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Reducing the Bioavailability of Per- and Polyfluorinated Alkyl Substances (PFAS) in Soils Using a Commercial Adsorbent

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Background/Objectives. Aqueous film-forming foams (AFFFs) are a class of fire-fighting foams that contain per- and polyfluorinated alkyl substances (PFAS). In 2009, perfluorooctane sulfonic acid (PFOS) was listed as a persistent organic pollutant (POP) by the Stockholm Convention due to its potential toxicity effects, persistency and bioaccumulation and biomagnifying properties. PFASs are soluble in water and so tend to readily leach from contaminated soil into groundwater, thus posing a potential risk to human health and environmental receptors.

In this study, the ability of a commercial aluminum hydroxide and carbon-based adsorption product (marketed as RemBind™) to reduce PFAS bioavailability in contaminated soils from two Australian commercial airports was investigated. The study was commissioned by a Government Airport Authority in Australia.

Approach/Activities. The two test soils were air-dried, de-agglomerated, screened and thoroughly homogenized before analysis. RemBind was added to each of the soils at 25% by weight to simulate the worst case scenario in terms of the effects of RemBind on the environmental receptors being tested here (2% to 7% addition rates are more commonly used in commercial projects).

The untreated and treated soils were analyzed for PFOS, perfluorooctanoic acid (PFOA), perfluorohexane sulfonate (PFHxS), and perfluorohexanoic acid (PFHxA) using LC-MS/MS for total concentrations (mg/kg) and leachable concentrations (µg/L). Leachates were prepared using the Australian Standard Leachating Protocol (ASLP; based on USEPA Method 1311) at pH 7 to simulate typical in situ environmental conditions.

To study bioavailability, samples were also used for a 10-week plant uptake study and a 28-day accumulation study in earth worms.

Results/Lessons Learned. The RemBind adsorbent was effective in substantially reducing the leachability and bioavailability of the analyzed PFAS compounds, based on earthworm, plant and leachate experiments. This paves the way for potential in situ applications of the RemBind product to reduce the ability of AFFF-impacted soils to act as ongoing source of PFAS contamination.