44(8):984-991(2016)

Researchers evaluated the contaminant removal efficiency of four soil flushing approaches—water flushing, surfactant flushing (Tween-80), bioremediation+water flushing, and bioremediation+surfactant flushing—in remediating two types of diesel-contaminated soil (sandy loam and silt loam) in lab studies. The bioremediation approach combined bioaugmentation (adding a diesel-degrading consortium) and biostimulation (adding nutrients). Sandy loam, with lower organic carbon content and higher permeability, had higher total petroleum hydrocarbon (TPH) removal efficiency than silt loam for all four flushing treatments. Compared to water flushing, surfactant flushing significantly enhanced the TPH removal efficiency for both soils. In contrast, bioremediation alone (without combining with surfactant flushing) failed to enhance TPH removal efficiency for either soil. A combination of surfactant flushing and bioremediation had the highest TPH removal efficiency (77.1% for sandy loam and 46.9% for silt loam) among the four flushing treatments.

MICROBIAL FUEL CELL: A GREEN APPROACH FOR THE UTILIZATION OF WASTE FOR THE GENERATION OF BIOELECTRICITY
Chaturvedi, V. and P. Verma.
Bioresoures and Bioprocessing 3:38(2016)

Microbial transformation of wastes using a novel bioremediation strategy, such as microbial fuel cells for energy generation, can offer an efficient and benign approach to environmental remediation. This paper presents a critical review of different classes of xenobiotics and wastes that can be employed for bioenergy generation, the microorganisms involved, power output, major benefits, and technology challenges.
http://www.bioresourcesbioprocessing.com/content/pdf/s40643-016-0116-6.pdf

General News

FRAMEWORK GUIDANCE MANUAL FOR IN SITU WETLAND RESTORATION DEMONSTRATION
Ruiz, N., J. Bleiler, and K. Gardner. ESTCP Project ER-200825, 83 pp, 2016

This manual is a guide to the use of in situ reactive amendment technologies for remediation of contaminated wetland hydric soils, providing a toolbox of methods with which to approach site characterization/monitoring, treatability testing and demonstration, and remedy implementation. This manual (1) provides a repository of literature sources for active in situ remedial projects; (2) outlines a conceptual approach to managing the remediation of wetland hydric soils; (3) offers suggestions for project objectives, metrics, and evaluation criteria; (4) discusses implementation means and methods; and (5) supports an assessment of technology cost. This guide is based upon a field demonstration conducted at Aberdeen Proving Ground to determine the most effective amendment to immobilize PCBs in wetland sediments among the following agents: powdered activated carbon slurry (Slurry Spray), two pelletized AC products (AquaBlok® and SediMite™), and an engineered manufactured soil cover system (sand control).
https://www.estcp.com/content/download/40731/389691/file/ER-200825%20Framework%20Guidance%20Manual%20In%20Situ%20Wetland%20Restoration%20For%20Posting.pdf
See also the ***ESTCP Cost & Performance Report*** *at* https://clu-in.org/download/contaminantfocus/pch/Sediments-ER-200825-CP.pdf

CLIMATE CHANGE ADAPTATION RESOURCE CENTER (ARC-X)
U.S. Environmental Protection Agency Website, Oct 2016

EPA has developed tools to help communities anticipate, plan for, and adapt to the changing climate. A new online portal provides information and tools to increase local resilience to climate change. Using a self-guided format, ARC-X provides users with information tailored specifically to their needs, based on where they live and the particular issues of concern to them. Resources are organized under Air, Water Management, Waste Management and Emergency Response, and Public Health. This tool conveys information on the risks posed by climate change to the issues of concern; relevant adaptation strategies; case studies illustrating how other communities have successfully adapted to those risks and tools to replicate their successes; and EPA funding opportunities. https://www.epa.gov/arc-x

CONFERENCE PROCEEDINGS: INTERNATIONAL CONFERENCE — CONTAMINATED SITES 2016
Slovak Environment Agency, Banska Bystrica, ISBN: 978-80-89503-54-4, 235 pp, 2016

Held 12-13 September 2016 in Bratislava, Slovakia, Contaminated Sites 2016 took place during the Slovak Presidency of the Council of the European Union, presenting a unique opportunity to provide an exceptional setting for all participants, including scientists, researchers, company representatives, and policy makers, to share their projects, scientific experience, innovations, and ideas about their contaminated sites. http://contaminated-sites.sazp.sk/

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.