PROJECT ID:
631

Ex-Situ Stabilization of PFAS-Impacted Soils and Sediments

Removing PFAS-impacted soil from a site can be highly labor-intensive and expensive. In contrast, in situ remediation—treating and containing directly at the site—can offer a more cost-effective and sustainable solution. (Image Credit: Jeremy Idleman).

OBJECTIVE

The objective of this effort is to demonstrate and fully evaluate stabilization and/or solidification (S/S) for ex-situ treatment of per and polyfluoroalkyl substances (PFAS)-impacted soil and sediment.

PROBLEM STATEMENT

The pervasive use of PFAS across the Navy complex, such as in firefighting activities using aqueous firefighting foam (AFFF), has resulted in impacts to soil and sediment, and subsequent potential impacts to stormwater, surface water, and groundwater. Disposal of PFAS-impacted soil and sediment during site characterization and remedial action activities is becoming increasingly more restrictive and costly as rapidly changing regulations, including the designation of perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) as hazardous substances under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are limiting disposal options from beneficial reuse or non-hazardous landfills to hazardous landfills. As such, there is a critical need for novel, low-cost, and sustainable treatment and disposal options for impacted soil and sediment.

DESCRIPTION

Stabilization and/or solidification (S/S) has been used for decades to treat contaminants in soils and sediments by physically encapsulating them or chemically transforming them into less mobile forms; however, its application to PFAS-impacted materials is still emerging. Several stabilization products, which mix with impacted soils to prevent mobilization of PFAS, have come to market recently. This project will evaluate and compare these commercially available and novel S/S amendments to obtain long-term performance metrics (i.e., kinetic leaching flux and mechanisms).

First, PFAS-impacted soil/sediment collected from Navy facilities will be fully characterized including PFAS and potential precursor concentrations and soil/sediment chemical and physical properties. Next, the commercially available amendments will be assessed in bench-scale tests, alone and in combination, to determine leach rates of PFAS from the treated

soil/sediment relative to untreated control soil/sediment. Determining how well these amendments prevent the leaching of PFAS out of soil/sediment will provide necessary data to develop a model to predict leaching kinetics to understand short (year 1) and long-term (year 10) performance.

Following laboratory studies, the best-performing treatment will be used in larger-scale field tests in mesoscale test cells. These tests will be conducted in controlled outdoor settings to simulate real-world conditions. The treated soil/sediment will be monitored for a year, but with artificially accelerated rainfall to simulate roughly 500 years of normal weather. This will provide a clear understanding of the stability of the PFAS amendments.

RETURN ON INVESTMENT

Use of S/S with reuse has the potential to save the Navy millions of dollars in treating and managing PFAS impacted soils. It is anticipated that this work could be used to evaluate remedial alternatives for impacted soils and sediments (e.g., AFFF source areas, PFAS impacted dredged sediments from stormwater retention basins) and applied to several sites across the Navy program.

Management and disposal are essential components of the life cycle cost to remove or treat PFAS impacted soil and sediment. As part of this effort, a life cycle cost assessment will be conducted to compare 1) disposal at a hazardous waste landfill, 2) S/S with beneficial onsite reuse or disposal, and 3) S/S with disposal at a nonhazardous waste landfill.

NAVY BENEFITS

This study will provide Navy Remediation Project Managers (RPMs) tools and information to support selecting more cost effective and sustainable remedies for PFAS-impacted soils and sediments and to facilitate regulatory acceptance of onsite reuse/disposal. The increased confidence in technology performance will help the Navy negotiate appropriate, scientifically defensible use of this technology with decision-makers.

TRANSITION DESCRIPTION

A comprehensive guide will be developed, targeting Navy RPMs and decision-makers. This document will summarize commercially available S/S amendments, detailing their benefits, limitations, and associated costs. It will also outline appropriate methods for selecting and applying S/S amendments based on site-specific conditions. Additionally, the document will include procedures for conducting bench-scale studies, such as Synthetic Precipitation Leaching Procedure (SPLP) and Leaching Environmental Framework (LEAF) leaching tests, to assess the performance of S/S treatments at specific sites. Finally, it will present methodologies for evaluating life cycle costs to support informed remedy selection.

CONTACT

For more specific information about this project, contact the Principal Investigator at jovan.popovic.civ@us.navy.mil.

ABOUT THE NESDI PROGRAM

The Navy Environmental Sustainability Development to Integration (NESDI) program is the Navy's environmental research and development demonstration and validation program, sponsored by Office of the Chief of Naval Operations (OPNAV) Compliance and Mission Readiness Division (N4I1) and managed by the Naval Facilities Engineering Systems Command (NAVFAC) from the Engineering and Expeditionary Warfare Center (EXWC) in Port Hueneme, CA.

The mission of the NESDI program is to support Fleet readiness by minimizing operational constraints associated with environmental and human health risks and to reduce cost of environmental compliance by demonstrating, validating, and integrating innovative technologies, processes, materials, and by filling knowledge gaps.

For more information, visit the program's web site at www.navfac.navy.mil/nesdi
or contact the NESDI Program Managers at NESDI.fct@navy.mil