PROJECT ID:
608

Application of Supercritical Water Oxidation to Destroy Per and Polyfluoroalkyl Substance Impacted Waste Streams

Soil and/or wastewater from well installations can be a source of per and polyfluoroalkyl substances. (Photo Credit: Theanne Tangen)

OBJECTIVE

The objective of this project is to demonstrate the efficacy of a mobile system to destroy per and polyfluoroalkyl substances (PFAS) in aqueous PFAS-impacted media.

PROBLEM STATEMENT

PFAS is the term for a group of thousands of chemicals that have become widespread and persistent compounds at Department of Defense sites. A recent Navy investigation determined that 149 facilities are currently generating PFAS-impacted investigation-derived waste (IDW) which could include wastewater from well installation and sampling events, soil from well installations, AFFF rinsate and concentrates from foam fractionation. Many of these sites will require some form of remediation. Hence, the Navy has an immediate need for technologies capable of destroying PFAS in a variety of wastes to meet applicable regulatory guidelines.

DESCRIPTION

Supercritical Water Oxidation (SCWO) has been demonstrated in the laboratory to destroy PFAS in aqueous feed solutions including groundwater, IDW, and aqueous film-forming foam (AFFF). This project is utilizing a mobile unit to demonstrate SCWO technology at field scale. SCWO destroys PFAS compounds to form carbon dioxide, water, and hydrofluoric acid (HF). HF is neutralized with a base such as sodium hydroxide prior to discharging the treated water. SCWO differentiates itself from other PFAS treatment technologies in that: (1) it can destroy PFAS in aqueous media in less than 10 seconds, (2) it is effective on short-chain and long-chain perfluoroalkyl carboxylic acids (PFCA) and perfluoroalkyl sulfonic acids (PFSA), (3) organic compounds such as petroleum hydrocarbons and volatile organic compounds (VOC) do not inhibit performance but rather provide additional heating value during the oxidation process, (4) it can treat dilute and highly

concentrated waste streams, and (5) it occurs at low temperatures and generates little to no waste. The mobile SCWO demonstration system designed by the team is capable of treating up to 500 gallons of impacted media per day. A larger system is also being constructed to treat up to 3,500 gallons per day.

This project will start with site selection (one or more sites will be chosen); samples will be collected and, bench scale treatability tests will be conducted. Results will inform the field demonstration, which will take place over a seven-day period. Concentrations of PFAS and other compounds will be measured at intervals in the influent and effluent streams (including vapor as applicable).

RETURN ON INVESTMENT

At Naval Air Station North Island, the cost to treat PFAS-impacted waste has been estimated to be $6/gallon. Assuming the pilot scale treatment system will be able to treat the waste for less than $1/gallon, with costs expected to decrease as the technology is further refined, a potential cost savings of at least $250,000 will be realized at this location alone. Assuming a similar situation occurs at 10 percent (15) of the 149 facilities the Navy is investigating, the return on investment for yearly treatment would be greater than 500 percent. Alternatively, it is estimated that the pilot scale SCWO system will treat up to 3,500 gallons per day if a preconcentration step is employed. Assuming a savings of about $5/gallon treated, it would only take just over one month of operation to result in a cost savings equivalent to the anticipated funding of this project.

NAVY BENEFITS

SCWO destroys PFAS rather than transfer them to other media, thereby eliminating future liability to the Navy. Successful demonstration of SCWO will validate it for application at other sites having similar PFAS-impacted wastes and will provide data necessary for Navy project managers (PMs) to assess the efficacy and cost of the technology. This demonstration will build on information obtained in any previous demonstrations and will focus on the treatment of a secondary waste stream generated by one of the technologies that removes but does not destroy PFAS.

TRANSITION DESCRIPTION

A cost and performance report and a fact sheet that provides guidance for applying the technology will be developed to assist Navy and other DoD PMs in assessing the suitability of SCWO at their sites. Results of the demonstration will be presented during at least one environmental remediation conference, and various technical conferences. The technology will be transferred to the federal and commercial sectors as well as the remediation community through conference presentations, proceeding papers, regularly scheduled seminars and peer-reviewed journal articles. A Navy Environmental Restoration Technology Transfer (T2) email announcement will be released regarding the final cost and performance report.

CONTACT

For more specific information about this project, contact the Principal Investigator at 805-982-5575.

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 OPNAV N4I Installations 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.

For more information, visit the program's 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.

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