

Immobilization and Safe Disposal of Aqueous Film-Forming Foam (AFFF)-Impacted Soil in Australia

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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, some PFASs were listed as Persistent Organic Pollutants (POPs) by the Stockholm Convention due to their potential toxicity effects. PFASs are highly soluble in water and so tend to readily leach from contaminated soil into groundwater, thus posing a potential risk to human health and the environment.

A Government Airport Authority in Australia was required to manage >1,000 tonnes of soil impacted with PFAS originated from infrastructure maintenance work at two airport sites. In this study, an aluminum hydroxide-based adsorption product, RemBind™, was used to reduce PFAS leachability in the soil to allow for safe disposal to landfill with regulatory approval.

Approach/Activities. Soils were segregated into high and low contamination levels based on in situ sampling. Lab-scale trials determined that an addition rate of 5% RemBind was adequate to reduce PFAS concentrations to the target criteria of <0.2 µg/L. The highly contaminated soil was treated with 10% RemBind (at the request of the Authority to allow for any scale-up mixing inefficiencies) using a conventional loader and excavator, with water added to achieve a 40% final moisture content.

After treatment, validation samples were sent to Australian Laboratory Services (ALS) and analyzed for an extended suite of 20 PFAS compounds, including perfluorooctane sulphonic acid (PFOS) and perfluorooctanoic acid (PFOA), using LC-MS/MS for total concentrations (mg/kg) and leachable concentrations (µg/L). Leachates were prepared using the Toxicity Characteristic Leaching Procedure (TCLP; USEPA Method 1311) at pH 7.

The Authority had confidence from previous independent studies that the RemBind binding reaction was stable long term as shown by the Multiple Extraction Procedure (MEP) based on USEPA Method 1320. This method simulates 1,000 years of stability in acid rain conditions in an improperly designed sanitary landfill situation.

Results/Lessons Learned. Validation results after treatment with RemBind confirmed that PFAS concentrations in soil leachates had been reduced to the level of reporting (LOR; 0.02 µg/L) in all treated samples. Based on these results, the local EPA gave written permission for the treated soil to be disposed to a local lined municipal waste landfill with no further remediation or management requirements.

For disposal, a burial area was prepared in the landfill by laying down a 6-inch layer of pure RemBind in the bottom of a trench as a liner for extra risk mitigation. The treated soil was then laid into the burial site on top of the RemBind liner and capped with RemBind and general waste.

It is believed to be the first PFAS immobilization project of this scale completed successfully in Australia. This paves the way for the use of RemBind as a rapid, easy and cost-effective remediation strategy for mitigating the impact of PFAS on the environment with proven long-term stability in a landfill situation.