Technology Innovation News Survey

Entries for December 1-15, 2016

Market/Commercialization Information

SUBSURFACE BIOGEOCHEMICAL RESEARCH
U.S. DOE, Office of Science Funding Opportunity DE-FOA-0001724, 2016

Applicants to this funding opportunity must propose either a Pilot or a Demonstrator Project or an Exploratory Project that will focus on measurements, experiments, and modeling to provide improved quantitative and predictive understanding of the hydrogeochemical functioning of subsurface systems. All projects are required to clearly delineate an integrative, hypothesis-driven approach to define key hydrogeochemical processes and interactions in the subsurface.

ENVIROMENTAL REMEDIATION SERVICES

This presolicitation is advertised as a 100% small business set-aside under NAICS code 562910. The Government plans to award three cost-plus-award-fee IDIQ contracts for one base year and four option years. The Government will award up to a total of $497 million to a single awardee.

MODELING WELL INSTALLATION AND SOIL AND GROUNDWATER SAMPLING
U.S. Army Corps of Engineers, USACE District, Philadelphia, Federal Business Opportunities, FBO-932L, Solicitation W12045-17-T-0088

This notice constitutes a request for submittal of SF-330 capabilities packages; it is not a request for proposals. This action will result in the award of one IDIQ contract for multi-discipline AE services in support of the Department of the Navy Environmental Restoration Program, consisting of the Installation Restoration and Munitions Response programs in compliance with CERCLA, and CERCLA, as amended, NCP, and in accordance with other applicable laws and regulations.

Cleaning News

USE OF ZVI CATALYZED HYDROXYL & SULFATE FREE RADICALS TO ADDRESSES ATEX DETECTION IN SITU CHEMICAL OXIDATION FOLLOWED BY INTRINSIC FACULTATIVE, BIOLGICALLY MEDIATED PROCESSES

In situ chemical oxidation via zero-valent iron-activated sodium persulfate and hydrogen peroxide was implemented to reduce VOC concentrations (e.g., trimethylbenzene) in soil and groundwater at two former gasoline station sites on base properties in Okaloosa, Florida (April 2010) and Clinton, New York (2009). This strategy realized the targeted contaminants and migrated away from the source area. The oxidation of organic compounds from the soil and groundwater by zero-valent iron and hydrogen peroxide results in the formation of highly oxidizing radicals, such as hydroxyl and sulfate free radicals. These reactions extended the oxidant and free radical residual and further stimulated biological mineralization of the petroleum compounds. The three-factor model validation of the trioxide oxidation was more than 12 months after completion of the injection event. The site in Clinton recorded a total decrease of 79% in BTX concentrations 17 months after implementation of the remedial design.

REMEDIAL ACTION STATUS UPDATE: EAST PARCEL (TAX LOT 800) OF FORMER METLER BROTHERS FACILITY, 3450 SOUTH SIXTH STREET, KLAMATH FALLS, OREGON
Oregon Department of Environmental Quality (DEQ), Voluntary Cleanup Program, 35 pp, 2016

The 0.74-acre site occupies the eastern portion of a former wood products mill operation prior to the 1970s by Metler Brothers and others. The remedial action objective approved by DEQ for this parcel included the treatment of 17,000 cubic feet (PCF) of groundwater contamination of 32 µg/L. Remedial activities at the site included an in situ chemical oxidation (ISCO) pilot test in August 2010 and two rounds of full-scale ISCO injections in November 2010 and May 2011. ISCO treatments consisted of injection of 15% sodium persulfate oxidant solutions (Kozur™) and an alkaline activator: a 1:1 ratio of ISCO oxidant and alkaline activator and injection pressure of 1,000 psi. The PCP concentrations in groundwater were reduced from a pretreatment concentration ranging between 19,250 µg/L to a post-treatment level of 848 µg/L. Source-area PCP concentrations vary but have increased slightly since 2013. Long-term post-treatment PCP concentrations in groundwater are much lower than pretreatment concentrations, with an 82% reduction in source-area concentrations observed in March 2016. Source-area PCP concentrations diminished to below analytical detection levels.

RECORD OF DECISION: SOLVENT FINISHERS STATE SUPERFUND PROJECT, JERICHO, NASSAU COUNTY, SITE NO. 130172
New York State Department of Environmental Conservation, 58 pp, 2016

The selected remedy calls for air sparging and soil vapor extraction, in situ chemical oxidation, enhanced bioremediation, and vapor mitigation. The estimated present worth cost to implement the remedy is $34,184,380. The cost to construct the remedy is estimated to be $12,036,000, and the estimated average annual cost is $304,005.

IN-SITU REMEDIATION OF RETAIL STATION IN DENMARK WITH INNOVATIVE INJECTION METHOD (TRAPP&TREAT® BOS200®) AND SITE CHARACTERIZATION PROCEDURES

A gasoline spill was discovered in 2003 from a leaking fuel supply pipe in the dispenser area at a retail gas station outside Copenhagen (Denmark). Remedial efforts by means of skimmer pumps, pump and treat, and soil vapor extraction were conducted from end of 2003 until 2013. Local geology consists of glacial till, boulder clay from upper soil to ~12 m bgs. An uneven layer of sand and gravels stretches down to the bedrock. An initial reconnaissance 1D-1H plume formation at ~10-11 m above the water table, along with a drop in groundwater level to ~1.5 m bgs, was observed. The site was identified as a site of interest, and an area with a history of fuel spills in the vicinity. A pilot test to assess effectiveness of TRAPP&TREAT® BOS200® injection was conducted in March 2012 in conjunction with a full-scale remedial design characterization event, which enabled the development of a solid 3D contaminant mass model assessing the total contaminant mass present on site. Full-scale injection operations commenced in October 2014 and were completed in
May 2015. The project delivered 73,000 kg of BOS200 to the subsurface via 285 injection points over a total surface area of 1,200 m². Nine months after injection completion a 90% average dissolved-phase reduction was observed throughout the selected monitoring wells. Mass reduction continues to be observed through the downward trends in groundwater dissolved concentrations.

Demonstrations / Feasibility Studies

PILOT STUDY OF ELECTROKINETICALLY DELIVERED THERMALLY ACTIVATED PERSULFATE IN CLAYEY TILL

Electrokinetic migration can help to establish the necessary contact between reactants and contaminants in low-permeability soils. This concept is being used in a technology demonstration of electrokinetically delivered thermally activated persulfate (EK-TAP), which combines electrokinetic delivery of persulfate with heat activation through electrical resistance heating. A pilot test of the EK-TAP technology was performed at a test site contaminated mainly with PCE and TCE. The geology consists of partly saturated glacial clay tills overlaying a Carboniferous limestone formation. The pilot is a single electrode test consisting of two electrode wells (anode and cathode) situated 3 m apart. Two monitoring wells and four thermistor wells are installed in the test site to monitor geochemical and temperature changes. The test was performed on a site located at the water table of the limestone formation. The pilot is a single dipole test consisting of two electrode wells (anode and cathode) situated 3 m apart. Two monitoring wells and four thermistor wells are installed in the test site to monitor geochemical and temperature changes. The test was performed on a site located at the water table of the limestone formation.

FIELD TESTING OF A NOVEL HIGH-PRESSURE OZONE INJECTION METHOD FOR REMEDIATION OF CHLORINATED SOLVENT SOURCE ZONES IN FRACTURED LIMESTONE

An innovative process combining surfactant foam and surfactant flushing for remediation of a shallow saturated soil contaminated with residual DNAPL was investigated at bench scale. Foam was generated from a surfactant and nitrogen mixture at constant pressure in the SAG process. During stopping points in the logging process, the light source can be switched from the standard UV LED to a visible LED to capture enhanced biological degradation of organic matter that might fuel methanogenesis. The project delivered 73,000 kg of BOS200 to the subsurface via 285 injection points over a total surface area of 1,200 m². Nine months after injection completion a 90% average dissolved-phase reduction was observed throughout the selected monitoring wells. Mass reduction continues to be observed through the downward trends in groundwater dissolved concentrations.

FULLY IN SILICO CALIBRATION OF EMPIRICAL PREDICTIVE MODELS FOR ENVIRONMENTAL FATE PROPERTIES OF NOVEL MUNITIONS COMPOUNDS
SERDP Project ER-1735, 67 pp, 2016

Predicting the environmental fate of novel munitions compounds requires data for the key properties that control contaminant fate, and the most common way to predict these properties is with empirical quantitative structure-activity relationships (QSARs). The traditional approach to QSAR development (calibration with experimental data) is challenging for new explosives compounds, however, because of limited availability of these materials. Some of the necessary environmental fate properties can be calculated directly from molecular structure data, but reliable calculated properties are not always suitable for use in QSAR models. Therefore, there is a strong need for high-throughput methods to predict these chemical metrics. The SERDP project ER-1735 used a hybrid, partially in silico approach to QSAR development, which is a combination of cheminformatics, high-throughput computational methods, and experimental testing. The hybrid approach to QSAR development is challenging for new explosives compounds, however, because of limited availability of these materials. Some of the necessary environmental fate properties can be calculated directly from molecular structure data, but reliable calculated properties are not always suitable for use in QSAR models. Therefore, there is a strong need for high-throughput methods to predict these chemical metrics. The SERDP project ER-1735 used a hybrid, partially in silico approach to QSAR development, which is a combination of cheminformatics, high-throughput computational methods, and experimental testing. The hybrid approach was used to predict acute oral toxicity, persistence, bioaccumulation, and environmental fate properties of novel munitions compounds for a comprehensive database of compounds.

FUEL FLUORESCENCE LOGGING USING THE OPTICAL IMAGING PROFILER (OIP): A NEW HIGH RESOLUTION DIRECT PUSH TOOL FOR DELINEATING LNAPL

The Optical Image Profiler (OIP), recently developed by Geoprobe Systems, is a percussion-driven, direct-push tool that utilizes modern UV LED and micro camera technology to generate and capture fuel fluorescence images in image. Images taken at 300s are analyzed by the software for typical fluorescence colors, which allows for the detection of LNAPL. The optical design of the OIP makes it possible to capture soil texture and visual information about the distribution of hydrocarbons within the soil matrix.

FUELPURGE

The Optical Image Profiler (OIP) is a percussion-driven, direct-push tool, which utilizes modern UV LED and micro camera technology to generate and capture fuel fluorescence images in image. Images taken at 300s are analyzed by the software for typical fluorescence colors, which allows for the detection of LNAPL. The optical design of the OIP makes it possible to capture soil texture and visual information about the distribution of hydrocarbons within the soil matrix.

INVESTIGATION OF CHLORINATED SOLVENT POLLUTION WITH RESISTIVITY AND INDUCED POLARIZATION

The OPEMF technique demonstrated promise for mapping underground structures and possibly bioavailability and transport properties of the chlorinated solvents. The OPEMF technique is expected to increase the ability to map and sample the spatial extent and characteristics of the contaminant plume.
underground structures and delineation of the pollutant situation. It likely will have a future in monitoring approaches measuring time-lapse induced polarization (IP) if more research is performed on the parameters and processes affecting IP signals to verify the interpretations. The IP technique might be used to verify the effectiveness of in situ remediation activities.

CHARACTERIZATION OF CHLORINATED SOLVENT CONTAMINATION IN LIMESTONE USING INNOVATIVE FLUITE TECHNOLOGIES IN COMBINATION WITH OTHER METHODS IN A LINE OF EVIDENCE APPROACH


Innovative field methods were combined to improve determination of source zone architecture, hydrogeochemistry, and contaminant distribution. The new FACT™ technology, a flexible borehole liner equipped with a reactive covering for NAPL detection, was applied and tested in a limestone aquifer at a contaminated site along with wire-line coreing with core sub-sampling, FLUITE-transport profiling, and multiple analyses. Sampling, Lab section studies were combined with a variety of contaminant update on the FACT™-K for data analyses on contaminates. Limestone aquifer Ch 1.3 for K and from 2.8 to 3.4 for Zn, whereas 10% zeolite amendment increased the adsorption capacity by a factor ranging from 7.5 to 13.5 for K and 3.1 to 3.7 for Zn. The lower increase in adsorption capacity is due to the retention behavior of both K and Zn, and the strong adsorption of K onto the microporous surface of the zeolite. The results demonstrate how the presence of ferromagnisols supplies electrons for the reductively dechlorinating microorganisms such that reductive dechlorination is not inhibited. These findings suggest that biostimulation or bioaugmentation could be applied to promote complete reductive dechlorination and enhance the destruction of more DNAPL. Another version of this paper is available at http://www.iwaponline.com/water/16/1/doi:10.2166/w2.2016.155.

REDUCTIVE DECHLORINATION IN RECALCITRANT SOURCES OF CHLOROETHENES IN THE TRANSITION ZONE BETWEEN AQUIFERS AND AQUITARDS


A field study was conducted to investigate the biodegradation of chloroethenes from aged pools (i.e., pools after decades of continuous groundwater flushing and dissolution) of PCE is favored in the transition zone. A field site where an aged pool exists at the bottom of a transition zone, two boreholes were drilled to obtain sediment and groundwater samples to perform chemical, isotopic, molecular, and cell library analyses and microcosm experiments. The main results were as follows: (a) the transition zone is characterized by a high microbial richness; (b) reductively dechlorinating microorganisms are present, and partial reductive dechlorination coexists with denitrification, Fe and Mn reduction, and sulfate reduction; (c) reductively dechlorinating microorganisms are also present in the zone of the aged pool; (d) high PCE concentrations in this zone resulted in a decrease in microbial richness; (e) however, the presence of fermenting microorganisms supplies electrons for the reductively dechlorinating microorganisms such that reductive dechlorination is not inhibited. These findings suggest that biostimulation or bioaugmentation could be applied to promote complete reductive dechlorination and enhance the destruction of more DNAPL. Another version of this paper is available at http://www.iwaponline.com/water/16/1/doi:10.2166/w2.2016.155.

ADSORPTIVE BEHAVIOR OF ZEOLITE-AMENDED BACKFILLS FOR ENHANCED METALS CONTAMINATION


Three commercially available zeolites—two chabazites and a clinoptilolite—were evaluated as soil-bentonite (SB) backfill amendments to enhance the adsorption capacity for potassium (K) and zinc (Zn). These amendments were evaluated in a batch sorption study with a ratio of 5% zeolite to 95% soil (by weight). Zeolite amendments with 5% Zn to 95% soil (by weight) produced an adsorption capacity that was 3.0-3.8 fold higher than for the unamended backfill sorbent for K and 3.1-3.7 fold higher for Zn. Depending on the specific zeolite, the addition of 5% zeolite increased the adsorption capacity relative to that for the unamended backfill sorbent by a factor ranging from 6.2 to 7.3 for K and from 2.8 to 3.4 for Zn, whereas 10% zeolite amendment increased the adsorption capacity by a factor ranging from 7.5 to 13.5 for K and 3.1 to 3.7 for Zn. The lower increase in adsorption capacity is due to the retention behavior of both K and Zn, and the strong adsorption of K onto the microporous surface of the zeolite. The results demonstrate how the presence of ferromagnisols supplies electrons for the reductively dechlorinating microorganisms such that reductive dechlorination is not inhibited. These findings suggest that biostimulation or bioaugmentation could be applied to promote complete reductive dechlorination and enhance the destruction of more DNAPL. Another version of this paper is available at http://www.iwaponline.com/water/16/1/doi:10.2166/w2.2016.155.

LONG-TERM CONTAMINANT MANAGEMENT USING INSTITUTIONAL CONTROLS

Interstate Technology & Regulatory Council (ITRC), IC-1, 2016

This guide focuses on long-term contaminant management using institutional controls (ICs) to provide protection from exposure to contaminants on a site. This guide assists those who are responsible for ICs stewardship by describing critical elements and best practices for an IC management program based on the successes and lessons learned from established state and federal models that are effective for integrating quantitative and qualitative information, and thus can strengthen decisions when empirical data are lacking. The developed BBMs combine data from various sources to improve the predictive abilities of IC management programs and test practitioners to understand, evaluate, and make informed decisions about geospatial analyses for increasing monitoring efficiency, and justifying decisions. This guide illustrates the practical application of geospatial analyses to support optimization activities and help practitioners apply the stewardship tool at information. The tool generates an editable long-term stewardship plan in Microsoft Word. The guide is available as a web-only document at http://institutionalcontrols.itrcweb.org/. Download the stewardship tool at http://www.irtcweb.org/documents/team/igc_tool.zip.

GEOSPATIAL ANALYSIS FOR OPTIMIZATION AT ENVIRONMENTAL SITES

Interstate Technology & Regulatory Council (ITRC), GRI-3, 2016

Geospatial analysis supports optimization activities throughout all stages of an environmental investigation or cleanup by improving performance of characterization and remediation activities, increasing monitoring efficiency, and justifying decisions. This guide illustrates the practical application of geospatial analyses to support optimization activities and help practitioners apply geospatial analyses to their projects. This information will help state regulators and other informants to understand, evaluate, and make informed decisions about geospatial analyses for optimizing activities during environmental investigation or remediation. The material presented does not provide only highly technical detail but also introductory information for those who may not have expertise in this area. This web-only document provides fact sheets, flow charts, checklists, and other tools to serve readers who have varying levels of expertise.

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 michael.adam@epa.gov or (703) 603-9915 with any comments, suggestions, or corrections.