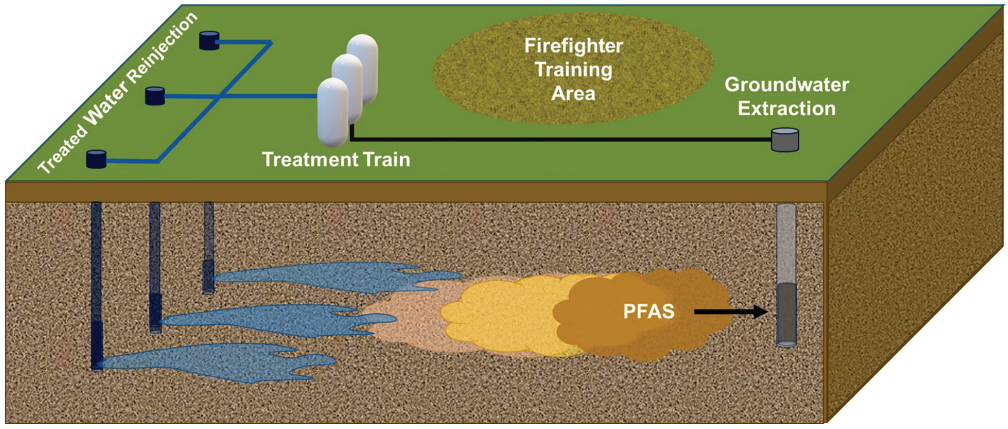
PROJECT ID:
602

Closed Loop, In Situ Soil Flushing at PFAS-Impacted Source Zones



The fundamental processes involved in in situ soil flushing for PFAS-impacted sites.
(Graphic Credit: Jovan Popovic)

OBJECTIVE

The goal of this effort is to demonstrate that in situ soil flushing, used in conjunction with sorption and destructive treatments, is a viable method for the removal and subsequent destruction of polyfluoroalkyl substances (PFAS) from affected soil.

PROBLEM STATEMENT

PFAS are a group of thousands of chemicals that have become widespread and persistent at Department of Defense sites primarily due to the use in aqueous film forming foams (AFFF) during firefighting training and execution. PFAS chemicals can persist for years following groundwater treatment. Further, waste management entities are becoming increasingly reluctant to accept any PFAS-laden material, thereby increasing the complexity of PFAS disposal.

DESCRIPTION

Meeting discharge limits will ultimately be achieved through both significantly reducing the source and destroying any PFAS captured during treatment. In situ source treatment will also decrease high concentration PFAS mass stored in soils, which may decrease the chemicals' persistence in soils and groundwater down the road. This approach is more accurate and less costly than treating the resultant plume.

In situ soil flushing is a minimally invasive technology that has historically been employed for subsurface remediation, allowing for sites to reach specified cleanup goals without excavation. This technology is predicated on the use of water to mobilize chemicals bound to source zone soils, after which the resultant mixture is pumped from an extraction well for subsequent treatment and reinjection.

Certain PFAS compounds adhere to clays or organic matter found in soil more readily than that of other PFAS, but it is becoming increasingly apparent that these compounds may flush out quite rapidly under augmented flow.

The first task will be laboratory testing of sample soils taken from an affected area. Flow conditions will represent that of the proposed treatment conditions, but at a much smaller scale. Upon successful completion of this task, a pilot scale trailer utilizing conventional PFAS removal strategies will be mobilized to treat source area groundwater. Treated water will subsequently be reinjected into an adjacent well to further dislodge PFAS bound to soil. PFAS concentrations are expected to decline with repeated cycles.

Using data leveraged from another NESDI project (no. 555: Demonstrating the Effectiveness of Novel Treatment Technologies for the Removal of Poly- and Perfluoroalkyl Substances from Groundwater), the project team will further investigate the potential for onsite sorbent regeneration. Sorbent regeneration can be achieved through either direct destruction of PFAS sorbed to the filter media (e.g., thermal, electrochemical or acoustic/sonolytic treatment) or eluting the sorbed PFAS into a small liquid matrix. This study intends to demonstrate the latter concept, where small batches of PFAS-containing liquid regenerant will undergo subsequent destruction using a pilot scale sonolysis reactor developed under a NAVFAC Headquarters-funded project.

Pilot treatment trailer containing sorption units and sonolysis reactor to be used for this project's field effort. (Photo Credit: Jovan Popovic)

Pilot-scale sonolysis reactor destroying PFAS-containing AFFF. (Photo Credit: Jovan Popovic)

RETURN ON INVESTMENT

It is estimated that impacted soil disposal can cost upwards of $1,500 per ton. Using sites such as former Naval Air Station Joint Reserve Base Willow Grove as an example, PFAS-impacted soil excavation and disposal at this one site may cost roughly $6.75 million. If the Navy has even three sites requiring a similarly invasive approach for soil cleanup, the estimated return on investment using the proposed method would be roughly 38.7.

NAVY BENEFITS

It is hoped that this process will replace or limit the expensive soil excavation method previously used for PFAS-impacted soils and and will eliminate the need for disposal. Further, given that a closed loop, direct extraction/treatment/reinjection approach will avoid laborious permitting requirements, this method may allow for more rapid deployment at sites which currently struggle with managing PFAS-impacted soils.

TRANSITION DESCRIPTION

Team members will directly interface with Navy site managers to understand the feasibility of implementing this approach at PFAS-impacted sites as both the project and reporting nears completion. Initial iterations of follow-on efforts will likely utilize the mobile treatment system described above to treat PFAS-impacted source areas at installations across the continental United States. This will ultimately allow for rapid mobilization and control of PFAS source areas in the Navy's portfolio. Using lessons learned from this effort, more permanent (or full-scale) source area treatment solutions will be investigated should this be required. A final report will be produced and additional knowledge dissemination will be achieved through presentations at the Remediation Innovative Technology Seminar (RITS), environmental restoration manager training and peer-reviewed journal articles.

CONTACT

For more specific information about this project, contact the Principal Investigator at 805-982-6081.

ABOUT THE NESDI PROGRAM

The Navy Environmental Sustainability Development to Integration (NESDI) program is the Navy's environmental research and development, demonstration and validation (6.4) program, sponsored by the Chief of Naval Operations, Energy and Environmental Readiness Division (OPNAV N45) and managed by the Naval Facilities Engineering Systems Command (NAVFAC) out of the Engineering and Expeditionary Warfare Center (EXWC) in Port Hueneme, CA.

The mission of the program is to provide solutions by demonstrating, validating and integrating innovative technologies, processes, materials, and filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Fleet readiness and lethality. The program accomplishes this mission through the evaluation of cost-effective technologies, processes, materials and knowledge that enhance environmental readiness of naval shore activities and ensure they can be integrated into weapons system acquisition programs.

The program is the Navy's complement to the Department of Defense's Environmental Security Technology Certification Program which conducts demonstration and validation of technologies important to the tri-Services, U.S. Environmental Protection Agency and Department of Energy.

For more information, visit the NESDI program web site at www.navfac.navy.mil/nesdi or contact Ken Kaempffe, the NESDI Program Manager at 805-982-4893, DSN: 551-4893 or kenneth.c.kaempffe.civ@us.navy.mil.