# Technology Innovation News Survey

## *Entries for August 16-31, 2016*

### Market/Commercialization Information

#### REMEDIATION ENVIRONMENTAL SERVICES

U.S. Environmental Protection Agency, Washington, DC.
FedConnect, Solicitation SOL-HQ-14-00023, 2016

The official solicitation for EPA's Remediation Environmental Services acquisition was posted September 16, 2016, on FedConnect. To view the solicitation and accompanying attachments, go to https://www.fedconnect.net/FedConnect/?doc=SOL-HQ-14-00023&agency=EPA [Note: It might be necessary to copy and paste the URL into your browser for direct access.]. Under Documentation, the folder containing the solicitation files (SOL-HQ-14-00023 and attachments 1-8 and 10-11) follows the Pre-Solicitation folder. Be advised that the folder that immediately follows, labeled Amendment 1, contains attachments 9 and 12. The RES Performance Work Statement describes the five functional (task) areas: 1. General Requirements; 2. Field Work and Analytical Support; 3. Remedial Action or Removal Action Implementation; 4. EPA-lead Remedy Operation including Long Term Response Action; and 5. Engineering Support. The General Requirements specifically call for contractor attention to greener cleanups and climate change considerations, clean diesel requirements, and renewable energy considerations, among other topics. The Government intends to make awards from this solicitation for Remediation Environmental Services (NAICS code 562910) to about seven contractors for each contract line item number, with a reserve of three IDIQ contracts for small businesses. Proposals are due by 4:30 PM ET on November 4, 2016.

#### WE'RE SENSING A CHANGE IN WATER MONITORING: INTRODUCING THE ARSENIC SENSOR PRIZE COMPETITION

EPA and the U.S. Bureau of Reclamation are joining forces to launch the Arsenic Sensor Prize Competition for the development of new technology to detect arsenic in water. Samples typically are sent from a drinking water treatment plant to a laboratory for analysis, with results available days to weeks later. New technology could accelerate this process by allowing for immediate detection of arsenic in water and faster treatment response. The competition seeks applicants from all fields with new ideas for rapid, accurate, and cost-effective ways to measure arsenic in water. Launch of the first phase of the Arsenic Sensor Prize Competition is scheduled for fall 2016. Entries will be judged and cash prizes will be awarded to winners. To receive notifications about the Arsenic Sensor Prize Competition, email PRIZE@usbr.gov with "Arsenic Sensor Prize Competition" in the subject line to join the email list. The official prize competition announcement will be posted on Challenge.gov. Read the full post from EPA at https://blog.epa.gov/blog/2016/09/were-sensing-a-change-in-water-monitoring-introducing-the-arsenic-sensor-prize-competition/.

#### DOE OFFICE OF ENVIRONMENTAL MANAGEMENT BUSINESS OPPORTUNITIES FORUM

U.S. Department of Energy, Washington, DC.
Federal Business Opportunities, FBO-5420, Solicitation EM_BIZ_OPPS_FORUM_10-2016, 2016

The next DOE Office of Environmental Management (EM) Business Opportunities Forum will be held in conjunction with the annual Business Opportunities Conference sponsored by the Energy, Technology and Environmental Business Association (ETEBA), October 11-13, 2016, in Knoxville, Tennessee. EM's Business Opportunity Forum will take place during the conference on October 13 (Thursday), from 3:30-5:30 PM. The overall focus of the ETEBA conference is to provide updates on upcoming procurement opportunities within DOE, NASA, National Nuclear Security Administration, U.S. Army Corps of Engineers, and interested commercial sectors. See the conference agenda at https://eteba.org/wp-content/uploads/Preliminary-Agenda-8.12.16.pdf for details. There is no cost to attend the EM Forum, but registration by October 11, 2016, is required. Participants not registered for the ETEBA conference will not be allowed access to the other conference activities. DOE will be offering WebEx capability for those unable to attend the ETEBA conference or the EM forum. Preregistration for the WebEx connection is recommended for timely receipt of the connection information.
https://www.fbo.gov/spg/DOE/PAM/HQ/EM_BIZ_OPPS_FORUM_10-2016/listing.html

#### UNRESTRICTED INDEFINITE DELIVERY CONTRACTS (IDC) FOR ARCHITECT-ENGINEER (A-E) SERVICES WITHIN EPA REGION 2 AND THE NORTHWESTERN DIVISION

U.S. Army Corps of Engineers, USACE District, Kansas City.
Federal Business Opportunities, FBO-5419, Solicitation W912DQ-17-R-3001, 2016

The Northwestern Division (NWD) of the U.S. Army Corps of Engineers (USACE) plans to acquire A-E Hazardous, Toxic, and Radioactive Waste/Environmental IDCs for execution of its environmental mission. The work will be located within U.S. EPA Region 2 and the NWD (the Kansas City, Omaha, and Seattle Districts), with the majority of the work in EPA Region 2. It is the Government's intent to award multiple contracts to firms in support of this requirement, and businesses of all sizes may respond. Firms will be expected to perform work on a wide variety of hazardous waste and other environmental projects, including but not limited to contaminated soil and groundwater, contaminated sediments, radioactive and mixed wastes, underground storage tanks and fueling systems, and habitat restoration and mitigation. USACE anticipates issuing a formal synopsis on or about October 11, 2016.
https://www.fbo.gov/spg/USA/COE/DACA41/W912DQ-17-R-3001/listing.html

#### BASIC ENVIRONMENTAL SERVICES SUPPORT III (BESS III)

Army Contracting Command, ACC - APG (W91ZLK) Tenant Contracting Div.
Federal Business Opportunities, FBO-5424, Solicitation W56ZTN-16-R-0002, 2016

Competition for this solicitation is limited to eligible 8(a) firms. The Government intends to award multiple IDIQ contracts in which firm-fixed-price and/or cost-plus-fixed-fee task orders likely will be issued during a period of performance of a single base year with two one-year options. The contractor shall provide a wide range of environmental services at properties within the control of U.S. Army Garrison Aberdeen Proving Ground and Garrison-supported organizations. Following the CERCLA process under the Military Munitions Response Program, the contractor shall perform munitions response activities that may involve the remediation and disposition of munitions and explosives of concern, including unexploded ordnance, discarded military munitions, and munitions constituents. Proposals are due by 2:00 PM ET on October 26, 2016. See additional details in the attachments to the FedBizOpps notice.
https://www.fbo.gov/notices/7ca46c77247725824cd9084ee40675a7

### Cleanup News

#### UNIVERSITY OF MARYLAND, SHORE MEDICAL CENTER AT CHESTERTOWN: GROUNDWATER REMEDIATION 2015/2016 ACTION PLAN SUMMARY REPORT

Maryland Department of the Environment, 35 pp plus 11 appendices, 2016

When a residual petroleum smear zone was revealed upon cessation of pump and treat at the Shore Medical Center, Chestertown, Maryland, the Maryland Department of Environment permitted a pilot test of the Ivey-Sol® push-pull surfactant flushing technology in July/August 2014. The success of the pilot led to approval for full-scale use of the technology in August 2015. By the 27th week of successful implementation (March 2016), the site team recommended system closeout. This report details the remediation activities and results. *Reports for the Chester River Hospital Center are posted under the* ***Kent County*** *heading at* http://www.mde.state.md.us/programs/Land/OilControl/RemediationSites/Pages/Programs/LandPrograms/Oil_Control/RemediationSites/index.aspx.

#### UTILIZING NUMEROUS REMEDIAL TECHNOLOGIES IN SYNERGY DURING ACCELERATED SITE CLEANUP

Crowder, K., J. LaChance, E. Hauber, S. Murphy, R. Robbennolt, M. Klemmer, and B. Parry.
RemTech 2015: Remediation Technologies Symposium, 25 slides, 2015

To meet both an aggressive schedule and cleanup goals (5 µg/L TCE, 20 µg/L 1,2-cis-DCE, and 2 µg/L VC) required for the planned sale and redevelopment of a 12-acre former rail yard, a remedial approach comprising excavation, in situ thermal remediation (ISTR), and directed groundwater recirculation (DGR) were selected to address impacts in the vadose zone, sand groundwater aquifer, and underlying clay aquitard. Portions of the excavated soils were placed inside the ISTR treatment area to reduce the quantity of hazardous soil requiring disposal, and groundwater treatment for both the ISTR and DGR processes was combined. The project began construction in April 2014, and ISTR and DGR operations began in February and April 2015, respectively. At the time of this presentation, the project was meeting or ahead of plan on all interim targets and goals.
**Slides:** http://www.esaa.org/wp-content/uploads/2015/10/15-Crowder.pdf
**Longer abstract:** http://www.esaa.org/wp-content/uploads/2015/09/2015Abstracts-83.pdf

#### LESSONS LEARNED IN THE REMEDIATION OF HERBICIDES CONTAMINATED GROUNDWATER USING ENGINEERED_PHYTOREMEDIATION℠

Campbell, W.
RemTech 2015: Remediation Technologies Symposium, 29 slides, 2015

An Engineered_Phytoremediation℠ system was constructed in 2005 at a former herbicide manufacturing facility in Western Canada that had detectable concentrations of 2,4-D, chlorophenols (e.g., 2,4-DCP), 3&4-chlorophenol, and PCP in its shallow soils and groundwater. The engineered planting system (1) promoted vertical root growth, resulting in deeper root penetration; (2) focused the hydraulic influences of trees on targeted groundwater zones; and (3) improved plant viability in environments containing elevated contaminant concentrations. About 475 trees were planted over ~1.8 acres in a grid pattern using

TreeWell® technology, which provides components to enhance vertical root growth and aeration. A variety of tree species able to grow in difficult site conditions (high herbicide concentrations, cold winter conditions, short growing season, nutrient-deficient soils, and large areas of asphalt) were planted across the site. Groundwater monitoring data over the past 10 years indicate decreasing concentrations of 2,4-D, 3&4-chlorophenol, and PCP. Some tree mortality occurred due to stress from winter kill, shallow water table, or toxicity, resulting in replantings of trees into already installed TreeWell® units. Three species—willow, green ash, and Russian olive—exhibit the most positive growth under the difficult site conditions.
**Slides:** http://www.esaa.org/wp-content/uploads/2015/10/15-Campbell.pdf
**Longer abstract:** http://www.esaa.org/wp-content/uploads/2015/09/2015Abstracts-43.pdf

#### CASE STUDY: USING LASER INDUCED FLUORESCENCE (LIF) TO ESTABLISH A MONITORING WELL NETWORK FOR A MOBILE LNAPL PLUME NEAR A SURFACE WATER BODY

Jones, L.
SMART Remediation, January 29, 2015, Toronto. 10 slides, 2015

In 1997, LNAPL was discovered discharging to the southwest shore of Lake Chipican in the City of Sarnia, north of the former Michigan Avenue Landfill. Following temporary measures to contain and collect the oil film, remedial measures were developed in 2000 to mitigate the discharges, including emplacement of a sheet-pile barrier wall along the south shore of the lake and installation of two oil recovery wells south of the barrier wall. After LNAPL was discovered in a sentry well located near the west end of the barrier wall, a subsurface investigation was undertaken using laser-induced fluorescence (LIF) to determine the current extent of LNAPL in the vicinity of the lake. PAHs present in the landfilled oily waste fluoresce when excited by light of a known wavelength and emit light of a specific wavelength range. In April 2012 and April 2013, a LIF investigation was completed at 49 locations, and monitoring wells (also referred to as trigger wells) were installed at 9 locations near the lake to provide advance warning of LNAPL plume migration. Since the start of the LIF investigation program, additional LNAPL migration has been discovered based on the network of monitoring wells installed and results of the LIF investigations. Traditional delineation methods would have used a larger grid size and might have missed a narrow (
http://www.smartremediation.com/wp-content/uploads/2014/10/SMART_Toronto-2015_Laura-Jones_Golder.pdf

#### DIRECTED GROUNDWATER RECIRCULATION … FAST TRACK TO SITE CLOSURE

Murphy, Z., M. Klemmer, and R. Robbennolt.
RAILTEC: The 17th Railroad Environmental Conference, 27-28 October 2015, Urbana, IL. 24 slides, 2015

Shallow groundwater affected by TCE, cDCE, and VC over 12 acres of a former rail yard required cleanup to stringent regulatory standards. A pending property transfer was the primary driver for the remedial approach, which included a substantial financial risk if the system did not remove a minimum of 50% of the contaminant mass within the first 6 months of operation. Affected properties included the former rail yard, a major urban thoroughfare, and an adjacent property. Directed groundwater recirculation (DGR) was the primary method for treating the full extent of the groundwater plume to meet the remedial timeframe. The design included installation of extraction wells through the interior section of the groundwater plume, with accompanying injection wells along the exterior edge of the plume in a ratio of ~2:1 injection to extraction. The extraction and injection nodes establish a flushing action through the groundwater aquifer. Three directional drill borings totaling over 1,300 linear ft were installed under the thoroughfare to connect the two properties. Design, construction, and startup of the DGR system were completed in 13 months. In addition to 29 extraction wells, 54 injection wells, 7,300 linear ft of trench, and 30,000 linear ft of HDPE conveyance piping, the DGR design incorporates a mobile treatment system capable of removing iron and chlorinated compounds to below detection limits. To mitigate the risk of aquifer fouling by reduced metals, the system requires oxygen removal to 1.0 mg/L or less from treated groundwater prior to re-injection. Performance monitoring of the system is performed in real time. Pore flush design calculations indicate the plume will reach remedial objectives for property transaction within 6 months and closure objectives ~15 months after onset of steady-state operation.
**Longer abstract:** http://railtec.illinois.edu/RREC/pdf/2015%20RREC/46_Murphy.pdf
*See more on DGR technology at* http://www.academia.edu/17976580/Resurgence_of_Pump_and_Treat_Solutions_Directed_Groundwater_Recirculation

#### LARGE DIAMETER AUGER EXCAVATION AND ENHANCED BIOREMEDIATION USING CHITOREM® AT THE FORMER DIXIE CLEANERS IN JACKSONVILLE

Brown, J.
Abstracts: Florida Remediation Conference, 2016 Technical Sessions, 6-7 Oct 2016, Orlando

Release of chlorinated solvents to the surficial groundwater under the former Dixie Cleaners building and through the sanitary sewer lift station resulted in a groundwater plume containing high PCE and TCE concentrations in an area of ~1 acre. The most significant PCE impacts in soils and DNAPL liquid were identified at a depth of ~18 ft bgs, following the contour of the stormwater drain along the northeast corner of the building. Historically, waste may have been disposed of outside the back door, where it then drained onto the asphalt and into a concrete culvert. Previous remedial activities conducted at the site included the injection of Hydrogen Release Compound, HRC-X®, and Bio-Dechlor Inoculum. [Detailed at https://drycleancoalition.org/profiles/?id=21, State Coalition for Remediation of Drycleaners] The initial biotreatments achieved >99% mass reduction in the shallow and deep intervals, but elevated PCE and TCE concentrations persisted in the intermediate interval near the sewer lift station. Additional measures included shallow source removal; injection of an edible oil carbon source, EOS®, below the building; injection of ammonium bicarbonate (2006) to raise the pH of the intermediate aquifer; and injection of EOS® and AquaBupH™ in 2009. Following the identification of an area of DNAPL in 2010, a large-diameter auger excavation took place in January 2016. Eighteen LDA boreholes were drilled to depths ranging from 17-30 ft bgs, each backfilled with flowable fill. Following soil removal, injection wells were constructed downgradient of the perimeter LDA boreholes. A mixture of gravel and CHITOREM® substrate was placed around the screened section of each well for further groundwater treatment.

#### NOVEL APPROACH TO LEACHATE MANAGEMENT AT AN OLDER LANDFILL: SOLAR PHOTOVOLTAIC LEACHATE EXTRACTION SYSTEM

Matz, S.
RemTech 2015: Remediation Technologies Symposium, 17 slides, 2015

The Spyhill Waste Management Facility is one of three operating landfills managed by the City of Calgary. As part of the closure plan for Stage 1, the leachate management strategy involved the design and construction of a new cover system to minimize infiltration into the waste (in progress), and a targeted leachate recovery program. Technical limitations surrounding equipment during pumping tests led to the development of a solar photovoltaic-powered system. Most of the leachate recovery locations did not warrant the capital investment of a permanent pumping system; hence, a self-contained mobile system that could be deployed for a few weeks or months at each location was a better fit for many of the recovery wells. The mobile system includes a PV power system, 1,800 gal storage tank with secondary containment, and a reciprocating piston pump. The simple PV power system requires minimal operator involvement and is low in cost. The system operates three seasons during daytime, allowing the leachate to recharge overnight. Initial results show that the pumping system runs consistently, as late as November, at rates comparable to portable electric systems.
**Slides:** http://www.esaa.org/wp-content/uploads/2015/10/15-Matz.pdf
**Longer abstract:** http://www.esaa.org/wp-content/uploads/2015/09/2015Abstracts-52.pdf

## Demonstrations / Feasibility Studies

#### APPARATUS AND METHOD FOR TIME-INTEGRATED, ACTIVE SAMPLING OF CONTAMINANTS IN FLUIDS DEMONSTRATED BY MONITORING OF HEXAVALENT CHROMIUM IN GROUNDWATER

Roll, I.B., E.M. Driver, and R.U. Halden.
Science of the Total Environment 556:45-52(2016)

Annual U.S. expenditures of $2B for site characterization invite the development of new technologies to improve data quality while reducing costs and minimizing uncertainty in groundwater monitoring. This work presents a new instrument for time-integrated sampling of environmental fluids using in situ solid-phase extraction (SPE). The In Situ Sampler (IS2) is an automated submersible device capable of extracting dissolved contaminants from water (100s-1000s mL) over extended periods (hours to weeks), retaining the analytes, and rejecting the processed fluid. A field demonstration of the IS2 revealed 28-day average concentration of Cr(VI) in a shallow aquifer affected by tidal stresses via sampling of groundwater as both liquid and sorbed composite samples, each obtained in triplicate. In situ SPE exhibited 75±6% recovery and an 8-fold improvement in reporting limit. Relative to use of conventional methods (100%), beneficial characteristics of the device and method included minimal hazardous material generation (2%), transportation cost (10%), and associated carbon footprint (2%). The IS2 is compatible with commercial SPE resins and standard extraction methods and has been certified for more general use (inorganics and organics) by DoD's Environmental Security Technology Certification Program. *More information at* https://serdp-estcp.org/Program-Areas/Environmental-Restoration/Contaminated-Groundwater/Monitoring/ER-201122/ER-201122/(modified)/11Jan2016 *and in I.B. Roll's dissertation at* https://repository.asu.edu/attachments/164033/content/Roll_asu_0010E_15398.pdf.

#### ON-SITE TREATABILITY EVALUATION: PASSIVE IN-SITU BIOSTIMULATION OF CHLORINATED-BENZENE GROUNDWATER CONTAMINANTS USING GREEN TECHNOLOGY

Armstrong, K.C.
RemTech 2015: Remediation Technologies Symposium, 30 slides, 2015

At an operating manufacturing/distribution facility, cleanup goals included identification of a strategy that could affect current site compliance issues with minimal disruption of activities. A field proof-of-concept evaluation, using direct-push injection, was performed for ~2 yr to demonstrate the cost-effectiveness of biostimulation (using TPHENHANCED™) and anaerobic remediation of chlorinated/non-chlorinated benzene contaminants in groundwater. Results demonstrated a >73.8% decrease in 1,2-DCB, with similar reductions in 1,4-DCB, chlorobenzene, and benzene. Significant solubilization of residual source mass was measured during the evaluation. After an initial 54% decrease in 1,2-DCB at month 3, dissolved-phase concentrations increased by 886%, followed by a >98% decrease in dissolved phase 1,2-DCB from peak bioavailability. Secondary evidence indicative and supportive of additive-induced anaerobic biodegradation was also observed: increased additive concentrations were followed by dramatic decrease of the same with concurrent decreases in COD levels, while both ORP and pH values increased. Additive distribution was accomplished in two direct-push deployment events (March 2013 and August 2014). Results demonstrated the cost-effectiveness of an anaerobic remediation strategy for dissolved-phase and residual source mass contaminants, realizing >98% reductions in contaminant concentrations after solubilizing source mass contaminants to minimize, if not eliminate, rebound and to cost-effectively enhance long-term site compliance.

**Slides:** http://www.esaa.org/wp-content/uploads/2015/10/15-Armstrong.pdf
**Longer abstract:** http://www.esaa.org/wp-content/uploads/2015/09/2015Abstracts-56.pdf

#### USE OF MASS-FLUX MEASUREMENT AND VAPOR-PHASE TOMOGRAPHY TO QUANTIFY VADOZE-ZONE SOURCE STRENGTH AND DISTRIBUTION

Brusseau, M.L. and J. Mainhagu.
ESTCP Project ER-201125, 115 pp, 2016

The overall goal of this project was to demonstrate that the multi-stage vapor-phase contaminant mass discharge (MS-CMD) test and vapor-phase tomography (VPT) can characterize persistent VOC sources in the vadose zone effectively and measure their associated mass discharge. Vapor-phase MS-CMD tests were implemented successfully at three sites that span the three primary general stages of soil vapor extraction operations and represent a variety of site properties and conditions. The demonstrations showed that MS-CMD can successfully produce measurements of CMD associated with vadose-zone VOC sources. The VPT test produced 3D maps of VOC concentrations and mass flux in which spatial differences were observed, indicating the location of a vapor source. The MS-CMD test and the VPT test can be used to improve and enhance characterization projects for many scenarios; illustrative examples are provided. The technologies are designed to be used in a tiered approach that is sensitive to associated cost-benefits and responsive to site-specific requirements.
https://www.estcp.com/content/download/40079/384637/file/ER-201125%20Final%20Report.pdf

## Research

#### DEGRADATION AND REMOVAL METHODS FOR PERFLUOROALKYL AND POLYFLUOROALKYL SUBSTANCES IN WATER

Merino, N., Y. Qu, R.A. Deeb, E.L. Hawley, M.R. Hoffmann, and S. Mahendra.
Environmental Engineering Science 33(9):615-649(2016)

This review presents a comprehensive summary of several categories of treatment approaches for per- and polyfluoroalkyl substances (PFASs): (1) sorption using activated carbon, ion exchange, or other sorbents; (2) advanced oxidation processes, including electrochemical oxidation, photolysis, and photocatalysis; (3) advanced reduction processes using aqueous iodide or dithionite and sulfite; (4) thermal and nonthermal destruction, including incineration, sonochemical degradation, sub- or supercritical treatment, microwave-hydrothermal treatment, and high-voltage electric discharge; (5) microbial treatment; and (6) other treatment processes, including ozonation under alkaline conditions, permanganate oxidation, vitamin-B12 and Ti(III) citrate reductive defluorination, and ball milling. Discussion of each treatment technology includes background, mechanisms, advances, and effectiveness. Further optimization of current technologies to analyze and remove or destroy PFASs below regulatory guidelines is needed. Due to the stability of the compounds, a combination of multiple treatment technologies likely will be required to address real-world complexities of PFAS mixtures and co-contaminants present in environmental matrices. *This paper is* ***Open Access*** *at* http://online.liebertpub.com/doi/abs/10.1089/ees.2016.0233.

#### MANAGING EXCESSIVE METHANOGENESIS DURING ERD/ISCR REMEDIAL ACTION

Mueller, J. and J.G. Booth.
Remediation Journal 26(3):53-71(2016)

Excessive production of methane can be observed at some remediation sites following the addition of organic hydrogen donors, such as (emulsified) oils/lecithin, sugars, and conventional carbon amendments. This circumstance can be attributed to the presence of methanogens, commonly the most ubiquitous indigenous microbes in anoxic aquifer settings. Under enriched environmental conditions, methanogens replicate every 1-2 hr (whereas *Dehalococcoides* spp., e.g., double in 24-48 hr). By utilizing hydrogen, the methanogens compete with dechlorinating microbes, thus making inefficient use of the remedial amendment. The use of antimethanogenic compounds as inhibitors of protein biosynthesis and the activity of enzyme systems unique to Archaea (i.e., methanogens) during in situ remedial action can improve contaminant removal while offering more efficacious treatment by impeding the ability of methanogenic bacteria to proliferate and out-compete desired bacterial communities. http://www.provectusenvironmental.com/marketing/articles/rem21469.pdf

#### EVALUATION OF LONG-TERM PERFORMANCE AND SUSTAINED TREATMENT AT ENHANCED ANAEROBIC BIOREMEDIATION SITES

McGuire, T.M., D.T. Adamson, M.S. Burcham, P.B. Bedient, and C.J. Newell.
Groundwater Monitoring & Remediation 36(2):32-44(2016)

The long-term performance of enhanced anaerobic bioremediation (EAB) at chlorinated solvent sites was investigated to determine if sustained treatment processes were helping to prevent concentration rebound. A database of groundwater concentration versus time records was compiled for 34 sites, with at least 3 years of post-treatment monitoring data. Long-term performance was evaluated based on order-of-magnitude changes in parent compound concentrations during various monitoring periods. Relative to the pretreatment concentration, a median concentration reduction of 90% was achieved for all 34 sites by the end of the post-treatment monitoring period. No rebound was observed at 65% of the sites between the first year of post-treatment monitoring and the final year. Results suggest that at a typical site, a 3-year monitoring period should be sufficient for evaluating performance; in the long term, after active treatment ends, sustained treatment processes contribute to relatively modest concentration reductions but do mitigate rebound at the majority of EAB sites. *See additional background on this study in M. Burcham's thesis at* https://scholarship.rice.edu/handle/1911/71930.

#### IMPROVING POLYCYCLIC AROMATIC HYDROCARBON BIODEGRADATION IN CONTAMINATED SOIL THROUGH LOW-LEVEL SURFACTANT ADDITION AFTER CONVENTIONAL BIOREMEDIATION

Adrion, A.C., D.R. Singleton, J. Nakamura, D. Shea, and M.D. Aitken.
Environmental Engineering Science 33(9):659-670(2016)

Although research using submicellar doses of surfactant as a second-stage treatment step is limited, findings from a recent study can inform the design of bioremediation systems at field sites treating soil contaminated with PAHs and other hydrophobic contaminants of low bioaccessibility. In previous test-tube-scale work, polyoxyethylene sorbitol hexaoleate (POESH) was found to be the optimum surfactant for enhancing PAH removal, especially high molecular weight PAHs. This work expanded the concept by treating the effluent from a slurry-phase bioreactor in a POESH-containing second-stage batch reactor for an additional 7 or 12 days. Surfactant amendment removed substantial amounts of PAHs and oxy-PAHs remaining after conventional slurry-phase bioremediation, including >80% of residual 4-ring PAHs. Surfactant-amended treatment decreased soil cytotoxicity but often increased soil genotoxicity. Potential ecotoxicity, measured using a seed germination assay, was reduced by bioreactor treatment and declined further after second-stage treatment with POESH. Of bacteria previously identified as potential PAH degraders under POESH-amended conditions in the earlier study, members of *Terrimonas* were associated with differences in high molecular weight PAH removal in the current study.

#### FIELD APPLICATION OF IRON AND IRON-NICKEL NANOPARTICLES FOR THE EX SITU REMEDIATION OF A URANIUM-BEARING MINE WATER EFFLUENT

Crane, R., H. Pullin, J. Macfarlane, M. Silion, I. Popescu, M. Andersen, V. Calen, and T. Scott.
Journal of Environmental Engineering 141(8):(2015)

Sodium borohydride-reduced nanoscale zero-valent iron (NZVI-BR), sodium borohydride-reduced NZVI-nickel (NZVIN-BR), NZVI sourced from NanoIron, s.r.o. (NZVI-Star), and NZVI sourced from Toda Kogyo Corporation (NZVI-RNIP) were batch-tested for ex situ removal of aqueous uranium from a bicarbonate-rich mine water effluent. The BR-reduced nanopowders removed >95% aqueous U within 15 min in all systems studied. Similar behavior was exhibited by the commercially sourced nanopowders for the uranyl-only solutions, but a maximum of only 30.0 and 43.2% removal was recorded for the 2-L mine water effluent by NZVI-Star and NZVI-RNIP, respectively. Results demonstrate that highly reactive forms of iron and iron-nickel nanoparticles are required for effective U removal from waters containing appreciable concentrations of complexing agents; also, the performance of such materials in commercial-scale applications likely will be lower than in lab-scale experiments due to the technical challenge of homogenous mixing of the nanopowder with the aqueous phase.

#### DEVELOPMENT OF NEW TREATMENT TECHNOLOGY FOR SULFOLANE-IMPACTED GROUNDWATER UTILIZING ENHANCED HEAT IRRADIATION

Min, B.J., S. Park, and S. Kim.
WaterTech 2016, 17 slides, 7 Apr 2016

Sulfolane is a polar aprotic solvent, readily soluble in water, and highly polar with very stable and recalcitrant properties, such as low Henry's constant, low retardation factor, and thermal stability. A study was conducted to develop a technically and economically sustainable remediation technology for sulfolane-contaminated water by utilizing novel enhanced stimulators and low energy heat irradiations (e.g., electromagnetic wave or induction heating). The stimulators possess unique functionalities, such as enhanced heat efficacy, photocatalytic properties, magnetic separation effects, and oxidizing reactions. The fundamental mechanisms of this technology can also be applied to address dissolved contaminants and NAPL. The various treatment combinations tested were able to achieve a significant mass reduction in an average 86 wt% of sulfolane within a very short time frame (several minutes at lab scale).
**Slides:** http://www.esaa.org/wp-content/uploads/2016/04/WT16BJMin.pdf
**Longer abstract:** http://www.esaa.org/wp-content/uploads/2016/03/WT2016Abstracts-7.pdf

#### EFFECT OF FRESH AND MATURE ORGANIC AMENDMENTS ON THE PHYTOREMEDIATION OF TECHNOSOLS CONTAMINATED WITH HIGH CONCENTRATIONS OF TRACE ELEMENTS

Hattab, N., M. Motelica-Heino, O. Faure, and J.L. Bouchardon.
Journal of Environmental Management 159:37-47(2015)

The study site near Lyon, France, is a metallurgical landfill located behind an active steel and iron factory. The main aim of this work was to assess the effect of

two different organic amendments (composted sewage sludge (CSS) and fresh ramial chipped wood (RCW)) on the phytoavailability, mobility, and soil exposure intensity of Cr, Mo, Zn, Cu, Co, and As in a metallurgical technosol remediated by assisted phytostabilization. Trace element phytoavailability was characterized by growing dwarf beans on potted soils and analyzing their foliar metals concentrations. Addition of fresh RCW and CSS had a positive effect on the contaminated technosols. RCW decreased the mobility of all the studied trace elements in the soil pore water, whereas CSS reduced Mo, Cr, and Co mobility while increasing Zn, Cu, and As mobility. The Zn soil exposure intensity was not significantly changed by the addition of RCW and CSS, while the Cr soil exposure intensity decreased significantly after RCW addition. Both RCW and CSS decreased the foliar concentration and the mineral mass of Mo, Zn, Cr, As, and Co in bean leaves but increased foliar Cu concentration. http://hal-emse.ccsd.cnrs.fr/insu-01167311/document *For an earlier version of this paper, see* ***pages 137-155*** *in N. Hattab's thesis at* ftp://ftp.univ-orleans.fr/theses/nour.hattab_3309.pdf.

## General News

**EXPERT PANEL REPORT ON THE BEHAVIOUR AND ENVIRONMENTAL IMPACTS OF CRUDE OIL RELEASED INTO AQUEOUS ENVIRONMENTS**
Lee, K., M. Boufadel, B. Chen, J. Foght, P. Hodson, S. Swanson, and A. Venosa.
The Royal Society of Canada, Ottawa, ON. ISBN: 978-1-928140-02-3, 489 pp, 2015

For this report, a panel of experts on oil chemistry, behavior, and toxicity reviewed the current science relevant to potential oil spills into Canadian marine waters, lakes, waterways, and wetlands. The reviewers examined spill impacts and oil spill responses for the full spectrum of crude oil types, including bitumen, diluted bitumen, and other unconventional oils. The survey of scientific literature, key reports, and selected oil spill case studies encompassed tanker spills, an ocean rig blowout, pipeline spills, and train derailments. The panel also consulted industry, government, and environmental stakeholders across the country. Dozens of crude oil types transported in Canada exist along a chemical continuum, from light oils to bitumen and heavy fuels. The unique properties of each of these oil types determine how readily spilled oil spreads, sinks, disperses, and affects aquatic organisms and wildlife, and what proportion ultimately degrades in the environment. Despite the importance of oil type, the reviewers concluded that the overall impact of an oil spill, including the effectiveness of a spill response, depends mainly on the environment and conditions (weather, etc.) where the spill takes place and time lost before remedial operations begin. The report contains many case studies. http://www.rsc.ca/sites/default/files/pdf/OIW%20Report_1.pdf

**TRACE ELEMENTS IN WATERLOGGED SOILS AND SEDIMENTS**
Rinklebe, J., A.S. Knox, and M. Paller (eds).
CRC Press, Boca Raton, FL. ISBN: 9781482240511, 386 pp, 2016

Many wetlands act as sinks for pollutants, particularly trace elements. In 18 chapters, this book brings current knowledge concerning trace elements in waterlogged soils and sediments together. It discusses factors controlling the dynamics and release kinetics of trace elements and their underlying biogeochemical processes. It also discusses current technologies for remediating sites contaminated with trace metals and examines the results of case studies. *View the* ***table of contents*** *at* http://www.crcnetbase.com/isbn/9781482240528.

**SOIL REMEDIATION: APPLICATIONS AND NEW TECHNOLOGIES**
de Albergaria, J.T.V.S. and H.P.A. Nouws (eds).
CRC Press, Boca Raton, FL. ISBN: 9781498743617, 174 pp, 2016

This book provides an overview of both traditional and emergent remediation technologies alongside case studies contributed by service providers. Soil and groundwater cleanup technologies such as electrokinetic remediation, biological treatments (including phytoremediation), and chemical remediation are presented. The potential utility of nanotechnologies in remediation and life cycle assessment as a decision tool for soil remediation are also considered. *View the* ***table of contents*** *at* http://www.crcnetbase.com/isbn/9781498743624.

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