On-Site Demonstration of Thermal Desorption Coupled with Thermal Oxidation Technology to Treat Solid PFAS-Impacted Soil Investigation Derived Waste

Pavankumar Challa Sasi, PhD, Frank Barranco, PhD, PE, PG (fbarranco@eaest.com), and Ivy Harvey, PE, (EA Engineering, Science, and Technology, Inc., PBC, Hunt Valley, MD, USA)
Carl Palmer, PE and George Hay, PE (TD*X Associates, Research Triangle Park, NC, USA)

Background/ Objectives. EA, Engineering, Science, and Technology, Inc., PBC and TD*X Associates under ESTCP Project No ER21-5119 will further examine the effectiveness of the proof of concept of *ex situ* thermal desorption (TD) coupled with thermal oxidation (TO) to treat solid investigation-derived waste (IDW), including contaminated soils, impacted with per- and polyfluorinated alkyl substances (PFAS). The objective of this project is to refine and scale up (using a direct fired thermal desorption (DTD) unit coupled with TO) the optimal TD/TO operating parameters utilizing actual PFAS-impacted soil from a Department of Defense (DoD) site. This study aims to answer the following questions:

- Can successful results achieve low parts per billion PFAS [and precursor] in treated soil and 99.99 DRE for TO exhaust emissions?
- Will total organofluorine (TOF) as well as targeted and non-targeted PFAS analyses of exhaust-gas-emissions as well as improvements in stack testing measurements significantly reduce field/analytical uncertainty (+/-30%) observed with fluorine balance?
- To what extent do PFAS Products of Incomplete Destruction (PIDs) through thermal transformations contribute to PFAS exhaust gas emissions?
- Can onsite TD/TO be a cost-effective alternative to limited current options, which include offsite transport/disposal, transport/destruction at incineration facilities, and high-temperature regenerative methods (for sorbent media)?

Approach/Activities: This project will consist of an onsite full-scale DTD/TO demonstration to treat impacted soils from a release area of aqueous film-forming foam (AFFF). The portable DTD/TO system consists of three major components: (1) an unlined rotating kiln primary treatment unit (PTU) operating between 315°C and 650°C for PFAS transfer to the gas phase, (2) a hot cyclone and baghouse for particulate removal and, (3) an afterburner as a secondary treatment unit (STU) operating between 1,000°C and 1,100°C to destroy PFAS and organic co-contaminants. The demonstration test will be performed over a period of 2 to 4 weeks during which 2,000 to 5,000 tons of PFAS-impacted site soil will be treated. Soil sampling will be conducted before and after treatment to evaluate targeted and nontargeted PFAS, TOPA, and TOF. Data will be evaluated for PFAS destruction removal efficiency and fluorine mass balance. A performance test will be conducted at a Department of Defense site to confirm air emissions from the TDU will meet State-issued air permit limits, confirm complete destruction of PFAS, and explore fluorine mass balance. The work is anticipated to take place in Spring 2023.

Results/Lessons learned: This project is currently in the planning phase, including establishment of the air permit and development of the Demonstration Test Plan. The air permitting process has been significantly inhibited given heightened public awareness and uncertainty surrounding PFAS regulations and exposure. EA will share lessons learned from the air permitting process, dynamic analytical developments, and additional lessons learned as we move forward with project planning, demonstration testing, and technology readiness for employment of thermal technologies for PFAS treatment.