

Technology Innovation News Survey

Entries for June 1-15, 2021

Market/Commercialization Information

EPA AWARDS OVER \$3 MILLION TO SMALL BUSINESSES TO SUPPORT COMMERCIALIZATION OF ENVIRONMENTAL TECHNOLOGIES

U.S. EPA News Release, 20 April 2021

EPA is providing \$3,192,989 in total funding for eight small businesses to further develop and commercialize technologies to protect public health and the environment. These small businesses are receiving up to \$400,000 in Phase II funding from EPA's Small Business Innovation Research (SBIR) program. The companies previously were awarded SBIR Phase I funding of up to \$100,000 for "proof of concept" of their innovative technologies and are now receiving Phase II funding to advance toward commercialization. Two of the technologies have a focus on environmental remediation:

- Hedin Environmental Inc., Pittsburgh, Pa., is creating an innovative, lower-cost carbonation process to treat acidic, metal-contaminated mine water that can be used by mining companies and those working to restore areas around abandoned mines.
- RemWell LLC, Potsdam, N.Y., is creating a remediation technology that uses high-frequency ultrasound to clean up groundwater contaminated by per- and polyfluorescent substances (PFAS).

<https://www.epa.gov/newsreleases/epa-awards-over-3-million-small-businesses-support-commercialization-environmental>

SBIR E-LEARNING FOR HAZMAT AND EMERGENCY RESPONSE

DHHS, National Institutes of Health, Funding Opportunity RFA-ES-21-005, 2021

This funding opportunity encourages SBIR grant applications from small business concerns that propose to further the development of advanced technology training products for health and safety training of hazardous materials (HAZMAT) workers; waste treatment personnel; skilled support personnel associated with an emergency/disaster; emergency responders in biosafety response, infectious disease training and cleanup; and emergency responders in environmental disasters and resiliency training. Desirable tools include online training, mobile device training, virtual reality, and serious gaming that complement all aspects of training from development to evaluation, including advanced technologies that enhance, supplement, improve, and provide health and safety training for hazardous materials workers. The closing date for applications is July 30, 2021. <https://www.grants.gov/web/grants/view-opportunity.html?oppld=333456>

PBA ENVIRONMENTAL ENGINEERING SERVICES

U.S. Department of the Army, Army Contracting Command, Rock Island, IL
Contract Opportunities at SAM.gov, Solicitation W52P1J-21-R-3109, 2021

This is a total small business set aside under NAICS code 541620. The Army Contracting Command's Munitions and Industrial Base Division requires environmental engineering services, including ecological surveys, toxicity testing, groundwater hydrogeological assessments of three RCRA Permit sites and 12 RCRA Corrective Action sites located on Pine Bluff Arsenal, GIS support, stormwater sampling, and continued regulatory compliance support. Work under this contract will be performed primarily at the contractor's facility. Additional work will be performed at Pine Bluff Arsenal, Jefferson County, Arkansas, as necessary. The government will award a firm-fixed-price contract, duration of one 12-month base and four 12-month options. Offers are due by 1:00 PM CT on August 4, 2021. <https://sam.gov/opp/c0af69571eb4e9795c4fdhba8d963c/view>

HAZARDOUS WASTE DISPOSAL AT REDSTONE ARSENAL, ALABAMA

Defense Logistics Agency, DLA Disposition Service - EBS, Battle Creek, MI
Contract Opportunities at SAM.gov, Solicitation SP450021R0010, 2021

This acquisition is issued for full and open competition on an unrestricted basis under NAICS code 562211 to destroy and dispose of excess liquid rocket propellants--unsymmetrical dimethyl hydrazine (UDMH) and dinitrogen tetroxide--located at Redstone Arsenal in Huntsville, AL. Both waste streams will be removed from their storage location at RSA and shipped to the Contractor using Government-provided equipment and transporters. Wastes will be delivered to the TSDF in Government-owned, specially designed 700-gallon tanks (16 bulk loads currently estimated for N 2O4) and 2,400-gallon tanker trailers (four bulk loads currently estimated for UDMH). Contractor shall provide treatment of both waste streams using thermal destruction or chemical treatment through RCRA incineration, chemical reduction, chemical oxidation, and/or other regulatory-approved destructive treatment methodology at properly permitted RCRA TSDFs. Each vessel, after fully drained of waste at the TSDF, will be triple-filled and triple-drained using fresh rinsing solvent, plus treatment/disposal of resulting rinseate as necessary. The firm-fixed-price, IDIQ, performance-based, 30-month contract can potentially be extended for up to six months. Proposals are due by 3:00 PM ET on August 9, 2021. <https://beta.sam.gov/opp/2d751cd71f3d4905bb224b82fca9251/view>

OSMRE MINE DRAINAGE TECHNOLOGY INITIATIVE (MDTI)

Department of the Interior, Office of Surface Mining, Funding Opportunity S21AS00545, 2021

OSMRE is looking for MDTI studies that address the following goals: (1) Develop an understanding of acidic and toxic mine drainage (MD) from coal mining to better predict, avoid, monitor, and remediate it; (2) Develop innovative solutions to acidic and toxic MD water-quality problems; (3) Identify, evaluate, and develop "best science" practices to predict acidic and toxic MD prior to mining; and (4) Identify successful remediation practices for existing sources of acidic and toxic MD and describe the best technology for its prevention. Applications are due by 5:00 PM ET on August 10, 2021. Funding of up to \$200,000 will be provided via a cooperative agreement. <https://www.grants.gov/web/grants/view-opportunity.html?oppld=334485>

Cleanup News

CASE STUDY TRANSITIONING FROM ACTIVE TO PASSIVE REMEDIATION BY REFINING THE CSM USING EXISTING DATA

Stromberg, S. | Sustainable Remediation Forum (SURF) webinar, 24 August, 55 minutes, 2020

Existing data were used to support remedy transition from multiple active remediation systems to MNA to incorporate sustainability and reduce the footprint of cleanup activities at a fuel terminal site. At the time, the two dual-phase extraction and two oxygen injection systems operated primarily at downgradient areas of the groundwater plume. Nearly 90 monitoring wells were sampled from quarterly to annually. Existing data were used to evaluate mass discharge rates over time at multiple transects to determine the effectiveness of downgradient systems that relied on contaminant transport. Dissolved phase plume behavior was evaluated to optimize the monitoring network. Results suggested that natural attenuation rates in groundwater exceeded mass discharge and would be able to meet remedial objectives. The well network could be reduced by nearly 40%, and monitoring frequency decreased to annual. Through evaluation of existing data, rebound testing of pilot shutdowns, and transparency with the regulatory agency, remedial systems were shut down in 2018, and manual LNAPL recovery was ended in 2020. <https://www.youtube.com/watch?v=dhQ13CHBE6k>
Also see case study: https://static1.squarespace.com/static/5a4eb702cd39c3e7d67cb562/t/5f5139ea5d9bd90931cb0484/1599158765851/SURF-CaseStudy+14+West+Sac_2020.pdf

RICKER PLUME ANALYTICS TOOLS FOR ACHIEVING SUSTAINABLE REMEDIATION OBJECTIVES

Ricker, J.A. | Sustainable Remediation Forum (SURF) webinar, 25 February, 60 minutes, 2021

The presentation highlights the transition from an active pump and treat system using 25 extraction wells to MNA for a chlorinated VOC (CVOC) plume at the Chem-Dyne Superfund site. Installed in 1987, the pump and treat system was shut down in June 2015 as part of a pilot test to evaluate the efficacy of MNA as a final remedial action for the remaining CVOC plume. Ricker Plume Analytics Tools, or Groundwater Plume Analytics®, an innovative evaluation technique to communicate meaningful patterns in groundwater data, was used to demonstrate that the active system could be reliably shut down and that MNA is sufficient for continued remediation of the CVOC plume. It also showed the reduction of environmental footprint metrics due to the transition. <https://www.youtube.com/watch?v=sdBYX4idA7U>

THE APPLICATION OF ENGINEERED PHYTOLOGY FOR REMEDIAL SYSTEM OPTIMIZATION AND ULTIMATE SITE CLOSURE - TWO CASE STUDIES

Gestler, R. and J. Linton | Design and Construction Issues at Hazardous Waste Sites Virtual Meeting, 26-28 October, 20 slides, 2020

This presentation briefly introduces the *TreeWell*® Technology, including how it works, key benefits, and risk management considerations. Successful applications of the technology are presented, showing its use as a replacement for pump-and-treat systems. Other applications of engineered phytotechnologies include landfill leachate phytomanagement, coal combustion residual impoundments, and treatment of PFAS. <https://clu-in.org/conftip/DCHW510/slides/25Slide-Presentation-for-Ron-Gestler-Gensynter-Consultants.pdf>

BIOGEOCHEMICALLY ENHANCED REDUCTIVE DECHLORINATION OF CHLORINATED ORGANICS

Leigh, D. | AEHS Foundation 30th Annual International Conference on Soil, Water, Energy, and Air, 22-25 March, Virtual, abstract only, 2021

Laboratory and field studies were conducted to evaluate the effectiveness of Geoform™ Extended Release and Geoform™ Soluble for biogeochemical reduction (BGR) of CVOCs at two sites. The two sites had similar hydrogeologic and geochemical conditions, but soil and groundwater at Site 1 had high concentrations of chlorinated ethenes (CEs), while Site 2 had high concentrations of CE, chloroethanes (CA), and chloromethanes (CM). Bench tests demonstrated that BGR enhancement significantly increased the reactivity of the ISCR reagent, while field tests demonstrated that the biological establishment of highly reducing conditions reduced the supplied sulfate to sulfide. The sulfide combined with the supplied ferrous iron causing rapid generation of reactive iron sulfide minerals and sulfidation of ZVI. BGR enhancement increased the PRB downgradient reactive zone at Site 1. The combination of ERD and ISCR with BGR at Site 2 resulted in rapid treatment of mixed CVOCs to the remedial goals. Site 2 received a no further action determination after 15 months of monitoring. See presentation from D. Leigh from 2020 webinar <https://peroxychem.com/media/337800/2020-5-6-leigh-biogeochemical-webinar-web.pdf>

CHARACTERIZING NATURAL DEGRADATION OF TETRACHLOROETHENE (PCE) USING A MULTIDISCIPLINARY APPROACH

Kasson, S.A., C.J. Sparrenbom, C.J. Paul, R. Jansson, and H. Holmstrand.
Ambio 50:1074-1088(2021)

Conventional groundwater analysis combined with compound-specific isotope data of carbon, microbial DNA analysis, and geoelectrical tomography techniques was used to investigate chlorinated solvents originating from a former drycleaning site in Sweden. The zone where natural degradation occurred was identified in the transition between two geological units, an observation confirmed by all methods. The change in hydraulic conductivity in this transition may have facilitated biofilm formation and microbial activity. The examination of the impact of geological conditions on the biotransformation process was facilitated by the unique combination of the applied methods. The extended array of investigation methods was thus beneficial with the potential to reduce remediation. <https://link.springer.com/content/pdf/10.1007/s13280-020-01418-5.pdf>

Demonstrations / Feasibility Studies

FIELD-SCALE INVESTIGATION OF NANOSCALE ZERO-VALENT IRON (NZVI) INJECTION PARAMETERS FOR ENHANCED DELIVERY OF NZVI PARTICLES TO GROUNDWATER

Ahn, J.Y., C. Kim, S.-C. Jun, and I. Hwang.
Water Research [Published online 3 July 2021 ahead of print]

A field-scale investigation was conducted to measure the effects of injection parameters on delivery of nanoscale zero-valent iron (NZVI) and bromide tracer (control) into contaminated groundwater. Two gravity injections at low flow rates decreased the mobility of NZVI (cumulative mass recoveries of 1.07%-2.43%). The dominant travel directions of NZVI and the bromide tracer differed, and NZVI reached some wells earlier than the bromide tracer. In gravity injection tests, the max NZVI concentrations and cumulative NZVI mass recoveries in wells decreased when the injected NZVI concentration and dose increased. Two pressure injections at high flow rates resulted in effective NZVI delivery to the wells (cumulative mass recoveries of 26.0% and 74.5%). Controlling the flow rate, NZVI concentration, and dose controlled NZVI mobility in the groundwater. NZVI particles without Derjaguin-Landau-Verwey-Overbeek energy barriers were successfully delivered to the target zone; decreased magnetic attractive forces between NZVI particles caused by iron corrosion probably decreased the degree of NZVI particle aggregation and

contributed to NZVI delivery to the target zone.

FIELD PERFORMANCE OF THE RADON-DEFICIT TECHNIQUE TO DETECT AND DELINEATE A COMPLEX DNAPL ACCUMULATION IN A MULTI-LAYER SOIL PROFILE

Barrio-Parra, F., M. Izquierdo-Diaz, J. Diaz-Curiel, and E. De Miguel. Environmental Pollution 269:116200(2021)

The radon (^{222}Rn)-deficit technique was evaluated at a site where a complex DNAPL mixture (primarily hexachlorocyclohexanes and chlorobenzenes) contaminated the backfill, silt, gravel, and marl soil profile layers. Soil gas samples were collected at 0.8 m and 1.7 m depths in seven field events, and 186 ^{222}Rn measurements were collected with an ionization detector. A statistical assessment indicated that the location of the sampling point and ground-level atmospheric temperature affected the measurements; sampling depth and atmospheric pressure did not affect the measurements. To remove the bias introduced by varying field temperatures and interpret ^{222}Rn measurements from different field events, ^{222}Rn concentrations were rescaled by dividing each individual datum by the mean ^{222}Rn concentration of its corresponding field event. The ^{222}Rn -deficit technique was unable to describe the vertical variation of contamination with depth but can be effective when the distance between the sampling probe inlet and the contaminant accumulation of the soil profile is within the diffusion length of ^{222}Rn .

IN SITU ANAEROBIC BIOREMEDIATION OF PETROLEUM HYDROCARBONS IN GROUNDWATER OF TYPICAL CONTAMINATED SITE IN SHANGHAI, CHINA: A PILOT STUDY

Huang, S., Y. Yin, R. Sun, and X. Tan. Environmental Engineering Science [Published online 19 May 2021 prior to print]

A microbial agent with quinone-respiration ability was applied to remove petroleum hydrocarbon (PHC) contamination from a contaminated site. In a single-well investigation, viable bacteria in groundwater decreased slightly after injection and maintained around 80% on day 28. The removal rate of PHCs in groundwater in injection and monitoring wells on day 28 was 96% and 52%, respectively, and decreased to 36% when the distance from the injection well increased to 2 m. In a multi-well investigation, the removal rate for PHCs (C

EVALUATION OF A RAPID BIOSENSOR TOOL FOR MEASURING PAH AVAILABILITY IN PETROLEUM-IMPACTED SEDIMENT

Conder, J., M. Jalalizadeh, H. Luo, A. Bess, S. Sande, M. Healey, and M.A. Unger. Environmental Advances 3:100032(2021)

The performance of a portable, field-deployable antibody-based PAH biosensor method capable of providing freely dissolved PAH (C_{free}) measurements within minutes using a small volume of sediment porewater was evaluated in the field. Four sediments with a wide range of PAHs (ΣPAH 2.4 to 307 mg/kg) from petroleum, creosote, and mixed urban sources were analyzed via bulk chemistry analysis, ex situ sediment passive sampling, and biosensor analysis of mechanically-extracted sediment porewater. Mean $\Sigma\text{PAH } C_{free}$ determined by the biosensor for the four sediments (3.1 to 55 $\mu\text{g/L}$) were within a factor of 1.1 (on average) compared to values determined by the passive samplers (2.0 to 52 $\mu\text{g/L}$). Results indicate that the biosensor can rapidly screen sediments potentially impacted with PAHs.

PLANT-SOIL-MICROBIOTA COMBINATION FOR THE REMOVAL OF TOTAL PETROLEUM HYDROCARBONS (TPH): AN IN-FIELD EXPERIMENT

Zuzolo, D., C. Guarino, M. Tartaglia, and R. Sciarillo. Frontiers in Microbiology 11:621581(2021)

An experimental trial was conducted on a 2,000 m²-area at a TPH-contaminated site in northern Italy to evaluate the phytoremediation efficiency of two species of Poaceae and Fabaceae and the role of the indigenous bacteria flora and endo-mycorrhizae consortium addition to promote plant growth. Resistance to contamination stress was also induced in the field experiment. The hydrocarbon degradation rate after 60 days/TPH evaluation suggests the rhizosphere effects and functional features of the plant should (i) have marked tolerance to specific contaminants, (ii) be characterized by an extensive root system, and (iii) be susceptible to arbuscular mycorrhizal fungi (AMF) infection. *This article is Open Access* <https://www.frontiersin.org/articles/10.3389/fmicb.2020.621581/full>

Research

BIOGEOCHEMICAL PROCESSES THAT CONTROL NATURAL ATTENUATION OF TRICHLOROETHYLENE IN LOW PERMEABILITY ZONES

Werth, C., A. Valocchi, R. Sanford, T. Strathmann, and C. Schaefer. SERDP Project ER-2530, 156 pp, 2020

Biotic and abiotic attenuation mechanisms impacting the fate and transport of TCE within low permeability zones (LPZs) comprised of clays and silts were evaluated. The goal was to quantify these processes and incorporate them into a computationally efficient model that can address natural attenuation time scales and cleanup at TCE-impacted sites. Batch studies were performed to evaluate the biogeochemical conditions that promote abiotic TCE reaction under anaerobic and aerobic conditions in soil. Results indicate that abiotic TCE reduction and oxidation are important natural attenuation pathways for TCE in clays, and reducing conditions favor formation of a suite of Fe(II) minerals that contribute to these reaction pathways. <https://www.serdp-estcp.org/content/download/53660/527445/file/ER-2530%20Final%20Report.pdf>

ADVANCED ENVIRONMENTAL MOLECULAR DIAGNOSTICS TO ASSESS, MONITOR, AND PREDICT MICROBIAL ACTIVITIES AT COMPLICATED CHLORINATED SOLVENT SITES

Loffler, F.E., K. Ritalahti, R.L. Hettich, K. Chourey, J. Yan, B. Şimşir, Y. Yang, F.K. Murdoch, G. Chen, D. Kaya, C.M. Swift, and I. Villalobos-Solis. SERDP Project ER-2312, 282 pp, 2020

The project objective was to advance molecular biological tools (MBTs) and their application to minimize biases. The objective was also to more effectively assess, predict, monitor, optimize, and manage reductive dechlorination processes at DoD sites impacted with chlorinated solvents. Additional aims were to assess measurable parameters that correlate with the detoxification or incomplete degradation of chlorinated ethenes and identify knowledge gaps that limit the efficiency of applying MBTs for decision-making at chlorinated solvent sites. <https://www.serdp-estcp.org/content/download/53661/527455/file/ER-2312%20Final%20Report.pdf>

SEQUENTIAL ANAEROBIC AND AEROBIC BIOAUGMENTATION FOR COMMINGLED GROUNDWATER CONTAMINATION OF TRICHLOROETHENE AND 1,4-DIOXANE

Li, F., D. Deng, L. Zeng, S. Abrams, and M. Li. Science of The Total Environment 774:145118(2021)

A sequential anaerobic and aerobic treatment strategy was developed to mitigate TCE and dioxane co-contamination. TCE was effectively removed after a primary anaerobic treatment using SDC-9 halorespiring consortium though TCE and cDCE remained. Subsequent aerobic bioaugmentation with *Azoarcus* sp. DD4 degraded dioxane at an initial concentration of 20 $\mu\text{g/L}$ to below 0.4 $\mu\text{g/L}$ and its dominance (~7%) in microcosms fed with propane. DD4 transformed VC and cDCE in tandem, though at relatively high concentrations (e.g., 1 mg/L), cDCE and VC inhibited propane assimilation and cell growth of DD4. Mutagenesis of DD4 revealed group-2 toluene monooxygenase and group-5 propane monooxygenase were responsible for cDCE and VC co-oxidation. A treatment train combining reductive dehalogenation and aerobic co-oxidation processes can clean up prevalent trace-level TCE and dioxane co-contamination and mitigate persistent products when complete dehalogenation occurs slowly in the field.

FIELD TECHNICAL APPLICABILITY AND COST ANALYSIS FOR MICROWAVE BASED REGENERATING PERMEABLE REACTIVE BARRIERS (MW-PRBS) OPERATING IN CS-CONTAMINATED GROUNDWATER TREATMENT

Falciglia, P.P., E. Gagliano, V. Brancato, G. Finocchiaro, A. Catalfo, G. De Guidi, S. Romano, P. Roccaro, and F.G.A. Vagliasindi. J. Journal of Environmental Management 260:110064(2020)

This study tested a novel microwave (MW) based regenerating permeable reactive barrier (MW-PRB) system to treat Cs-contaminated groundwater. Granular activated carbon (GAC) was used as adsorptive materials in batch and column MW-regeneration experiments. Batch experiments investigated the effects of 10 adsorption-MW regeneration cycles under different MW irradiation conditions (applied electric field 200-460 V/m; irradiation times 1-15 min) and assessed the GAC variation properties of regeneration yield (δ), specific area, and weight loss (WL). Column tests were carried using a dedicated setup, including a column filled with GAC implanted in a MW oven cavity (MW electric field of 385 V/m, irradiation times 5-15 min). Results showed that MW treatment removed Cs from GAC, demonstrated by regeneration yield ($\delta = 79-110\%$) and WL (6.78% for 10 cycles). Results were confirmed in dynamic conditions by data from MW-column tests: the highest Cs removal was ~80% when the max regeneration time was applied. Residual Cs concentration in breakthrough curves fitted well with the proposed Yoon and Nelson model. A techno-economic analysis revealed the MW-PRB viability and its advantages when compared with conventional PRB systems. Cost analysis demonstrated the potential cost-effectiveness of the MW-PRB system.

MECHANOCHEMICAL REMEDIATION OF PERFLUOROCTANESULFONIC ACID (PFOS) AND PERFLUOROCTANOIC ACID (PFOA) AMENDED SAND AND AQUEOUS FILM-FORMING FOAM (AFFF) IMPACTED SOIL BY PLANETARY BALL MILLING

Turner, L.P., B.H. Kueper, K.M. Jaansalu, D.J. Patch, N. Battye, O. El-Sharnouby, K.G. Mumford, and K.P. Weber. | Science of The Total Environment 765:142722(2021)

A study was conducted to test planetary ball mill to remediate PFAS-contaminated PFOS-amended dry sand and AFFF-affected soil mechanochemically. The study evaluated the effect of sand mass, KOH as a co-milling reagent, and water saturation on the degradation of PFOA and PFOS. Concentrations were reduced up to 98% for PFOS-amended dry sand and 99% for PFOA-amended dry sand within 4 hours of milling without the addition of a co-milling reagent. Water saturation significantly hindered the mechanochemical destruction of PFOS and PFOA. A maximum of 89% of fluoride was recovered from PFOS-amended sand when KOH was used as a co-milling reagent, likely due to a reaction between reactive particles generated from the fracture of sand grains with PFAS molecules to initiate destruction, which can result in full defluorination. Milling experiments conducted on the soil from a Canadian firefighting training area (FFTA) demonstrated PFOS concentrations can be reduced by up to 96%.

OBSERVATION OF CONDITIONS PRECEDING PEAK INDOOR AIR VOLATILE ORG COMPOUND CONCENTRATIONS IN VAPOR INTRUSION STUDIES

Lutes, C., C. Holton, B. Schumacher, J. Zimmerman, A. Kondash, and R. Truesdale. Groundwater Monitoring & Remediation 41(2):99-111(2021)

Peak indoor air chlorinated VOC concentrations were compared with indicator and tracer (I&T) conditions before and during peak events at five VI sites that differed geographically and in their VI conceptual site models (CSMs). Relative to site-specific baseline values, the results show that cold or decreasing temperatures, rising cross-slab differential pressures, and increasing indoor radon concentrations can predict peak VOC concentrations. However, cold outdoor air temperature was not useful as a site one where elevated shallow soil temperature was a better predictor. Correlations of peak VOC concentrations to elevated or rising barometric pressure and low wind speed were also observed, with some exceptions. The study shows how independent variables that control or predict peak indoor air VOC concentrations are specific to building types, climates, and VI CSMs.

TREATMENT OF PETROLEUM HYDROCARBON-POLLUTED GROUNDWATER WITH INNOVATIVE IN SITU SULFATE-RELEASING BIOBARRIER

Hsia, K.F., C.C. Chen, J.H. Ou, K.H. Lo, Y.T. Sheu, and C.M. Kao. Journal of Cleaner Production 295:126424(2021)

Batch and column studies were conducted to assess the applicability of using an in situ sulfate-reducing biobarrier to contain and control petroleum-hydrocarbon plumes. Sulfate-releasing materials (SRMs) were developed by blending rice husk powder, magnesium sulfate, and poly(lactic acid) (PLA) together, smelted to form a liquid at 190°C and transferred to a cylinder for formation. A column study investigated the effectiveness of developed SRMs on the treatment of MTBE and toluene-contaminated groundwater. The optimal sulfate release rate was achieved when the mass ratio of sulfate/starch/PLA was 0.5/0.5/2 (sulfate release rate (mg/d/g) = 0.009 × release period (d) + 3.4 (mg)). Approximately 70% of MTBE and 92% of toluene were remediated via sulfate reduction processes. Evidence of sulfate reduction of toluene and MTBE included: 1) increased concentrations of sulfate and sulfide; 2) decreased concentrations of toluene and MTBE; 3) production of tert-butyl alcohol (degradation byproduct of MTBE); and 4) increased sulfate-reducing and petroleum-hydrocarbon bacteria.

USING TREE SWALLOWS TO ASSESS REDUCTIONS IN PCB EXPOSURE AS A RESULT OF DREDGING AT GREAT LAKES RESTORATION INITIATIVE (GLRI) SITES IN THE UPPER MIDWEST, USA

Custer, C.M., T.W. Custer, and P.M. Dummer. Ecotoxicology [Published online 4 June 2021 Prior to Print]

Tree swallows (*Tachycineta bicolor*) were used to assess full or spot sediment dredging effectiveness to reduce PCB exposure to wildlife at locations across the Great Lakes. Other locations where no dredging occurred were also assessed for comparative purposes. Egg and nesting concentrations of total PCBs and accumulation rate (μg of total PCBs accumulated/day) were compared pre- and post-dredge. Accumulation rates decreased by 95% at Waukegan Harbor due to dredging. Accumulation rates were reduced by ~ 50% at less contaminated locations in Wisconsin and Ohio. A small amount (0.01-0.06 $\mu\text{g/day}$) of PCBs accumulated each day at reference locations due to the prevalence of PCB in the environment. The profile of individual PCB congeners demonstrated significant changes pre-and post-dredge as a result of dredging activities.

General News

THE U.S. ENVIRONMENTAL PROTECTION AGENCY, DEPARTMENT OF DEFENSE, AND STATE PARTNERS ANNOUNCE WINNERS OF INTERNATIONAL CHALLENGE SEEKING INNOVATIVE WAYS TO DESTROY PFAS IN FIREFIGHTING FOAM

EPA Press Office, 13 May 2021

EPA announced the winners of the Innovative Ways to Destroy PFAS Challenge, a partnership between federal and state agencies focused on identifying ways to destroy PFAS in concentrated aqueous film-forming foam (AFFF). The challenge is part of the Agency's efforts, including Administrator Regan's new EPA Council on PFAS, to better understand and ultimately reduce the potential risks caused by these chemicals. Challenge winners include: •Dr. Brian Pinkard of Aquagga Inc. (First Place) for a hydrothermal processing concept using high-temperature and high-pressure water to dispose of PFAS-contaminated waste onsite that may be potentially applicable for AFFF. •Dr. Denise Kay and Meng Wang of the Ramboll Group in Denmark and Dr. Cheng Gu of Nanjing University in China (Tie, Second Place) for their concept to use ultraviolet light and non-toxic additives to destroy PFAS. •Dr. Sarah (Xiao) Wu of the University of Idaho (Tie, Second Place) for her concept using a continuous flow liquid-phase plasma discharge process to destroy PFAS in AFFF.

<https://www.epa.gov/newsreleases/us-environmental-protection-agency-department-defense-and-state-partners-announce>

APPLYING A CONCEPTUAL SYSTEMS MODEL FOR SUSTAINABLE AND RESILIENT BROWNFIELDS

Thun, R.I. Sustainable Remediation Forum Webinar, 31 May, 38 minutes, 2021

While conceptual site models focus on environmental contamination, conceptual systems models seek to predict and account for all significant influences that may affect the future of the redevelopment. The conceptual systems model can be applied to various aspects of Brownfield redevelopment, including the reliability of utilities and solid waste management. When properly implemented, using the conceptual systems model will often result in a more sustainable, lower-risk project, with improved access to capital, reduced insurance premiums, higher corporate environmental, social, and governance (ESG) ratings, and better return on investment (ROI). https://www.youtube.com/watch?v=zQA_0Xty6lY&t=1s

THIRTY-FIVE YEARS OF RESTORING GREAT LAKES AREAS OF CONCERN: GRADUAL PROGRESS, HOPEFUL FUTURE

Hartig, J.H., G. Krantzberg, and P. Alsip.
Journal of Great Lakes Research 46(3):429-442(2020)

Remedial action plan developments were initiated to restore impaired beneficial uses in 43 Great Lakes Areas of Concern (AOCs). As of 2019, seven AOCs were delisted, two were designated as Areas of Concern in Recovery, and 79 of 137 known use impairments in Canadian AOCs, and 90 of 255 known use impairments in U.S. AOCs were eliminated. Between 1985 and 2019, \$22.78 billion was spent to restore AOCs in the U.S. The pace of U.S. AOC restoration accelerated under the Great Lakes Legacy Act (GLLA) and Great Lakes Restoration Initiative (GLRI). Other major AOC program achievements include use of locally-designed ecosystem approaches, contaminated sediment remediation, habitat rehabilitation, controlling eutrophication, and advancing science. Key lessons learned include ensuring meaningful public participation, engaging local leaders, establishing a compelling vision, establishing measurable targets, practicing adaptive management, building partnerships, pursuing collaborative financing, building a record of success, quantifying benefits, and focusing on life after delisting.

COMMUNICATING ABOUT CONTAMINATED SITE CLEANUP USING COORDINATED AND CONSISTENT METRICS: OPPORTUNITY AND CHALLENGE FOR THE U.S. DEPARTMENT OF ENERGY

Lowrie, K., H. Mayer, and M. Greenberg.
Risk Analysis [Published online 16 October 2020 prior to print]

This article discusses how lessons drawn from risk communication literature can inform practices for communicating metrics related to cleanup progress at former DOE nuclear weapon sites to different audiences. Following a literature review, the article presents a case study that explores metrics used and communicated on DOE websites and its largest cleanup sites. The use of consistent metrics and implications for the public to understand the progress of achieving cleanup goals is discussed. The article applies principles from the literature to the findings from the case study to suggest how the DOE could consider improvements in the format, content, or delivery of cleanup progress metrics to its various audiences.

REMOVAL OF TOXIC ELEMENTS AND MICROBIAL CONTAMINANTS FROM GROUNDWATER USING LOW-COST TREATMENT OPTIONS

Da'ana, D.A., N. Zouari, M.Y. Ashfaq, M. Abu-Dieyeh, M. Khraisheh, Y.M. Hijji, and M.A. Al-Ghouti. | Current Pollution Reports [Published online 7 May 2021 prior to print]

The article presents low-cost treatment techniques such as adsorption, permeable reactive barriers, and biological techniques to remove chemical and microbial contaminants from groundwater simultaneously. Mechanisms of different treatment techniques, the challenges of groundwater treatment, how to choose the appropriate treatment technique, and cost analysis of groundwater treatment is discussed. <https://link.springer.com/content/pdf/10.1007/s40726-021-00187-3.pdf>

REMEDATION TECHNIQUES FOR RADIOACTIVE CONTAMINATED LAND ON NUCLEAR LICENSED SITES

Office for Nuclear Regulation (ONR), Report R2043, 79 pp, 2020

This report is a comprehensive guide on remediation techniques for radioactively contaminated land currently available for use in the Great Britain nuclear industry. Information on the effectiveness and applicability of these techniques is discussed, focusing on the factors that need to be considered in selecting an appropriate remediation technique. Guidance on broader aspects, including balancing resources versus risk to reach a mutually acceptable solution between regulators, owners, and stakeholders, is discussed. <https://www.onr.org.uk/documents/2020/onr-rrr-052.pdf>

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