

Technology Innovation News Survey

Entries for September 1-15, 2022

Market/Commercialization Information

ENHANCED AQUIFER RECHARGE PERFORMANCE AND POTENTIAL RISK IN DIFFERENT REGIONAL AND HYDROGEOLOGIC SETTINGS

EPA Office of Science Advisor, Policy and Engagement, Office of Research and Development
Funding Opportunity EPA-G2022-STAR-J1, 2022

The U.S. Environmental Protection Agency (EPA), as part of its Science to Achieve Results (STAR) program, is seeking applications proposing research to improve understanding of fit-for-purpose uses and risks to advance the scientific and technical foundation of enhanced aquifer recharge (EAR). While EAR implementation and management has been an active research topic for many years, significant knowledge gaps remain concerning "best practices" in the design, siting, performance (hydrologic and water quality), longevity, maintenance, and monitoring of EAR in different land use and hydrogeologic settings. Applications should address three of the four research areas below:

- Research Area 1: Research on the effect of local subsurface geology and hydrology on EAR effectiveness
- Research Area 2: Research on the effect of source water (excluding oil and gas-produced water) and the ability of sub-surface geology to degrade or attenuate conventional and emerging contaminants (including pathogens) that might be found in different sources of water
- Research Area 3: Research on methods and technologies for monitoring and maintenance of EAR systems to improve and maintain performance and operational efficiency (both quality and quantity) and reduce potential environmental and public health risk
- Research Area 4: Research on computational modeling and scientific visualization

Public and private nonprofit institutions/organizations, public and private institutions of higher education (IHEs), and hospitals located in the U.S. and its territories or possessions; state and local governments; Federally Recognized Indian Tribal Governments; and U.S. territories or possessions are eligible to apply. Profit-making firms and individuals are not eligible to apply. It is anticipated that approximately \$8 million will be awarded under this announcement, depending on the availability of funds, quality of applications received, and other applicable considerations. The EPA anticipates funding approximately 4 awards under this RFA. Requests for amounts in excess of a total of \$2,000,000 per award, including direct and indirect costs, will not be considered. The total project period requested in an application submitted for this RFA may not exceed 3 years. Offers are due by November 9, 2022 at 11:59 pm EDT. <https://www.epa.gov/research-grants/enhanced-aquifer-recharge-performance-and-potential-risk-different-regional-and>

STRATEGIC ENVIRONMENTAL RESEARCH AND DEVELOPMENT PROGRAM (SERDP) – SUPPLEMENTAL BROAD AGENCY ANNOUNCEMENT

U.S. Army Corps of Engineers, Humphreys Engineer Center Support Activity, Alexandria, VA.
Contract Opportunities on SAM.gov, Solicitation W912HQ22S0025, 2022

The Department of Defense (DoD) Strategic Environmental Research and Development Program (SERDP) Office is interested in receiving proposals for research focused on developing analytical methodologies for determining total PFAS in PFAS-free firefighting formulations. This announcement declares SERDP's intent to competitively fund research and development for environmental research that addresses the Statements of Need in the Announcement under (NAICS) code 541715 with the small business size standard of 1000 employees. The Program Announcement and complete submittal instructions are found on the DoD SERDP website at www.serdp.eastcp.org/workingwithus. No request for proposals (RFP), solicitation, or other announcement of this opportunity will be made. Awards will take the form of contracts. Submission of pre-proposals is not restricted in any way to any particular entity. There is no commitment by SERDP to make any contract awards nor to be responsible for any costs incurred by the offeror before contract award is made. It is anticipated that multiple awards totaling approximately \$10.0 million will be made available for projects dependent upon the quality of proposals received and availability of funds. Prior to award, selected contract proposals that exceed \$750,000 submitted by all Other than Small Business concerns must be accompanied by a Small Business Subcontracting Plan in accordance with FAR 52.219-9 (Deviation) and elements as described in the checklist in DFARS PGI 219.705-4 at <http://business.defense.gov/Acquisition/Subcontracting/>. Additionally, selectees located outside the United States and outlying areas who will perform their project outside of the United States and outlying areas are exempt from submitting a Small Business Subcontracting Plan. To be eligible for consideration, readers wishing to respond to this announcement must submit a proposal in accordance with all instructions on the SERDP website no later than 2:00 p.m. EDT on October 28. No electronic mail, faxed, or hard copy proposals will be accepted. <https://sam.gov/npp/5056d65090364899a167e2129d30e/view#general>

REQUEST FOR RESPONSES TO GROUNDWATER DATA WAREHOUSE SURVEY

Michigan's Department of Environment, Great Lakes, and Energy (EGLE), 2022

Michigan's Department of Environment, Great Lakes, and Energy (EGLE) is working to create a warehouse for groundwater data. The goal is to create a system that provides a one-stop shop for groundwater data that can be leveraged easily within the department, gives consultants and members of industry a user-friendly tool for data input, and that also provides relevant and interactive data to the public. This survey is intended to determine what similar systems exist, to find the best practices already being utilized, and to understand what lessons can be learned before starting this journey. EGLE appreciates the time and effort required to complete the survey and recognizes that users may need to reach out to colleagues to answer some of these questions. There is only one required question, and users are allowed to skip any other question not required. Users may share the link with others that may provide relevant information. This survey will be available through Friday, October 21st. Users may provide their email at the end of the survey if they are interested in reading about survey results. *The survey can be accessed at* <https://survey123.arcgis.com/share/8ee03cfd0a0b476d827238af8c108672width=1000>.

Cleanup News

COUPLED HYDROGEOCHEMICAL APPROACH AND SUSTAINABLE TECHNOLOGIES FOR THE REMEDIATION OF A CHLORINATED SOLVENT PLUME IN AN URBAN AREA

Ciampi, P., C. Esposito, E. Bartsch, E.J. Alesi, C. Nielsen, L. Ledda, L. Lorini, and M.P. Papini.
Sustainability 14:10317(2022)

Using a geodatabase-driven and coupled hydrogeochemical approach, two distinct technologies were chosen to remediate a PCE plume in a district characterized by complex hydrology and limited accessibility. Coaxial groundwater circulation (CGC) wells coupled with air sparging (AS) aspire to promote in situ transfer of PCE from the contaminated matrices into a gaseous stream that was then treated above ground. Reagent injections were used to enhance chemical reduction combined with in situ adsorption, creating contaminant adsorbent zones to stimulate dechlorinating biological activity. Developing an integrated conceptual site model harmonized geological, hydrochemical, and membrane interface probe data to capture site-specific hydrogeochemical peculiarities to support decision-making. Hydrochemical monitoring revealed contamination dynamics and decontamination mechanisms in response to treatment, quantifying the performance of the adopted strategies and investigating possible rebound effects. The estimation of masses extracted by the CGC-AS system validated the effectiveness of a new and sustainable technique to abate chlorinated solvents in groundwater. *This article is Open Access at* <https://www.mdpi.com/2071-1050/14/16/10317/html>.

POST-REMEDIATION GEOPHYSICAL ASSESSMENT: INVESTIGATING LONG-TERM ELECTRICAL GEOPHYSICAL SIGNATURES RESULTING FROM BIOREMEDIATION AT A CHLORINATED SOLVENT CONTAMINATED SITE

Kessouri, P., T. Johnson, F.D. Day-Lewis, C. Wang, D. Ntargiannis, and L.D. Slater.
Journal of Environmental Management 302(Part A):113944(2022)

A post-remediation geophysical assessment was conducted in a shallow, chlorinated solvent-contaminated aquifer 6 to 8 years after amendment delivery. Surface resistivity imaging, cross-borehole resistivity, and induced polarization (IP) imaging were performed on a transect that spanned treated and untreated zones of the aquifer. Established relationships between IP parameters and surface electrical conductivity predicted vertical profiles of electrolytic conductivity and surface conductivity from the inverted cross-borehole images. Aqueous geochemistry data and natural gamma and magnetic susceptibility logs were used to constrain the interpretation. The electrical conductivity structure determined from surface and borehole imaging was foremost controlled by the electrolytic conductivity of the interconnected pore space, being linearly related to fluid-specific conductance. The electrolytic conductivity (and thus the conductivity images alone) did not discriminate between treated and untreated zones of the aquifer. In contrast, inverted phase angles and surface conductivities did discriminate between treated and untreated zones of the aquifer, with the treated zone being up to an order of magnitude more polarizable in places. Supporting aqueous chemistry and borehole logging datasets indicate that this geophysical signal from the long-term impact of the remediation on the aquifer is most likely associated with the formation of polarizable, dispersed iron sulfide minerals.

RAPID SOURCE ZONE REMEDIATION OF TCE IN FRACTURED BEDROCK USING HIGH-FLOW INJECTION

Pizarro, D. I. DCHWS Design and Construction Spring 2022 Symposium, 30 March-1 April, Philadelphia, PA, 14 slides, 2022

Trap & Treat® BOS 100® was injected in shale fractured bedrock at a commercial site in New Jersey to remediate TCE in fractured bedrock. Efforts focused on treating groundwater in bedrock since chlorinated solvent impacts were not above limits for overburden soils. Transition zone injections were completed by installing Pre-Drill access points for Direct Push Technology injection using high-pressure and high-flow Vanner pumps. Wells were installed with air rotary/HSA, and the vertical interval of interest was left uncased for borehole geophysical tooling, discrete interval (18-inch) sampling via straddle packer, and straddle-packer injection. The custom bedrock injection unit was mobilized to the site to provide effective distribution of BOS 100 in secondary and primary porosities in the bedrock. The project objective for TCE and 1,1-DCE in groundwater was 1 ug/L. BOS 100 slurry was applied within the fracture network of three wells and ten pre-drilled points within the transition zone. Fracture Network Injections were conducted using a bedrock truck unit that provides high flow rates through a narrow (18-inch) straddle packer system. Transition Zone injections were also conducted using the bedrock truck unit; injections were completed using high flow rates through 2.25" direct-push rods with a custom port injection tip. Injection flow rates of 70 to 100 gals/min were used throughout the project. Before transition and bedrock zone injections, the maximum baseline concentrations for the target contaminants in MW-2 were 73.1 ug/L for TCE and 3.3 ug/L for 1,1-DCE. All monitoring wells within the treatment footprint achieved the project objective of 1 ug/L for TCE and 1,1-DCE in less than 6 months of the injection event. https://drive.google.com/file/d/175C0rTRT8I_ezw6E_T42rM_IaG1IGY1a7/view.

Demonstrations / Feasibility Studies

EPA ANNOUNCES PROPOSED PLAN FOR REMEDY MODIFICATION

EPA Region 2, 17 pp, 2022

This Proposed Plan evaluates alternatives to address the remaining groundwater source area contamination where concentrations are the highest at the Cosden Chemical Coatings Superfund site in Beverly, New Jersey. The preferred alternative includes groundwater remediation using in-situ treatment in source areas. EPA will select a final remedy for the site after reviewing and considering all information submitted during the 30-day public comment period. Previous site work includes decontamination and demolition, a soil vapor extraction system to remediate the vadose zone, and groundwater extraction with onsite treatment and recharge. This amendment adds additional remedial action objectives to the existing remedy. EPA initiated an in situ chemical oxidation (ISCO) pilot study to determine if it could address the remaining groundwater source area contamination. Thousands of individual groundwater contaminant analyses were obtained during the ISCO pilot study. New monitoring wells installed during the pilot study helped to delineate the extent of total xylenes (TEX) and the magnitude of the remaining TEX groundwater contamination. In addition, water-level elevations measured using new and existing monitoring wells confirmed the direction of shallow groundwater flow. ISCO injections successfully eliminated or reduced TEX concentrations at monitoring wells within targeted treatment zones. Of 16 monitoring wells, 14 showed significant declines (>50%) in TEX compound concentrations between initial and after pilot test sampling. TEX concentrations in groundwater remained high in some monitoring wells. Ethylbenzene levels during the same period decreased by ~50%. Based on pilot study calculations, the volume of contaminated groundwater was reduced by the four rounds of ISCO injections by ~73%. <https://semspub.epa.gov/work/02/645019.pdf> See focused feasibility study for more information on the pilot study: <https://semspub.epa.gov/work/02/645019.pdf>

PERFORMANCE OF FIELD-SCALE PERMEABLE REACTIVE BARRIERS: AN OVERVIEW ON POTENTIALS AND POSSIBLE IMPLICATIONS FOR IN-SITU GROUNDWATER REMEDIATION APPLICATIONS

Singh, R., S. Chakma, and V. Birke.
Science of The Total Environment [Published 16 September 2022 before print]

This study presents a comprehensive overview of field-scale PRBs applications and their long-term performance after onsite emplacements. In-depth insight into PRBs as a potential passive remedial measure, covering all significant dimensions for eliminating the contaminated plume over a long time in the subsurface, is provided. The overview will allow stakeholders to understand

the implications of PRB's field-scale application and undertake the required measures before its onsite application to avoid any potential failure.

PILOT TEST WORK PLAN: PER- AND POLYFLUOROALKYL SUBSTANCES GROUNDWATER REMEDIATION AT SITE 5 – FORMER FIRE TRAINING AREA, FORMER NAVAL AIR STATION JOINT RESERVE BASE WILLOW GROVE, HORSHAM TOWNSHIP, PENNSYLVANIA

Tetra Tech for the Department of Navy, 116 pp, 2021

A pilot test is being conducted at the Site 5 Fire Training Area to evaluate the effectiveness of single-use and regenerable ion exchange (IX) resin technologies coupled with evaluating the feasibility of plasma treatment of still bottoms produced from regeneration to treat PFAS from extracted groundwater. The treatment goals for the pilot study are the EPA risk-based tap water screening levels for PFBS, the EPA Lifetime Health Advisory for total combined PFOA and PFOS, and the water quality management (WQM) permit equivalency discharge limits. Groundwater will be pumped from the plume into a treatment train system housed in two containers. Container 1 consists of the equalization tank, feed pump, sand filters, bag filters, single-use IX vessels, regenerable IX vessels, GAC vessels, effluent holding tank, effluent discharge pump, backwash holding tank, and backwash pump. Container 2 will house a plasma treatment system. Water from the extraction wells is collected in an influent equalization tank when water first enters Container 1 and is transferred to parallel sand filters and then through bag filters to remove any suspended solids and precipitated iron. From the bag filters, the water flow will be split into two IX treatment trains for the treatment of PFAS compounds. Train 1 will consist of two vessels in series using SORBIX™ single-use IX resin. Train 2 will consist of two vessels in series with SORBIX regenerable A3F IX resin. The PFAS-treated water from the two IX treatment trains will be combined into a single stream and treated using two granular activated carbon vessels in series to remove VOCs or other organics prior to discharge. After ~three months, the regenerable IX resin train will be taken offline for resin regeneration in the lead vessel. The regenerated vessel will be returned to the lead position to complete a second and third loading cycle to evaluate the performance of the IX resin after regeneration. The spent regenerant produced during the resin regeneration process will be processed into "still bottoms" for treatment in Container 2 using plasma treatment technology. Sampling will occur after each treatment step and from surrounding monitoring wells to evaluate the system's effectiveness during the pilot study.

https://www.horshamlibrary.org/files/ugd/565697_dfe9113b694efaafbf06cfd2e8ad3.pdf All site documents, including monitoring results from 2022:
<https://www.horshamlibrary.org/willow-grove-nas>

Research

BIOTRANSFORMATION OF 6:2 FLUOROTELOMER THIOETHER AMIDO SULFONATE IN AQUEOUS FILM-FORMING FOAMS UNDER NITRATE-REDUCING CONDITIONS

Yi, S., K.C. Harding-Marjanovic, E.F. Houtz, E. Antell, C. Olivares, R.V. Nichiporuk, A.T. Iavarone, W.-Q. Zhuang, J.A. Field, D.L. Sedlak, and L. Alvarez-Cohen. Environmental Science & Technology 56(15):10646-10655(2022)

Microcosms were constructed under nitrate-reducing conditions to simulate biotransformation at AFFF-impacted groundwater sites. The biotransformation of 6:2 fluorotelomer thioether amido sulfonate (6:2 FT(AoS)), a principal PFAS constituent of several AFFF formulations, was investigated using quantitative liquid chromatography-tandem mass spectrometry and qualitative high-resolution mass spectrometry analyses. Results reveal that the biotransformation rates of 6:2 FT(AoS) under nitrate-reducing conditions were ~10 times slower than under aerobic conditions but ~2.7 times faster than under sulfate-reducing conditions. Although minimal production of 6:2 fluorotelomer sulfonate and perfluorohexanoate was observed, fluorotelomer thioether and sulfinyl compounds were identified in aqueous samples. Evidence for the formation of volatile PFAS was obtained using the total oxidizable precursor assay and detection of 6:2 fluorotelomer thiol by gas chromatography-mass spectrometry. Results underscore the complexity of PFAS biotransformation and the interactions between redox conditions and microbial biotransformation activities and contribute to the better elucidation of PFAS environmental fate and impact.

COMBINED TECHNOLOGIES FOR IN SITU REMEDIATION OF TC-99 AND U IN SUBSURFACE SEDIMENTS

Gartman, B.N., E.S. Arnold, J.E. Szescody, C. Bagwell, C.F. Brown, S.A. Saslow, C.I. Pearce, V.L. Freedman, and N.P. Qafoku. Pacific Northwest National Laboratory Report PNNL-31959, 35 pp, 2021

In this study, systematic bench-scale experiments were conducted to compare the effectiveness of combinations of chemical-based remedial treatments for the stable sequestration of radionuclide contaminant mixtures. A perched aquifer sits beneath the B-Complex in the 200 East Area at the Hanford Site. Contamination of the vadose zone and the perched aquifer results from planned releases from infiltration galleries and unplanned releases from the overlying tank farms and associated facilities. The perched zone is a continuing source for U, Tc, and NQ; to the underlying aquifer. Water extraction is the current response action, but the large footprint and low hydraulic conductivity limit the effective removal of contaminants. A chemical reductant to geochemically transform Tc and U to reduced (insoluble) species was applied, followed by a sequestration treatment that coats or incorporates the radionuclides into precipitate phases to prevent oxidative re-mobilization. The results demonstrate effective stabilization of co-mingled contaminants, which could provide a technical foundation from which a strategy for in situ remediation and stabilization of long-lived contaminants can be based. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-31959.pdf

PYROLYSIS PROCESSING OF PFAS-IMPACTED BIOSOLIDS, A PILOT STUDY

Thoma, E.D., R.S. Wright, I. George, M. Krause, D. Presezi, V. Villa, W. Preston, P. Deshmukh, P. Kauppi, and P.G. Zemek. Journal of the Air & Waste Management Association 72(4):309-318(2022)

A limited-scope study investigated removing target PFAS using a commercial pyrolysis system processing biosolid. Two independent labs analyzed 41 target PFAS compounds in biosolids and biochar. The concentrations of 21 detected target compounds in the input biosolid ranged between ~2 µg/kg and 85 µg/kg. No PFAS compounds were detected in the biochar, therefore, concentrations in the biochar were assumed to equal the compounds' minimum detection limits (MDLs). The pyrolysis system's target PFAS removal efficiencies (REs) were estimated to range between >81.3% and >99.9% (mean >97.4%) with the lowest REs being associated with the lowest detected PFAS concentrations and the highest MDLs. No information on non-target PFAS compounds in influent or effluent media or products of incomplete combustion was considered. Selected gaseous emissions were measured by Fourier transform infrared spectroscopy and gas chromatography time-of-flight mass spectrometry to provide additional information on air emissions after process controls. <https://www.tandfonline.com/doi/epub/10.1080/10962247.2021.2009935?needAccess=true>

SELECTION OF OPTIMIZED BINDERS FOR DECHLORINATION OF TRICHLOROETHYLENE-CONTAMINATED SITES BY JET GROUTING AND DEEP SOIL MIXING

Freitag, P., H. Maurer, and T.G. Reichenauer. Journal of Environmental Engineering 147:11(2021)

Six binder materials (bentonite and ordinary portland cement [OPC], among others) were investigated for interactions with the reductive dechlorination of TCE by nanoscale zero-valent iron (nZVI). The installation process was simulated in batch experiments, and the reaction products (CHC, intermediate products, and hydrogen) were observed using headspace gas chromatography. None of the binders inhibited dechlorination of TCE compared to a control experiment, and two clay materials catalyzed the reaction by a factor of up to 12.9. Hydrogen evolution was determined as a sensible indicator for the suitability of a particular binder, ranging from 12.8 to 4,400 mmol.

A NOVEL TWO-STEP APPROACH FOR OPTIMAL GROUNDWATER REMEDIATION BY COUPLING EXTREME LEARNING MACHINE WITH EVOLUTIONARY HUNTING STRATEGY BASED METAHEURISTICS

Majumder, P. and C. Lu. Journal of Contaminant Hydrology 243:103864(2021)

A simulation-optimization (S-O) model based on a novel two-step strategy was proposed to optimize the design of groundwater remediation systems. S-O models were developed by coupling simulation models directly or through an extreme learning machine (ELM) with evolutionary hunting strategy-based metaheuristics (EHSMs). In the first step, EHSMs with a combinatorial optimization technique were used to obtain optimal pumping locations by minimizing the percentage of contaminant mass that remained in the aquifer while keeping the pumping strategy constant. The optimal pumping locations were used as direct inputs in the second step. A composite function was employed to minimize the sum of the water extraction rates and the percentage of extracted contaminant mass by constraining hydraulic heads and contaminant concentrations. The performance of the two-step strategy was slightly better and computationally more efficient than the alternate approach. Moreover, various statistical measures suggest the superiority of EHSMs over other metaheuristics for groundwater remediation.

ANTHROPOGENIC DRIVERS OF VARIATION IN CONCENTRATIONS OF PERFLUOROALKYL SUBSTANCES IN OTTERS (LUTRA LUTRA) FROM ENGLAND AND WALES

O'Rourke, E., J. Hynes, S. Losada, J.L. Barber, M.G. Pereira, E.F. Kean, F. Hailer, and E.A. Chadwick. Environmental Science & Technology 56(3):1675-1687(2022)

The presence of PFAS in Eurasian otters (*Lutra lutra*) in England and Wales and their association with anthropogenic sources are reported in this study. Fifteen compounds were analyzed: 10 PFCAs, 4 PFASs, and PFOSs in the lipid diet between 2007 and 2019. PFASs were detected in all otters, with 12 of 15 compounds detected in ≥80% of otters. PFOSs accounted for 75% of the PFASs profile, with a maximum concentration of 6,800 µg/kg wet weight (ww). Long-chain (≥C8) PFCAs accounted for 99.9% of the PFCA profile, with PFDA and PFNA having the highest maxima (369 µg/kg ww and 170 µg/kg ww, respectively). PFCA concentrations were negatively associated with the distance from a factory that used PFOA in polytetrafluoroethylene manufacture. Most PFAS concentrations in otters were positively associated with load entering wastewater treatment works (WWTW) and with arable land, suggesting that WWTW effluent and sewage sludge-amended soils are significant pathways of PFASs into freshwaters. Results reveal the widespread pollution of British freshwaters with PFASs and demonstrate the utility of otters as effective sentinels for spatial variation in PFAS concentrations.

CO2 FOOTPRINT ANALYSIS OF CONSOLIDATED AND INNOVATIVE TECHNOLOGIES IN REMEDIATION ACTIVITIES

Vocciante, M., A. de Folly D'Auris, E. Franchi, G. Petruzzelli, and S. Ferro. Journal of cleaner production 297:126723(2021)

The potential application of different remediation approaches to heavy metal contamination was studied by examining the consequences of their environmental impact through a Life Cycle Assessment (CO₂ footprint analysis) procedure to identify the least impacting option from an environmental point of view. Phytoremediation (with various options for the disposal of the biomass generated) and an electrokinetic approach (powered by renewable and non-renewable sources) were compared with soil washing (off-site or ex situ onsite) and excavation and landfill disposal (commercial or municipal waste). Environmental impacts were reported in terms of global warming potential over 100 years and normalized to the cubic meter of soil to be remediated. The analyses considered each process in its entirety (from cradle to grave) and was applied on a ~700 m² area in an abandoned industrial district in Tuscany, Italy. Results for each technology were compared, highlighting the phases, activities, and materials that present the greatest impacts for each approach (both in relative and absolute terms). Aspects that would otherwise have been difficult to notice, such as the weight of chelating agents in phytoremediation or the use of energy from renewable sources for the electrokinetic approach, were revealed. The resulting increase in knowledge of the technologies considered paves the way for further "eco-compatible" changes and improvements.

General News

SUSTAINABLE ENVIRONMENTAL REMEDIATION VIA BIOMIMETIC MULTIFUNCTIONAL LIGNOCELLULOSIC NANO-FRAMEWORK.

Li, J., X. Li, Y. Da, J. Yu, B. Long, P. Zhang, C. Bakker, B.C. McCarl, J.S. Yuan, and S.Y. Dai. Nature Communications 13:4368(2022)

An in situ PFAS remediation system was developed that employs a plant-derived biomimetic nano-framework to synergistically achieve highly efficient adsorption and subsequent fungal biotransformation. The Renewable Artificial Plant for In-situ Microbial Remediation (RAPIMER) exhibits high adsorption capacity for PFAS compounds and diverse adsorption capability toward co-contaminants. Subsequently, RAPIMER provides the substrates and contaminants for in situ bioremediation via fungus *Irpex lacteus* and promotes PFAS detoxification. RAPIMER arises from inexpensive lignocellulosic sources, enabling a broader impact on sustainability and a means for low-cost pollutant remediation.

A REVIEW OF RECENT STUDIES ON TOXICITY, SEQUESTRATION, AND DEGRADATION OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

Dickman, R.A. and D.S. Aga. Journal of Hazardous Materials 436:129120(2022)

Selected papers from the Journal of Hazardous Materials between January 2018 and May 2022 on the toxicity, sequestration, and degradation of PFAS are reviewed and made available as open-access publications for one year to facilitate the distribution of critical knowledge surrounding PFAS. The review discusses routes of toxicity as observed in mammalian and cellular models

and the observed human health effects in exposed communities. The paper highlights studies that evaluate toxicity through in-silico approaches; discusses removal of PFAS through modified carbon sorbents, nanoparticles, and anion exchange materials; and compares treatment efficiencies for different classes of PFAS. Various biotic and abiotic degradation techniques and the pathways and mechanisms involved are reviewed to better understand the removal efficiencies and cost-effectiveness of existing treatment strategies.

THE IMPORTANCE OF ABIOTIC TRANSFORMATIONS IN NATURAL ATTENUATION OF CONTAMINATED GROUNDWATER

Naval Facilities Engineering Systems Command, 4 pp, 2022

This fact sheet focuses on abiotic transformations in the natural attenuation of chlorinated ethenes in groundwater. For sites where active remediation has been in place for many years, documenting the occurrence of abiotic processes may facilitate a transition to monitored natural attenuation (MNA), defined by EPA as "the reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a timeframe that is reasonable compared to that offered by other more active methods." https://exwc.navy.mil/Portals/88/Documents/EXWC/Restoration/er_pdfs/rits/AbioticTransformations_FactSheet.pdf?ver=-h10IVR-SPNCU6QXm4h70%3d%3d

FORECASTING GROUNDWATER CONTAMINANT PLUME DEVELOPMENT USING STATISTICAL AND MACHINE LEARNING METHODS

McConnell, L., K.K. Askarani, K.E. Cognac, E.E. Mack, C. Bartlett, M.J. Ronayne, and J. Blötevogel. | Groundwater Monitoring & Remediation 42(3):34-43(2022)

The viability of two forecasting models -Prophet and damped Holt's exponential smoothing model - were used to predict groundwater contaminant plume development and evaluate the impacts of spatial and temporal data density on the accuracy of the forecasts. The damped Holt's method achieved more accurate forecasts for wells with declining contaminant concentrations. Only the Prophet model allowed for the inclusion of exogenous regressors, enabling predictions of future declining trends in wells with still increasing contaminant concentrations. Applying the models requires robust training data and an understanding of model biases. While powerful data-driven models are available for contaminant plume prediction, groundwater sampling approaches need to improve by collecting real-time spatial and temporal high-resolution data to take full advantage of their capabilities. <https://ngwa.onlinelibrary.wiley.com/doi/epdf/10.1111/gwmr.12523>

INNOVATIVE UTILIZATION OF MOLECULAR IMPRINTING TECHNOLOGY FOR SELECTIVE ADSORPTION AND (PHOTO)CATALYTIC ERADICATION OF ORGANIC POLLUTANTS

Guan, G., J.H. Pan, and Z. Li. | Chemosphere 265:129077(2021)

This review introduces molecular imprinting technology (MIT) to understand their preparation processes, recognition mechanisms, and common imprinted systems. Their specific binding affinities are demonstrated to selectively adsorb and remove target molecules with a large capacity. An overview of the innovative utilization of MIT in catalytic eradication of pollutants is provided to emphasize their enhanced efficiency and improved performances, classified by the used catalytically-active nanocrystals and imprinted systems. Recent advances in these fields are summarized, limitations are discussed, and possible suggestions are given to guide the future exploitation of MIT for environmental protection.

The Technology Innovation News Survey welcomes your comments and suggestions, as well as information about errors for correction. Please contact Michael Adam of the U.S. EPA Office of Superfund Remediation and Technology Innovation at adam.michael@epa.gov or (703) 603-9915 with any comments, suggestions, or corrections.

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