Field Demonstration to Enhance PFAS Degradation and Mass Removal Using Thermally-Enhanced Persulfate Followed by Pump-and-Treat Treatment

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Background/Objectives. Aqueous film-forming foams (AFFF) have been used at hundreds of Air Force and Navy sites and have contaminated vadose zone soils and groundwater with a complex mixture of perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), other polyfluoroalkyl and perfluoroalkyl substances (PFAS) and other AFFF constituents. PFAS are stable in the environment and, as a result, are extremely difficult to treat using any single proven remediation technology. The objective of this recently-awarded Environmental Security Technology Certification Program (ESTCP) project is to demonstrate a cost-effective in situ treatment train approach to destroy and capture PFAS, thereby reducing contaminant mass and the overall duration and cost of remediation.

Approach/Activities. This demonstration will assess an in situ treatment train to destroy PFAS present in groundwater. Treatment consists of in situ chemical oxidation (ISCO) using thermally-enhanced persulfate in a low-pH environment, followed by groundwater extraction and granular activated carbon (GAC) sorption. The team will complete the following tasks: 1) describe sites that are well-suited for this technology and select a demonstration site 2) describe data needs and level of characterization needed prior to treatment, 3) conduct site-specific soil and groundwater treatability tests in the laboratory to develop design parameters such as oxidant demand and persulfate dose, 4) demonstrate ISCO effectiveness at a full-scale field demonstration at a Navy facility, 5) disseminate key demonstration findings and conclusions via fact sheets, YouTube video, newsletter announcements, webinars, and a user-friendly technical paper/article, and 6) complete all required deliverables including a site selection memorandum, final report, and cost and performance report and project management tasks.

Results/Lessons Learned. Persulfate treatment at low pH has already been confirmed to fully oxidize PFOA and other perfluorinated carboxylic acids (PFCAs) as well as anionic, cationic and zwitterionic polyfluorinated substances that are potential precursors of PFCAs. This innovative technology would be fully effective at sites where only fluorotelomer-based aqueous film-forming foams were used (e.g., crash sites, recent or future spill sites). However, multiple independent laboratory studies indicate that PFOS and other perfluorinated sulfonic acids are resistant to chemical oxidation. PFOS and other PFSAs will therefore be addressed by ex situ GAC treatment. This treatment train approach will reduce contaminant mass and save significant cost and treatment time.