Technology Innovation News Survey

Entries for December 1-15, 2020

Market/Commercialization Information

REMEDIAL INVESTIGATIONS FOR PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) IMPACTED AREAS AT ARMY INSTALLATIONS IN THE NORTHEAST REGION

U.S. Army Corps of Engineers, Baltimore District, Baltimore, MD.
Contract Opportunities at Beta.SAM, Solicitation W912DR21R0020, 2021

This notice is for market research purposes only. The Government is seeking to identify qualified business sources both large and small under NAICS code 562910 (Remediation Services), small business size standard 750 employees. The USACE Baltimore District is interested in sources with current relevant qualifications, experience, personnel, and capabilities to support USACE and its customers in conducting remedial investigations, with the option to conduct feasibility studies, at sites across approximately 12 installations in areas where releases of aqueous film-forming foam or other per- and polyfluoroalkyl substances have occurred. The installations are located in Virginia, Maryland, Pennsylvania, New Jersey, and New York. An 8-year period of performance is anticipated. Capabilities statements are due by 12:00 noon ET on February 1, 2021. https://beta.sam.gov/opp/6bd34f9089124bed8e67e2366188d0ba/view

LEGACY (PCB-CONTAMINATED) ELECTROLYTIC DISSOLVER TRANSFORMER DISPOSITION

Savannah River Nuclear Solutions LLC (DOE Contractor), Aiken, SC.
Contract Opportunities at Beta.SAM, SRNS2021114TRANSFORMERDISPOSITION, 2021

The intent of this request for information is to identify potential offerors for market research purposes only. Savannah River Nuclear Solutions LLC (SRNS), which manages and operates portions of the Savannah River Site under a DOE prime contract, solicits expressions of interest from companies capable of legacy (PCB-contaminated) electrolytic dissolver transformer disposition. The subcontractor shall be an EPA-approved TSCA contractor, responsible for dismantling, removing and transporting a PCB-contaminated transformer from the Savannah River Site to an EPA-approved TSCA-compliant facility for scrap metal recovery and/or land disposal; with scrap metal recovery being the preferred method of disposition. The transformer is 12.54 ft high by 7.9 ft wide by 16.13 ft long and weighs about 27,050 lbs. It has been drained of all free-flowing liquids. Sampling results of drained oil yielded PCB concentrations of 500 ppm. The subcontractor shall complete all transformer disposition actions necessary, including up-front planning, document reviews, inspections, characterization (sampling if necessary), spill prevention, size reduction, packaging, transportation, and treatment in compliance with TSCA, OSHA, DOT, and the recycling or disposal facility's licensing requirements. Supplier response to this RFI does not guarantee selection to participate in the RFP. Capabilities statements are due by 5:00 PM ET on February 1, 2021. https://beta.sam.gov/opp/153c76b632e64519a510edb9357973f5/view

ENVIRONMENTAL SERVICES FOR VARIOUS WASTE SERVICES

Naval Facilities Engineering Systems Command Southwest, San Diego, CA.
Contract Opportunities at Beta.SAM, Solicitation N6247321S0229, 2021

The Naval Facilities Engineering Systems Command Southwest (NAVFAC SW) is issuing this sources sought as market research to determine whether there are potentially qualified small businesses; 8(a); HUBZone; service-disabled veteran-owned; small disadvantaged; woman-owned; and/or veteran-owned small business concerns under NAICS code 562211 (Hazardous Waste Treatment and Disposal) that have the current qualifications, experience, personnel, and capability to provide, under contract, all management, labor, incidental engineering, travel, transportation, equipment, material, and supervision necessary to perform specific environmental services. The Government is considering a new solicitation for the following services: (1) operation of Government-owned facilities that process industrial and/or oily wastes, (2) containerized solid waste services, (3) oil and hazardous substance spill response, and (4) IDIQ professional services for site assessment, remediation, and/or compliance projects. The majority of services would be performed for Navy and Marine Corps installations within the Southern California region, although the NAVFAC SW region also includes Arizona, Nevada, Colorado, and New Mexico. A DRAFT performance-based work statement is provided for reference at beta.sam. The Government will use responses to this sources sought to make acquisition plans. Capabilities statements are due by 2:00 PM PT on February 4, 2021. https://beta.sam.gov/opp/3f25e1948a2d4cc5bcacc87f7e3e22fa/view

SUPERFUND HAZARDOUS SUBSTANCE RESEARCH AND TRAINING PROGRAM

DHHS, National Institutes of Health, Funding Opportunity RFA-ES-20-014, 2020

The National Institute of Environmental Health Sciences (NIEHS) supports problem-based, solution-oriented research centers for the Superfund Hazardous Substance Research and Training Program. See details at http://grants.nih.gov/grants/guide/rfa-files/RFA-ES-20-014.html. The scope of the Superfund Hazardous Substance Research and Training Program includes (1) advanced techniques for the detection, assessment, and evaluation of the effect on human health of hazardous substances; (2) methods to assess the risks to human health presented by hazardous substances; (3) methods and technologies to detect hazardous substances in the environment; and (4) basic biological, chemical, and physical methods to reduce the amount and toxicity of hazardous substances. The closing date for research grant applications is February 15, 2021. A P42 clinical trial is optional.
https://www.grants.gov/web/grants/view-opportunity.html?oppId=328914

OAK RIDGE RESERVATION CLEANUP CONTRACT (ORRCC) - FINAL RFP

U.S. DOE, Environmental Management Consolidated Business Center, Cincinnati, OH.
Contract Opportunities at Beta.SAM, Solicitation 89303319REM000047, 2020

The ORRCC Final RFP reflects an IDIQ contract under which cost-reimbursement and/or fixed-price task orders may be issued. The contract ordering period will be 10 years, including a 90-day transition period. The contract is estimated to be worth up to approximately $8.3B over the 10-year ordering period. The NAICS code is 562910. See additional information at the EMCBC ORRCC procurement website: https://www.emcbc.doe.gov/seb/orrcc/rfppage.php. Offers are due by 4:00 PM ET on February 16, 2021. https://beta.sam.gov/opp/19ead9dbdf30472da4c54dc02dbc9f08/view

Cleanup News

REVIEW OF REMEDIAL OPTIONS FOR THE BOAT HARBOUR REMEDIATION PROJECT IN NOVA SCOTIA, CANADA

Eichinger, L. and T.R. Walker. | Remediation 31(1):91-104(2020)

The Boat Harbour Effluent Treatment Facility (BHETF) received industrial effluent wastewater from a nearby kraft pulp mill and chlor-alkali plant until 2020. The discharge resulted in widespread contamination of sediments and surface water with metals, dioxins and furans, and PAHs. The province of Nova Scotia has committed to remediating the BHETF with a goal of returning Boat Harbour to its natural state as a tidal estuary to restore the land's historical, traditional, and recreational uses. A list of approaches was developed along with subsequent alternatives for each design component. They were screened to eliminate options that were not technically feasible or did not align with remediation goals. The remaining feasible concepts underwent detailed review and evaluation to select qualified remedial options to be shared with stakeholders for input. *For more information on the project, see* https://novascotia.ca/boatharbour/.

A FULL-SCALE APPLICATION OF PHYTOREMEDIATION TO ADDRESS A 1,4-DIOXANE PLUME

Ovbey, T. and A. Brenzikofer, Parsons Technical Webinar (58 minutes), 15 October 2020

A formal industrial site on the coast of South Carolina was a source of 1,4-dioxane and VOC contamination in groundwater. In 2007, the PRP installed a phytoremediation system to accelerate contamination attenuation in shallow groundwater. Investigations of the system found that trees were removing VOCs from the top of the surficial aquifer, but roots were not reaching VOCs located in the bottom portion of the surficial aquifer. In addition, VOC concentrations were not diminishing in the groundwater, indicating an onsite contamination source. A soil removal action was completed that uncovered a former sump and possible source area. The contaminated soil above the water tables was removed and replaced with clean fill material. Natural attenuation processes are being examined through lab studies, including isolating 1,4-dioxane-degrading bacteria from the site aquifer samples. The PRP plans to install an expanded phytoremediation system, including the potential use of TreeWell® systems, in the next several years.
https://www.parsons.com/2020/10/a-full-scale-application-of-phytoremediation-to-address-a-14-dioxane-plume/

FINAL REMEDIAL DESIGN REPORT SOIL VAPOR EXTRACTION AND TREATMENT SYSTEM AND IN SITU BIOREMEDIATION BANDERA ROAD GROUND WATER PLUME SUPERFUND SITE BEXAR COUNTY, TEXAS

EPA Region 6, 586 pp, 2020

This report presents remedial design criteria to construct SVE and in situ bioremediation (ISB) systems for treating chlorinated VOCs at the Bandera Road Ground Water Plume Superfund site. SVE will be used to treat the shallow vadose zone with Vertebrae™ wells and the deeper vadose zone using horizontal wells. ISB will be conducted to remediate groundwater. The design criteria are based on remedial action objectives that include preventing exposure to contamination in groundwater and indoor air concentrations greater than cleanup levels; preventing or minimizing further migration of contamination in surface soils, subsurface soils, vadose zone bedrock, and groundwater concentrations greater than cleanup levels; and returning groundwater to their expedited beneficial use wherever practical. The cost for remediation, including construction, operation, and post-remedy monitoring, is estimated to be $6,245,000.

http://www.leonvalleytexas.gov/government/public_works/docs/Bandera%20Road%20Final%20Remedial%20Design%20Report_Revision%2000.pdf

2019 ANNUAL SUMMARY REPORT DARTMOUTH COLLEGE, RENNIE FARM SITE
GZA GeoEnvironmental, Inc. on behalf of Dartmouth College, 911 pp, 2020

In 2011, Dartmouth remediated a portion of Rennie Farm where the school disposed of animal carcasses from medical research in the 1960s and 70s. Post-remediation monitoring detected a 1,4-dioxane plume (270-520 µg/L) likely sourced from the disposal area that migrated offsite. Dartmouth installed groundwater extraction and treatment systems to remediate contamination and prevent further migration. The systems utilize liquid-phase granular activated carbon (LGAC) and Ambersorb® filters in sequence to remove 1,4-dioxane. The Ambersorb is periodically steam-regenerated. The contaminated condensate is treated through two LGAC canisters in series before being combined with treatment system influent. Performance data indicates that the systems are meeting remedial objectives. Based on results and estimates, the period of active remediation of the source area system will likely be less than 6 years. Dartmouth plans to expand the systems to treat groundwater in areas beyond the current capture zone.
https://www.dartmouth.edu/ehs/docs/rennie_info/desannualreport2019041420.pdf
To see all site data, including site maps, photographs, and documents such as the design plans for the system expansion, see https://www.dartmouth.edu/ehs/rennie_links.html#Information.

Demonstrations / Feasibility Studies

HARMFUL ALGAL BLOOM INTERCEPTION, TREATMENT, AND TRANSFORMATION SYSTEM, "HABITATS"
Page, M., B. MacAllister, A. Urban, C. Veinotte, I. MacAllister, K. Pokrzywinski, J. Riley, E. Martinez-Guerra, C. White, C. Grasso, A. Kennedy, C. Thomas, J. Billing, A. Schmidt, D. Levy, B. Colona, D. Pinelli, and C. John. Army Corps of Engineers Engineer Research and Development Center (ERDC), 97 pp, 2020

The objective of ERDC's HABITATS project is to develop a rapidly deployable system for mitigating large harmful algal blooms (HABs) at various design scales. Progress in the project's first year includes: 1) development and deployment of an interception technology that efficiently collects algae at the water surface, 2) validation of high throughput treatment using dissolved air flotation (DAF) technology to clarify algae-laden water, 3) oxidation of the DAF effluent using ozonation for removing microcystin and other potential cyanotoxins, 4) successful permitting with the Florida Department of Environmental Protection to discharge the treated water back to a surface water body at the demonstration site, 5) demonstration of rapid concentration of algae from a natural water source, transformation of concentrated algae from the study site into biocrude oil at bench scale, and 6) development of a scalability analysis model to establish baseline estimates for full-scale performance and cost. https://apps.dtic.mil/sti/pdfs/AD1089605.pdf

CLEANING OF OIL-POLLUTED BOTTOM SEDIMENTS OF THE BOREAL LAKE, SAMOTLOR OIL FIELD, NORTH RUSSIA: CASE REPORT
Frank, Y.A., D.S. Vorobiev, O.E. Merzlyakov, F.R. Sataev, A.A. Trifonov, E.O. Kopylov, K.V. Stryuk, E.A. Kalinovskaya S.V. Gronskiy, O.V. Chibrikov, V.V. Perminova, Y.V. Branevskiy, S.P. Kulizhskiy, and T.S. Hunter | Water Science & Technology 82(12): 3062-3073(2020)

A flotation-based technology using specially designed airlift plants was tested to remove crude oil from the bottom sediments of a boreal lake. The sediments are dominated by peat and are unevenly polluted. The average total oil concentration was reduced from 111 g/kg to 1.99 g/kg during the 1.5-month field test. Secondary water contamination was minimal; the content of oil hydrocarbons in the water after the project was completed did not exceed 0.09 ± 0.04 mg/L.
This article is ***Open Access*** *at* https://iwaponline.com/wst/article/82/12/3062/78280/Cleaning-of-oil-polluted-bottom-sediments-of-the.

INNOVATIVE PULSED OZONE MICRODIFFUSION SPARGE APPROACH FOR TETRACHLOROETHYLENE REMEDIATION AT AN ARIZONA STATE SUPERFUND SITE
Craig, K. | Design and Construction Issues at Hazardous Waste Sites Virtual Meeting, 26-28 October, 17 slides, 2020

The East Central Phoenix 24th Street and Grand Canal site is in an urban area with relatively deep depth to groundwater, making implementing an effective remedial approach for PCE in groundwater challenging and expensive. A proprietary specialized five-well ozone sparge pilot system was designed and installed in April 2020 as an aggressive and cost-effective alternative to expedite the site remedial process. The system uses a cyclical injection pressure pulse process incorporating micro-diffusers and specially designed injection wells. The process resulted in an increase in dissolved-phase ozone compared to traditional sparging and a significantly larger radius of influence than was expected. Groundwater monitoring indicated a significant decrease in PCE concentration in the groundwater influenced by the system. The presentation covers the nuances of this remedial approach, challenges that were overcome, the system's effectiveness, and the anticipated path forward for this site and others.
Slides: https://clu-in.org/conf/tio/DCHWS12/slides/2Slide_Presentation_for_Kirk_Craig,_P.E.;_Geosyntec_Consultants.pdf
To see more information on the site, including documents, see https://azdeq.gov/ecp-24th-gc

SIMPLE RESISTIVITY PROBE SYSTEM FOR REAL-TIME MONITORING OF INJECTED REAGENTS
Stevenson, D., F. Solano, Y. Wei, N.R. Thomson, J.F. Barker, and J.F. Devlin.
Groundwater Monitoring & Remediation 40(4):54-66(2020)

A prototype real-time monitoring dipole resistivity probe (DRP) was designed to generate information on injected reagent distribution. The probe is comprised of a two-wire resistivity circuit. It was built to be attached as arrays to a central stalk and installed by direct-push techniques. An installed network of multilevel DRPs can detect the arrival, persistence, and relative concentration of a high-conductivity reagent solution in real time across a zone of interest. Static cell and sandbox experiments were conducted to test and refine the DRP design before field testing. Results from field studies demonstrated the utility of the DRPs to generate information efficiently and cost-effectively regarding the arrival and persistence of reagents. While additional field testing is warranted, results are encouraging and suggest that the system can improve understanding of the detailed migration of injected reagents in treatment zones.

KINETIC PASSIVE SAMPLING: IN SITU CALIBRATION USING THE CONTAMINANT MASS MEASURED IN PARALLEL SAMPLERS WITH DIFFERENT THICKNESSES
Fuchte, H.E. A. Schaffer, K. Booij, and K.E.C. Smith.
Environmental Science & Technology 54(24):15759-15767(2020)

A complementary calibration approach was developed to determine dissolved contaminant concentrations by measuring the contaminant mass ratio (CMR) from two samplers with different thicknesses. The CMR calibration was tested in a lab experiment with defined and constant concentrations and in the field at a stormwater retention site. Silicone passive samplers with different thicknesses were used to sample a range of dissolved PAHs. In the lab study, concentrations derived from the CMR calibration were compared with those from water extraction and passive dosing. The comparison resulted in differences below a factor of 2. In the field, CMR-derived concentrations were compared with performance reference compound calibrations. Differences ranged by a factor of 1 to 3. Findings indicate that the CMR calibration can be applied as a stand-alone or complementary calibration method for kinetic passive sampling.

Research

DESTRUCTION OF PERFLUOROALKYL ACIDS ACCUMULATED IN TYPHA LATIFOLIA THROUGH HYDROTHERMAL LIQUEFACTION
Zhang, W., H. Cao, S.M. Subramanya, P. Savage, and Y. Liang.
ACS Sustainable Chemistry & Engineering 8(25):9257-9262(2020)

Researchers investigated whether hydrothermal liquefaction (HTL) could degrade PFAAs accumulated in plant biomass. Researchers first evaluated the degradation of individual and mixed PFAAs in pure aqueous solutions using HTL. All five PFCAs were completely removed after 2 hours at 300°C. Three PFSAs had less than 20% removal efficiencies, which were increased to 85.9 ± 1.2% after amending with KOH. HTL removed PFAAs that accumulated in common cattails (*Typha latifolia*), including nearly 100% of PFCAs. Removal of PFOS was 98.4% in roots was 98.4% and 49.7% in shoots. Results indicate the need for further investigation to optimize HTL to handle plant biomass used for phytoremediation of PFAS.

EVALUATION OF PILOT SCALE IN-VITRO AND EX-SITU HYDROCARBON BIOREMEDIATION POTENTIAL OF TWO NOVEL INDIGENOUS STRAINS OF BACILLUS VALLISMORTIS
Basumatary, M., S. Das, M. Gogoi, I. Das, D. Charingia, and D. Borah.
Bioremediation Journal 24(2-3):190-203(2020)

Indigenous *Bacillus vallismortis* viz. strains DU12 and DU14 were isolated from oil-impacted soil samples collected from automobile garages located in Assam, India. After 28 days under in vitro conditions, the isolates effectively degraded 26.34% and 53.85% of used engine oil. Pilot-scale ex-situ bioremediation assays on used engine oil and diesel-contaminated soil samples by both isolates showed similar germination rates of *Vigna radiata* and *Cicer arietium* seeds after 20 days of treatment. Both seedlings showed significant growth after bioremediation as compared to the respective controls.

PER- AND POLYFLUOROALKYL SUBSTANCES IN THE AIR PARTICLES OF ASIA: LEVELS, SEASONALITY, AND SIZE-DEPENDENT DISTRIBUTION
Lin, H., S. Taniyasu, E. Yamazaki, S. Wei, X. Wang, N. Gai, J.H. Kim, H. Eun, P.K.S. Lam, and N. Yamashita | Environmental Science & Technology

54(22):14182-14191(2020)

In this study, 248 size-specific particulate matter (PM) samples collected from nine Asian cities were analyzed for 34 PFAS. Of the 34 investigated PFAS, PFOA and PFOS were the major compounds. Hexafluoropropylene oxide dimer acid, an emerging PFAS, was quantified in PM for the first time, with concentrations ranging from less than 0.086 to 21.5 pg/m^3. Spatially PFOA and PFOS were the predominant compounds in China, while precursors, emerging PFAS, and short-chain PFAS dominated in India, Japan, and South Korea, respectively. A size-dependent distribution investigation showed that most PFAS were predominantly affiliated in fine particles, while PFOS and its alternatives tended to attach on coarser particles. PFOS distributed on specific sizes exhibited seasonal and regional dependency, while no such patterns were observed for PFOA.

PFAS AND DISSOLVED ORGANIC CARBON ENRICHMENT IN SURFACE WATER FOAMS ON A NORTHERN U.S. FRESHWATER LAKE

Schwichtenberg, T., D. Bogdan, C.C. Carignan, P. Reardon, J. Rewerts, T. Wanzek, and J.A. Field | Environmental Science & Technology 54(22):14455-14464(2020)

PFAS and dissolved organic carbon (DOC) were analyzed in nine pairs of foam and underlying bulk water samples collected from a PFAS-impacted freshwater lake. Foams were composed of 16 PFAS with concentrations as high as 97,000 ng/L (PFOS) and longer-chain, more hydrophobic PFAS. Only five PFAS, including PFOS and shorter chain lengths, were quantified in underlying bulk waters. Enrichment factors ranged from 10 (PFHxA) up to 2,830 (PFOS). AFFF-impacted foams contained the highest concentrations and numbers of PFAS classes with PFOS concentrations exceeding the 70 ng/L EPA health advisory level. PFAS concentrations were significantly below published critical micelle concentrations. Concentrations represented less than 0.1% of overall DOC concentrations in foam, indicating that PFAS are a minor fraction of DOC and that DOC likely plays a central role in foam formation. Estimates indicated that foam ingestion is a potentially important route of exposure for children and adults when they are in surface waters where foam is present.

LEAD TOLERANT ENDOPHYTE *TRAMETES HIRSUTA* IMPROVED THE GROWTH AND LEAD ACCUMULATION IN THE VEGETATIVE PARTS OF *TRITICUM AESTIVUM* L.

Malik, A., T.A. Butt, S.T.A. Naqvi, S. Yousaf, M.K. Qureshi, M.I. Zafar, G. Farooq, I. Nawaz, and M. Iqbal. | Heliyon 6(7):e04188(2020)

Trametes hirsute, an endophytic fungus, was isolated from the *Chenopodium album* L. plant growing in Pb-contaminated soil of an industrial area. When tested in vitro, the fungus was tolerant to 1,500 mg/L Pb. Wheat seedlings (*Triticum aestivum L.*) infected by *T. hirsute* showed Pb tolerance. With fungal inoculation, cumulative plant growth and total chlorophyll content increased by 24% and 18%, respectively, compared to their respective non-inoculated controls at 1000 mg/kg Pb. Similarly, 50% more Pb accumulation was measured in the shoots of fungal inoculated plants at 1500 mg/kg Pb as compared to control. Results suggest that fungi inoculation can improve host plant survival and assist with phytoextraction of heavy metals from polluted sites by increasing uptake by host plants.

PER- AND POLYFLUOROALKYL SUBSTANCES IN DUST COLLECTED FROM RESIDENTIAL HOMES AND FIRE STATIONS IN NORTH AMERICA

Hall, S.M., S. Patton, M. Petreas, S. Zhang, A.L. Phillips, K. Hoffman, and H.M. Stapleton.
Environmental Science & Technology 54(22):14558-14567(2020)

Researchers collected dust samples from 184 homes in North Carolina and 49 fire stations across the U.S. and Canada to analyze for PFAS. FTOHs and diPAPs were the most prevalent PFAS in both fire station and house dust samples, with medians of ~100 ng/g dust or greater. PFOS, PFOA, PFHxS, PFNA, and 6:2 diPAP were significantly higher in dust from fire stations, and 8:2 FTOH was significantly higher in homes. When comparing results to earlier published values, PFAA levels in residential dust appeared to decrease over time, particularly PFOA and PFOS. Results highlight a need to better understand what factors contribute to PFAS levels in dust and how much dust contributes to overall human PFAS exposure.

PUMP-AND-TREAT CONFIGURATIONS WITH VERTICAL AND HORIZONTAL WELLS TO REMEDIATE AN AQUIFER CONTAMINATED BY HEXAVALENT CHROMIUM

Bortone, I., A. Erto, A. DiNardo, G.F. Santonastaso, S. Chianese, and D. Musmarra.\
Journal of Contaminant Hydrology 235:103725(2020)

Researchers comparatively tested the efficacy of an innovative pump-and-treat (P&T) configuration for groundwater remediation by adopting either a range of spatially-optimized arrays containing vertical wells (VRW) or a single horizontal well (HRW). The study utilized a 3D transient finite element model of an unconfined aquifer containing a Cr(VI)-contamination plume to test the configurations. A sensitivity analysis helped determine the best configuration to minimize the remediation time and related cost by comparing different well diameters, pumping rates, and position of wells. A comparative cost analysis demonstrated that a single HRW achieved the clean-up goals in the same time span as the vertical wells, but at a higher price due to the excavation costs. *Read the introduction and section snippets of the article at* https://www.sciencedirect.com/science/article/abs/pii/S0169772220303144.

SPATIAL TRENDS OF ANIONIC, ZWITTERIONIC, AND CATIONIC PFASS AT AN AFFF-IMPACTED SITE

Nickerson, A., A.E. Rodowa, D.T. Adamson, J.A. Field, P.R. Kulkarni, J.J. Kornuc, and C.P. Higgins | Environmental Science & Technology 55(1):313-323(2021)

Soil and groundwater from an AFFF-impacted site were sampled at high resolution (n = 105 for soil, n = 58 for groundwater) and analyzed for an extensive list of anionic, zwitterionic, and cationic PFAS. Spatial trends for PFAAs and many precursors enabled a better understanding of PFAS composition, transport, and transformation. Summed PFAS and individual PFAS concentrations were often higher at depth than near the surface in soil and groundwater. Zwitterionic and cationic compounds composed up to 97% of the total PFAS mass in firefighter training area (FTA) soil. Composition of PFAS class, chain length, and structural isomers changed with depth and distance from the FTA, suggesting in situ transformation and differential transport. The percentage of branched PFOS increased with depth, consistent with differential isomeric transport. However, linear PFOA was enriched, suggesting fluorotelomer precursor transformation to linear PFOA. Perfluorohexane sulfonamide, a potential transformation product of sulfonamide-based PFAS, was present at high concentrations (maximum 448 ng/g in soil, 3.4 mg/L in groundwater). Precursor compounds may create long-term sources of PFAAs, although many pathways remain unknown. Precursor analysis is critical for PFAS fate and transport understanding.

General News

INCREMENTAL SAMPLING METHODOLOGY (ISM) UPDATE

ITRC Incremental Sampling Methodology Team, 283 pp, Oct 2020

The incremental sampling methodology (ISM) is a structured composite sampling and processing protocol that reduces data variability and provides a reasonably unbiased estimate of mean contaminant concentrations in a volume of soil targeted for sampling. ISM provides representative samples of specific soil volumes defined as decision units by collecting numerous (typically 30 to 100) increments of soil that are combined, processed, and subsampled according to specific protocols. This updated ITRC Incremental Sampling Methodology guidance document (ISM-2) builds on the 2012 version (ISM-1) and reflects advancements in technology. It share case studies that provide insight into the potential applications, benefits, and challenges of the approach. A clarification statement was also appended to the beginning of the ISM-1 document.
Web-based version: https://ism-2.itrcweb.org/
PDF file: https://ism-2.itrcweb.org/wp-content/uploads/2020/11/itrc_ism_compiled_508_110920.pdf

RECENT ADVANCES IN THE APPLICATION, DESIGN, AND OPERATIONS & MAINTENANCE OF AERATED TREATMENT WETLANDS

Nivala, J., C. Murphy, and A. Freeman. | Water 12(4):1188(2020)

This paper outlines recent advances in the design, application, and operations and maintenance (O&M) of aerated treatment wetland systems and current research trends. The review covers a comprehensive estimate of the number of aerated treatment wetlands and their geographic distribution worldwide, new developments in aerated wetland design and application, first-hand experiences and challenges with O&M of full-scale aerated treatment wetland systems, and knowledge gaps and suggestions for future research. *This article is* ***Open Access*** *at* https://www.mdpi.com/2073-4441/12/4/1188.

TREATMENT WELL (HRX WELL®) FOR MANAGING CONTAMINANT PLUMES IN COMPLEX GEOLOGICAL ENVIRONMENTS

Divine, C. ESTCP ER-201631, software, 2021

The HRX Well design tool was developed to provide preliminary site design estimates to practitioners considering implementing the HRX Well. Many HRX Well configurations are possible, but the applicability of any design is subject to site-specific factors. The tool allows the user to optimize the design based on user-provided values using equations described in https://onlinelibrary.wiley.com/doi/abs/10.1002/rem.21571. Supplemental literature values can also be used as inputs to support high-level estimations. The tool predicts well length, capture width, and the number of wells required to meet target treatment goals. In addition, the associated costs and sustainability implications are calculated, which can further inform design selection. For many sites, a site-specific numerical flow and transport model may be useful for final design and predict and assess HRX Well performance.
https://www.serdp-estcp.org/content/download/52158/513260/file/ER-201631%20Design%20Tool.xlsx *User's Guide:*
https://www.serdp-estcp.org/content/download/52165/513376/file/ER-201631%20Design%20Tool%20User%E2%80%99s%20Guide.pdf

PHYTOREMEDIATION: A PROMISING APPROACH FOR REVEGETATION OF HEAVY METAL-POLLUTED LAND

Yan, A., Y. Wang, S.N. Tan, M.L.M. Yusof, S. Ghosh, and Z. Chen.
Frontiers in Plant Science 11:359(2020)

A better understanding of the mechanisms underlying heavy metal accumulation and tolerance in plants is necessary to improve phytoremediation efficiency. This review describes the mechanisms of how heavy metals are taken up, translocated, and detoxified in plants with a focus on the strategies applied to improve the efficiency of phytostabilization and phytoextraction, including the application of genetic engineering, microbe-assisted, and chelate-assisted approaches. *This article is* ***Open Access*** *at* https://www.frontiersin.org/articles/10.3389/fpls.2020.00359/full.

STRATEGIES FOR MANAGING RISK DUE TO BACK DIFFUSION

Brooks, M.C., E. Yarney, and J. Huang.
Groundwater Monitoring & Remediation [Published 16 December 2020 prior to print]

Contaminant back diffusion from secondary sources may hamper site remediation if it is not properly addressed in the remedial design. This paper reviews reported technologies and strategies that have been or could be applied to address plume persistence due to back diffusion as published in the peer-reviewed literature. The technologies and strategies are classified into four major categories: 1) passive low permeable zones (LPZ) management approaches; 2) strategies that promote contaminant destruction through the forward diffusion of amendments into the LPZ; 3) strategies that alter physical characteristics of the secondary source, including viscosity modification, fracturing, and soil mixing; and 4) thermal and electrokinetic remediation.

IDENTIFYING AND MANAGING AQUEOUS FILM-FORMING FOAM-DERIVED PER- AND POLYFLUOROALKYL SUBSTANCES IN THE ENVIRONMENT

Leeson, A., T. Thompson, H.F. Stroo, R.H. Anderson, J. Speicher, M.A. Mills, J. Willey, C. Coyle, R. Ghosh, C. Lebron, and C. Pattonk.
Environmental Toxicology and Chemistry 40(1):24-36(2021)

This paper provides an overview of research and development efforts to date by SERDP and ESTCP related to analytical advancements, fate and transport, ecological risks, and remedial strategies to assist in managing aqueous film-forming foam (AFFF)-impacted sites. The projects aim to measure PFAS in the environment, characterize AFFF-associated sources of PFAS, understand PFAS fate and behavior in the environment, assess the risk to ecological receptors, develop in situ and ex situ treatment technologies for groundwater, treat soils and investigation-derived wastes, and examine the ecotoxicity of PFAS-free fire suppression formulations. https://setac.onlinelibrary.wiley.com/doi/epdf/10.1002/etc.4894

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