STAR and STARx – Smouldering Remediation of PFAS-Impacted Soils

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Poly and perfluoroalkyl substances (PFAS) have been identified by many regulatory agencies as being compounds of emerging concern within the environment. PFAS are commonly associated with fire training areas, aviation hangars, municipal fire stations, and transportation crash sites (due to the use of aqueous film-forming foam [AFFF]); however, consideration of the potential presence and risks associated with PFAS is expanding to wastewater treatment plants, landfills, and brownfields sites. PFAS can present many challenges for remediation given their chemical/physical properties, resistance to degradation and treatment by conventional approaches, and their largely undefined regulatory framework.

Smouldering combustion is a low-cost, self-sustaining (i.e., energy efficient) thermal technique for the treatment of contaminated soils. This approach is commercially available as the STAR (in situ) and STARx (ex-situ) technologies and has traditionally been used for the treatment of heavy hydrocarbons. PFAS are not contaminants that can support self-sustained smouldering combustion in and of themselves, and their high thermal stability requires temperatures at or above 900°C to maximize complete destruction to hydrofluoric acid (HF). Therefore, a surrogate fuel is required to facilitate smouldering remediation.

A study conducted under the US Department of Defense (DoD) Strategic Environmental Research Program (SERDP) explored the use of granular activated carbon (GAC) as a surrogate fuel to treat PFAS-impacted soils since it is often a by-product of water treatment and can also contain PFAS. Tests completed to date have demonstrated that relatively low concentrations of GAC will achieve the smouldering temperatures in excess of 900°C required to promote PFAS destruction. Laboratory results have shown post-treatment concentrations of PFAS in the remaining sand, soil, and ash can be reduced to below detection limits (0.05 µg/kg).

A second SERDP study is currently underway to refine the fluorine mass balance and investigate parameters to further enhance PFAS destruction via smouldering. In addition, testing of field soils from a US DoD site and Canadian Forces Base (CFB) Trenton in an intermediate scale reactor (ISR; ~10x volume of lab column) is currently underway, with a field pilot test (~15x volume of ISR) at CFB Trenton also scheduled for Fall 2021. The ISR and pilot testing will explore the impacts of scale and heterogeneity on PFAS destruction. The presentation will provide a summary of the promising laboratory results to date and an update on the scale up testing program currently underway.

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Laura Kinsman, M.E.Sc., is a Professional at Savron. She completed her M.E.Sc. studies at the University of Western Ontario under the direction of Dr. Jason Gerhard and Dr. Jose Torero – co-inventors of the STAR technology. Ms. Kinsman joined Savron in 2014 and has been actively involved in system design, field operations, and project management at sites across North America and Asia, including pilot testing and full-scale applications of both in situ and ex situ smoldering remediation.