Technology Innovation News Survey

Entries for March 1-15, 2015

Market/Commercialization Information

ENVIRONMENTAL SECURITY TECHNOLOGY CERTIFICATION PROGRAM (ESTCP) INNOVATIVE TECHNOLOGY TRANSFER APPROACHES

U.S. Army Corps of Engineers, USACE HEC, Ft. Belvoir, VA. Solicitation BAA-15-0005, 2015

ESTCP has issued a special solicitation to request proposals from DoD organizations, universities, and private industry for innovative technology transfer approaches applicable to technologies that have been successfully demonstrated under ESTCP or to project results appropriate for direct transfer that have been developed under SERDP. Information about SERDP and ESTCP projects can be found athttps://www.serdp-estcp.org/Program-Areas. Approaches of interest include but are not limited to short courses (either live or on line), videos, webinars, monographs, updates to standards and regulations, endorsements by regulatory bodies, fact sheets, websites, and workshops. Proposals for this competitive funding opportunity must be received by or before 2:00 PM ET on May 14, 2015. Depending on availability of funds, multiple awards totaling about $2M will result.
https://www.serdp-estcp.org/Funding-Opportunities/ESTCP-Solicitations/Technology-Transfer-Solicitation

2015 ORONOGO-DUENWEG MINING BELT SITE

U.S. Environmental Protection Agency, Region VII, Lenexa, KS.
Federal Business Opportunities, FBO-4885, Solicitation SOL-R7-15-00007, 2015

The remedial action for the Oronogo-Duenweg Mining Belt Site located in Jasper County, Missouri, is for the Phase 10 Remedial Design applicable to OU1 pursuant to the 2004 OU1 Record of Decision. The work to be performed under this contract consists of excavation, consolidation, disposal, capping, and revegetation of mining wastes and contaminated soil at portions of the site. Work performed under the base period of the contract will address ~200 acres of mine wastes and contaminated soil. Four option periods will be included for completion of subsequent remedial designs. EPA anticipates issuing an indefinite-quantity contract with fixed unit prices, comprising a base period and four option periods with an estimated dollar value between $45M - $55M. This procurement will be a small business set-aside. Release of the RFP is expected to occur on or about May 20, 2015, on FedConnect and FedBizOpps: https://www.fedconnect.net/FedConnect/?doc=SOL-R7-15-00007&agency=EPA and https://www.fbo.gov/spg/EPA/OAM/RegVII/SOL-R7-15-00007/listing.html.

ARL-ARO CORE BROAD AGENCY ANNOUNCEMENTS FOR BASIC AND APPLIED SCIENTIFIC RESEARCH FOR FISCAL YEARS 2012 THROUGH 2017

Department of the Army, Army Contracting Command, Research Triangle Park, NC.
Federal Business Opportunities, FBO-4876, Solicitation W911NF-12-R-0011-03 and W911NF-12-R-0012-03, 2015

The Army Research Office (ARO) and the Army Research Laboratory (ARL) releases of updated BAAs for research needs through 2017 identify two areas for environmental research:

- Advanced Concepts for Hazardous Material Sensing Applications (ARL) supports development of sensors (both point and standoff) for field use in detection of hazardous substances. Potential applications include water safety and defense, toxic industrial material sensing, improvised explosive device detection, unexploded ordinance, and chemical and biological defense. Key sensor research areas are transduction technique, biological or chemical recognition, and direct spectroscopic methodologies, as well as development of both point and remote sensing for hazardous materials using synthetic molecular recognition elements, electrochemical transduction, and optical technologies.
- The Environmental Chemistry Program (ARO and ARL) supports the Army's need to understand chemistry in the environment through high-risk, high-impact basic research, particularly with respect to chemical warfare agent and toxic industrial compound assessments, remediation of hazardous areas, and access to clean water resources in deployment areas.

The ARL extramural research programs are described in a PDF file at
https://acquisition.army.mil/asfi/synopsis_attach_viewer.cfm?psolicitationnbr=W911NF-12-R-0011-03&pseqnbr=519955&pnot_type=COMBINE
The ARO research areas of interest are described in a PDF file at
https://acquisition.army.mil/asfi/synopsis_attach_viewer.cfm?psolicitationnbr=W911NF-12-R-0012-03&pseqnbr=519963&pnot_type=COMBINE
Scientific and technical questions can be referred to the appropriate technical point of contact identified at the end of each research area of interest. The BAAs are open continuously from the date of issuance through March 31, 2017.

AE SERVICES TO PROVIDE CERCLA/RCRA/UST STUDIES WITHIN THE NAVFAC SW AOR, NAVFAC ATLANTIC AOR, AND OTHER INSTALLATIONS NATIONWIDE

Naval Facilities Engineering Command, NAVFAC Southwest, Environmental Contract Core
Federal Business Opportunities, FBO-4876, Solicitation N6247315R0809, 2015

AE services are required for a single firm-fixed-price IDIQ contract to meet statutory environmental requirements for all applicable environmental laws and regulations. Services include studies, investigations, evaluations, consultations, conceptual design, value engineering, human health and ecological risk assessments, pilot or treatability projects to demonstrate innovative technologies, and operation, monitoring, and optimization of environmental treatment or control systems. Performance will be predominantly in the Naval Facilities Engineering Command Southwest Area of Responsibility, i.e., in California and to a lesser extent in Arizona, Colorado, Nevada, New Mexico, and Utah. The proposed contract is 100% set-aside for small business firms. The applicable NAICS code is 541330 with a size standard of $15M. The contract term is for a one-year base period with four one-year options. The total amount ordered under this contract (including option years) will not exceed $75M for the entire contract term. All information needed for interested parties to submit a Standard Form 330, Architect-Engineer Qualifications, is contained in the notice posted at FBO.gov. No solicitation is available to download at this time. Completed SF 330 packages must be received by 2:00 PM PT, April 30, 2015https://www.fbo.gov/spg/DON/NAVFAC/N68711A6A/N6247315R0809/listing.html

Cleanup News

NAVFAC HAWAII IMPLEMENTS SUSTAINABLE APPROACH TO REMEDIATE CONTAMINATED SOIL

Currents Magazine, 38-41, Fall 2014

On Joint Base Pearl Harbor-Hickam, Hawaii, the Defense Logistics Agency funded a project to remediate petroleum-contaminated soil at Spill Site Stripper Pit No. 43, the site of an accidental release of ~2,000 gal of jet fuel in 1997. The 2011 remediation Decision Document specified land use controls (LUCs), in situ chemical oxidation (ISCO) using calcium peroxide, and monitored natural attenuation (MNA), with the option of conducting excavation and offsite disposal. To minimize landfilling, a revised remedy called for LUCs, excavation and ex situ chemical oxidation (ESCO), reuse/disposal of petroleum-contaminated soil, ISCO of subsurface soil/soil gas outside the source area, and MNA. About 3,200 yd^3 of petroleum-contaminated soil within the source area was excavated; placed within a mixing pit set up in the excavation area; mixed by an excavator with 50,000 lb of solid sodium persulfate activated with 24,000 lb of hydrated lime and water; separated into 32 stockpiles of 100 yd^3 each; and covered with polyethylene plastic sheeting for 14 days. Thirteen of the stockpiles (~1,300 yd^3) were remixed for further reduction of petroleum constituent concentrations. Analytical results indicated stockpile concentrations below the cleanup goals, with up to 85% destruction of petroleum constituents. Implementing ESCO provided an estimated cost savings of $300,000.
http://greenfleet.dodlive.mil/files/2014/10/Fall14_NAVFAC_Hawaii_Remediate_Soil.pdf

DEGRADING CAHS: A CASE STUDY

Lakhwala, F. and J. Ogden.
Pollution Engineering, Vol 46 No 7, 26-28, 2014

In situ chemical reduction (ISCR) amendments—EHC® Liquid and a powdered solid—were applied to remediate 1,1,1-TCA and breakdown products in saturated soil and groundwater at an active Illinois industrial facility. TCA historically was measured at concentrations of up to 5,600 mg/kg in saturated soil, suggesting the presence of DNAPL. The remediation strategy called for application of the solid ISCR amendment into the hottest areas for source mass removal, followed by application of liquid ISCR amendment for plume treatment, all via direct-push technology. Following favorable results in 2008 of pilot-scale injection of solid ISCR amendment, the solid amendment was introduced in 2010 into a TCA source area and injected in a permeable reactive barrier configuration in a VC hot spot. Injections of EHC® Liquid were conducted in 2011 to expedite treatment, targeting a larger treatment depth from 5-19 ft bgs. Source area concentrations of TCA subsequently declined from an average of 3,450 mg/kg measured at the baseline to an average of 93 mg/kg in February 2011, well below the target concentration of 1,200 mg/kg. In response to the combined applications of solid and liquid amendment, groundwater concentrations decreased >99% from a maximum of 709 mg/L to 0.782 mg/L. Remedial objectives were met for all constituents except VC, which has remained relatively steady at between 0.1 and 0.5 mg/L but is expected to decline over timehttp://www.peroxychem.com/media/108999/EHC-article_-Pollution-Engineering_FNL.pdf OR
http://digital.bnpmedia.com/publication/?i=214862&p=28

REMEDIATION OF THE MILLTOWN DAM SEDIMENTS IN MONTANA

Neuman, D.R.

Mine Design, Operations & Closure Conference, 29-30 April - 1 May, 2014, Hot Springs, Montana. 43 slides, 2014

About 2.2 million yd^3 of sediment trapped behind the Milltown Dam were excavated in 2009, moved by rail and truck, and deposited to a depth of ~60 cm over some 700 acres on the Opportunity Tailings Ponds, a large impoundment containing smelter tailings. Following 2-3 years of unsuccessful attempts to revegetate the sediments, lab and greenhouse studies were conducted to determine the best strategy for improving the sediment to support a sustainable vegetative cover. A replicated greenhouse study investigated the effects of six different potential field treatments, including a local calcareous cover soil, lime kiln dust (LKD), and local organic matter sources on three grass species (smooth brome, Great Basin wild rye, and thickspike wheatgrass). Application of LKD and organic matter resulted in increased depth of rooting into sediment. Water-soluble Mn and Zn concentrations fell to very low levels after LKD addition, and metal concentrations in aboveground plant tissue were below phytotoxic ranges. After investigators determined that addition of LKD to sediments and use of a local calcareous borrow source as cover soil offered the best opportunity for successful revegetation, full-scale field remediation of the Milltown Dam sediments commenced in summer 2012. http://www.mtech.edu/mwtp/conference/2014_presentations/dennis-neuman.pdf

LOW TEMP THERMAL TREATMENT OF SPECIAL ORGANIC WASTES IN SOIL

McGowan, T.F.
The 33rd International Conference on Thermal Treatment Technologies and Hazardous Waste Combustors, 13-15 October 2014, Baltimore, MD. Paper 26, 15 pp, 2014

This paper focuses on problem areas in the use of low-temperature thermal desorption and limits of the technology as applied to the more difficult-to-treat organics, such as PCBs, dioxins, and explosive constituents in media ranging from easy-to-handle sand to more difficult clays and silts. Also covered are waste testing and matching the feed to the equipment, feed preparation and feed moisture content, the basics of solids handling, achievable and appropriate stack limits, and required air pollution control equipment. Good soil testing for combustion-based properties, and then matching the layout (e.g., cocurrent versus countercurrent flow) of the system, establishing the right product and oxidizer temperatures, and selecting intermediate (e.g., hot cyclone) and final (e.g., baghouse, acid gas absorber) air pollution control elements are essential to a successful project. Several case studies of full-scale projects are included.
http://www.tmtsassociates.com/images/IT3%202014%20McGowan%20Soil%20Treat%20final%20No%2026%20PDF.pdf

Demonstrations / Feasibility Studies

COMBINING LOW-ENERGY ELECTRICAL RESISTANCE HEATING WITH BIOTIC AND ABIOTIC REACTIONS FOR TREATMENT OF CHLORINATED SOLVENT DNAPL SOURCE AREAS: ESTCP COST AND PERFORMANCE REPORT

ESTCP Project ER-200719, 81 pp, 2015

This field demonstration combined electrical resistance heating (ERH) with zero-valent iron (ZVI) and in situ bioremediation (ISB) for TCE treatment in two separate test cells at the East Gate Disposal Yard at Joint Base Lewis-McChord near Tacoma, Washington. The objectives included quantifying the effect of low-energy heating on the extent and rate of contaminant degradation, the impacts on the mass removal rate, relative contributions of biotic and abiotic contaminant degradation mechanisms at different temperatures, and the costs and benefits of applying low-energy heating with in situ treatments.
https://www.serdp-estcp.org/content/download/32859/320476/file/ER-200719-CP.pdf

APPLICATION OF NANOSCALE ZERO VALENT IRON FOR CONTAMINANT SITE REMEDIATION: RESULTS FROM TWO FIELD TRIALS

O'Carroll, D.M., C. Kocur, A. Chowdhury, K.P. Weber, H.K. Boparai, M.M. Krol, N. Sakulchaicharoen, L.M. Austrins, C. Peace, B.E. Sleep, E. Edwards, and L. Lomheim.
2014 RPIC Federal Contaminated Sites National Workshop, 14-16 April, Ottawa, Ontario, 39 slides, 2014

Rapid nanometal settling and poor mobility in the subsurface has been a problem in subsurface remediation applications, reportedly due to the ferromagnetic attractive forces between particles leading to agglomeration. To demonstrate the scale-up of existing synthesis techniques to produce nanometal particles on site, field-synthesized nanometals were injected at two sites contaminated with PCE, TCE, and daughter products. Detailed characterization of the field site before, during, and after the trial indicates that the injected nanoparticles were quite mobile and therefore available for contaminant destruction. Characterization of the injected nanometals and those captured at the monitoring wells after subsurface transport is presented.
http://www.rpic-ibic.ca/documents/RPIC_FCS2014/Presentations/1-OCarroll_DMORPIC2014v2ForTranslation.pdf

FOURTH FIVE-YEAR REVIEW REPORT: YORK OIL SUPERFUND SITE, FRANKLIN COUNTY, MOIRA, NEW YORK

U.S. EPA Region 2, 39 pp, 2014

Historical (1962-1975) storage and processing of waste oils at the 17-acre York Oil Company site contaminated on-site soils, sludges, sediments, and surface water with phenols, heavy metals, VOCs, and PCBs. In 2009, investigations revealed an area of subsurface soil that contained cis-1,2-DCE and PCE in addition to waste oil. A proprietary in situ chemical reduction (ISCR) reagent consisting of a combination of controlled-release carbon and zero-valent iron was selected for a pilot study. Phase I began in October 2009 with the installation of a 200 ft long ISCR reagent-amended permeable reactive barrier (PRB) targeted at 6 to 35 feet bgs. By 2011, monitoring results from the site proper showed that only benzene still exceeded the MCL, while results from the downgradient contamination pathways monitoring wells had lower PCE concentrations in the shallower wells and increasing concentrations of cis-1,2-DCE and VC in the deeper wells. In October-September 2011, the Phase II expansion of the ISCR pilot had to be abandoned after numerous attempts to direct push to 43 feet bgs were unsuccessful due to the presence of a cobble layer. The current scope of the groundwater remedy consists of ongoing monitoring of the ISCR reagent PRB. The inspections, maintenance, sampling, monitoring, data evaluation, and reporting costs are ~$77,750 on an annual basis.
http://www.epa.gov/region02/superfund/npl/yorkoil/pdf/yorkoil_fourth_fyr_fy15.pdf

FIELD ASSESSMENT OF GUAR GUM STABILIZED MICROSCALE ZEROVALENT IRON PARTICLES FOR IN-SITU REMEDIATION OF 1,1,1-TRICHLOROETHANE

Velimirovic, M., T. Tosco, M. Uyttebroek, M. Luna, F. Gastone, C. De Boer, N. Klaas, H. Sapion, H. Eisenmann, P.O. Larsson, J. Braun, R. Sethi, and L. Bastiaens.
Journal of Contaminant Hydrology, Vol 164, 88-99, 2014

A pilot-scale injection with guar gum-stabilized microscale zero-valent iron (ZVI) particles was performed at test site V (Belgium), where 1,1,1-TCA, 1,1-DCA, 1,1-DCE, TCE, and cDCE were present in the subsurface. One hundred kilograms of 56 µm-diameter ZVI (~70 g/L) was suspended in 1.5 m^3 of guar gum (~7 g/L) solution and injected into the test area. A single direct-push, bottom-up injection (Geoprobe) of the stabilized ZVI slurry targeted five depths between 10.5 and 8.5 m bgs. The maximum observed delivery distance was 2.5 m. Distribution of the ZVI in the porous medium suggested that preferential flow paths were created during the high-pressure injection, and the slurry arrived at a different depth than intended; however, a significant decrease in 1,1,1-TCA concentrations was observed in areas with the highest concentration of ZVI.http://porto.polito.it/2578937/1/Aarschot_final_forUGOV.pdf
See also M. Velimirovic's 2013 Ph.D. thesis for additional details:
https://aquarehab.vito.be/output/Documents/ScientificOutput/PhD_thesis_final_M.Velimirovic.pdf

STAUFFER CHEMICAL COMPANY, TARPON SPRINGS, FLORIDA

Florida Department of Environmental Protection, 7 pp, 2014

The plant processed elemental phosphorus from phosphate ore between 1947 and 1981, when operations ceased. Over 500,000 tons of chemical process wastes were disposed of on site during operations. The site was placed on the NPL in 1994. In accordance with the 1998 ROD for soil contamination, Stauffer initiated field studies in February 2006 for in situ solidification and stabilization within Pond 48. An 8.5-ft auger was used to consolidate contaminated soil and materials with cement slurry to a maximum depth of 20 ft bgs. As a result of the cement curing, the elemental phosphorous ignited and created a fire, which was extinguished after several hours. Phosphine gas was detected at low levels on site but not high enough to warrant evacuation of nearby residents. The field study was discontinued due to the uncertainty of potential locations of buried elemental phosphorous. EPA issued an ESD in May 2007 for the construction of a cut-off wall and cap to replace the in situ stabilization remedy. http://www.dep.state.fl.us/waste/quick_topics/publications/wc/sites/summary/095.pdf

Research

INTEGRATED STABLE ISOTOPE-REACTIVE TRANSPORT MODEL APPROACH FOR ASSESSMENT OF CHLORINATED SOLVENT DEGRADATION: USER'S GUIDE

Kuder, T., P. Philp, B. van Breukelen, H. Thouement, M. Vanderford, and C. Newell.
ESTCP Project ER-201029, 245 pp, 2014

The objective of this document is to help site managers apply a reactive transport modeling approach for improved compound-specific isotope analysis (CSIA) data interpretation and to estimate more accurate attenuation processes for chlorinated solvents. Quantification of destructive and transport processes and how they contribute to plume size and longevity may help extend monitored natural attenuation remedies to sites previously unable to use them. The report contains a description of standard CSIA laboratory methods, simple data interpretation, and a step-by-step guide to downloading and using software developed as part of this project. The approach presented has benefits over traditional data interpretation, i.e., (1) improvement of a conceptual site models by identification and quantification of prevalent attenuation pathways and identification of secondary inputs from DNAPL dissolution or nondegradative sinks, such as sorption or volatilization, diffusion, or dispersion; (2) a more accurate assessment of degradation of the parent contaminant; (3) and quantitative assessment

of the net degradation/accumulation of the dechlorination intermediates.
https://www.serdp-estcp.org/content/download/32641/318663/file/ER-201029%20User%27s%20Guide.pdf

POLYHYDROXYALKANOATE (PHB) AS A SLOW-RELEASE ELECTRON DONOR FOR ADVANCED IN SITU BIOREMEDIATION OF CHLORINATED SOLVENT-CONTAMINATED AQUIFERS

Baric, M., L. Pierro, B. Pietrangeli, and M.P. Papini.
New Biotechnology, Vol 31 No 4, 377-382, 2014

This paper describes an investigation of the coupling of zero-valent iron (ZVI) with a long-lasting, slow-release substrate (i.e., poly-hydroxybutyrate, or PHB) as a strategy to enhance the degradation performance of ZVI barriers emplaced to treat chlorinated ethane contamination. This combination has the potential to stimulate biological reductive dechlorination downgradient of the PRB. Results demonstrate the feasibility of the proposed approach and the potential for a biodegradable polymer produced for a different commercial use to be utilized advantageously in the groundwater remediation market.

GREEN STABILIZATION OF MICROSCALE IRON PARTICLES USING GUAR GUM: BULK RHEOLOGY, SEDIMENTATION RATE AND ENZYMATIC DEGRADATION

Gastone F., Tosco T., Sethi R.
Journal of Colloid and Interface Science, Vol 421, 33-43, 2014

Guar gum can be used to improve the stability and mobility of microscale zero-valent iron (ZVI) particles used in groundwater remediation. Guar gum is a food-grade, environment-friendly natural polysaccharide often employed as thickening agent. Its high viscosity in static conditions and low viscosity in dynamic conditions enables dispersion stability of ZVI slurry and reduces the sedimentation rate of the particles. This paper provides a comprehensive rheological characterization of guar gum-based microscale ZVI slurries. A model was developed for prediction of the sedimentation rate of the iron particles. Also discussed is the influence of the preparation procedure (cold or hot dissolution and high shear processing) on suspension viscosity and stability as well as dosage and concentration of enzymes for enhancing and controlling suspension degradation kinetics.
http://porto.polito.it/2526337/1/Gastone_et_al_2014_preprint_perUGOV.pdf

IMMOBILIZED SYNTHETIC PATHWAY FOR BIODEGRADATION OF TOXIC RECALCITRANT POLLUTANT 1,2,3-TRICHLOROPROPANE

Dvorak, P., S. Bidmanova, J. Damborsky, and Z. Prokop.
Environmental Science & Technology, Vol 48 No 12, 6859-6866, 2014

A novel biotechnology for transforming the emerging groundwater contaminant 1,2,3-trichloropropane (TCP) is based on an immobilized synthetic pathway composed of three enzymes from two different microorganisms: engineered haloalkane dehalogenase from *Rhodococcus rhodochrous* NCIMB 13064, and haloalcohol dehalogenase and epoxide hydrolase from *Agrobacterium radiobacter* AD1. Together, they catalyze consecutive reactions that convert toxic TCP to harmless glycerol. A packed-bed reactor filled with the immobilized biocatalysts continuously converted 52.6 mmol of TCP into glycerol within 2.5 months of operation. TCP conversion efficiency to intermediates was 97%, and conversion efficiency to glycerol was 78% during the operational period. The immobilized biocatalysts are suitable for removing TCP from contaminated water up to a 10 mM solubility limit.
http://loschmidt.chemi.muni.cz/peg/wp-content/uploads/2014/05/est14.pdf

FILTER MATERIALS FOR METAL REMOVAL FROM MINE DRAINAGE: A REVIEW

Westholm, L.J., E. Repo, and M. Sillanpaeae.
Environmental Science & Pollution Research, Vol 21 No 15, 9109-9128, 2014

This review discusses a wide range of organic and inorganic filter materials for removal of heavy metals from mine drainage. Bark, chitin, chitosan, commercial ion exchangers, dairy manure compost, lignite, peat, rice husks, vegetal compost, and yeast are examples of organic materials, while biocarbons, calcareous shale, dolomite, fly ash, limestone, olivine, steel slag, and zeolites are examples of inorganic materials. The majority of these materials have been investigated only in the laboratory, although a few (e.g., steel slag) have been assessed under field conditions with promising results. *This paper is* ***Open Access*** *at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4148316/.

MICROORGANISM AND ENZYME IMMOBILIZATION: NOVEL TECHNIQUES AND APPROACHES FOR UPGRADED REMEDIATION OF UNDERGROUND-, WASTEWATER AND SOIL

MINOTAURUS Grant Agreement no. 265946, FP7-CP-FP, 71 pp, 2015

The MINOTAURUS project aimed to elevate technologies mainly of academic interest to field application and make them more available to end users. This objective has been largely achieved for several groundwater remediation technologies. A bioaugmented packed-bed reactor (PBR) with a specialized consortium to degrade MTBE was tested successfully on site with real groundwater over relevant periods and now can be considered validated for larger-scale implementation. MINOTAURUS partners developed a new and targeted process for cometabolic aerobic biodegradation of TCE. Bioelectrochemically assisted reductive dechlorination, a chemical-free approach that allows for in situ restoration of groundwater within the aquifer, is another promising treatment for TCE-contaminated groundwater. This report summarizes the MINOTAURUS studies undertaken from January 2011 through December 2013.
http://cordis.europa.eu/docs/results/265/265946/final1-final-report-minotaurus-gano-265946.pdf

RELEASE OF ANTIMONY FROM CONTAMINATED SOIL INDUCED BY REDOX CHANGES

Hockmann, K., M. Lenz, S. Tandy, M. Nachtegaal, M. Janousch, and R. Schulin.
Journal of Hazardous Materials, Vol 275, 215-221, 30 Jun 2014

Release of toxic antimony (Sb) from corroding ammunition at shooting ranges can contaminate the soil. This paper describes an investigation of Sb concentration and speciation dynamics in a calcareous shooting range soil in terms of changing redox conditions. The transition to reducing conditions invoked by indigenous microbial activity at first led to the immobilization of Sb as Sb(V) was converted to Sb(III), which binds more extensively to iron (hydr)oxides. When reducing conditions continued, the previously sorbed Sb(III) was gradually released into solution due to reductive dissolution of the iron (hydr)oxides. Speciation measurements showed that Sb(III) predominated at low redox conditions (Eh For additional information, see K. Hockmann's Ph.D. thesis at http://e-collection.library.ethz.ch/eserv/eth:8135/eth-8135-02.pdf.

STABILIZATION OF METALS AND METALLOIDS IN CONTAMINATED SHOOTING RANGE SOILS: THE EFFECT OF IRON-BASED AMENDMENTS

Grasshorn-Gebhardt, Karl-Alexander, Master's thesis, University of Oslo, Norway. 80 pp, 2014

Test plots were set up at a shooting range bullet trap at Steinsjoen (Hurdal, Norway) to investigate the long-term retention effects of two different iron-based amendments for stabilizing metals and metalloids (Pb, Zn, Cu, Sb) in the soil. Plots were established with reference soil (no amendments), soil with CFH-12 and limestone (iron oxyhydroxides and limestone for pH regulation), and soil with zero-valent iron (ZVI) in varying proportions (2-4%) and amendments mixed in or on top. Mixing the amendments into the soil stabilized contaminants more effectively than top application. Porewater from soil mixed with 2% CFH-12/limestone showed increased pH due to the limestone, very good Pb retention (>94%), and moderate retention for Sb (59-74%), Cu (64-70%), and Zn (60-73%). In soil mixed with 4% CFH-12/limestone, Sb retention was higher (>85%) despite higher pH, whereas retention of the other elements was in the same range as for 2% amendment. Porewater concentrations in soil mixed with 2% ZVI showed similar retention for Pb (>94%), Cu (> 46%) and Sb (~73%), but Zn retention was very low (26%) and even negative (-26%). Cu concentrations in soil mixed with 4% ZVI increased dramatically, likely due to ion exchange reactions with Ca and the presence of Cu in the amendment. Retention percentages indicate that the stabilization efficiency of both amendments changed only slightly from 2010 to 2013. https://www.duo.uio.no/handle/10852/41562?show=full

TOLERANCE OF ANAEROBIC BACTERIA TO CHLORINATED SOLVENTS

Koenig, J.C., K.D. Groissmeier, and M.J. Manefield.
Microbes and Environments, Vol 29 No 1, 23-30, 2014

Researchers evaluated the effects of PCE, carbon tetrachloride (CT), chloroform (CF) and 1,2-DCA on the growth of eight anaerobic bacteria: four fermentative species (*Escherichia coli*, *Klebsiella* sp., *Clostridium* sp., and *Paenibacillus* sp.) and four respiring species (*Pseudomonas aeruginosa*, *Geobacter sulfurreducens*, *Shewanella oneidensis*, and *Desulfovibrio vulgaris*). Effective concentrations of solvents that inhibited growth rates by 50% (EC_{50}) were determined. The octanol-water partition coefficient or log $P_{O/W}$ of each compound proved a generally satisfactory measure of its toxicity. Most species tolerated roughly 3-fold and 10-fold higher concentrations of the two relatively more polar chlorinated aliphatics, CF and 1,2-DCA, respectively, than the two relatively less polar compounds, PCE and CT. EC_{50} values correlated well with growth rates observed in solvent-free cultures, with fast-growing organisms displaying higher tolerance levels. Overall, fermentative bacteria were more tolerant of chlorinated aliphatic hydrocarbons than respiring species, with iron- and sulfate-reducing bacteria in particular appearing highly sensitive to CAHs. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4041229/

IN SITU GROUNDWATER AND SEDIMENT BIOREMEDIATION: BARRIERS AND PERSPECTIVES AT EUROPEAN CONTAMINATED SITES

Majone, M., R. Verdini, F. Aulenta, S. Rossetti, V. Tandoi, N. Kalogerakis, S. Agathos, S. Puig, G. Zanaroli, and F. Fava.
New Biotechnology, Vol 32 No 1, 133- 2015

From a general survey of the literature, a critical examination of the current application of environmental technologies for bioremediation of contaminated

groundwater and sediments indicates that in situ bioremediation is a highly promising and cost-effective technology for remediation of contaminated soil, groundwater, and sediments; however, in situ bioremediation is also knowledge-intensive, and its application requires a thorough understanding of the geochemistry, hydrogeology, microbiology, and ecology of contaminated soils, groundwater, and sediments under both natural and engineered conditions. Its potential in Europe remains partially unexploited, largely because of a lack of general consensus and public concerns regarding possible side effects (e.g., accumulation of toxic metabolites). This paper compares the use of in situ bioremediation in Europe and the United States and discusses the different techniques. http://aulentalab.webplus.net/New%20Biotechnol%202015_32%281%29%20133-146.pdf

ASSESSMENT OF TWO KINETIC TESTS TO PREDICT THE ACID MINE DRAINAGE IN WASTE ROCK SAMPLES OF A URANIUM MINE

de Abreu, A.T., E.M. de Faria, C.T.F. Chaves, A. do Lago Leite, and J.C. de Lena.
REM: R. Esc. Minas, Ouro Preto, Vol 67 No 1, 107-113, 2014

The main goal of this work was to assess and compare two kinetic tests in an attempt to predict acid generation from the waste rock of the Osamu Utsumi Mine located in Caldas, Minas Gerais (Brazil). Tests were carried out using a Soxhlet extractor and a leaching column. The leachate from the tests was analyzed for the physical-chemical parameters (pH, Eh, and electric conductivity) and metals and metalloids. http://www.scielo.br/pdf/rem/v67n1/v67n1a16.pdf

BENCH-SCALE BIODEGRADATION TESTS TO ASSESS NATURAL ATTENUATION POTENTIAL OF 1,4-DIOXANE AT THREE SITES IN CALIFORNIA

Li, M., E.T. Van Orden, D.J. DeVries, Z. Xiong, R. Hinchee, and P.J. Alvarez.
Biodegradation, Vol 26 No 1, 39-50, Feb 2015

Researchers assessed the biodegradation potential of 1,4-dioxane (dioxane) in microcosm studies using groundwater and sediment samples from three sites in California. Biodegradation of dioxane was observed in 12 of 16 microcosms mimicking natural attenuation within 28 weeks. Rates varied from as high as 3,449 ± 459 µg/L/week in source-zone microcosms to a low of 0.3 ± 0.1 µg/L/week in microcosms with trace level of dioxane. ^{14}C-labeled dioxane to assess dioxane fate. Degradation and mineralization activity decreased significantly with increasing distance from the contaminant source area ($p < 0.05$), possibly due to less acclimation. Both respiked and repeated microcosms prepared with source-zone samples from Site 1 confirmed relatively rapid dioxane degradation (i.e., 100% removal by 20 weeks). Results show that indigenous microorganisms capable of degrading dioxane are present at these three sites and suggest that monitored natural attenuation is a feasible remedial response. *Additional information on this study can be found in E.T. Van Orden's 2014 thesis at* https://scholarship.rice.edu/handle/1911/77387?show=full.

INNOVATIVE METHODS FOR CHARACTERIZING CHLORINATED VOLATILE ORGANIC COMPOUNDS IN THE VADOSE ZONE

Morrison, Candice N., Ph.D. dissertation, University of Arizona, 181 pp, 2014

Projects were undertaken to evaluate four innovative techniques for characterizing CVOCs: (1) In phytoscreening, vegetation can be used to verify the presence of VOCs in the vadose zone and its subsequent correlation to groundwater contamination. This tool also can be used to screen an area for vapor intrusion potential [Appendix A, p. 54]. (2) A method for determination of low concentration (µg/L) vapor-phase TCE in soil gas samples using solid sorbent cartridge with GCMS was modified from the NIOSH Manual of Analytical Methods #1022 for TCE and applied at the Tucson International Airport Authority Superfund site. The method is targeted to situations requiring cost-effective sample collection, particularly for cases when concentrations are at or below MCLs [Appendix B, p. 95]. (3) Measurement of the spatial variability of vapor flux to characterize vadose-zone VOC sources in flow-cell experiments was conducted to evaluate the premise that that the magnitudes and temporal variability of vapor concentrations measured at different monitoring points within the interrogated area will be a function of the geospatial positions of the points relative to the source location, a technique known as vapor-phase tomography [Appendix C, p. 115]. (4) A gas-phase tracer test was conducted at a landfill in Tucson, Arizona, to evaluate the impact of landfill gas generation on the transport and fate of CVOCs in the vadose zone [Appendix D, p. 159]. http://arizona.openrepository.com/arizona/bitstream/10150/333041/1/azu_etd_13531_sip1_m.pdf

General News

A PRACTITIONER'S GUIDE FOR THE ANALYSIS, MANAGEMENT AND REMEDIATION OF LNAPL

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment, Adelaide, Australia. CRC CARE Technical Report no. 34, 85 pp, 2015

This guide draws on the wealth of literature on LNAPL remediation globally and on the documented experience of remediation practitioners in Australia, Europe, and North America. It acknowledges the diversity of technical expertise required of the professions engaged in the management and remediation of LNAPL-contaminated sites. By setting out the entire project life cycle—from problem characterization to risk assessment, decision-making, engineering design, execution, and ultimately closeout—the unified approach of this guide is intended to support specialists in any one area of the project life cycle with perspectives on other areas. *See the most recently posted technical report at* http://www.crccare.com/publications/technical-reports.

ADDRESSING METHANE AT ANAEROBIC BIOREMEDIATION SITES

Indiana Department of Environmental Management, 11 pp, 2014

Anaerobic conditions can produce methane, and methane concentrations of 5-10% are explosive. In general, methane groundwater concentrations in excess of 10 mg/L or monitoring well/subsurface/subslab gas concentrations in excess of 10% of the lower explosive limit of 5% methane are a cause for concern, and monitoring is needed to determine if adequate oxygenated vadose zone exists to mitigate the methane or if additional measures are necessary to protect potential receptors. This document was developed to address the issue of appropriate methane monitoring/mitigation at bioremediation sites to avoid explosive hazards; it does not discuss using methane concentrations as a remediation performance measure during bioremediation.
http://www.in.gov/idem/landquality/files/remediation_tech_guidance_methane_mitigation.pdf

SUSTAINABILITY: A NEW IMPERATIVE IN CONTAMINATED LAND REMEDIATION

Hou, D. and A. Al-Tabbaa.
Environmental Science & Policy, Vol 39, 25-34, 2014

Based on results from a questionnaire survey and review of existing theories and empirical evidence, this paper suggests the expanding emphasis on sustainable remediation is driven by three general factors: (1) increased recognition of secondary environmental impacts (e.g., life-cycle greenhouse gas emissions, air pollution, energy consumption, and waste production) from remediation operations; (2) stakeholders' demand for economically sustainable brownfield remediation and green practices; and (3) institutional pressures (e.g., social norm and public policy) that promote sustainable practices, such as renewable energy, green building, and waste recycling. This paper presents a holistic view of sustainability considerations in remediation and an integrated framework for sustainability assessment and decision-making, concluding that sustainability is becoming a new imperative in environmental remediation.

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.