PFAS Source Zone Management with Novel Immobilization Methods and Materials

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Background/Objectives. The past use and direct environmental release of materials containing per- and polyfluoroalkyl substances (PFAS) have created a tremendous volume of contaminated soils on airports and other industrial sites. Driven by infiltration and leaching from rainwater, PFAS-impacted soils are often the sustaining source of groundwater plumes that impact drinking water sources and threaten surface waters. Proper restoration of these water resources will require sustainable, cost-effective methods and tools to eliminate or greatly reduce the leaching and mass discharge of PFAS from source zone soils.

Approach/Activities. An evolving approach to source zone soil treatment is the use of adsorbents to modify the leachability and mass flux of PFAS and other contaminants from vadose soils to the underlying aquifer. A new amendment and use strategy were developed to achieve these goals. The treatment involves the combination of bulk sorbent addition to heavily contaminated soils and the emplacement of a horizontal colloidal activated carbon (CAC) barrier within a target soil treatment volume. Bulk sorbents address the leachability of a large portion of the soil mass present and a lower layer horizontal CAC barrier penetrates the undisturbed soils below through preferential vadose zone flow channels. Soil leachability testing was performed as well as a series of lab-scale simulated rainfall experiments. To access field performance, a pilot-scale demonstration of the approach was performed in a known PFAS source area at the Grayling Army Airfield in Grayling, Michigan.

Results/Lessons Learned. Early data from laboratory and field scale demonstrations of this remediation strategy are encouraging. Lab data collected during amendment development support the notion that CAC can perform as a superior adsorbent versus powdered activated carbon in creating a vadose zone horizontal barrier. At the bench scale, reductions in total PFAS mass discharge were higher when using an equivalent mass dose of CAC versus powdered activated carbon under simulated heavy rainfall conditions. Initial data from the pilot test will be presented, with a focus on the application, mixing, and early performance of bulk sorbents to immobilize PFAS in on test plot soils at Grayling Army Airfield. Continued and planned monitoring of the test area will aid in further understanding the distribution of the CAC within the vadose zone and performance of the combined treatment approach to reduce contaminant mass discharge from PFAS-impacted soils.