Technology Innovation News Survey

Entries for May 1-15, 2018

Market/Commercialization Information

2018-2019 SMALL BUSINESS INNOVATION RESEARCH (SBIR) PHASE I

U.S. Environmental Protection Agency Funding Opportunity 68HE0D18R0010, 2018

The U.S. EPA 2018-2019 SBIR Phase I solicitation is open from June 13 to July 31, 2018. The Agency invites small businesses to apply for Phase I awards for up to $100,000 to demonstrate proof of concept in one of the following SBIR solicitation topic areas. CLEAN AND SAFE WATER - (1) Innovative technologies for the rapid detection and treatment of antibiotic-resistant bacteria in wastewater; (2) Novel technologies for the rapid detection of PFASs in water; (3) Innovative pretreatment technologies for PFASs in industrial wastewater; (4) Novel sampling devices for microplastics; and (5) Novel technologies for the rehabilitation of water infrastructure. AIR QUALITY - Innovative measurement tools for ground-level air pollution levels from wildland fires. LAND REVITALIZATION - Innovative technologies that can sample, detect, analyze, remove, or destroy PFASs in and from soil, sediment, water, and groundwater. HOMELAND SECURITY - Novel water distribution and stormwater system sensors. MANUFACTURING - Novel technologies for the reduction of chemicals in food processing. SUSTAINABLE MATERIAL MANAGEMENT - (1) Novel technologies to identify harmful materials in construction & demolition materials; (2) Novel technologies to aid building deconstruction; and (3) Recyclable composite building materials. SAFER CHEMICALS - Novel, safer paint and coating removal products.
https://www.epa.gov/sbir/sbir-funding-opportunities.
On June 11, EPA held a webinar to discuss the SBIR topics; review administrative, submission, eligibility and peer-review concerns; and explain how to apply via FedConnect at https://www.fedconnect.net/FedConnect/?doc=68HE0D18R0010&agency=EPA. Links to the archived webinar and subsequent Q&A session are available at https://www.epa.gov/sbir/2018-2019-small-business-innovation-research-sbir-phase-i-informational-webinar.

LICENSED SITE PROFESSIONAL SUPPORT SERVICES, VOLPE PROPERTY

Department of Transportation (DOT), Volpe National Transportation Systems Center, Cambridge, Mass.

Federal Business Opportunities, FBO-5949, Solicitation 6913G618R200019, 2018 The solicitation will be issued as a 100% small business set-aside under NAICS code 541620 (Environmental Consulting Services), size standard $15M. The U.S. DOT plans to issue a solicitation for Licensed Site Professional support services for ongoing environmental activities to address the presence of historically released oil and hazardous materials located on and near the Volpe Center Property, Cambridge, Mass., during its redevelopment. Release of the solicitation is anticipated on or about June 29, 2018, with proposals due approximately 15 days thereafter. The solicitation will be issued on an IDIQ basis with the ability to issue firm-fixed-price task orders for a single award. Duration will be 4.5 years from date of award. https://www.fbo.gov/notices/67c67e0bea51ffa8aa0dd4e50cd6bede

Cleanup News

CONSTRUCTION COMPLETION REPORT, SEABOARD CHEMICAL CORPORATION AND RIVERDALE DRIVE LANDFILL SITE

North Carolina Dept. of Environmental Quality, NCD071574164, 267 pp, 2017

The cleanup area and joint remediation effort encompasses the City of High Point's landfill site adjacent to Seaboard Chemical's closed treatment, storage, and disposal facility. The landfill is now capped and maintained under an approved post closure plan. The site is affected by chlorinated and non-chlorinated organics, DNAPL (ethenes, ethanes, and others), and 1,4-dioxane in the shallow and deep groundwater and landfill leachate. The most effective long-term method to accomplish the hydraulic containment of the plumes and treatment of the groundwater and leachate collected at the site was determined to be shallow and deep groundwater extraction in conjunction with leachate recovery and treatment in physical and natural systems. The main physical treatment area encompasses the AOP unit, settling vat effluent filters, water chemistry lab, and effluent storage tanks. Prior to being pumped to the cap of the landfill for phytoremediation, the leachate and groundwater from the extraction wells go through the clarifier (for solids to settle), aeration/filtration treatment removes metals, and an air stripper reduces the organics concentration. A 33-acre stand of mainly pine tree species is maturing on the landfill cap. http://edocs.deq.nc.gov/WasteManagement/0/edoc/686219/NCD071574164_%20Seaboard%20Chemical%20Construction%20Completion%20Report_20170517.pdf

IN SITU TREATMENT OF PFAS-IMPACTED GROUNDWATER USING COLLOIDAL ACTIVATED CARBON

McGregor, R.
Remediation Journal 28(3):33-41(2018)

Colloidal activated carbon injections were implemented at a site in Canada where PFOA and PFOS were detected in groundwater at concentrations up to 3,260 ng/L and 1,450 ng/L, respectively. The shallow silty-sand aquifer was anaerobic with an average linear groundwater velocity of ~2.6 m/d. The colloidal activated carbon was applied using direct-push technology, and PFOA and PFOS concentrations < 30 ng/L were subsequently measured in groundwater samples over an 18-month period. With the exception of perfluoroundecanoic acid (20 ng/L) and perfluorooctanesulfonate (40 ng/L), all PFASs analyzed were below their respective method detection limits in all postinjection samples after 18 months. As measured in cores up to 5 m from the injection point, the colloidal activated carbon was distributed successfully within the target zone of the impacted aquifer.

MCGRAW-EDISON (CENTERVILLE, IOWA)

Iowa Department of Natural Resources, 6 pp, 2017

The McGraw-Edison facility manufactured toasters and toaster ovens. An undetermined quantity of hazardous waste was left in the plating area and the wastewater treatment system when operations ceased in 1978. Soil contaminated with Cr, Ni, Cu, Zn, and Pb was removed during the 1989 Phase I and Phase II removal actions. TCE (up to 810,000 µg/L on-site and 370 µg/L off-site) and 1,2-DCE contaminate the groundwater. EPA is the site lead. The 1993 ROD required groundwater monitoring, on-site drainage controls, and groundwater pump and treat using filtration and UV oxidation. EPA issued a ROD amendment in July 1999 to change the preferred remedy for groundwater to an iron permeable reactive barrier (PRB) and natural attenuation. A dual-phase soil vapor extraction (SVE) system was operated from the early 2000s to 2010, when the TCE remedy appeared to be failing. Testing to determine SVE and PRB status was conducted in early 2011. In January 2015 a fire destroyed the former McGraw-Edison facility, including the SVE system. Successful small-scale testing of in situ soil stabilization and in situ chemical oxidation led to the development of a site-wide work plan for these remedies in 2015. In late 2017 EPA approved the injection (scheduled for 2018) of 137,250 gal of emulsified vegetable oil, 183 gal Nutrimens, 183 gt calcium polysulfide, 3,660 lb sodium bicarbonate, and 183 L of KB-1 at 83 injection points as part of a site-wide enhanced in situ biodegradation project to reduce the levels of TCE and daughter products. http://www.iowadnr.gov/portals/idnr/uploads/cossites/rmcgraw.pdf

BOEING PLANT 2 SEDIMENT REMEDIATION: REMEDIAL DREDGING METHODS TO MANAGE THE RISKS OF RESIDUALS, RESUSPENSION AND RELEASE; THE BENEFITS AND COSTS

Webb, R.S., B. Anderson, S. Tochko, P. Fuglevand, and T. Dreher.
Proceedings of the Western Dredging Association Dredging Summit & Expo '17, Vancouver, British Columbia, Canada, June 26-29, 2017. p 473-484 + 20 slides, 2017

The recently completed Boeing Plant 2 site restoration project on the Lower Duwamish Waterway Superfund site in Seattle, Washington, proved successful in implementing multiple advanced technologies for PCB-contaminated sediment remediation. Highly variable site conditions included tidal fluctuations, changes in water salinity, and widely ranging suspended solids concentrations. The remedial dredging methods used during the project demonstrated that residuals and releases from mechanical dredging can be significantly reduced or eliminated. In addition, state-agency required dredge-water quality limits resulted in the development and first-time use of electrocoagulation for dredge water processing on a large scale. To meet the strict chemical and physical criteria for the dredge return water, electrocoagulation was used as the primary form of treatment. The project was awarded the World Organization of Dredging Association's 2016 Environmental Excellence Award for Environmental Dredging.
Paper: https://www.westerndredging.org/phocadownload/2017_Vancouver/Proceedings/7a_4.pdf
Slides:
https://www.westerndredging.org/index.php/information/category/281-session-7a-sediment-remediation?download=1507:7a-4-boeing-plant-2-sediment-remediation-remedial-dredging-methods-to-manage-the-risks-of-residuals-resuspension-and

ALTERNATIVE APPROACHES FOR MANAGING DREDGED SEDIMENT

Jaglal, K., D.M. Crawford, S.W. Anagnost, and B.E. White.
Proceedings of the Western Dredging Association Dredging Summit & Expo '17, Vancouver, British Columbia, Canada, June 26-29, 2017. p 158-163 + 17 slides, 2017

Traditionally, uncontaminated sediment was disposed of in open water while contaminated sediment was more often landfilled or placed in confined disposal facilities (CDFs). The economic element of sustainability has increased emphasis on green and sustainable environmental solutions, which has reduced the desirability and cost of trucking materials over large distances to a landfill. Also, most existing CDFs are full or nearly so, thereby presenting additional challenges for disposal of dredged sediment. Many lessons can be learned from the use of alternate disposal approaches at smaller sites. Multiple examples are presented of strategies for minimization of dredged quantities, reuse of dredged sediment, and on-site consolidation of dredged sediment.
Paper: https://www.westerndredging.org/phocadownload/2017_Vancouver/Proceedings/4a_3.pdf **Slides:**
https://www.westerndredging.org/index.php/information/category/275-session-4a-beneficial-reuse-and-management-of-dredged-sediment?download=1481:4a-3-alternative-approaches-for-managing-dredged-sediment

Demonstrations / Feasibility Studies

SCREENING-LEVEL FEASIBILITY ASSESSMENT AND DESIGN TOOL IN SUPPORT OF 1,4-DIOXANE REMEDIATION BY EXTREME SOIL VAPOR EXTRACTION (XSVE)

Hinchee, R. ESTCP Project ER-201326, 20 pp, 2017

XSVE, or extreme soil vapor extraction, is an enhanced form of soil vapor extraction (SVE) for remediation of 1,4-dioxane in vadose soils. XSVE is enhanced by focused extraction and heated air injection to facilitate 1,4-dioxane removal. *HypeVent XSVE for 1,4-Dioxane* (HypeVent XSVE) is a spreadsheet-based tool that runs in Microsoft Excel®. The tool was developed in anticipation of remediation professionals' need for a screening-level feasibility assessment and design tool for XSVE applications. HypeVent XSVE facilitates quick exploration of the best-case performance for 1,4-dioxane removal from soils using the XSVE technology.
https://www.serdp-estcp.org/content/download/46225/436752/file/ER-201326%20User%20Guide.pdf
Documentation of the ESTCP-sponsored field demonstration of XSVE is still in preparation. Monitor the project website for updates at https://www.serdp-estcp.org/Program-Areas/Environmental-Restoration/Contaminated-Groundwater/Emerging-Issues/ER-201326.

DEMONSTRATION AND VALIDATION OF ENHANCED MONITORED NATURAL RECOVERY AT DOD SITES: ESTCP COST AND PERFORMANCE REPORT

Kirtay, V., G. Rosen, M. Colvin, J. Guerrero, C. Katz, B. Chadwick, K. Fetters, V. Magar, et al.
ESTCP Project ER-201368, 71 pp, 2018

Enhanced monitored natural recovery (EMNR) involves the placement of a thin layer (commonly < 30 cm) of clean sand or clean sediment over contaminated sediment, coupled with ongoing natural recovery processes and a monitoring program to achieve ecological recovery and risk reduction at contaminated sediment sites. In some cases, dredged sediment may be preferable to quarried sand because it has natural organic matter to support benthic life. In general, thin-layer capping (TLC) is not designed to provide complete chemical isolation but to provide a reasonable degree of physical isolation and reduction toward lower chemical concentrations targeting site-specific remedial action objectives and goals. EMNR also reduces potential resuspension or transport of contaminated sediment particles. The demonstration was implemented at Site 99, the Quantico Embayment site, Quantico, Virginia. TLC grain sizes were selected in the final design to be stable during both normal river flows and during periods of flood flows and storm-generated waves. For the Quantico Embayment site, the clean sand EMNR remedy was shown to be effective in reducing exposure in surface sediments as measured by bulk sediment total DDX concentrations, porewater DDX concentrations, and direct measurement of bioaccumulation in two site-exposed benthic organisms.
https://www.serdp-estcp.org/content/download/47277/451061/file/ER-201368%20Cost%20&%20Performance%20Report.pdf

INVESTING IN SUSTAINABLE SOIL & WATER TREATMENT

Spill Alert 18:13(2017)

In the Amazon, oil pipeline spills have contaminated areas of several hectares. Cleanup operations are challenged by the remoteness of the area, high levels of rainfall, and difficult access. Mechanical cleanup and soil remediation were combined to optimize remediation of the area. The treatments included pressure washing and mechanical removal of the contaminated vegetation and EKO/GRID™ treatment to oxidize the remaining soil hydrocarbons. The low energy demand for this innovative system offers possibilities for using alternative energy sources, such as wind or solar power. The cleaning effect is based on an oxidation process initiated by electrokinetic and electro-osmotic principles. Results from field tests in Brazil show that the PAH mass was reduced by 91% during the first 30 days and to undetectable levels after 90 days.https://www.ukspill.org/spillalert/SpillAlert-Edition18.pdf

IN SITU METALS IMMOBILIZATION: PILOT TESTING WORK PLAN, WEST OF 4TH SITE, SITE UNIT 1

Washington State Department of Ecology, 108 pp, 2017

This Work Plan describes the pilot study activities proposed to evaluate engineered in situ pH neutralization to treat dissolved plating metals (Ni, Cd, Cu, and Zn) present in Site Unit 1 source area groundwater. Pilot testing will assess the effectiveness and cost of using pH neutralization to immobilize plating metals in groundwater, with a specific focus on Ni in water table interval groundwater. Pilot results will be used to refine the description and evaluation of remedial alternatives presented in the SU1 feasibility study and to select the preferred remedy. Model simulations predict that under the influence of three processes—metal oxide/hydroxide precipitation, metal sulfide precipitation, and net neutralization potential—elevated Ni concentrations will not be transported downgradient and the plume will shrink over time. https://fortress.wa.gov/ecy/gsp/DocViewer.aspx?did=70062 This work is a small part of the ongoing cleanup of the Burlington Environmental LLC Georgetown site in Washington State. See additional project reports at https://fortress.wa.gov/ecy/gsp/CleanupSiteDocuments.aspx?csid=2622.

BIOREMEDIATION TREATABILITY STUDY FOR NITROBENZENE, ANILINE, AND DIPHENYLAMINE AT A FORMER MANUFACTURING FACILITY, NEW JERSEY

Uppal, O., R. Lees, K. McKeever, and S. Yalvigi.
RemTEC Summit, 7-9 March 2017, Denver, Colorado. Poster, 2017

A comprehensive treatability study of biological land treatment for nitrobenzene (NB), aniline, and diphenylamine (DPA) in soil was conducted to evaluate the feasibility of the biological land treatment application, develop contingent remedial approaches to mitigate the technical obstacles posed for land treatment, and develop data to support the remedial design basis. A full-scale pilot test was implemented to evaluate site specific conditions and confirm design and operational protocols. The lab treatability study consisted of four tasks: (1) soil sampling; (2) bulking simulation; (3) pre-treatment; and (4) land treatment simulation. The pilot test comprised four different test cells with varying contaminant constituents, soil texture (plastic clays, cohesive silts, sands), and bulking agents. The presence of lower permeability soils proved to be a significant challenge. The study yielded an improved understanding of the major contaminants, mainly that NB could not be degraded effectively through reactive chemical oxidation methods or at elevated levels > 2,500 mg/kg through biodegradation. NB and aniline are dissipated via abiotic processes, however, and can be readily degraded under moderate concentrations < 1,500 mg/kg. Elevated aniline > 2,500 mg/kg may pose toxicity to microbes. DPA was confirmed to pose no toxicity at elevated levels and degraded readily. DPA cannot be lost through abiotic processes under ambient temperatures; hence, DPA reduction would solely rely on biodegradation.

Research

TRENDS IN METHYL TERT-BUTYL ETHER CONCENTRATIONS IN PRIVATE WELLS IN SOUTHEAST NEW HAMPSHIRE: 2005 TO 2015

Flanagan, S., J. Levitt, and J. Ayotte.
Environmental Science & Technology 51(3):1168-1175(2017)

In southeast New Hampshire, where reformulated gasoline was used from the 1990s to 2007, MTBE concentrations ≥ 0.2 µg/L were found in water from 26.7% of 195 domestic wells sampled in 2005. In 2015 (8 yr after MTBE was banned), 10.3% continued to have MTBE. Most wells (140 of 195) had no MTBE detections (concentrations < 0.2 µg/L) in 2005 and 2015. On average, MTBE concentrations decreased 65% among 47 wells, whereas MTBE concentrations increased 17% among 4 wells between 2005 and 2015. The percent change in detection frequency from 2005 to 2015 (the decontamination rate) was lowest in areas of high population density and in wells completed in the Berwick Formation geologic units. The decontamination rate was highest where population densities were low and wells were completed in bedrock composed of granite, metamorphic, and mafic rocks. Wells in the Berwick Formation are characteristically deeper and have lower yields than wells in other rock types and have shallower overburden cover, which may allow for more rapid transport of MTBE from land-surface releases. **Slide presentation:**
https://umaine.edu/mitchellcenter/resource/sarah-flanagan-mswc-2017/

CURRENTLY COMMERCIALLY AVAILABLE CHEMICAL SENSORS EMPLOYED FOR DETECTION OF VOLATILE ORGANIC COMPOUNDS IN OUTDOOR AND INDOOR AIR

Szulczynski, B. and J. Gebicki.
Environments 4(1):21(2017)

This review discusses the principles of operation and design of the most popular chemical sensors for measurement of VOCs in outdoor and indoor air, encompassing sensors for detection of toxic compounds, such as electrochemical (amperometric), photoionization, and semiconductor with solid electrolyte sensors, as well as sensors for evaluation of explosion risk, including pellistors and IR-absorption sensors. The metrological parameters—measurement range, limit of detection, measurement resolution, sensitivity, and response time—are presented for each, including development trends and prospects for metrological parameter improvement. http://www.mdpi.com:8080/2076-3298/4/1/21/pdf.

SECONDARY IMPACTS OF IN SITU REMEDIATION ON GROUNDWATER QUALITY AND POST-TREATMENT MANAGEMENT STRATEGIES
Pennell, K.D., N.L. Capiro, S. Gaeth, T. Marcet, F.E. Loeffler, and Y. Yang.
SERDP Project ER-2129, 163 pp, 2017

To study the potential of combined remedies, the project evaluated the impacts of in situ thermal treatment and in situ anaerobic bioremediation on groundwater quality and relevant subsurface processes. Specific objectives were to identify potential electron donors released following thermal treatment and assess the ability of these substrates to support microbial contaminant degradation; to characterize the extent of metal sulfide precipitation and impacts on aquifer permeability; and to quantify impacts of pH reduction on bioremediation performance and microbial community structure. Results show that (1) thermal treatment of soils resulted in electron donors and fermentable substrates (formate, acetate, propionate, and butyrate) that were able to support microbial reductive dechlorination of PCE to ethene, (2) reductions in permeability (up to 80%) due to the formation of iron (II) sulfide precipitates restricted or blocked pore throats and caused preferential flow, and (3) dechlorination of PCE to ethene was possible at pH 5.5 in microcosms but was not observed in sediment-free enrichment cultures. These findings provide new information about the impacts of combining thermal treatment and biostimulation on groundwater quality and biogeochemistry. https://www.serdp-estcp.org/content/download/47228/451071/file/ER-2129%20Final%20Report.pdf

GEOPHYSICAL METHODS FOR MONITORING SOIL STABILIZATION PROCESSES
Saneiyan, S., D. Ntarlagiannis, D Werkema, and A. Ustra.
Journal of Applied Geophysics 148:234-244(2018)

Carbonate precipitation is a promising method for stabilizing soil. Carbonate precipitation, typically in the form of calcite, is a naturally occurring process that can be manipulated to deliver soil strengthening results or permeability changes. This study investigated the ability of spectral-induced polarization (SIP) and shear-wave velocity for monitoring calcite-driven soil strengthening processes. The results support the use of these geophysical methods as soil strengthening characterization and long-term monitoring tools. Both methods are sensitive to calcite precipitation, with SIP offering additional information related to long-term stability of precipitated carbonate. Carbonate precipitation has been confirmed with direct methods, such as direct sampling and scanning electron microscopy.

POST-DREDGING RESIDUAL SEDIMENT STABILIZATION
Hayes, D.F. and B.I. Starr.
Proceedings of the Western Dredging Association Dredging Summit & Expo '17, Vancouver, British Columbia, Canada, June 26-29, 2017. p 462-472 + 19 slides, 2017

Where residual sediments are contaminated, post-dredging erosion can contribute significant constituent concentrations to the water column. One approach to reduce sediment and contaminant loss is to increase the critical shear stress of the residual sediments through amendments. Sand, bentonite, kaolin and lime, and a matrix of combinations were tested for relative effectiveness at increasing erosional strength of dilute sediments. Comparison of the sediment mixtures was performed using a SedFlume apparatus. Results indicated that bentonite clay provides the greatest resistance to erosion, requires the least mass addition per mass of treated sediment, and represents the most cost-effective admixture.
Paper: https://westerndredging.org/images/2017/proceedings/7a_3.pdf **Slides:**
https://www.westerndredging.org/index.php/information/category/281-session-7a-sediment-remediation2download=1506:7a-3-post-dredging-residual-sediment-stabilization

WEATHERED PETROLEUM HYDROCARBONS (SILICA GEL CLEAN-UP)
Wright, J. and D. Slee.
Cooperative Research Centre for Contamination Assessment and Remediation of the Environment, Newcastle, Australia. CRC CARE Technical Report 40, 77 pp, 2018

The presence of polar metabolite compounds (e.g., alcohols, phenols, ketones, aldehydes, and organic acids) in samples collected from soil and groundwater affected by weathered petroleum hydrocarbons can impede the development of risk assessments based on total recoverable hydrocarbons. The project goal was to identify an appropriate silica gel cleanup (SGC) method for removing polar metabolite compounds prior to the analysis of petroleum hydrocarbons, and to provide guidance on interpretation of the data collected. The in situ SGC method involves adding silica to the extract to form slurry in which the silica then interacts and absorbs polar analytes. In the ex situ method, the extract is applied to a silica gel glass column that removes polars from the extract. The extracts are then analyzed by GC-FID. Advantages and disadvantages of both techniques are discussed. *See* ***Technical Report 40*** *at* https://www.crccare.com/publications/technical-reports.

CASE STUDY OF TESTING HEAVY-PARTICLE CONCENTRATOR-AIDED REMEDIATION OF LEAD-CONTAMINATED RIFLE SHOOTING RANGE SOIL
Thangavadivel, K., S. Ranganathan, P. Sanderson, S. Chadalavada, R. Naidu, and M. Bowman.
Remediation Journal 28(3):67-74(2018)

Trials were conducted to optimize the parameters of a heavy-particle concentrator (HPC) for the remediation of Pb-contaminated soil stockpiles at the Mount Stuart training area in Townsville, Queensland, Australia. Treatments evaluated included orbital screening to separate soil particle size fractions, HPC, and a combination of orbital screen and HPC. Treatment efficiency as well as reduction in Pb and Australian Standard Leaching Procedure was considered. A combination of orbital screening, HPC, and phosphate-aided immobilization completely remediated the stockpiled material by reducing total Pb below the Australian health level (Recreational: < 600 mg/kg Pb). The optimized parameters of HPC at 4 tonnes per hour of the < 40 mm orbital screen feed fraction were inclination angle 4°, trommel speed 1,860 rpm, HPC belt speed 3.5 rpm, material distribution chute extension 100 mm, and water flow 480 L/min.

DEGRADATION OF LOW CONCENTRATED PERFLUORINATED COMPOUNDS (PFCS) FROM WATER SAMPLES USING NON-THERMAL ATMOSPHERIC PLASMA (NTAP)
Jovicic, V., M.J. Khan, A. Zbogar-Rasic, N. Fedorova, A. Poser, P. Swoboda, and A. Delgado.
Energies 11(5):1290(2018) doi:10.3390/en11051290

Researchers studied non-thermal atmospheric plasma (NTAP) decomposition of very low concentrations (< 1 µg/L) of perfluorinated compounds (especially PFOA and PFOS) present in wastewater produced during the process of cleansing contaminated soil. The efficiency of the NTAP decomposition process was investigated for air, oxygen, and nitrogen plasma, with exposure times of 1-10 min and different plasma nozzle and reactor sizes. In experiments NTAP treatment degraded > 50% of the initial PFC concentration in the water samples in < 200 s. The final concentration of perfluorinated compounds showed strong dependence on the tested parameters. http://www.mdpi.com/1996-1073/11/5/1290/pdf

TREATMENT OF AQUEOUS FILM-FORMING FOAM BY HEAT-ACTIVATED PERSULFATE UNDER CONDITIONS REPRESENTATIVE OF IN SITU CHEMICAL OXIDATION
Bruton, T.A. and D.L. Sedlak.
Environmental Science & Technology 51(23):13878-13885(2017)

To investigate the potential for remediating AFFF contamination in groundwater with heat-activated persulfate, oxidation of poly- and perfluoroalkyl substances and the generation of transformation products was evaluated under well-controlled conditions. Fluorotelomer- and perfluoroalkyl sulfonamide-based polyfluorinated compounds were transformed to perfluorinated carboxylic acids, which underwent further degradation under acidic conditions produced after persulfate decomposed. The presence of aquifer sediments decreased the efficiency of the remedial process but did not alter the transformation pathways. At high concentrations, the presence of organic solvents, such as those present in AFFF formulations, inhibited transformation of a representative perfluorinated compound, PFOA. Heat-activated persulfate did not transform PFOS or PFHxS under any conditions. http://pubs.acs.org/doi/pdf/10.1021/acs.est.7b03969

ROTARY DRUM SOIL BLENDING FOR SOURCE ZONE REMEDIATION: VARIOUS APPLICATION SCENARIOS
Markesic, S., J. Rossabi, J. Haselow, J. Romano, and T. Adams.
Remediation Journal 28(3):57-66(2018)

The typical aim of soil blending is to homogenize the soil while effectively distributing amendments (e.g., oxidants, stabilizing or reducing agents, biological enhancements) to soil zones made accessible by blending. This homogenization, however, can increase the void ratio and disrupt the shear strength and bearing capacity of the soil; hence, an important component of the blending technology is proper recovery of these geotechnical parameters, which can be achieved by using well-known soil improvement techniques, such as amending all or a portion of the blended area with Portland cement or lime. This paper provides several case study examples of soil blending treatments of different contaminants and amendments in a variety of soil types.

BIOREMEDIATION IN FRACTURED ROCK: 1. MODELING TO INFORM DESIGN, MONITORING, AND EXPECTATIONS
Tiedeman, C.R., A.M. Shapiro, P.A. Hsieh, T.E. Imbrigiotta, D.J. Goode, P.J. Lacombe, et al.
Groundwater 56(2):300-316(2018)

Field characterization of a TCE source area in fractured mudstones produced a detailed understanding of the geology, contaminant distribution in fractures and the rock matrix, and hydraulic and transport properties. Groundwater flow and chemical transport modeling that synthesized the field characterization information proved critical for designing bioremediation of the source area. The planned bioremediation involved injecting emulsified vegetable oil and bacteria to enhance TCE biodegradation. Modeling showed that injection would spread amendments widely over a zone of lower-permeability fractures, with long residence times expected because of small velocities after injection and sorption of emulsified vegetable oil onto solids. Amendments transported out of this zone would be diluted by groundwater flux from other areas, limiting bioremediation effectiveness downgradient. Results emphasized that in fracture-dominated flow regimes, the extent of injected amendments cannot be conceptualized using simple homogeneous models of groundwater flow commonly adopted to design injections in unconsolidated porous media.

BIOREMEDIATION IN FRACTURED ROCK: 2. MOBILIZATION OF CHLOROETHENE COMPOUNDS FROM THE ROCK MATRIX
Shapiro, A.M., C.R. Tiedeman, T.E. Imbrigiotta, D.J. Goode, P.A. Hsieh, P.J. Lacombe, et al.
Groundwater 56(2):317-336(2018)

A mass balance formulated to evaluate the mobilization of chlorinated ethane (CE) compounds from the rock matrix of a fractured mudstone aquifer under pre- and postbioremediation conditions relied on a limited number of monitoring locations and was constrained by a detailed description of the groundwater flow regime. Groundwater flow modeling developed under the site characterization identified groundwater fluxes to formulate the CE mass balance in the rock volume exposed to the injected remediation amendments. The initial CE mass in the rock matrix prior to remediation was estimated using analyses of CE in rock core. Differences in the CE fluxes into and out of the rock volume identified total CE mobilized from diffusion, desorption, and NAPL dissolution under pre- and postinjection conditions. The CE mass mobilized per year under preinjection conditions is small relative to the total CE mass in the rock, indicating that current pump and treat and natural attenuation conditions likely will require hundreds of years to achieve groundwater concentrations that meet regulatory guidelines. During 5 years of monitoring postinjection, the CE mobilization rate increased by roughly an order of magnitude.

IMPROVING PHYTOEXTRACTION OF ZINC AND ARSENIC WITH A SMALL ADDITION OF CHELATING AGENT NTA
Licinio, A., N. Brereton, C.F. Dussault, M. Labrecque, and F.E. Pitre.
IPC2017: 14th International Phytotechnologies Conference, 25-29 September, Montreal, Canada. Poster PS2-31-27, 2017

Chelating agents have been criticized for leaching into groundwater and damaging the soil microbiome. To avoid these problems, rapidly biodegradable nitrilotriacetic acid (NTA) was selected and used in small repeated doses to minimize potential leaching and toxicity during an evaluation of the As and Zn phytoextraction potentials of two species of willows, two grasses, and one commercial plant mix for soil stabilization. Both willow species extracted the highest levels of Zn, with over 100% more than in the best-performing grass species, whereas *Festuca arundinacea* and the commercial plant mix accumulated 100% to 200% more As than either willow species. The addition of NTA increased phytoextraction of Zn by an additional 35% for *Salix purpurea* and *F. arundinacea*, which was linked to an increase in above-ground biomass. Zn was successfully phytoextracted in the experiment with NTA addition, but As phytoextraction was overall mediocre regardless of the species and treatments used. See more on this study in **pages 36-63** of A. Licinio's thesis at https://papyrus.bib.umontreal.ca/xmlui/handle/1866/19403.

NANO-SCALE ZERO VALENT IRON (NZVI) TREATMENT OF MARINE SEDIMENTS SLIGHTLY POLLUTED BY HEAVY METALS
De Gisi, S., D. Minetto, G. Lofrano, G. Libralato, B. Conte, F. Todaro, and M. Notarnicola.
Chemical Engineering Transactions 60:139-144(2017)

Investigators used the commercial iron product Nanofer 25s in a study to evaluate the effectiveness of NZVI treatment for the decontamination of marine sediments containing heavy metals (Al, As, B, Ba, Co, Cu, and Ni). Experimental activities were conducted on sieved sediment with a particle size < 5 mm. The NZVI treatments included 2, 3, and 4 g of product per kg of sediment (low dosage) and 5, 10, and 20 g of product per kg of sediment (high dosage). The optimal amount of NZVI for sediment reclamation was selected as 4% and 5% in the case of low and high dosages, respectively. Results indicated that NZVI was better suited to the removal of specific elements rather than to application for generalized contamination. http://www.aidic.it/cet/17/60/024.pdf

General News

EXAMPLES OF GROUNDWATER REMEDIATION AT NPL SITES
U.S. EPA, Office of Superfund Remediation and Technology Innovation.
EPA 542-R-18-002, 114 pp, 2018

This report highlights a select number of example National Priorities List (NPL) sites where EPA has used innovative and established technologies to restore groundwater for use as a source of drinking water. Groundwater was restored for use as drinking water at 17 NPL sites, and significant progress toward groundwater restoration has been made at an additional 13 NPL sites where contaminants remain above safe drinking water levels in only a few groundwater wells. This report is intended for federal and state agency personnel, potentially responsible parties, cleanup consultants, and remediation site managers to demonstrate where innovative and established technologies have been used to restore groundwater to beneficial use. http://www.epa.gov/remedytech/examples-groundwater-remediation-npl-sites.

REMEDIATION MEASURES FOR RADIOACTIVELY CONTAMINATED AREAS
Gupta, D.K. and A. Voronina (eds).
Springer International Publishing AG. Online ISBN: 978-3-319-73398-2, 325 pp, 2018

The 14 chapters in this book offer extensive information to researchers working on decontamination of radioactively contaminated areas. The text is aimed at professionals specializing in radioecology, safe disposal of radioactive waste, decontamination, remediation legacies, and impact of radioactive waste material on the environment. The chapters give a broad overview and reviews of original publications on remediation strategies that were explored after the Chernobyl and Fukushima nuclear power plant accidents. Several case studies explore the latest technological developments and future trends for affected area decontamination. *View the table of contents and chapter abstracts at* https://link.springer.com/book/10.1007/978-3-319-73398-2.

CHEMMAPS
North Carolina State University, 2018

Researchers from North Carolina State University have created ChemMaps, a new online portal that allows users to interactively navigate the chemical space of over 47,000 environmental compounds and 8,000 drugs in 3D and real time. ChemMaps is designed to be a central resource for students and researchers who want easy visualization when studying complicated sets of chemical structures. The first release of the free-to-use website is available at http://www.chemmaps.com. With ChemMaps, the chemicals look like stars, points of light scattered across the screen. Each star, or compound, is positioned in relationship to the others within the complex chemical space based on their structural properties. When a user clicks on a particular compound-star, several key characteristics of that chemical are displayed: its systematic name, brand name, chemical structure, external identifiers, and other physical and chemical properties. The environmental map (EnvMap) includes compounds of relevance to U.S. EPA and NIEHS (e.g., pesticides, flame retardants) and is potentially useful to chemical risk assessment. A paper on the development and use of ChemMaps, "Exploring drug space with *ChemMaps.com*," by A. Borrel, N.C. Kleinstreuer, and D. Fourches will be published in *Bioinformatics*.

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.