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 Standard Project or an Exploratory Project that will focus on measurements, experiments, and modeling to provide improved quantitative and predictive understanding of the hydrobiogeochemical functioning of watershed systems. All projects are required to clearly delineate an integrative, hypothesis-driven approach and clearly describe the existing needs and gaps in state-of-the-art models. Brief pre-applications are due by 5:00 PM ET on February 7, 2017; if the Office of Science requests a full application, it is due by 5:00 PM ET on April 5, 2017. http://www.grants.gov/web/grants/view-opportunity.html?oppId=290915 *Additional information*: http://science.energy.gov/~/media/grants/pdf/foas/2017/SC_FOA_0001724.pdf

ENVIRONMENTAL REMEDIATION SERVICES

Department of the Navy, Naval Facilities Engineering Command, NAVFAC Atlantic.
Federal Business Opportunities, FBO-5501, Solicitation N6247017R8000, 2016

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 one-year options with a total maximum value of $240M. Work performed by the issuance of task orders will primarily support the remediation of sites contaminated with hazardous substances in accordance with CERCLA in Alabama, Alaska, Arkansas, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, North Dakota, Ohio, Oklahoma, Oregon, South Carolina, South Dakota, Tennessee, Texas, Washington, Wisconsin, Wyoming, the areas of the Caribbean, Central America, and Puerto Rico, as well as anywhere outside NAVFAC Atlantic's area of responsibility required by the Government. Release of the solicitation on NECO and FBO is anticipated in the latter part of January 2017. https://www.fbo.gov/spg/DON/NAVFAC/N62470CON/N6247017R8000/listing.html

ESTCP FY 2018 ENVIRONMENTAL TECHNOLOGIES SOLICITATION

DoD's Environmental Security Technology Certification Program (ESTCP) is soliciting proposals for demonstrations of environmental technologies as candidates for funding beginning in FY 2018. Brief pre-proposals targeting one or more of the following needs areas are due no later than 2:00 PM ET on March 9, 2017:

- Innovative technology transfer approaches for technologies successfully demonstrated under ESTCP or for technologies developed under SERDP that are appropriate for direct transfer.
- Long-term management of contaminated aquatic sediments (PAHs, PCBs, and metals).
- Management of contaminated groundwater (chlorinated solvents, energetic compounds, emerging contaminants of interest to DoD, or mixtures of these contaminants).
- Detection, classification, and remediation of military munitions in underwater environments.
- Use of unmanned aerial vehicles for safe and cost-effective natural resources management on DoD lands.
- Demonstration/validation of alternatives to hexavalent chromium in manufacturing and maintenance of weapons systems.
- Waste-to-energy converters for overseas contingency operations.

ESTCP projects are formal demonstrations in which innovative technologies are rigorously evaluated. The demonstrations are conducted at DoD facilities and sites to document improved efficiency, reduced liability, improved environmental outcomes, and cost savings. Details, instructions, and deadlines are posted on the ESTCP website at https://serdp-estcp.org/Funding-Opportunities/ESTCP-Solicitations.

MONITORING WELL INSTALLATION AND SOIL AND GROUNDWATER SAMPLING

U.S. Army Corps of Engineers, USACE District, Philadelphia.
Federal Business Opportunities, FBO-5532, Solicitation W912BU-17-T-0008

In December 1999, the Pennsylvania Department of Environmental Protection issued the Defense Logistics Agency an administrative order requiring the recovery of LNAPL from the site subsurface at the former Defense Supply Center Philadelphia. Two monitoring wells are needed to calibrate the site groundwater conceptual model. Soil and groundwater samples will be collected during installation of the well and analyzed for the chemical parameters specified in the solicitation. The period of performance is 90 days after contract award. This contract will contain three options for additional work. The NAICS code is 237110 and the size standard is $36.5M. Submit offers via email by 2:00 PM ET on January 29, 2017. Please note that although the FBO notice says "this procurement is 100% set-aside for small business," the solicitation form proper says, "This acquisition is set aside 100% for economically disadvantaged women-owned small business." https://www.fbo.gov/spg/USA/COE/DACA61/W912BU-17-T-0008/listing.html

ARCHITECT-ENGINEER SERVICES FOR COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY V (CLEAN V)

Naval Facilities Engineering Command, NAVFAC Pacific, Pearl Harbor.
Federal Business Opportunities, FBO-5528, Solicitation N6274217R1800

This notice constitutes a request for submittal of SF-330 capabilities packages; it is not a request for proposals. This acquisition will result in the award of one IDIQ contract for multi-discipline AE services in support of the Department of the Navy's Environmental Restoration Program, consisting of the Installation Restoration and Munitions Response programs in compliance with CERCLA, and other similar programs. Required services will be performed at various Navy and Marine Corps facilities within the NAVFAC Pacific area of responsibility, predominantly in Hawaii and Guam, and potentially including Japan, Diego Garcia, and other areas in the Pacific or Indian oceans. This acquisition is solicited on an unrestricted basis under NAICS code 541330. SF-330 capabilities packages must be received by 2:00 PM Hawaii Standard Time on February 14, 2017. Interviews for slated firms will be conducted in Joint Base Pearl Harbor-Hickam, Hawaii. https://www.fbo.gov/spg/DON/NAVFAC/N62742/N6274217R1800/listing.html

Cleanup News

USE OF ZVI CATALYZED HYDROXYL & SULFATE FREE RADICALS TO ADDRESS BTEX CONTAMINATION VIA IN-SITU CHEMICAL OXIDATION FOLLOWED BY INTRINSIC FACULTATIVE, BIOLOGICALLY MEDIATED PROCESSES

Scalzi, M. and A. Karachalios.
IPEC 2016: 23rd Annual International Petroleum Environmental Conference, 33 slides, 2016

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 service stations in St. Augustine, Florida (April 2008), and Clinton, New York (October 2009). This strategy initially oxidized the targeted contaminants and then promoted facultative biodegradation in the subsurface. The introduction of a mixture of hydroxyl, peroxyl, and sulfate free radicals allowed for both Fenton-like reactions and long-lived sulfate free radical oxidation. These reactions extended the oxidant and free radical residual and further stimulated biological mineralization of the petroleum compounds. The three targeted wells in St. Augustine showed BTEX concentration decreases of 74%, 95% and 91%, respectively, 12 months after completion of the injection event. The site in Clinton recorded a total decrease of 79% in BTEX concentrations 17 months after implementation of the remedial design. Trimethylbenzene was successfully reduced below the state standard within 12 months of the remedial event.
Slides: http://ipec.utulsa.edu/Conf2016/MANUSCRIPTS/Use_ZVI.pdf

IN-SITU BIOLOGICAL TREATMENT OF A 29 ACRE GROUNDWATER TRICHLOROETHENE PLUME IN NEW JERSEY: COSTS AND LESSONS LEARNED

Cronce, R. and M. Alexander.
Abstracts: ETEBA 17th Annual Business Opportunities Conference, 11-13 October 2016

In situ anaerobic bioremediation is being used to treat a 29-acre groundwater plume containing primarily TCE at the Monitor Devices Inc./Intercircuits Inc. Superfund site in New Jersey. This treatment involves injection of emulsified vegetable oil (EVO) and sodium bicarbonate (SB) to create neutral, anaerobic aquifer conditions, followed by injection of a specialized strain of *Dehalococcoides* bacteria to degrade TCE by reductive dechlorination. Over a 6-yr period (2010-2015) ~5.8 million gal of amendment solution containing 3.5 million lb of SB and 148,500 gal of EVO were injected into 290 100-ft-deep multi-screen injection wells, achieving 85% removal of TCE and 1,1-DCE contaminant mass and 75% reduction of plume size. Lessons learned and evaluation of project injection and treatment results led to continuous improvements in amendment mixing and distribution, injection well design, types and quantities of amendments injected, and monitoring protocols. Every optimization improvement increased treatment effectiveness while decreasing project costs.

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 operated prior to the 1970s by Metler Brothers and others. The remedial action objective approved by DEQ for this site is a pentachlorophenol (PCP) groundwater concentration of 52 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 (Klozur®) and an alkaline activator: a 12% calcium peroxide solution (PermeOx Plus®) for Phase 1 injection, and sodium hydroxide for Phase 2. PCP concentrations in the source area decreased from a pretreatment concentration averaging 19,250 µg/L to a post-treatment low of 648 µg/L in February 2013. 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 have fluctuated between ~1,000 and 5,500 µg/L since August 2011, and a small residual mass of PCP remains in the area immediately surrounding source-area well MW-2. PCP concentrations diminish to below analytical detection levels See this report and others at http://www.deq.state.or.us/Webdocs/Forms/Output/FPController.ashx?SourceIdType=11&SourceId=4457.

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 $14,181,000. The cost to construct the remedy is estimated to be $12,036,000, and the estimated average annual cost is $204,000.
http://www.dec.ny.gov/docs/remediation_hudson_pdf/130172rod.pdf

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

Ceriani, G.G. and P. Ejlskov.
NORDROCS 2016: The 6th Joint Nordic Meeting on Remediation of Contaminated Sites — Short Papers and Abstracts, p 187, 2016

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 2012. Local geology consists of glacial till, boulder clay from upper soil to ~12 m bgs. An uneven layer of weathered limestone is present above the competent limestone formation, which starts at 13-14 m bgs. Groundwater is found at ~10 m bgs. LNAPL presence was observed across a large area. A pilot test to assess effectiveness of Trap&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

Nedergaard, L.W., I.H. Kern-Jespersen, M. Terkelsen, C. Riis, H. Steffensen, S. Jensen, et al.
NORDROCS 2016: The 6th Joint Nordic Meeting on Remediation of Contaminated Sites — Short Papers and Abstracts, p 60, 2016

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 is underway in Ballerup, Denmark, at a test site contaminated mainly with PCE and TCE. The geology consists of partly saturated glacial clay tills overlying a Danien 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 plot. The dipole test is divided into 3 operational stages: pre-heating, EK persulfate migration, and post-migration soil heating. For EK persulfate migration, current is applied to the electrodes using a DC power supply, and persulfate is amended to the cathode electrode well. After distribution of the persulfate throughout the test area, post-migration soil heating is applied via AC power to the electrodes, providing electrical resistance heating of the soil to a minimum 35°C to activate the persulfate. Following the heating stage, soil cores are sampled from the test area and analyzed to assess the effectiveness of the combined remedy. Experience with the technology and setup has been gained during all three stages of the pilot study, and the design has been optimized.

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

Milter, H., J. Piper, L.T. Karlby, C. Ross, and J.L. Mortensen. NORDROCS 2016: The 6th Joint Nordic Meeting on Remediation of Contaminated Sites — Short Papers and Abstracts, p 184, 2016

Initial testing of a novel high-pressure ozone injection system (>80 psi) was performed at the Oelsemagle shallow fractured limestone site in the eastern part of Denmark where the subsurface close to the water table is contaminated with low levels of PCE (100-4500 µg/L). After excavation of the main spill, the depth to contamination was ~5-9 m bgs. Testing at the shallow site consisted of 10 injection wells (10 m lateral spacing) for introducing a combination of air and ozone plus water extracted downgradient. The gas mixture was delivered to the subsurface through a 15 cm long stainless steel diffuser installed in the bottom of a 5-cm stainless steel well screen. Nine wells were screened from 8.5-10 m bgs; one well in the center of the hotspot was screened from 18.5-20 m bgs. Injection followed a preprogrammed sequence, creating an oxidizing front that flowed with the natural gradient in the fractures. Water was injected into the injection wells simultaneously with air/ozone gas, resulting in aqueous and gaseous transport into the fractures that extended the radius of influence (ROI). Injection pressures up to 100 psi were observed, only limited by injection well back-pressure. Testing at the shallow site consistently showed a ROI in the fractures of 15 m, with some locations achieving a 20-m ROI, thereby indicating the potential for installing injection wells at 15 m spacing.

Research

EFFECTS OF ORGANIC MATTER ADDITION ON METHYLMERCURY FORMATION IN CAPPED AND UNCAPPED MARINE SEDIMENTS

Ndungu, K., M. Schaanning, and H.F.V. Braaten.
Water Research 103:401-407(2016)

Although in situ subaqueous capping can be effective in isolating mercury species migration into overlying water, capping can also alter the location and extent of biogeochemical zones and potentially enhance methylmercury (MeHg) formation in Hg-contaminated marine sediments. A boxcosm study was conducted to investigate whether the addition of organic carbon (OC) to Hg-contaminated marine sediments beneath an in situ cap would initiate or enhance MeHg formation of the inorganic Hg present. The introduction of algae OC to Hg-contaminated sediments triggered high rates of MeHg production as long as sufficient OC was present, but MeHg production was limited by OC availability. Results also confirmed that within the 6-month duration of the study and in the absence of bioturbating fauna, a 3-cm sediment clay cap could reduce fluxes of Hg species to the overlying water effectively and isolate the contaminated sediments from direct surficial deposition of organic matter that might fuel methylation. http://dl.umsu.ac.ir/bitstream/Hannan/125211/1/2016%20WR%20Volume%20103%20October%20(20).pdf

SURFACTANT FOAM FLUSHING FOR IN SITU REMOVAL OF DNAPLS IN SHALLOW SOILS

Maire, J. and N. Fatin-Rouge.
Journal of Hazardous Materials 321:247-255(2017)

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 formed by injecting DHSS surfactant and nitrogen alternately in soil (the SAG process) at constant pressure and then the effect of pressure gradients set point (=90 kPa/m) on DNAPL recovery was investigated. The foam front mobilized DNAPL with a piston-like fast propagation (1.8 m/d) despite the low pressure gradients. About 34-60% of DNAPL residual was extracted with low surfactant consumption (

FIELD TRACER TEST FOR THE DESIGN OF LNAPL SOURCE ZONE SURFACTANT FLUSHING

Robert, T., R. Martel, R. Lefebvre, J.-M. Lauzon, and A. Morin.
Groundwater Monitoring & Remediation 36(2):68-82(2016)

A field tracer test was carried out in an LNAPL source zone using a well pattern consisting of one injection well surrounded by four extraction wells (5-spot well pattern). Multilevel sampling was carried out in two observation wells located inside the test cell characterized by heterogeneous lithology. Tracer breakthrough curves showed relatively uniform flow within soil layers. A numerical flow and solute transport model was calibrated on hydraulic heads and tracer breakthrough curves. The model was used to estimate an average accessible porosity of 0.115 for the swept zone and an average longitudinal dispersivity of 0.55 m. The model was further used to optimize the relative effects of viscous forces versus capillary forces under realistic imposed hydraulic gradients and to establish optimal surfactant solution properties. Maximum capillary number (NCa) values between injection and extraction wells were obtained for an injection flow rate of 16 L/min, a total extraction flow rate of 20 L/min, and a surfactant solution with a viscosity of 0.005 pascal second. Surfactant and chase water slug sizing was optimized with a radial form of the simplified Ogata-Banks analytical solution so that injected concentrations could be maintained in the entire 5-spot cell.

INSIGHTS INTO THE BIODEGRADATION OF WEATHERED HYDROCARBONS IN CONTAMINATED SOILS BY BIOAUGMENTATION AND NUTRIENT STIMULATION

Jiang, Y., K.J. Brassington, G. Prpich, G.I. Paton, K.T. Semple, S.J.T. Pollard, and F. Coulon.
Chemosphere 161:300-307(2016)

The biotransformation potential of weathered hydrocarbon residues in soils collected from two commercial oil refinery sites (Soil A and B) was studied in microcosm experiments. Soil A had undergone on-site bioremediation, and it was believed that no further degradation was possible, while soil B was untreated. Amendment strategies, including bioaugmentation with hydrocarbon degrader, biostimulation with nutrients, and soil grinding, were applied to the microcosms as putative biodegradation improvement strategies. Hydrocarbon concentrations in each amendment group were monitored throughout 112 days incubation. Microcosms treated with biostimulation (BS) and biostimulation/bioaugmentation (BS+BA) showed the most significant reductions in the aliphatic and aromatic hydrocarbon fractions. Soil grinding was shown to reduce the effectiveness of nutrient treatment on biotransformation extent by up to 25% and 20% for the aliphatic and aromatic hydrocarbon fractions, respectively, likely due to disruption to the indigenous microbial community in the soil. Ecotoxicological responses (mustard seed germination and Microtox assays) showed that a reduction of total petroleum hydrocarbon (TPH) concentration in soil was not directly correlatable to toxicity reduction; thus, monitoring TPH alone is not sufficient for assessing the environmental risk of a contaminated site after remediation.
https://dspace.lib.cranfield.ac.uk/bitstream/1826/10138/1/Insights_into_the_biodegradation_of_weathered_hydrocarbons-2016.pdf

BIOAUGMENTATION FOR THE ENHANCEMENT OF HYDROCARBON PHYTOREMEDIATION BY RHIZOBACTERIA CONSORTIUM IN PILOT HORIZONTAL SUBSURFACE FLOW CONSTRUCTED WETLANDS

Al-Baldawi, I.A., S.R.S. Abdullah, N. Anuar, and I. Mushrifah.
International Journal of Environmental Science and Technology 14(1):75-84(2017)

The effect of bioaugmentation during the phytoremediation of diesel-contaminated water in pilot horizontal subsurface flow constructed wetlands was investigated for 63 days. The objective was to examine the enrichment of rhizobacteria in a pilot-scale system for efficient treatment of total petroleum hydrocarbon (TPH) effluent. A consortium of three rhizobacteria strains (*Bacillus aquimaris*, *Bacillus anthracis*, and *Bacillus cereus*), which were able to utilize hydrocarbon compounds as sole carbon sources, was injected into the constructed wetlands (batchwise operation) planted with *Scirpus grossus*. TPH removals from water, without or with rhizobacteria addition, were found to be 72 and 84%, while removals from sand were 59 and 77% for each treatment, respectively. These results demonstrated that the rhizobacteria strains could enhance *S. grossus* growth by decreasing diesel stress, with 12 and 18% additional TPH removal from water and sand, respectively.

FULLY IN SILICO CALIBRATION OF EMPIRICAL PREDICTIVE MODELS FOR ENVIRONMENTAL FATE PROPERTIES OF NOVEL MUNITIONS COMPOUNDS

Tratnyek, P.G., A.J. Salter-Blanc, E.J. Bylaska, and K.R. Glaesemann.
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 theory, but reliable calculations of this type require considerable theoretical expertise and computational effort. To overcome this combination of challenges, SERDP project ER-1735 used a hybrid, partially in silico approach to QSAR development, where some of the calibration data (both the target variable and the descriptor variables) were calculated from molecular structure theory.
https://www.estcp.com/content/download/41076/392358/file/ER-1735%20Final%20Report.pdf

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

Pipp, D., T. Christy, J. Wiley, J. Fontana, and S. Doxtader.
IPEC 2016: 23rd Annual International Petroleum Environmental Conference, 31 slides, 2016

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 in image form. Images taken at 30hz are analyzed by the software for typical fluorescence color exhibited by fuels. The software then outputs an instantaneous graphical log of NAPL distribution and relative magnitude. During stopping points in the logging process, the light source can be switched from the standard UV LED to a visible LED to capture soil texture characteristics and visual information about the distribution of hydrocarbons in the soil matrix. This presentation reviews OIP logs and saved fluorescence images from a variety of sites with LNAPL contaminants ranging from crude oil to gasoline. The OIP technology is also compared to existing fluorescence technology using logs displayed side-by-side in identical cross-section formats. **Slides:** http://ipec.utulsa.edu/Conf2016/MANUSCRIPTS/Pipp.pdf

INVESTIGATION OF CHLORINATED SOLVENT POLLUTION WITH RESISTIVITY AND INDUCED POLARIZATION

Sparrenbom, C.J., S. Akesson, S. Johansson, D. Hagerberg, and T. Dahlin.
Science of the Total Environment 575:767-778(2017)

The use of the direct current resistivity and time-domain induced polarization tomography (DCIP) method was investigated at a DNAPL-contaminated site in Varberg, Sweden, where an in situ stimulated reductive dechlorination pilot test had been performed by push injection. The emerging DCIP technique demonstrates promise for mapping underground structures and possibly biogeochemical spatial and temporal changes. The methodology could in combination with drilling, sampling, and other complementary methods give an almost continuous image of the

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.
http://trust-geoinfra.se/publikationer/Sparrenbom%20et%20al_Renen%202016.pdf

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

Broholm, M.M., G.S. Janniche, K. Mosthaf, A.S. Fjordboge, P.J. Binning, A.G. Christensen, et al.
Journal of Contaminant Hydrology 189:68-85(2016)

Innovative field methods were combined to improve determination of source zone architecture, hydrogeology, 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 coring with core subsampling, FLUTe® transmissivity profiling, and multilevel water sampling. Lab sorption studies were combined with a model of contaminant uptake on the FACT for data interpretation. Limestone aquifers can be difficult to sample with existing methods because of core loss, particularly from soft zones in contact with chert beds. Water FLUTe multilevel groundwater sampling (under two flow conditions) and FACT sampling and analysis combined with FLUTe transmissivity profiling and modeling were used to provide a line of evidence for the presence of DNAPL dissolved- and sorbed-phase contamination in the limestone fractures and matrix. The combined methods were able to provide detailed vertical profiles of DNAPL and contaminant distributions, water flows, and fracture zones in the aquifer. Results for the limestone aquifer indicate horizontal spreading in the upper crushed zone, vertical migration through fractures in the bryozoan limestone down to about 16-18 m depth, with some horizontal migrations along horizontal fractures within the limestone. The use of FACT and Water FLUTe data significantly improved documentation of the DNAPL source in the limestone aquifer.

A BAYESIAN BELIEF NETWORK APPROACH FOR ASSESSING UNCERTAINTY IN CONCEPTUAL SITE MODELS AT CONTAMINATED SITES

Thomsen, N.I., P.J. Binning, U.S. McKnight, N. Tuxen, P.L. Bjerg, and M. Troldborg.
Journal of Contaminant Hydrology 188:12-28(2016)

A Bayesian belief network (BBN) approach is presented for constructing conceptual site models (CSMs) and assessing their uncertainty at contaminated sites. BBNs are graphical probabilistic models that are effective for integrating quantitative and qualitative information, and thus can strengthen decisions when empirical data are lacking. The developed BBNs combine data from desktop studies and initial site investigations with expert opinion to assess which of the CSMs are more likely to reflect the actual site conditions. The method is demonstrated on a Danish field site contaminated with chlorinated ethenes. Four different CSMs are developed by combining two contaminant source zone interpretations (presence or absence of separate phase contamination) and two geological interpretations (fractured or unfractured clay till). The beliefs in each of the CSMs are assessed sequentially based on data from three investigation stages (screening, a more detailed investigation, and an expert consultation) to demonstrate how the beliefs can be updated as more information becomes available.
https://www.infona.pl/resource/bwmeta1.element.elsevier-e72bd011-f6c9-31fe-8d21-ea9d880b39db/content/partDownload/8900b0c7-b69c-39dc-8cbd-94217452a25f

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

Puigserver, D., J. Herrero, M. Torres, A. Cortes, I. Nijenhuis, K. Kuntze, B.L. Parker, and J.M. Carmona. Environmental Science and Pollution Research 23(18):18724-18741(2016)

A field study was conducted to investigate if 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. At 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 clone 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 dissolution of more DNAPL. *Another version of this paper is available at* http://www.witpress.com/Secure/elibrary/papers/WP16/WP16011FU1.pdf.

ADSORPTIVE BEHAVIOR OF ZEOLITE-AMENDED BACKFILLS FOR ENHANCED METALS CONTAINMENT

Hong, C.S.-J., C.D. Shackelford, and M.A. Malusis.
Journal of Geotechnical and Geoenvironmental Engineering 142(7):(2016)

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). 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 for Zn relative to K was attributed to preferential selectivity of K relative to Zn. The adsorption behavior of both K and Zn was consistent with cation exchange as the dominant mechanism, provided that the chemical speciation of Zn was taken into account. Results show that adding zeolite to SB backfills can enhance the containment of metals via an increase in adsorption capacity, but the enhanced adsorption capacity will be a function of both the metal and the type and amount of zeolite, such that material-specific adsorption studies will be required for practical application.

General News

IN-SITU CAPPING OF CONTAMINATED SEDIMENTS

Jersak, J., G. Goeransson, Y. Ohlsson, L. Larsson, P. Flyhammar, and P. Lindh.
Swedish Geotechnical Institute (SGI), Linkoeping. Sections 30-1E - 30-7E, 2016

This publication was developed to serve as a basis for the design and assessment of remediation alternatives to dredging by providing a technology overview of various capping-based techniques and describing their possibilities and limitations. The guide consists of a main text (Section 30-1E) plus several supporting but stand-alone appendices: a preliminary review of contaminated sediments in Sweden (30-2E); a general overview of established ex situ and in situ sediment remediation technologies (30-3E); a preliminary overview of remedial sediment capping projects worldwide (30-4E); a short discussion on anticipated challenges with capping Sweden's fiberbank sediments (30-5E); an extensive bibliography of international technical references (30-6E); and an overall summary (30-7E). http://www.swedgeo.se/en/about-sgi/press/nyhetslista/in-place-capping-of-contaminated-sediments-a-technology-overview/

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 agency programs. To support cost-effective program development, ITRC developed a downloadable tool that can be used to document critical information about an IC. The tool can help to create a lasting record of the site that includes the regulatory authority, details of the IC, the responsibilities of all parties, a schedule for monitoring IC performance, and other relevant 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.itrcweb.org/Documents/team_ic/IC_Tool.zip.

GEOSPATIAL ANALYSIS FOR OPTIMIZATION AT ENVIRONMENTAL SITES

Interstate Technology & Regulatory Council (ITRC), GRO-1, 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 practitioners to understand, evaluate, and make informed decisions about geospatial analyses for optimizing activities during environmental investigation or remediation. The material presented provides not 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.
http://gro-1.itrcweb.org/

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