

RemBind enabled the safe disposal of 1,000 tonnes of Aqueous Film Forming Foam (AFFF) impacted soil

The Problem

Aqueous Film Forming Foams (AFFFs) are a class of fire-fighting foams that contain per- and polyfluoroalkyl substances (PFAS). In 2009, perfluorooctane sulfonate (PFOS) was listed as a Persistent Organic Pollutant (POP) by the Stockholm Convention due to its potential toxicity effects. Most 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.

In 2015, an Australian client was required to manage 1,000 tonnes of soil impacted with PFAS originating from infrastructure maintenance work at two airport sites.

In this study, RemBind was used to reduce PFAS leachability in the soil to allow for safe disposal to landfill with regulatory approval.



Adding RemBind to form the base of the burial pit

The RemBind Solution

Lab-scale trials determined that an addition rate of 5% (w/w) RemBind to the soil was adequate to reduce PFAS concentrations in soil leachates to below the target criteria of <math><0.2 \mu\text{g/L}</math>.

Soils were segregated into high and low contamination levels based on *in-situ* sampling and analysis for PFAS.

The highly contaminated soil 'hotspots' were treated with RemBind using a conventional loader and excavator, with water added to achieve a 40% (w/w) final moisture content.

After treatment, validation samples were sent to Australian Laboratory Services (ALS) and analysed for an extended suite of 20 PFAS compounds, including PFOS and perfluorooctanoic acid (PFOA), using LC-MS/MS for total concentrations (mg/kg) and leachate concentrations ($\mu\text{g/L}$). Leachates were prepared using the Toxicity Characteristic Leaching Procedure (TCLP; USEPA Method 1311) at pH 5.

Ziltek's client had previously demonstrated the long-term stability of the RemBind immobilization reaction using 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.

Z088-02 02/18

Approval for Safe Disposal

Validation results after treatment with RemBind confirmed that PFAS concentrations in soil leachates had been reduced to the level of reporting (LOR; 0.01 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 lined landfill with no further remediation or management requirements.

For disposal, a burial pit was prepared in the landfill by laying down a 4-inch layer of pure RemBind in the bottom of a trench as an extra level of risk mitigation. The treated soil was then placed on top of the RemBind liner and capped with a 4-inch layer of pure RemBind.

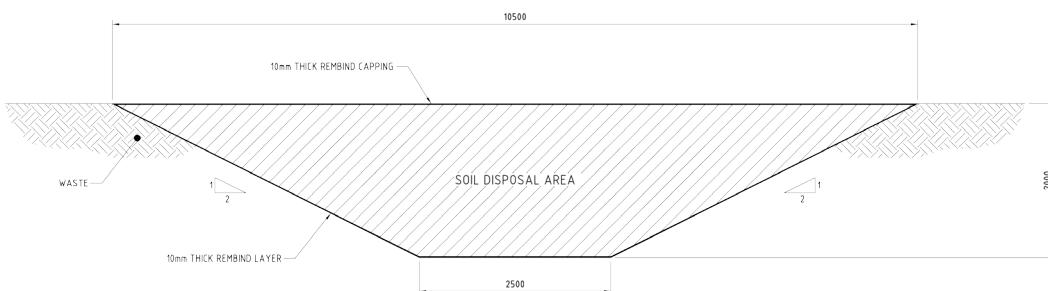
This is the first PFAS soil disposal project of this scale (1,000 tonnes) completed in Australia with EPA regulatory sign-off. This paves the way for the use of RemBind as a rapid, easy and cost-effective remediation strategy for mitigating the impact of PFAS contaminated soil on the environment. With proven long-term stability in a landfill situation, it also opens up the future possibility of re-using immobilized soil on site.



The finished RemBind cap on the burial pit



RemBind bulky bags being loaded



Design of burial pit with a pure RemBind liner and cap (mm)

Soil leachate concentrations of target PFAS compounds following RemBind treatment

	Hotspot 1 (µg/L)*	Hotspot 2 (µg/L)*	Compliance Limit (µg/L)*
PFOS	<0.01	<0.01	0.2
PFOA	<0.01	<0.01	
6:2 Fluorotelomer sulfonate	<0.1	<0.1	
8:2 Fluorotelomer sulfonate	<0.2	<0.2	

*Soil leachate concentrations as measured by TCLP at pH 5