Technology Innovation News Survey

Entries for August 16-31, 2018

Market/Commercialization Information

RESPONSE, ENGINEERING AND ANALYTICAL CONTRACT (REAC)

U.S. Environmental Protection Agency, Office of Acquisition Management, Washington, DC.
Federal Business Opportunities, FBO-6052, Solicitation 68HE0S18R0010, 2018

U.S. EPA's Office of Acquisition Management, Superfund-RCRA Regional Procurement Operations Division intends to issue an RFP for the Response, Engineering, & Analytical Contract (REAC) in the early portion of the first quarter of FY 2019, most likely in late October. The Government reserves the right to adjust this timeframe. The REAC supports EPA's Environmental Response Team, which provides scientific and engineering services for the Office of Land and Emergency Management, EPA regional on-scene coordinators, remedial project managers, and other Agency groups. EPA intends that the future REAC contract will be used to provide response support to all 10 EPA regions, ranging from emergency, time-critical removal actions, and Homeland Security/Incident of National Significance, to non-time critical removal and remedial actions. The Government intends to award a single fixed-rate IDIQ contract, with work ordered through the issuance of task orders, for a period of performance consisting of a 36-month base period with two 12-month option periods. Acquisition will be based on full and open competition; no set-asides are anticipated. Solicitation number 68HE0S18R0010 will be associated with this acquisition, replacing 68HE0S18R0003 under which it was issued previously. This announcement has been posted for information and planning purposes only.
https://www.fbo.gov/spg/EPA/OAM/HQ/68HE0S18R0010/listing.html

NATIONAL SCIENCE FOUNDATION GRANT OPPORTUNITIES

As of August 15, 2018, all core programs in the National Science Foundation's Directorate for Engineering will accept proposals at any time throughout the year. NSF no longer restricts when an unsolicited proposal can be submitted for consideration to the core programs. In general, proposals should address the novelty or potentially transformative nature of the proposed work compared to previous work in the field. It is also important to address why the proposed work is important in terms of engineering science while projecting the potential impact of successful research on society and industry.

- **Environmental Engineering:** Funding Opportunity PD-18-1440, 2018. Purpose: Support potentially transformative fundamental research that applies scientific and engineering principles to (1) prevent or minimize solid, liquid, and gaseous discharges of pollution to soil, water, and air; (2) mitigate the ecological and human-health impacts of such releases by smart/adaptive/reactive amendments or manipulation of the environment, and (3) remediate polluted environments through engineered chemical, biological, and/or geo-physical processes. http://www.grants.gov/web/grants/view-opportunity.html?oppId=305200
- **Environmental Sustainability:** Funding Opportunity PD-18-7643, 2018. Purpose: Restore ecological function to natural systems; enable life cycle assessment via novel metrics for measuring sustainable systems; and develop innovations in management of storm water, recycling and reuse of drinking water, and other green engineering techniques to support sustainability. http://www.grants.gov/web/grants/view-opportunity.html?oppId=305202
- **Biological and Environmental Interactions of Nanoscale Materials:** Funding Opportunity PD-19-1179, 2018. Purpose: Advance fundamental and quantitative understanding of the interactions of nanomaterials and nanosystems with biological and environmental media. http://www.grants.gov/web/grants/view-opportunity.html?oppId=305194

Cleanup News

BARBEE MILL GROUNDWATER REMEDIATION PROJECT: PERFORMANCE MONITORING REPORT

Washington State Department of Ecology, 39 pp, 2017

The groundwater at the Barbee Mill Site, a former lumber mill located in Renton, Washington, is affected by occurrences of arsenic, zinc, and petroleum hydrocarbons. Cleanup actions have included the removal of 55,000 tons of As-contaminated soil from the source area in 2006 and the installation of several other measures: a passive attenuation zone (PAZ) along the downgradient boundary of the property to prevent As migration off site, a pump-and-treat system upgradient of the PAZ to remove additional As mass from the groundwater, and a network of monitoring wells and piezometers. The PAZ, installed in 2007, is designed to reduce groundwater As concentrations by at least 95% as the water flows through a permeable iron wall. Although As concentrations at two monitoring wells (CMW-1 and CMW-6) exceed the cleanup level of 20 µg/L, ongoing flushing of residual contamination upgradient of the PAZ is expected eventually to reduce As concentrations below the cleanup level. https://fortress.wa.gov/ecy/gsp/DocViewer.ashx?did=65705

LARGE-SCALE IMPLEMENTATION OF RECIRCULATION SYSTEMS FOR IN-SITU TREATMENT OF HEXAVALENT CHROMIUM IN GROUNDWATER IN HINKLEY, CA

Gentile, M., F. Lenzo, K. Sullivan, and I. Baker.
WM2017: Waste Management Conference, March 5-9, 2017, Phoenix, Arizona. Paper 17338, 2017

At the PG&E Hinkley Compressor Station in Hinkley, Calif., in situ reactive zones (IRZs) and recirculation systems are achieving in situ reduction of Cr(VI) to Cr(III) in groundwater within the plume core. The groundwater is extracted, amended with the organic carbon substrate (lactate or ethanol, in this case), and re-injected into the aquifer to form IRZs that currently are treating an area of 0.8 km by 1.6 km, targeting the core of the plume, where Cr(VI) concentrations range from 10s of µg/L to several mg/L. Following pilot testing from 2004 to 2006, large-scale implementation of this in situ treatment began in late 2007 and is ongoing. Through Third Quarter 2015, the remediation system had removed > 44% of the mass in the target treatment area. Within the IRZs, concentrations rapidly declined within the timeframe of weeks to a few months. Downgradient of the IRZs, treatment was observed at distances over 915 m. This paper describes the design, operation, adaptive management, and results of this remediation effort. http://www.wmsym.org/archives/2017/pdfs/FinalPaper_17338_01311021406.pdf

OVERCOMING VICINITY PROPERTY AND GROUND WATER CHALLENGES AT THE FUSRAP MIDDLESEX SAMPLING PLANT PROJECT

Ewy, A., D. Hays, H. Edge, and D. Kennedy.
WM2017: Waste Management Conference, March 5-9, 2017, Phoenix, Arizona. Paper 17529, 2017

The U.S. Army Corps of Engineers is conducting remedial activities at the Formerly Utilized Sites Remedial Action Program (FUSRAP) Middlesex Sampling Plant Site (MSP) in accordance with CERCLA. The MSP has been an active FUSRAP site since the early 1980s and was added to the National Priorities List in 1999. The project team currently is addressing challenges related to groundwater movement through fractured bedrock and assessments of vicinity properties (VPs). During the feasibility study phase of the CERCLA process for groundwater, the project team has encountered and overcome significant challenges with regard to contaminant plume bounding and groundwater movement through the secondary porosity of dipping bedding plane partings and fractured bedrock of the Passaic Aquifer beneath the site. This paper describes the challenges, the approaches used, and lessons learned while delineating carbon tetrachloride and TCE constituents in the groundwater. Soils remediation at MSP was completed in 2008, but VPs were not part of the 2005 soils ROD. Additionally, the State of New Jersey recently identified another potentially contaminated VP. The contaminated VPs of the MSP were addressed prior to the adoption of the CERCLA process for FUSRAP sites. While reassessing the previously addressed VPs for inclusion under the soils ROD as part of the CERCLA process, the Corps of Engineers expects to revisit and potentially remediate up to 12 VPs. This paper discusses the approach, challenges, and lessons learned in adequately addressing VPs from both a field work and a post-ROD regulatory perspective.
http://www.wmsym.org/archives/2017/pdfs/FinalPaper_17529.pdf

CLOSURE PLAN: BOOMSNUB/AIRCO SUPERFUND SITE, HAZEL DELL, WASHINGTON

Washington State Department of Ecology, 65 pp, 2018

The primary site contaminants are Cr(VI) and chlorinated VOCs, originating respectively from the Boomsnub and BOC/Linde (formerly Airco) facilities. Site remediation goals include the reduction of total Cr in groundwater to 80 µg/L and the reduction of TCE to 5 µg/L. Following removal of accessible Cr-contaminated soils in OU-1, in-well stripping and soil vapor extraction systems were implemented for the OU-2 VOC source area. Although the systems were successful in reducing TCE mass in groundwater by > 97% before asymptotic removal rates were reached and the systems were shut off, groundwater VOC concentrations remained above cleanup levels. The need for in situ treatments is anticipated in this area to reduce TCE concentrations to below cleanup levels within a reasonable timeframe. The successful results achieved in a 2006 pilot study at the site via injections of EHC-M™, a combination of controlled-release carbon and zero-valent iron particles, suggest a potential approach for reductive dechlorination of TCE and chemical reduction/precipitation of Cr(VI). The OU-3 site-wide groundwater is addressed by extraction and ion exchange treatment. An infiltration gallery provides for treated water disposal. This Closure Plan updates the site conceptual model; presents the procedures that will be used to demonstrate that site remediation is complete; and describes the process for decommissioning and removal of the extraction, treatment, and monitoring systems. https://fortress.wa.gov/ecy/gsp/DocViewer.ashx?did=71198

CLEANING UP LARGE GROUNDWATER PLUMES TO DRINKING WATER STANDARDS: DYNAMIC GROUNDWATER RECIRCULATION AT REESE AIR FORCE BASE

Houston, K., S. Potter, and S. Suthersan.
WM2017: Waste Management Conference, March 5-9, 2017, Phoenix, Arizona. Paper 17248, 2017

Recent experience with dynamic operation of groundwater extraction, treatment, and strategic reinjection (collectively referred to as dynamic groundwater recirculation, or DGR) demonstrates that large plume remediation can be both time and cost effective. A large-scale application of DGR was implemented under a firm-fixed-price contract at the former Reese AFB located in Lubbock, Texas. The strategy proved effective for a sole-source drinking water aquifer affected by a dissolved-phase TCE plume 3 miles long. DGR allowed groundwater pump-and-treat rates to be lowered from >3,400 L/min to http://www.wmsym.org/archives/2017/pdfs/FinalPaper_17248.pdf

Demonstrations / Feasibility Studies

IN-SITU CHROMIUM TREATABILITY STUDY RESULTS REPORT, NEVADA ENVIRONMENTAL RESPONSE TRUST SITE, HENDERSON, NEVADA: REVISION 1

Nevada Environmental Response Trust, Chicago, IL. 1139 pp, 2018

Separate field treatability studies were performed at the Trust site to evaluate biological and chemical reduction of Cr(VI) in the groundwater. For the biological reduction treatability study (Nov. 2016-Oct. 2017) in the Central Retention Basin, three separate substrate injection events were conducted to promote in situ biological reduction of Cr(VI). Carbon substrates injected over the three injection events included EOS PR_{Q}®, industrial sugar wastewater, granular sugar, and/or molasses. Monosodium orthophosphate (Aquapure 3601®) and a 39% solution urea/diammonium phosphate blend were injected as additional sources of phosphate and nitrogen nutrients. Sodium sulfite and ascorbic acid, both oxygen scavengers, were mixed with the substrate solution to promote anaerobic conditions prior to injecting. Sodium bicarbonate was also mixed with the substrate solution to adjust the pH as needed. Stabilized Lake Mead Water (SLMW), used as chase/flush water, was injected to enhance the carbon substrate distribution across the injection well network. For the chemical reduction study conducted August 7-8, 2017, the injection and monitoring wells installed as part of the Ammonium Perchlorate Area Up-Flushing Treatability Study were used for a single chemical injection event of a total of 600 gal of a calcium polysulfide (CPS) solution (60 gal of CPS and 540 gal of SLMW). The solution was injected across the shallow and intermediate injection wells associated with Plots 1 and 2 in the flushing treatability study area. A total of 3,910 gal of SLMW was injected as chase/flush water to enhance subsurface distribution. The findings of these treatability studies will be included in the feasibility study of remedial action alternatives to address Henderson legacy conditions.
http://nertjoomla.azurewebsites.net/index.php/project-documents/access-project-documents/Reports/2018/2018-06-22%20In-Situ%20Chromium%20Treatability%20Study%20Results%20Report%20Rev%201

A PRACTICAL APPROACH FOR REMEDIATION PERFORMANCE ASSESSMENT AND OPTIMIZATION AT DNAPL SITES FOR EARLY IDENTIFICATION AND CORRECTION OF PROBLEMS CONSIDERING UNCERTAINTY

Parker, J., U. Kim, B. Borden, and A. Fortune.
SERDP Project ER-2310, 286 pp, 2018

The objective of this project was to develop and test a methodology to periodically assess and optimize remediation and monitoring strategies at sites affected by DNAPL where remedies are in place. Methods were developed to model cost and performance of source zone and dissolved plume remediation technologies—including thermal treatment, chemical oxidation, enhanced bioremediation, and reactive barriers—and to optimize system operation and monitoring to meet user-defined cleanup criteria with minimum life-cycle cost, considering uncertainty in performance predictions using a stochastic optimization approach. The capability of the Stochastic Cost Optimization Toolkit (SCOToolkit) developed under SERDP Project ER-1611 was greatly extended in this project. The previous 2D contaminant transport model was rewritten to simulate 3D transport with steady-state groundwater flow along linear or curvilinear streamlines with multiple DNAPL sources. https://www.serdp-estcp.org/content/download/47716/454874/file/ER-2310%20Final%20Report.pdf
SCOToolkit tutorial:http://scotoolkit.csuohio.edu/getstarted.php
SCOToolkit files: http://scotoolkit.csuohio.edu/downloads.php

DEMONSTRATION OF FLUORESCENT MAGNETIC PARTICLES FOR LINKING SOURCES TO SEDIMENTS AT DOD SITES

Leather, J.
ESTCP Project ER-201214, 250 pp, 2018

Particle tracking offers a practical means to investigate source-sink relationships and map the transport pathways of contaminated sediments both at the point of and following delivery into waterways, through time and across space. This project demonstrated a particle tracking technology for quantitative mapping of the spatiotemporal distribution and depositional footprint of particles released from typical DoD contaminant sources into adjacent aquatic environments. Fluorescent ferromagnetic particles were released from specific sources, tracked through the water column, and collected at the sediment surface. The particles then were analyzed to determine their spatial distribution and depositional pattern and demonstrate quantitatively the linkage between sources and receiving water areas where the particle sources were most likely to impact the sediments.
https://www.serdp-estcp.org/content/download/47652/454338/file/ER-201214%20Final%20Report.pdf *See also the* ***ESTCP Cost and Performance Report*** *at*
https://www.serdp-estcp.org/content/download/47864/456094/file/ER-201214%20Cost%20&%20Performance%20Report.pdf

SLOW RELEASE MULTI-OXIDANT CYLINDERS FOR REMEDIATION OF A 1,1-DCE PLUME AT AN INDUSTRIAL SITE IN THE UPLANDS OF SOUTH CAROLINA

Hollifield, E. and J. Byrd.
The 26th Annual David S. Snipes/Clemson Hydrogeology Symposium, April 12, 2018: Book of Abstracts, p. 20-21, 2018

A slow-release oxidant pilot test was conducted at a manufacturing facility in South Carolina to address the dilute downgradient portion of a VOC plume extending from the former hazardous waste surface impoundment. The plume—defined primarily by low levels of 1,1-DCE in the groundwater—is maintained by a residual dissolved-phase contaminant mass that remains in the groundwater following source area remediation activities conducted between 1989 and 2005. The pilot treatment area occupied 70 ft of saturated aquifer between the top of the water table and the partially weathered rock zone. The reagent, RemOx® SR+ ISCO (Carus Remediation), was selected to provide a sustained release source of potassium permanganate and sodium persulfate for soil and groundwater treatment. The oxidant cylinders consist of ~38% solid potassium permanganate and 38% solid sodium persulfate dispersed homogenously within a solid paraffin wax matrix. The wax matrix slows the dissolution of oxidant and allows for sustained release into groundwater. A total of 15 multi-oxidant cylinders (each 18 in long) occupied seven injection wells in the pilot test area. Each 2-in PVC injection well was constructed with 30 ft of screen. The injection wells were placed on 5-ft centers. Reductions in 1,1-DCE concentrations in the pilot test injection wells between 85-100% were observed immediately following cylinder emplacement. The 1,1-DCE data collected from the injection wells indicated that the oxidant cylinders created a reactive zone where oxidation of 1,1-DCE was sustained for a period of at least 9 months. Visible oxidant was present at distances up to 30 ft downgradient of the injection well barrier wall within 3 months following emplacement of the cylinders and remained in many of the pilot test wells through the 9-month sampling duration.

Research

EXPANDED APPLICATION OF THE PASSIVE FLUX METER: IN-SITU MEASUREMENTS OF 1,4-DIOXANE, SULFATE, CR(VI) AND RDX

Haluska, A.A., M.S. Thiemann, P.J. Evans, J. Cho, and M.D. Annable.
Water 10:Article 1335(2018)

Flux measurements of low-partitioning contaminants (e.g., 1,4-dioxane, RDX) and reactive ion species (e.g., sulfate, Cr(VI)) are challenging because of their low retardation during transport and quick transformation under highly reducing conditions, respectively. This study is the first application of passive flux meters (PFMs) for in situ mass flux measurements of 1,4-dioxane, RDX, Cr(VI), and sulfate reduction rates. Lab experiments were performed to model kinetic uptake rates and extraction efficiency for sorbent selections. Silver-impregnated GAC was selected for the capture of 1,4-dioxane and RDX, while Purolite 300A (Bala Cynwyd) was selected for Cr(VI) and sulfate. PFM field demonstrations measured 1,4-dioxane fluxes ranging from 13.3 to 55.9 mg/m^2/day, an RDX flux of 4.9 mg/m^2/day, Cr(VI) fluxes ranging from 2.3 to 2.8 mg/m^2/day, and sulfate consumption rates ranging from 20 to 100 mg/L/day. These data suggest other

low-partitioning contaminants and reactive ion species could be monitored using the PFM. https://www.mdpi.com/2073-4441/10/10/1335/pdf

25 YEARS MONITORING OF PAHS AND PETROLEUM HYDROCARBONS BIODEGRADATION IN SOIL
Harmsen, J. and R.P.J.J. Rietra.
Chemosphere 207:229-238(2018)

Monitoring of the biodegradation of PAHs and total petroleum hydrocarbons (TPH) in sediment and soil on seven experimental field sites has been conducted for periods of up to 25 years. This unique dataset enabled the investigation of long-term very slow biodegradation under field conditions. The data show that three biodegradation rates can be distinguished for PAHs: 1) rapid degradation during the first year, 2) slow degradation during the following 6 years, and 3) very slow degradation during the period of 7-25 years (the subject of this paper). Besides 2-, 3-, and 4-ring PAHs, aromatics (5- and 6-ring PAHs) were also degraded at the very slow degradation rate. During the period of very slow degradation, 6%/yr of the PAHs present were removed in five fields and 2%/yr in two other fields, while in the same period no degradation of TPH could be observed; the remaining petroleum hydrocarbons were high boiling and non-toxic. The PAHs degradation curves of all seven monitored fields were modeled using the calculated degradation rates and the independently measured bioavailability of the PAHs (Tenax method). By applying the model and data obtained with the Tenax method for fresh contaminated material, results of long-term biodegradation can be predicted, which might support the use of bioremediation to obtain a legally acceptable residual concentration. *This paper is* ***Open Access*** *at* https://www.sciencedirect.com/science/article/pii/S0045653518308853

PHYTOSCREENING FOR VOLATILE ORGANIC COMPOUNDS IN A CLAY-BASED GLACIAL TILL AT THE NIAGARA FALLS STORAGE SITE, NEW YORK
Frederick, W.T., M. Masset, S. Souder, and N. Miller.
WM2017: Waste Management Conference, March 5-9, 2017, Phoenix, Arizona. Paper 17372, 2017

Chlorinated VOC-impacted soil in the northern portion of the Niagara Falls Storage Site has produced a groundwater plume with significant concentrations of PCE constituents and associated daughter compounds. Active groundwater remediation is impractical due to the clayey soils; hence, the Buffalo District of the U.S. Army Corps of Engineers may evaluate excavation options, with secondary phytoremediation approaches as passive alternatives to lessen groundwater impacts during the project's life cycle. A preliminary field study in the VOC plume area sampled the interior of a Black Locust (*Robinia pseudoacacia*) tree using a Haglof tree corer. Detectable levels of dissolved-phase PCE, TCE, and cis-DCE were found in the woody interior of the tree. Subsequent sampling and analyses performed on proximal trees of varying species in and around the currently delineated VOC plume indicated that poplar and native cottonwood variants preferentially contain the VOCs, whereas collocated hardwood trees produced non-detectable results. The tree-sampling data can be considered a broad surrogate for soil sampling to delineate the VOC plume without performing additional invasive sampling of the subsurface (e.g., drilling). The results also will be used to determine which native tree species preferentially take up VOCs from soil and groundwater. These species, and possibly other hybrid species known for VOC uptake and transpiration, could be propagated to promote interim VOCs phytoextraction during the maintenance period between decision document completion and remedial action.
http://www.wmsym.org/archives/2017/pdfs/FinalPaper_17372_0320045546.pdf

USE OF TEST BEDS TO FACILITATE IMPLEMENTATION OF INNOVATIVE TECHNOLOGIES AT COMPLEX SITES
Eddy-Dilek, C. and K. Kostelnik.
WM2017: Waste Management Conference, March 5-9, 2017, Phoenix, Arizona. Paper 17147, 2017

A challenge that often limits the adoption of new remediation technologies is the lack of information about their performance under real-world conditions. This issue is particularly true of the complex radiological and chemical environments present at many DOE sites. With the ability to test at field-scale, meso-scale, and/or lab-scale size and scope, testbeds allow scientists and researchers to explore theories, technologies, and tools within replicated "real-world" physical, chemical, and environmental conditions. DOE's testbed efforts focus on key issues and challenges that confront site operators. Priority environmental remediation concerns are technetium-99, cesium-137, and strontium-90. Additionally, DOE has determined that advanced robotic and remote sensing techniques offer promise in increasing operational efficiency, reducing personnel exposure, and enhancing safety. This paper describes the testbed program being implemented at Savannah River National Laboratory. http://www.wmsym.org/archives/2017/pdfs/FinalPaper_17147_0320115511.pdf

EFFECT OF CO-CONTAMINANTS URANIUM AND NITRATE ON IODINE REMEDIATION
Szecsody, J.E., B.D. Lee, A.R. Lawter, et al.
PNNL-26955, 44 pp, 2017

Iodine exists in different states in the subsurface, as different isotopes, as different species, and in different phases. Predominant isotopic compositions are I-127 and I-129, although only the latter is radioactive. Subsurface fate and transport of iodine is also largely dependent on its chemical speciation, as iodine can be present in both aqueous and solid phases. Unlike most aqueous species, iodine in its reduced form as iodide is more mobile than when it is in its oxidized form as iodate. The impacts of co-contaminants on the migration and transformation of iodine species in the Hanford subsurface environment are being studied because remedies that target individual contaminants like iodine may affect not only the fate and transport of other contaminants in the subsurface but also inhibit the effectiveness of a targeted remedy. For example, iodine as iodate co-precipitates with calcite and has been identified as a potential remedy because it immobilizes iodine; however, uranium also co-precipitates with calcite in field sediments and so uranium presence might inhibit iodine co-precipitation. In the case of iodine and nitrate, the presence of nitrate promotes biogeochemical reduction of iodate to iodide, thereby increasing iodine species subsurface mobility (as iodide exhibits less sorption). This study reports on experiments that investigated (a) the change in iodate uptake mass and rate of uptake into precipitating calcite due to the presence of differing amounts of uranium, (b) the amount of change of the iodate bioreduction rate due to the presence of differing nitrate concentrations, and (c) whether nitrite can reduce iodate in the presence of microbes and/or minerals acting as catalysts. http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-26955.pdf

EVALUATION OF IODINE REMEDIATION TECHNOLOGIES IN SUBSURFACE SEDIMENTS: INTERIM STATUS REPORT
Strickland, C.E., A.R. Lawter, N.P. Qafoku, J.E. Szecsody, M.J. Truex, and G. Wang.
PNNL-26957, 34 pp, 2017

Releases of I-129 to the subsurface have resulted in several large though dilute plumes in the Hanford groundwater, including the plume in the 200-UP-1 operable unit. I-129 also remains in the vadose zone beneath disposal or leak locations. Because I-129 is an uncommon contaminant, relevant remediation experience and scientific literature are limited. Iodine cannot be degraded or transformed to a less toxic form; therefore, the primary metric for remediation is changing the fate and transport properties in a way that works to decrease radioiodine concentrations in groundwater. To this end, targeted lab experiments were conducted to provide proof-of-principle screening of remedial options and to evaluate scale-up and performance elements. The evaluation of different iodine remediation technologies will occur over multiple years. This report provides status on two in situ sequestration methods (apatite and iron oxides) and two methods examining iodine mobilization (Na-dithionite and carbonate solutions) to enhance the effectiveness of pump and treat. http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-26957.pdf

DETERMINATION OF CR(III) SOLIDS FORMED BY REDUCTION OF CR(VI) IN A CONTAMINATED FRACTURED BEDROCK AQUIFER: EVIDENCE FOR NATURAL ATTENUATION OF CR(VI)
Zhao, J., T. Al, S.W. Chapman, B.L. Parker, K.R. Mishkin, D. Cutt, and R.T. Wilkin.
Chemical Geology 474:1-8(2017)

Redox reactions with naturally occurring minerals and organic compounds can reduce Cr(VI) to Cr(III), forming labile Cr(III) oxyhydroxide precipitates, which is a natural attenuation (NA) process. In fractured bedrock aquifers, reduction of Cr(VI) in the rock matrix can enhance NA beyond that from matrix diffusion only, and potentially reduce back diffusion if concentrations in fractures decline following source reduction via natural processes or engineered remediation. An extraction method was developed for labile Cr(III) precipitates from Cr(VI) reduction using 5% H_2O_2. By combining Cr(III) extractions with an established sodium hydroxide method for determination of Cr(VI) concentrations in rock pore water, a measure of the labile Cr(III) and Cr(VI) fractions in geologic samples was achieved. The methods were applied to cores from a contaminated groundwater system in fractured porous bedrock to assess NA effectiveness and whether Cr(VI) mass that diffused into the bedrock matrix was undergoing reduction. Detailed vertical distributions display two depth intervals with corresponding elevated concentrations of Cr(VI) in the pore water and extractable total Cr. The correspondence of Cr(VI) and labile Cr(III) provided evidence for reduction of Cr(VI) contamination in the bedrock matrix. Mineralogical analysis pointed to the Fe(II)-bearing minerals chlorite and biotite as likely candidates for natural reductants. This study provides evidence for NA of anthropogenic Cr(VI) contamination in the porewater of a fractured bedrock aquifer and outlines a quantitative method for evaluating NA effectiveness in groundwater systems.

LEACHABILITY AND STABILITY OF HEXAVALENT-CHROMIUM-CONTAMINATED SOIL STABILIZED BY FERROUS SULFATE AND CALCIUM POLYSULFIDE
Zhang, T.-T., Q. Xue, and M.-L. Wei.
Applied Sciences 8(9):1431(2018)

The leachability and stability of Cr(VI) and Cr are important factors affecting the effectiveness of Cr(VI)-contaminated soil stabilization. This study compared the leachability and stability of Cr(VI) and Cr in Cr(VI)-contaminated soil stabilized using ferrous sulfate ($FeSO_4$) and calcium polysulfide (CaS_5). The contaminated soil was characterized before and after stabilization, and the effectiveness of each treatment was assessed with respect to leaching, bioaccessibility, alkaline digestion, sequential extraction, and X-ray diffraction tests. Results showed that while both amendments significantly reduced the leachability and Cr(VI) content in the contaminated soil, the acid-buffering capacity and stability (leachability, bioaccessibility, speciation distribution, and mineral composition) of the Cr(VI)/Cr and Cr(VI) content of CaS_5 were greater than those of $FeSO_4$. *This paper is* ***Open Access*** *at* https://www.mdpi.com/2076-3417/8/9/1431

APPLICATION OF IRON-LOADED ACTIVATED CARBON ELECTRODES FOR ELECTROKINETIC REMEDIATION OF CHROMIUM-CONTAMINATED SOIL IN A THREE-DIMENSIONAL ELECTRODE SYSTEM
Yan, Y., F. Xue, F. Muhammad, L. Yu, F. Xu, B. Jiao, Y. Shiau, and D. Li.
Science Report 8(1):5753(2018)

In a study of the 3D electrokinetic remediation (EKR) of Cr-contaminated soil from an industrial site, activated carbon particles coupled with Fe ions (AC-Fe) were used as the third electrode. The optimum dose ratio of the electrode particles and remediation time were selected on the basis of single-factor experiments. X-ray photoelectron spectroscopy analysis was carried out to explore the reduction of Cr(VI) on the surface of the electrode particles. Results showed that AC-Fe had a positive effect on Cr(VI) reduction, achieving a removal rate of 80.2% after 10 d with a 5% dose of electrode particles. The 3D EKR system's removal mechanism likely combined the processes of electromigration, electrosorption/adsorption, and Cr(VI) reduction. https://www.nature.com/articles/s41598-018-24138-z

CITRIC-ACID PREACIDIFICATION ENHANCED ELECTROKINETIC REMEDIATION FOR REMOVAL OF CHROMIUM FROM CHROMIUM-RESIDUE-CONTAMINATED SOIL
Meng, F., H. Xue, Y. Wang, B. Zheng, and J. Wang.
Environmental Technology 39(3):356-362(2018)

An acidification-electrokinetic remediation technology was proposed to solve the problem of inefficient Cr removal with ordinary electrokinetic treatment of a contaminated soil sampled from a chemical plant in China. Electrokinetic remediation removal efficiency of total chromium at 6.23% and Cr(VI) at 19.01% in the acid-free experiments was significantly enhanced to 26.97% and 77.66%, respectively, by a 5-day acidizing pretreatment. The acidification treatment also reduced Cr biological availability.

General News

WHITE PAPER ON THERMAL REMEDIATION TECHNOLOGIES FOR TREATMENT OF CHLORINATED SOLVENTS: SANTA SUSANA FIELD LABORATORY, SIMI VALLEY, CALIFORNIA
California Department of Toxic Substances Control, 69 pp, 2018

The objective of this white paper is to present information that will support the eventual evaluation of in situ thermal remediation (ISTR) to meet remedial objectives in selected areas of groundwater contamination at the Santa Susana Field Laboratory site. Corrective measures studies will be prepared separately by DOE, NASA, and Boeing for their respective areas of responsibility. The ultimate remedial objectives for the site are chlorinated solvent mass removal to a level that meets applicable state and federal risk-based groundwater standards. The ISTR evaluation consists of a comprehensive literature review focused on the application of ISTR to remove VOCs from bedrock sites. This paper is not intended to be a general review of all reported ISTR applications, nor does it provide details regarding ISTR system construction and operation. Rather, this paper summarizes the primary types of ISTR, discusses their effectiveness in reducing chlorinated VOC contamination in bedrock, and provides several specific examples of full-scale implementation. https://www.dtsc-ssfl.com/files/lib_feasibilitystudy/TreatabilityReports/62791_Thermal_Technologies_White_Paper_073018.pdf

SERDP REPORT WINS RECOGNITION FOR EXCELLENCE IN TECHNICAL COMMUNICATIONS
SERDP/ESTCP Headlines, Summer 2018

The Society for Technical Communication, a professional association dedicated to the advancement of the technical communication field, recently presented an award, "User Materials Category Best in Show," for SERDP's 2016 report entitled, *Regional Sea Level Scenarios for Coastal Risk Management: Managing the Uncertainty of Future Sea Level Change and Extreme Water Levels for Department of Defense Coastal Sites Worldwide*. Authored by J. Hall, S. Gill, J. Obeysekera, W. Sweet, K. Knuuti, and J. Marburger, the report provides regionalized sea level and local extreme water level scenarios for 2035, 2065, and 2100 for >1,500 DoD sites worldwide. The report aims to enhance and increase the efficacy of screening-level vulnerability and impact assessment for DoD coastal sites that contain permanent or enduring assets. Detailed sections document the authors' approach, results, and application as illustrated by case studies.
https://www.serdp-estcp.org/News-and-Events/Blog/Strategic-Environmental-Research-and-Development-Program-Report-Wins-Recognition-for-Excellence-in-Technical-Communications

SW-846 UPDATES IN 2018
Langlois-Miller, C. and K. Kirkland.
NEMC 2018: National Environmental Monitoring Conference, August 6-10, 2018, New Orleans.

This poster briefly identifies methods in EPA SW-846 (*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*) for which updates are planned or in progress in 2018.
http://apps.nelac-institute.org/nemc/2018/docs/pdf/-Poster-Other-29_13-Langlois-Miller.pdf

NEMC 2018: NATIONAL ENVIRONMENTAL MONITORING CONFERENCE, NEW ORLEANS, AUGUST 6-10, 2018

The NELAC Institute and the U.S. Environmental Protection Agency co-sponsored the ninth Environmental Measurement Symposium, the largest conference focused on environmental measurements in North America. NEMC 2018 featured over 180 presentations and posters on recent innovations in environmental monitoring techniques and equipment. A large number of studies were presented on the sampling and analysis of per- and polyfluorinated substances.
http://nemc.us/meeting/2018/technprog.php

WATER RESEARCH FOUNDATION: HEXAVALENT CHROMIUM

In 2017, the Water Research Foundation published final reports for three projects funded under its Hexavalent Chromium Focus Area to fill critical knowledge gaps. **Project 4497** investigated (1) sources of Cr(VI) within drinking water treatment plants, and (2) fate and transport and how Cr speciation can change throughout the water treatment process and in the distribution system. **Project 4556** researched and documented alternative waste minimization techniques that can be implemented at Cr(VI) treatment facilities employing any of the three major treatment technologies: disposable weak base anion resin; or reduction, coagulation, and filtration. **Project 4561** aimed to provide guidance to utilities needing to treat water containing > 10 µg/L Cr(VI) at a flow of 2 million gal/d or less. In addition to its final report, Project 4561 produced the Cr(VI) Treatment Design & Costing Tool, available at http://www.waterrf.org/resources/pages/PublicWebTools-detail.aspx?ItemID=35.

- *Sources, Chemistry, Fate, and Transport of Chromium in Drinking Water Treatment Plants and Distribution Systems* / Brandhuber, P., L. McNeill, J. McLean, N. Rogers, and Z. Bukhari. / Water Research Foundation Project #4497. 244 pp, 2017 http://www.waterrf.org/Pages/Projects.aspx?PID=4497.
- *Cost-Effective Cr(VI) Residuals Management Strategies* / Najm, I., O. Romero-Maraccini, P.A. Maraccini, D. Askenaizer, and B. Gallagher. / Water Research Foundation Project #4556. 123 pp, 2017 http://www.waterrf.org/Pages/Projects.aspx?PID=4556.
- *Bench-Scale Evaluation of Alternative Cr(VI) Removal Options for Small Systems* / Parks, J.L., A. Mantha, M. Edwards, S. Kommineni, Y. Shim, K. Porter, and G. Imamura. Water Research Foundation Project #4561. 135 pp, 2017 http://www.waterrf.org/Pages/Projects.aspx?PID=4561.

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.