

Technology Innovation News Survey

Entries for October 1-15, 2021

Market/Commercialization Information

FY22 GUIDELINES FOR BROWNFIELD PROGRAM GRANTS
Environmental Protection Agency, Funding Opportunities, 2021

EPA's Brownfields Program provides funds to empower states, communities, tribes, and nonprofit organizations to prevent, inventory, assess, clean up, and reuse brownfield sites. The closing date for applications for all of these opportunities is December 1, 2021.
• **EPA-OLEM-OBLR-21-04: 2021, FY22 Guidelines for Brownfields Assessment Grants.** EPA anticipates 78 awards (award ceiling \$2M) for brownfield assessment out of total estimated program funding of \$47M. <https://www.grants.gov/web/grants/view-opportunity.html?oppId=335878>
• **EPA-OLEM-OBLR-21-06: FY22 Guidelines for Brownfield Cleanup Grants.** EPA anticipates 26 awards (award ceiling \$650,000) for brownfield cleanup out of total estimated program funding of \$13M. <https://www.grants.gov/web/grants/view-opportunity.html?oppId=335879>
• **EPA-OLEM-OBLR-21-05: FY22 Guidelines for Brownfield Revolving Loan Fund Grants.** EPA anticipates 8 awards (award ceiling \$1M) for brownfield cleanup out of total estimated program funding of \$8M. <https://www.grants.gov/web/grants/view-opportunity.html?oppId=335879>

USACE TULSA DISTRICT RFP FOR \$120M ERS UNRESTRICTED MEGA IDC MATOC
U.S. Army Corps of Engineers (USACE), Tulsa District, Tulsa, OK
Contract Opportunities on SAM.gov, Solicitation W912B21R0018, 2021

The government intends to solicit and award a firm fixed-price indefinite delivery (IDC) multiple-award task-order contract (MATOC) for environmental remediation services (ERS) projects under NAICS code 562910. This solicitation will facilitate award of up to ten (10) IDCs with a maximum shared capacity of \$120 million. This contract will provide a full range of ERS to support projects assigned to the USACE assigned to the Southwestern Division (SWD) Regional Planning and Environmental Center (RPEC) and projects assigned to the Southwestern Division (SWD) and South Pacific Division (SPD). Work to be performed may include, but not necessarily be limited to: Department of Defense Environmental Restoration Program (DERP); Formerly Used Defense Sites (FUDS); Military Munitions Response (MMR) for various Department of Defense (DoD) customers, including conventional munitions and other munitions-related services; DoD Environmental Compliance Program, Environmental Support for Others (ESFO) Program; support to the Environmental Protection Agency (EPA) including Superfund and Brownfield Programs; Formerly Utilized Sites Remedial Action Program (FUSRAP); environmental cleanup for various military and Intergovernmental Support (IIS) customers; environmental stewardship, and other environmental-related regulatory programs. The geographic territory for this contract will include the geographic boundaries of the SWD and the SPD and projects assigned to SWD and SPD outside the AOR, including any of a variety of military installations, federal agencies, and civil work entities where the USACE is otherwise authorized to respond. Responses are due by 3:00 PM CDT on December 7, 2021. <https://sam.gov/opp/2a935b33503141178837274e145ae3b/wiew>

DEVELOPMENT OF INNOVATIVE APPROACHES TO ASSESS THE TOXICITY OF CHEMICAL MIXTURES
Environmental Protection Agency, Funding Opportunity EPA-G2022-STAR-A1, 2021

EPA is soliciting research focused on the development and evaluation of innovative methods and approaches to inform human health risk assessment of environmental chemical mixtures. Potential chemical mixtures exposures of public health concerns typically encountered in environmental media might include classes or subclasses of compounds (e.g., PFAS, phthalates, PAHs, disinfection by-products, or any other well-characterized mixtures). Applications are sought that propose approaches and strategies that integrate in vitro, in silico, and/or non-mammalian in vivo methods that can contribute to decision-making science associated with toxicity evaluation and human health assessment of chemical mixtures. EPA anticipates four awards (award ceiling \$750,000) out of total estimated program funding of \$4.2M (<https://www.grants.gov/web/grants/view-opportunity.html?oppId=336043>). In addition to the four regular awards, EPA anticipates two early career awards (award ceiling \$600,000) to fund research projects smaller in scope and budget that are proposed by early career primary investigators (<https://www.grants.gov/web/grants/view-opportunity.html?oppId=336050>). The application closing date for both opportunities is December 8, 2021.

BLIND TECHNICAL EVALUATION PANEL TECHNIQUE

Environmental Protection Agency, Washington, DC
Contract Opportunities on SAM.gov, Solicitation 68HERH22R0020, 2021

The U.S. EPA is issuing this request for information for market research purposes to gather broad industry input regarding the EPA's planned implementation and use of a Blind Technical Evaluation Panel strategy for technical proposal evaluation. The NAICS code is 541390. For more information, see the attachment on FedConnect at <https://www.fedconnect.net/FedConnect?doc=68HERH22R0020&agency=EPA>. Responses are due via FedConnect by 5:00 PM ET on December 9, 2021. <https://www.fedconnect.net/FedConnect?doc=68HERH22R0020&agency=EPA>

NATURE CAREERS PODCASTS: BUSINESS OF SCIENCE

Nature: The International Journal of Science, 2021

Introducing new technology to the marketplace is a complex undertaking. In 2021, Nature: The International Journal of Science sponsored Business of Science, a six-part podcast series aimed at scientist entrepreneurs that explores how to commercialize your research and launch a spin-off. Although not focused on environmental technologies, the series provides an overview of the commercialization process by looking at investor pitches, patents, scaling up, and how to survive inevitable setbacks along the way.

1. Tips and tricks for a perfect investor pitch (05/12/21). <https://www.nature.com/articles/d41586-021-01003-0>
2. How to register a patent (05/19/21). <https://www.nature.com/articles/d41586-021-01004-2>
3. How technology-transfer teams can help your spin-off succeed (05/26/21). <https://www.nature.com/articles/d41586-021-01005-0>
4. How to grow your start-up (06/02/21). <https://www.nature.com/articles/d41586-021-01006-0>
5. The setbacks that can help your start-up succeed (06/09/21). <https://www.nature.com/articles/d41586-021-01007-0>
6. The transferable skills that straddle academia and industry (06/12/21). <https://www.nature.com/articles/d41586-021-01008-9>

Cleanup News

INTEGRATED PHYTOMANAGEMENT OF A CARBON TETRACHLORIDE-CONTAMINATED SITE IN MURDOCK, NEBRASKA (USA)
Cundy, A.B., L. LaFreniere, R. Bardos, E. Yan, R. Sedivy, and C. Roe.
Journal of Cleaner Production 290:125190(2021)

An ~59,000 m² integrated phytomanagement system consisting of a mixed stand of Niope willow and Eastern Cottonwood for treating CCl₄ was assessed in terms of its effectiveness in mitigating site risk and realizing wider social and environmental benefits. Remediation of the site was achieved by the integrated phytomanagement system removing 300–600g CCl₄ annually. Eastern Cottonwood played an increasing role in CCl₄ removal over time, from 55% of the total mass removal in 2008 to 69% in 2014. A wider range of social and environmental benefits was realized using a site design focused on enhancing the social and physician environment and risk mitigation. Sustained stakeholder engagement and effective site design were important in fully realizing a range of both core and wider benefits.

IN-SITU REMEDIATION OF DISSOLVED METALS PLUME — FROM CONCEPT TO FULL-SCALE REMEDIATION

Beveridge, M. I. REMTECH 2021. The Remediation Technologies Symposium, Banff, AB, Canada, 13-15 October, 19 slides, 2021

An innovative approach was developed at an active commercial property to remediate an inaccessible dissolved metals plume that discharges to an adjacent freshwater aquatic receptor. Ferric iron was injected, followed by in situ oxidation to precipitate hydrous ferric oxide, which decreased dissolved metal concentrations via coprecipitation and adsorption in the aquifer. Preliminary post-injection groundwater samples indicate up to a 98% decrease in dissolved metal concentrations compared to baseline. The project was conducted iteratively, from conceptual design in 2015 to full-scale implementation in 2020, with ongoing post-injection verification sampling in 2021. Based on lessons learned from the site investigation and pilot-scale testing, two injection areas were installed to progressively treat the plume and stabilize the source zone. Real-time data monitoring at downgradient wells ensured control of the injections to prevent loss of injected materials. Post-injection verification groundwater analytical results indicate decreases up to 98% of dissolved metal concentrations compared to baseline. <https://www.remedy.com/content/uploads/2021/10/R21-Beveridge.pdf>

USING PROTOTYPES TO ENABLE DEVELOPMENT OF COMMERCIALIY VIABLE FIELD SCALE CONTAMINATED SITE REMEDIATION PROCESSES
Guern, T.F. I Chemosphere 288(Part 2):132481(2022)

Laboratory prototypes were developed for biopile, bioflushing, bioreactor, and slurry reactor treatment of contamination at a site where a large fire and solvents damaged soil structure. Following 96% removal of the main contaminant, phenol, the bioflushing prototype was applied in the field before scaling it up to commercial cleaning. After 800 days of treatment, soil grid sampling revealed hotspots of solvents remaining and heterogeneity in the subsurface; however, overall concentrations were substantially decreased. The process decreased soil phenol concentrations from ~500 mg/kg to 75 mg/kg in the most contaminated areas. Phenol toxicity increased with depth and is linked to increasing oxygen deficit. Based on the study, the prototyping process enabled site cleanup and scaling for bioremediation, provided certainty for the owner on treatment elements, and improved environmental and commercial outcomes.

TREATING 1,4-DIOXANE WITH ACTIVATED POTASSIUM PERSULFATE
Telesz, S., B. Smith, and B. Desjardins.
REMTECH 2021. The Remediation Technologies Symposium, Banff, AB, Canada, 13-15 October, 24 slides, 2021

Following column and pilot studies, full-scale application of alkaline-activated potassium persulfate was evaluated at two sites contaminated with 1,4-dioxane, chlorinated ethenes, and chlorinated ethanes. The data indicate that the potassium persulfate reduces contaminant concentrations to below detection limits. Field data indicate that the potassium persulfate persists as expected based on the observed groundwater velocities and that 1,4-dioxane was treated to below the detection limit at the PRB, and downgradient concentrations were significantly reduced. <https://www.remedy.com/content/uploads/2021/10/R21-Telesz.pdf>

MITIGATION OF IMPACT OF A MAJOR BENZENE SPILL INTO A RIVER THROUGH FLOW CONTROL AND IN-SITU ACTIVATED CARBON ADSORPTION
Jin, G., Z. Zhang, Y. Yang, S. Hu, H. Tang, D. Andrew Barry, and L. Li.
Water Research 172:115489(2020)

In 2012, a major spill accident released 3 tons of benzene in a river section 70 km upstream of a natural reserve on the Huae River in Eastern China. Two emergency measures were taken to minimize the impact of the accident on the natural reserve: 1) flow control by adjusting upstream sluices to delay the arrival of the contaminant plume at the reserve and 2) in-situ treatment using activated carbons to reduce the contaminant concentration. A process-based mathematical model was developed to analyze the monitoring data collected shortly after the accident and explore not only how effective the adopted measures were over the incident but, more importantly, the mechanisms and critical conditions underlying the effectiveness of these measures. The model can be used as a tool for designing optimal management responses to similar spill accidents in regulated river systems, combining flow control and in-situ treatment. <https://reader.elsevier.com/reader/sd/pii/S0043135420300257?token=1365D21A8A8A72459259F3EC940E55020DF13A888C4398E9D43C25131044A3863309FF71AD97249505C54CF4CF530B80nginRegion=us-east-1&originCreation=20211111>

Demonstrations / Feasibility Studies

FIELD DEMONSTRATION OF A PILOT-SCALE PLASMA REACTOR FOR THE RAPID REMOVAL OF POLY- AND PERFLUOROALKYL SUBSTANCES IN GROUNDWATER
Nau-Hix, C., N. Multani, R.K. Singh, S. Richardson, P. Kulkarni, R.H. Anderson, T.M. Holten, and S.M. Thagard. I ACS ES&T Water 1(3):880-887(2021)

A pilot-scale plasma-based water treatment system containing two enhanced contact plasma reactors was deployed at Wright-Patterson Air Force Base to treat PFAS in AFFF-impacted groundwater from two monitoring wells. Extracted water was treated through the plasma trailer in a semi-batch mode at flow rates ranging from 2.4 to 4.4 L/min. Long-chain PFAAs (fluorocarbon chain of ≥8) and PFAS precursors were reduced by ≥90% for all flow rates in a single cycle through the reactors. Combined PFOA and PFOS concentrations lower than EPA's health advisory level of 70 ng/L were achieved in fewer than three cycles through the reactors. Short-chain PFAAs (fluorocarbon chain of ≤5) were removed to a lesser extent (0-95%) due to their generation during plasma treatment of long-chain PFAAs and PFAS precursors and limited accumulation at the plasma-liquid interface of the reactor. Batch mode experiments were performed by adding cetrimonium bromide to improve the destruction of short-chain PFAAs, resulting in an 88% reduction within 120 min of treatment. <https://pubs.acs.org/doi/10.1021/acs.est.0c00170> More information: <https://www.wright-pf.com/News/Article-Detail/Article/2007590?title=first-in-class-plasma-reactor-for-degrading-electro-pfca-pfas>

PFAS REMOVAL FROM GROUNDWATERS USING SURFACE-ACTIVE FOAM FRACTIONATION
Burns, D.J., P. Stevenson, and P.J.C. Murphy. I Remediation 31(4):19-33(2021)

A field trial conducted at the Oakley Army Aviation Centre in Queensland, Australia, evaluated the effectiveness of the Surface-Active Foam Fractionation (SAFF) process at removing PFAS in groundwater. The SAFF process removed ≥99.5% of PFOS, PFHxS, and PFOA aggregates in PFAS-contaminated groundwater. The field trial also demonstrated the sustainability attributes of SAFF. An anionic exchange (AIX) resin "polisher" installed downstream of SAFF removed all trace detectable PFAS species. By reducing the PFAS loading, the SAFF process extends the lifespan of the AIX resin. The extent of PFAS species removal closely correlated with the adsorption coefficient of the molecules at the gas-liquid interface. When the reported adsorption coefficient was greater than ~1.0 × 10⁻⁶ m, nearly all PFAS species, including PFOS, PFHxS, and PFOA, were removed by SAFF. Longer-chain PFAS species that benefit from higher adsorption coefficients were easier to remove than shorter-chain species. <https://www.youtube.com/watch?v=OpAdvUsrT0U> To view site documents for the Oakley site, see <https://efedence.gov.au/Environment/PFAS/Oakley/Monitoring.aspx>

EVALUATION OF PASSIVE DIFFUSIVE-ADSORPTIVE SAMPLERS FOR USE IN ASSESSING TIME-VARYING INDOOR AIR IMPACTS RESULTING FROM VAPOR INTRUSION
Guo, Y., H. O'Neill, P. Dahlen, and P.C. Johnson.
Groundwater Monitoring & Remediation [Published online 15 September 2021 prior to print]

Passive sampler performance for VI pathway assessment was examined in settings with time-varying indoor air concentrations by comparing passive sampler results to concentrations determined by 24-hr active sorbent tube sampling in a series of multi-week deployments. Sampling was performed in a residential building and industrial buildings for one to seven weeks. Strong linear correlations were noted between passive and active sampling concentration results for some passive samplers, with passive sampling results being similar to or lower than measured active sampling results by ~50% in the residential study and ~25% higher in the industrial study. Other samplers produced a poor correlation. Results indicated that passive samplers may have potential for use in multi-week indoor air quality monitoring, though accepted procedures to validate and calibrate passive samplers for use in the field are needed.

COMPARATIVE FIELD STUDIES OF REAL-TIME SOIL SCREENING TECHNIQUES FOR TWO PETROLEUM HYDROCARBON SITES
Le May, A. I. REMTECH 2021. The Remediation Technologies Symposium, Banff, AB, Canada, 13-15 October, 30 slides, 2021

Two field studies were conducted to compare soil screening methodologies using a PID and a portable field spectrometer at two petroleum hydrocarbon (PHC) sites during challenging winter conditions. The first field study at a remedial excavation site evaluated how near-infrared spectroscopy (NIRS) with proprietary machine learning technology could support field decision-making and reduce remediation costs compared to soil excavation screening using a PID. Fifty soil samples were field screened using the NIRS and a PID. Confirmation soil samples were submitted for lab analysis. The second study was conducted during a site investigation of potentially contaminated soil at a former bulk fueling yard to evaluate how the NIRS would compare to the PID for gasoline and diesel-range PHCs where few surface structures or landmarks remained. Over 150 discrete soil samples were collected over three days using PID and NIRS, and samples were analyzed in the lab. Results from both studies using advanced field screening technology can enable effective field-based decision-making for efficient remedial excavation, backfilling, and contaminant delineation. <https://www.remedy.com/content/uploads/2021/10/R21-LeMay.pdf>

Research

ROOM-TO-ROOM VARIABILITY OF AIRBORNE POLYCHLORINATED BIPHENYLS IN SCHOOLS AND THE APPLICATION OF AIR SAMPLING FOR TARGETED SOURCE EVALUATION.

ROOM-TO-ROOM VARIABILITY OF AIRBORNE POLYCHLORINATED BIPHENYLS IN SCHOOLS AND THE APPLICATION OF AIR SAMPLING FOR TARGETED SOURCE EVALUATION. Bannavü, M.K., J.C. Jahnke, R.F. Marek, C.L. Just, and K.C. Hornbuckle. Environmental Science & Technology 55(14):9460-9468(2021) This study evaluated a hypothesis that both Arorol and non-Arroclor sources of PCBs exist within a single school and that concentration and congener profiles differed in 9 rooms within a single building. Results indicated that schoolroom concentrations exceeded outdoor air concentrations; concentrations and congener profiles also varied in different rooms. The concentrations were highest in a math room (35.75 ng/m³ ± 8.08) and lowest in a practice gym (1.54 ng/m³ ± 0.25). Rooms in the oldest wing of the building had the highest concentrations. The congener distribution patterns indicated historical use of Arroclor 1254 and modern sources of non-Aroclor congeners associated with paint pigments and surface coatings.

THE INFLUENCE OF MOLECULAR STRUCTURE ON PFAS ADSORPTION AT AIR-WATER INTERFACES IN ELECTROLYTE SOLUTIONS.

Brusseau, M.L. and S. Van Glubt. *Chemosphere* 281:130829(2021)

A study was conducted to characterize the influence of PFAS molecular structure on air-water interfacial adsorption in electrolyte solutions. Measured and literature-reported surface-tension data sets were aggregated to generate the largest compilation of interfacial adsorption coefficients measured in aqueous solutions comprising environmentally representative ionic strengths. The surface activities and interfacial adsorption coefficients (K_i) exhibited chain length trends, with greater surface activities and larger K_i values corresponding to longer chain length. The impact of multiple-component PFAS solutions on the surface activity of a select PFAS was a function of the respective surface activities and concentrations. Quantitative structure-property relationship analysis (QSPR) employing a single molecular descriptor characterized the impact of PFAS molecular structure on air-water interfacial adsorption. A QSPR model based on PFAS data generated for deionized-water solutions was updated to include more than 60 different PFAS, comprising all head-group types and a wide variety of tail structures. The QSPR model developed for PFAS in electrolyte solution compared favorably to the model developed for deionized water.

EMERGING CORE CONCEPTS FOR ASSESSMENT AND ENHANCEMENT OF ABIOTIC NATURAL ATTENUATION OF GROUNDWATER CONTAMINANTS

Tratnyek, P.G., R.L. Johnson, Y. Lan, K. Inoue, A. Pavitt, G. O'Brien Johnson. SERDP Project ER-2620, 96 pp, 2021

The overall aim of this project was to develop improved methods to measure abiotic natural attenuation (NA) processes into "core concepts" to help form a foundation for field application of abiotic NA and related varieties of in situ chemical reduction. The three methods developed under ER-2620 include (i) standardized and validated performance metrics; (ii) enhancement of performance by mediation or activation; and (iii) rigorous yet practical quantification of reductant demand. Each objective was pursued through a combination of conceptual model development, data mining, laboratory experiments, and modeling. <https://www.serdp-estrcn.org/content/download/53837/528785/file/ER-2620%20Final%20Report.pdf>

A SYSTEMATIC APPROACH FOR PRIORITIZING LANDFILL POLLUTANTS BASED ON TOXICITY: APPLICATIONS AND OPPORTUNITIES

Rogers, E.R., R.S. Zalesny Jr., and C.-H. Lin. *Journal of Environmental Management* 284:112031(2022)

A literature review collected *in vitro*, *in vivo*, and predicted human toxicity data from ToxCast, ECOTOX, and CTV Predictor and identified 484 landfill leachate contaminants with available CAS numbers. The data were integrated using the Toxicological Priority Index for 322 contaminants which had available toxicity data from at least two databases. Four modifications to the general prioritization scheme were developed to demonstrate the flexibility to address varied research and applied objectives. The general scheme served as a basis to compare results from the modified schemes and identified contaminants uniquely prioritized in each of the schemes. The schemes outlined can identify the most harmful contaminants in environmental media to design relevant mitigation strategies and monitoring plans. https://www.fs.fed.us/nrs/pubs/jrnl/2021/nrs_2021_rogers_001.pdf

ASSESSMENT OF CONTAMINANT TRENDS IN PLUMES AND WELLS AND MONITORING NETWORK OPTIMIZATION AT THE BADGER ARMY AMMUNITION PLANT, SAUK COUNTY, WISCONSIN

Patrjowski, M., P. Goodling, and M. Metes. USGS Report 2020-5106, 94 pp, 2021

Soil and groundwater at the Badger Army Ammunition Plant (BAAP), Sauk County, Wisconsin, were affected by several contaminants from production and waste disposal practices common during its operation from 1942 to 1975. Three distinct plumes of contaminated groundwater originate from BAAP property and extend off-site. In cooperation with the Army Environmental Command, USGS conducted a study to apply a systematic data aggregation and interpolation scheme to derive the likely maximum extent of the groundwater plume in four 3-year periods between 2000 and 2018, at the Badger Army Ammunition Plant (BAAP), Sauk County, Wisconsin. Three distinct contaminated groundwater plumes originated on BAAP property and extended off-site. The Enforcement Standard defined the plume extent for each contaminant of concern (COC) and represented the maximum concentration observed in each 3-year period. Maps identified the plume boundaries, the sampling well network used to delineate the plume, and wells sampled between 2010-12. A series of statistical analyses were applied to COC concentration data collected from 2000-2012 and 2013-2018. Spatial moment analysis of concentration data from the well network was used to assess the stability of each plume for the COCs. A temporal optimization analysis identified optimal sampling frequencies for 125 wells. Remedial actions directed at the Propellant Burning Ground plume coincided with a general decrease in plume mass and size, although in specific areas and depths, the plume size for specific contaminants may still be increasing. <https://pubs.usgs.gov/sir/2020/5106/sir20205106.pdf>

IN SITU GAS SPARGING FOR CONCENTRATION AND REMOVAL OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) FROM GROUNDWATER

Newell, C.J., P.R. Kulkarni, and D.T. Adamson. *Remediation* 31(4):35-47(2021)

A small-scale lab experiment showed that a sparge gas introduced in a groundwater treatment zone causes higher PFAS concentrations and a PFAS foam/buoyant material to collect at the air-groundwater interface and be drawn upwards by the buoyancy of the sparged gas. The sparging resulted in lower PFAS concentrations in the deeper portions of the sparged zone. The sparging will also create higher PFAS concentrations and a PFAS foam/buoyant material comprised of a mixture of air, water, and PFAS that is less dense than water (and therefore buoyant in the subsurface). This buoyant material migrates to near the top of the aquifer, sometimes through channels formed by the material and/or through pressure. This migration makes it easier to remove the PFAS by skimming groundwater containing higher concentrations of PFAS and/or by directly removing any foam/buoyant material. The resulting in situ PFAS-contaminated groundwater and buoyant material may: (i) reduce the volume of the contaminated plume; (ii) reduce the amount of extracted groundwater that needs to be treated; (iii) facilitate PFAS removal from the subsurface; and (iv) reduce PFAS-impacted waste generation. Alternatively, concentrated PFAS could be left in place as PFAS retention in unsaturated soils is strong due to air/water partitioning. This process can be applied to PFAS sites where conventional air-sparging can be re-purposed to manage PFAS groundwater plumes.

REMOVAL OF TRANSITION METALS FROM CONTAMINATED AQUIFERS BY PRB TECHNOLOGY: PERFORMANCE COMPARISON AMONG REACTIVE MATERIALS

Mayacela-Rojas, C.M., A. Molinari, J.L. Cortina, O. Gbert, C. Ayora, A. Tavorlano, M.F. Rivera-Velasquez, and C. Fallico. *International Journal of Environmental Research and Public Health* 18:6075(2021)

A series of batch and column tests were conducted to test new reactive materials as filters to remove Zn, Cu, and Cd in the construction of PRBs. Batch testing of cubaya, natural clinoptilolite zeolites, sodium mordenite, and mordenite achieved a > 99% removal rate. In column testing, cubaya fiber presented the lowest absorption time (~189 h), while natural zeolite mordenite showed the highest time (~833 h). The RETRASO code reproduced the experimental values, corroborating the trend between the observed and simulated values with respect to the best reactive substance. *This article is Open Access at* <https://www.mdpi.com/1660-4601/18/11/6075>

General News

MULTI-INDUSTRY PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) STUDY – 2021 PRELIMINARY REPORT

EPA Office of Water, EPA-821-R-21-004, 81 pp, 2021

This preliminary report summarizes the readily available information and data EPA's Office of Water collected and reviewed concerning industrial discharges of PFAS from five industrial point source categories: organic chemicals, plastics, and synthetic fibers (OCPSF) manufacturing; metal finishing; pulp, paper, and paperboard manufacturing; textile mills; and commercial airports. It presents EPA's estimates of the types and concentrations of PFAS, including legacy long-chain PFAS and short-chain replacement PFAS, present in wastewater discharges from these facilities. Few facilities in these industries currently have monitoring requirements, effluent limitations, or pretreatment standards for PFAS in their wastewater discharge permits. EPA identified available wastewater treatment technologies, such as activated carbon, ion exchange, and membrane filtration, that may reduce PFAS in wastewater discharges from facilities in these industrial point source categories. https://www.epa.gov/system/files/documents/2021/09/multi-industry-pfas-study_preliminary-2021-report_508_2021_09_08.pdf

ELECTROCHEMISTRY-STIMULATED ENVIRONMENTAL BIOREMEDIATION: DEVELOPMENT OF APPLICABLE MODULAR ELECTRODE AND SYSTEM SCALE-UP

Wang, A.-J., H.-C. Wang, H.-Y. Cheng, B. Liang, W.-Z. Liu, J.-L. Han, B. Zhang, and S.-S. Wang. *Environmental Science and Ecotechnology* 3:100050(2020)

This article reports a scalable composite-engineered electro module (EM) (total volume of 1 m³), fabricated using graphite-coated stainless steel and carbon felt, that integrates bioelectrochemical systems (BESs) into mainstream wastewater treatment technologies. The cost-effectiveness and scalability of this EM provide a viable path to facilitate the transition between the success of the lab studies and applications of BESs to potentially solve multiple environmental issues at full-scale.

ELECTROKINETICALLY-DELIVERED, THERMALLY-ACTIVATED PERSULFATE OXIDATION (EK-TAP) FOR THE REMEDIATION OF CHLORINATED AND RECALCITRANT COMPOUNDS IN HETEROGENEOUS AND LOW PERMEABILITY SOURCE ZONES

Cox, E., M. Watling, D. Gent, M. Singletary, and A. Wilson., ESTCP Project ER-201626, 175 pp, 2021

This project demonstrated electrokinetic (EK)-enhanced amendment delivery for in-situ bioremediation (EK-BIO) via enhanced reductive dechlorination (ERD) of a tetrachloroethene source area in clay. The EK-enhanced amendment delivery technology established a direct-electric field in the subsurface using a network of electrodes. The electrical current and voltage gradient provided the driving force to transport remediation amendments, including electron donors, chemical oxidants, and bacteria, through the subsurface. This project showed that EK could achieve relatively uniform transport in low-permeability materials. <https://www.serdp-estrcn.org/content/download/53858/529161/file/ER-201626%20Final%20Report.pdf>

LESSONS LEARNED FROM 20 YEARS OF MOLECULAR BIOLOGICAL TOOLS IN PETROLEUM HYDROCARBON REMEDIATION

Taggart, D.M. and K. Clark. *Remediation* 31(4):83-95(2021)

This article discusses the use of molecular biological tools (MBTs) to select the best remediation strategy for petroleum hydrocarbon-contaminated sites. The critical importance of obtaining multiple lines of evidence-chemistry (concentrations of contaminants and daughter products), geochemistry (redox status, electron acceptors and donors), microbiology (species and their genes for catalyzing biodegradation of reactions), and the contaminant degradation ongoing at baseline (stable isotope methods) during site characterization is presented. <https://onlinelibrary.wiley.com/doi/epdf/10.1002/rem.21695>

PATENTED QUANTITATIVE PASSIVE VOC SOIL-GAS MONITORING WITH THE WATERLOO MEMBRANE SAMPLER™

Pautler, B.G., and T.A. McAlary. *Remediation Seminar*, 24 June, 38 slides, 2021

This presentation provides technical information on the Waterloo Membrane Sampler™ (WMS™), a passive permeable sampler that incorporates a polydimethylsiloxane membrane across the face of a vial filled with sorbent medium. The sampler design incorporates a thicker membrane, reducing the potential for "starvation," a common issue when collecting soil gas samples with passive samplers. The benefits relative to the conventional Summa Canister™-15 sampling and analysis methods are also discussed. [Slides:https://www.remediationseminar.com/images/presentations/webinar72021710624_Passive_Soil_Gas_Presentation.pdf](https://www.remediationseminar.com/images/presentations/webinar72021710624_Passive_Soil_Gas_Presentation.pdf). Register to see recording: <https://register.gotowebinar.com/recording/9163693160608178952>

MONITORED NATURAL ATTENUATION TO MANAGE PFAS IMPACTS TO GROUNDWATER: POTENTIAL GUIDELINES

Newell, C.J., D.T. Adamson, P.R. Kulkarni, B.N. Nzeribe, J.A. Connor, J.F. Popovic, and H.F. Stroo. *Remediation* 31(4):7-17(2021)

Guidelines based on a three-tiered line of evidence (LOE) approach were developed to evaluate MNA at PFAS-impacted groundwater sites using the scientific basis described in a companion paper (<https://nrgwa.onlinelibrary.wiley.com/doi/10.1111/nwrm.12486>). The approach applies direct and indirect measurements, calculations, and field and modeling methods to assess PFAS retention in the subsurface. The paper identifies data requirements to assess LOEs to quantify retention in both the vadose and saturated zones and provides tools that can be used to address key questions about PFAS MNA. Finally, the paper lists potential methods to enhance PFAS MNA for sites where MNA alone may not effectively manage PFAS. <https://onlinelibrary.wiley.com/doi/epdf/10.1002/rem.21692>

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