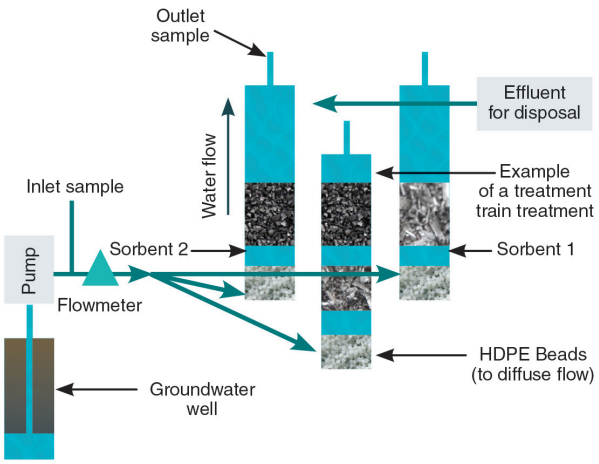
PROJECT ID:
578

Mesocosm Field Testing of In situ PFAS Treatment Trains

Possible sorbents to be evaluated in this project include granulated activated carbon, ion-exchange resin and biochar. (Photo Credit: Nick Hayman)



General schematic of field-testing apparatus to be deployed at the former Tustin Marine Corps Air Station. (Photo Credit: Nick Hayman)

OBJECTIVE:

This project team plans to demonstrate an efficient method to evaluate promising in situ adsorptive amendment materials to tackle the problem of per- and polyfluoroalkyl substances in groundwater.

PROBLEM STATEMENT:

Per- and polyfluoroalkyl substances (PFAS) are a group of chemicals that have potential widespread impacts to groundwater at Department of Defense sites largely through their use in aqueous film-forming foams (AFFF), commonly used in fire fighting. The unique properties of AFFFs makes them ideal for fighting a wide variety of fires.

Current in situ amendments that are generally used for other organic solvents (e.g., activated carbon) are not always suitable for these compounds, partially due to their mobility in the aqueous phase and their recalcitrant properties. Currently, Navy facilities are primarily using pump and treat with granulated activated carbon (GAC) to remove PFASs from groundwater. While this method has proven somewhat effective, it does require frequent and costly GAC replacement. There is also evidence that GAC does not work as well on the short-chained PFASs in newer AFFF formulations. Further, the installation of pump and treat systems can be very costly. A variety of possible sorbent in situ treatments have been suggested, but many of these have not received sufficient scientific scrutiny for application at Navy facilities.

DESCRIPTION:

This project team will study various adsorbents for the purpose of PFAS treatment. Several amendmentswill be tested—GAC, colloidal active carbon, an ion-exchange resin and biochar among others. Most of these sorbents have shown promise as possible options for in situ amendments, although some amendments (such as GAC) appear to be a more effective treatment for the longer-chained constituents. Further, many of these amendments have had limited studies to determine their efficacy across sites or in comparison with other adsorptive amendments—a knowledge gap this project aims to fill.

The first objective is to complete a series of laboratory studies to quantify adsorptive capacities for both long- and short-chained PFASs. In addition, the team will assess breakthough potential and bioavailability of the compounds. These laboratory studies will indicate what amendments

would be most effective for different PFAs constituents and water quality conditions, which vary from site to site.

This project team plans to demonstrate an efficient method to evaluate promising in situ adsorptive amendment materials to tackle the problem of per- and polyfluoroalkyl substances in groundwater.

It is expected that a sequential exposure to multiple amendments may be necessary to achieve cleanup goals of the wide variety of PFAS constituents that occur at impacted sites. Therefore, the project's second objective is to develop a mesocosm field-testing apparatus to test the efficacy of adsorptive amendments, in parallel and in sequence, at specific field sites. A mesocosm system is an in situ approach that provides a link between laboratory experiments and field testing. This team will develop a semi-portable mesocosm apparatus that will be deployed adjacent to an impacted groundwater well at a training site at the former Tustin Marine Corps Air Station.

Water will be pumped from the well and split into different vessels, each containing an amendment/treatment or combination of amendments. The water will be allowed to slowly percolate though the amendment (as it would in situ) and exit through an output line with a valve that will either direct water into a water collection container for chemical analysis, to a secondary treatment container (to replicate sequential in situ treatment), or collected for wastewater treatment.

The initial mesocosm test will be deemed successful if at least one sorptive treatment demonstrates sufficient optimization (considering relevant PFAS concentrations, water quality and other compounds at the field site) to reduce PFAS concentrations significantly and/or below health advisory level. If so, a pilot field test at a highly impacted site will follow. This pilot field demonstration will not only demonstrate the utility of the field-testing apparatus, but evaluate the technology for site-specific factors, such as water quality and presence of other compounds, to be tested across numerous amendments simultaneously. This will inform the evaluation of effective treatments for a given site.

TRANSITION DESCRIPTION:

The field-testing apparatus and methodology developed under this project will be transitioned to industry through both guidance documents and presentations at relevant meetings and conferences. In addition, the team plans to continuously evaluate future amendments when developed using the apparatus.

The field-testing apparatus can be transitioned to site managers and allow them to determine which treatment will work the best at their site, given local soil and water characteristics, in a much more cost-effective manner than installing a large in situamendment, and will provide more relevant results than simple laboratory experiments.

CONTACT:

For more specific information about this project, contact the Principal Investigator at 619-553-3304. Contact the NESDI Program Manager at 805-982-4893 for more general information about the program.

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 the Chief of Naval Operations Energy and Environmental Readiness Division and managed by the Naval Facilities Engineering Systems Command from the Engineering and Expeditionary Warfare Center in Port Hueneme, CA. The mission of the program is to provide solutions by demonstrating, validating and integrating innovative technologies, processes and materials and by filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Navy readiness and lethality.

Visit the program's public website at https://www.navfac.navy.mil/NESDI for more information.