Entries for October 16-31, 2015

Market/Commercialization Information

SMALL BUSINESS INNOVATION RESEARCH (SBIR) / PHASE I SOLICITATION
U.S. Environmental Protection Agency, Solicitation NO. 16-006, 2015

EPA has a requirement for proposals for Phase I Small Business Innovation Research (SBIR) project proposals to develop technologies to address environmental problems. The solicitation is intended to encourage research and development of innovative technologies for projects to commence August 1, 2016. Small business firms may apply for Phase I awards up to $100,000 to demonstrate proof of concept in seven topic areas: air quality, bio-energy, contaminated sediment and soil cleanup, drinking water, ecosystem services, hazardous waste remediation, and natural resource conservation.

SYNOPSIS REQUEST FOR SBIR: AE SERVICES MINI CONTRACT
U.S. Environmental Protection Agency, Region IV, Atlanta, GA.

EPA has a requirement for professional AE services to support remedial planning and oversight activities for hard-rock mine sites and mine-related sites located in Regions 4, 6, 8, 9, and 10. Hard-rock mine sites encompass non-ferrous, metal- and non-metallic mining associated with gold, silver, copper, molybdenum, and lead-zinc. Selection process includes a solicitation and evaluation of proposals. EPA expects to make award(s) to one or more proposed firms. Interested businesses are invited to apply. Phase I bidding, up to $50,000 to further develop commercialize their technologies.

Cleanup News

REMEDATION WORK PLAN ADDENDUM, INDIANA MACHINE WORKS, 135 EAST HARRISON STREET, MOORESVILLE, INDIANA
Indiana Department of Environmental Management, 315 pp, 2015

This plan proposes a site-specific closure strategy for the site main contaminants—TCE, VOCs, 1,1,1-TCA, and TCE—at Volunteer Remediation Program Site 6051201. Based on the results of a successful in situ chemical oxidation (ISCO) pilot test conducted in 2013, 3D-enhanced reduction electro-degradation (SOD) is proposed to treat the two groundwater plumes. After ISCO pilot treatment, groundwater monitoring results within the 1144 feet of the 150-day monitoring period met the Superfund Tier 1 treatment goal of $10,000 per month. In addition, Benzene concentrations declined significantly in some downgradient monitoring wells. Future monitoring will assess changes in natural attenuation parameters, microbial activity, and composition to provide a basis for selecting the best in situ bioremediation approach to implement at the site.

Demonstrations / Feasibility Studies

PILOT STUDY IMPLEMENTATION REPORT, EVANDALE AVENUE SOURCES, MIDDLEFIELD-ELLS-WHIMAN REGIONAL GROUNDWATER REMEDIATION PROGRAM, MOUNT VERNON, CALIFORNIA

The scope of work for the in situ chemical oxidation (ISCO) pilot study at the CPT-15 and CPT-21 areas was completed with the installation, development, and baseline sampling of nine temporary performance monitoring wells downgradient of the study areas. A 50-HP vacuum blower was used at a target depth between 30 ft and 175 ft bgs. The air that was pumped was cleaned aboveground using two 1000-lb vessels of activated carbon. No contaminants were detected after treatment. The pilot test removed ~300-500 mg/L of VOCs in the first 15 days of testing. More importantly, vacuum and concentration changes in monitoring wells were observed all around and as far away as 370 ft from the extraction well. Follow-up tests were conducted in October 2014 to determine the long-term performance of the technologies at each site.

REMEDATION FOR MERCURY STABILIZATION BY IN-SITU CHEMICAL REDUCTION (ISCR) IN GROUNDWATER (BRAZIL SITE)
EPA Region 2, 127 September, Philadelphia, PA, 13 votes, 2015

A groundwater in a active mill in Sao Paulo State (Brazil) is contaminated with mercury at concentrations up to 895 μg/L. The contaminant plume extends over 6,000 m² (roughly 124 m x 111 m) in a depth of about 8 m. Remedial action plans for the site were conducted in October 2013 and 2014. In action stage to include reducing the pH of the site from between 5 to about 3. In 2014, the concentrations of Hg declined significantly in some monitoring wells. The EPA expects this site to be in the future evaluated as exposed to the environmental and human health risks.

FIELD STUDY: BIOVENTING
2015 Year in Review, Santa Susana Field Laboratory, 2015

NASA conducted a bioventing field study in July 2014 in the Bravo Test Stand area of the Santa Susana Field Laboratory site. Three wells and four monitoring points were installed to measure whether air injection into the ground releases contaminants as gases through soil aeration. Bioventing was observed to be operating through a subsurface with little in-situ degradation occurring, increased oxygen levels enhance the biological breakdown of hydrocarbons in the Bravo bedrock. NASA was able to raise the oxygen to over 20% at every spot measured. NASA is considering a second phase of bioventing field work to see the success of bioventing near the Bravo site where traces of fuel were found in the soil. NASA expects this first phase to be in the future evaluated as exposed to the environmental and human health risks.

BEDROCK VAPOR EXTRACTION
2015 Year in Review, Santa Susana Field Laboratory, 2015

A bedrock vapor extraction pilot study was conducted in Area A of the Santa Susana Field Laboratory site to see whether this technology could be implemented in the SST bedrock and if so to evaluate its effectiveness in removing VOCs. Field work began in July 2014 with the installation of seven vapor monitoring wells in the Bravo-Slim field area. In August and September, NASA began testing if an extracted air from an existing core hole in the rock could be moved through bedrock. It was found that the air ventilation was reduced by a factor of 6 to 10 due to the presence of bedrock and the injection of air was reduced by 50% to 80% due to the presence of the bedrock.

MANGANESE ACTIVATED PERSULFATE (MAP) FOR THE TREATMENT OF GROUNDWATER: AN INNOVATIVE DUAL OXIDATION FORMULATION
CleanUp Conference 2015, September 13-16, Melbourne, Australia.

A novel in situ chemical oxidation (ISCO) method utilizes manganese oxides to activate sodium persulfate (MnAP). In mode of action, MnAP increases manganese oxide content within the target treatment zone via delivery of freshly precipitated manganese oxides from persulfate consumption that then act as activators for persulfate to propagate persulfate radical-based oxidative chemistry. Two laboratory treatability studies of MnAP achieved >99.9% TCE removal at concentrations between 300 and 500 mg/L in both aqueous and solid phases. The treatability data also showed that MnAP can achieve this level of TCE treatment using less of each of the two oxidants compared to single-oxidant approaches and a 50-HP vacuum blower was used at a target depth between 30 ft and 175 ft bgs. The air that was pumped was cleaned aboveground using two 1000-lb vessels of activated carbon. No contaminants were detected after treatment. The pilot test removed ~300-500 mg/L of VOCs in the first 15 days of testing. More importantly, vacuum and concentration changes in monitoring wells were observed all around and as far away as 370 ft from the extraction well. Follow-up tests were conducted in October 2014 to determine the long-term performance of the technologies at each site.

COMBINED ABOTIC AND BIOTIC IN-SITU REDUCTION OF CHROMIUM HORIZON IN GROUNDWATER USING NZVI AND WHEY: A REMEDIATION PILOT TEST
Ramezanianifar, A., C. Rees, L. Hussey, M. Herreid, and G. Dufou
CleanUp Conference 2015, September 13-16, Melbourne, Australia.

This plan proposes a site-specific closure strategy for the main site contaminants—PCE, TCE, cis-1,2-DCE, VC, 1,1,1-TCA, and 1,1-DCA—at Volunteer Remediation Program Site 6051201. Based on the results of a successful in situ chemical oxidation (ISCO) pilot test conducted in 2013, 3D-enhanced reduction electro-degradation (SOD) is proposed to treat the two groundwater plumes. After ISCO pilot treatment, groundwater monitoring results within the 1144 feet of the 150-day monitoring period met the Superfund Tier 1 treatment goal of $10,000 per month. In addition, Benzene concentrations declined significantly in some monitoring wells. Future monitoring will assess changes in natural attenuation parameters, microbial activity, and composition to provide a basis for selecting the best in situ bioremediation approach to implement at the site.


IMPROVING CHARACTERIZATION OF FRACTURED ROCK USING 3D CROSS-BOREHOLE ELECTRICAL RESISTIVITY TOMOGRAPHY (ERT)

This study evaluated the potential of time-lapse electrical resistivity tomography (ERT) for mapping SNAPP mass reduction during remediation. A new numerical model was developed to explore this potential at the field scale, generating realistic ERT surveys and predicting the response of an ERT survey. Central to the model was the development of a novel linkage between hydrogeological and geoelectrical properties. A lab experiment was conducted that demonstrated, for
The first line, the effectiveness of 4D (three spatial dimensions plus time) ERT at capturing the surface for mapping evolving DNAPL distribution. Independent simulation of the measurements obtained revealed an improvement in the rate of potential for real-time monitoring, which was then demonstrated by a model for simulating real systems. The numerical model was then used to optimize the AD surface-based damage as field scale for monitoring a range of realistic DNAPL remediation scenarios. The approach showed excellent potential for mapping subsurface DNAPL migration. Although the AD surface-based damage was less sensitive to changes in reservoir properties and contaminant distribution, the numerical model was able to capture the 4D surface-based damage as well as field-scale remediation scenarios. A second lab experiment demonstrated that the new configuration better resolves changes in DNAPL distribution and surface damage, thus improving the overall effectiveness of the model.

**DIFFUSION FROM THIN LOW PERMEABILITY ZONES**


Aquifers can serve as long contaminant sources to aquifers when contaminant mass diffuses from the aquifer following aquifer source mass depletion. This study describes analytical and experimental approaches to understand reactive and nonreactive solute transport in a thin aquifer bounded by an adjacent aquifier. Lab results showed that solute with low retardation accumulated more stored mass with greater penetration distance compared to high-retardation solutes. Another key finding is that additional source changes resulting from a semi-unique solution analysis to a finite diffusion domain provides a novel approach to identify the feasible solutions to the reactive-solute diffusion length and thickness of clay layers.

**IMPACT OF CLAY-DNAPL INTERACTIONS ON THE TRANSPORT OF CHLORINATED SOLVENTS IN LOW PERMEABILITY SUBSURFACE ENVIRONMENTS**


Mobile particle models revealed that core diffusion coefficient for TCE in a silty-clay mixture was at least two to four fold smaller than predictions used in field studies. Calculations based on the measurements obtained in this study suggest an even greater distribution of diffusion mass in low permeability layers and what can be attributed to diffusion. It was postulated that direct contact between the waste and the layers altered the chemical properties of the clay, affecting the residual transport properties. Measurements on clay-core diffusion showed that contact with contaminated water decreased the residual diffusion mass of certain contaminants by 1.5% to 15%.

**PARTICLE TRANSFORMATIONS FOLLOWING A RADIOLOGICAL EVENT: A LITERATURE REVIEW AND SUMMARY**


This comprehensive review provides an overview of radiological waste generation and management practices, highlighting the importance of surface and subsurface geometries in determining the fate of radionuclides. The review concludes by identifying knowledge gaps and research needs to improve risk assessment and recovery following a radiological dispersion event.

**CONTAMINATED SOIL CONTAINING LEAD TREATMENT BY STABILIZATION/STANDARDIZATION TECHNIQUES**


IIEE International Conference Engineering (IIEE-ICE), 1-4 December, 2014, Universiti Tun Hussein Onn Malaysia, Johor. 5 pp, 2014

In an investigation of solid-phase extraction performed with commercial polymer beads to treat soil contaminated by chlorophenols (4-chlorophenol, 2,4-dichlorophenol, and PCB) as single and in a mixture, soil-polymer beads elution and the recontamination of the soil with the native contaminant were studied. The soil contaminated with chlorophenols was treated with the beads until the concentration of the contaminant decreased below the water table during application of ERH in heterogeneous porous media during the co-boiling stage, which occurs prior to reaching the boiling point of water. Lab experiments were completed in a 2D flow cell to investigate gas production and migration during the application of electrical resistance heating (ERH) for DNAPL removal. Experiments consisted of heating water in homogeneous silica sand below the water table during application of ERH in heterogeneous porous media during the co-boiling stage, which occurs prior to reaching the boiling point of water.

**MICROFACIAL TESTS FOR NATURAL ATTENUATION, BIOSTIMULATION, AND BIOAUGMENTATION OF SOILS CONTAMINATED WITH PCBS, DIOXINS, PAKS, AND PETROLEUM HYDROCARBONS**


DOE funded a project to (1) estimate potential biodegradation rates of diverse contaminants of interest in Santa Susana Field Laboratory soils via natural attenuation and (2) determine the potential for successful biostimulation and bioaugmentation in a microcosm study. Different types of soil microorganisms were established in which dissolved and particulate concentrations decreased significantly, but none of the other COE concentrations declined significantly over 244 days of incubation. For additional information on this study, see: A. Hikma, Masters’ thesis at University of Puerto Rico, Mayaguez. 2015.

**PARTICLE TRANSPORT OF RADIONUCLIDES FOLLOWING A RADIOLOGICAL EVENT: A LITERATURE REVIEW AND SUMMARY**


This paper compares different type of nuclear incidents and their derived contaminants to better understand radiological dispersal and how it might interact with urban environments. This review provides an overview and analysis of the current state of knowledge and technologies of dispersal models with reference to particulate transport and the behavior of radionuclides in urban and rural environments, and explores the current state of knowledge of transport models. The review concludes by identifying knowledge gaps and research needs to improve risk assessment and recovery following a radiological dispersion event.

**TARGETING SOIL IN-SITU REMEDIATION TECHNOLOGIES APPLICABLE TO PETROLEUM HYDROCARBON CONTAMINATED SITES IN THE ANTARCTIC AND ARCTIC**

Carmack, N.; H. Wurts, and J. Hargrave.


This paper assesses technologies currently being adapted or developed for the remediation of petroleum-hydrocarbon contaminated sites in the Arctic and Antarctic—bioremediation, landfarming, bioaugmentation, photoremediation, electrokinetic remediation, and permeable reactive barriers—and discusses their advantages, limitations, and potential for the long-term management of contaminated soil and groundwater at extremely cold sites.

**PYROLYTIC TREATMENT AND ENHANCED SOIL CONTAMINANTS WITH HEAVY HYDROCARBONS**


Environmental Science & Technology (Web publication prior to print, 18 Aug 2015)

Pyrolysis of contaminated soils at 420°C converted resistive halogenated hydrocarbons into chloro-carbonaceous material (like petroleum coke) and enhanced soil fertility. Pyrolytic treatment reduced total petroleum hydrocarbons to below regulatory standards. Physical and chemical properties of the treated soils were also evaluated. Additionally, pyrolysis was analyzed for its capability to separate hydrocarbons from other contaminants in a sequential process.

**FACOTRS AFFECTING GAS MIGRATION AND CONTAMINANT REDISTRIBUTION IN HETEROGENEOUS POROUS MEDIA SUBJECT TO ELECTRICAL RESISTANCE HEATING**


Lab experiments were completed in a 2D flow cell to investigate gas production and migration during the application of electrical resistance heating (ERH) for DNAPL removal. Experiments consisted of heating water in homogeneous silica sand below the water table during application of ERH in heterogeneous porous media during the co-boiling stage, which occurs prior to reaching the boiling point of water. High-velocity gas flow was observed at low ERH intensities but was suppressed at higher intensities. Leaching experiments on low-permeability sandstone showed that high-velocity gas flow was only achieved during initial stages of ERH.

**ASSESSMENT OF MITIGATION SYSTEMS ON VAPOR INTRUSION: TEMPORAL TRENDS, ATTENTION FACTORS, AND CONTAMINANT MIGRATION ROUTES UNDER MITIGATED AND NON-MITIGATED CONDITIONS**


EPA 600-B-15-241, 60 pp, 2015

In 2011, we began investigating the principal mechanisms of how vapors enter into a single residence study site, a highly instrumented pre-1920 residential duplex located in Indianapolis, Indiana. This report, the second in a series of reports based on that research, demonstrates the reliability of the DNAPL ERT model system for simulating real systems. The numerical model was then used to optimize the AD surface-based damage as field scale for monitoring a range of realistic DNAPL remediation scenarios. The approach showed excellent potential for mapping subsurface DNAPL migration. Although the AD surface-based damage was less sensitive to changes in reservoir properties and contaminant distribution, the numerical model was able to simulate the surface AD ERT for a realistic, field-scale DNAPL scenario with remediation depth. A second lab experiment demonstrated that the new configuration better resolves changes in DNAPL distribution and surface damage, thus improving the overall effectiveness of the model.