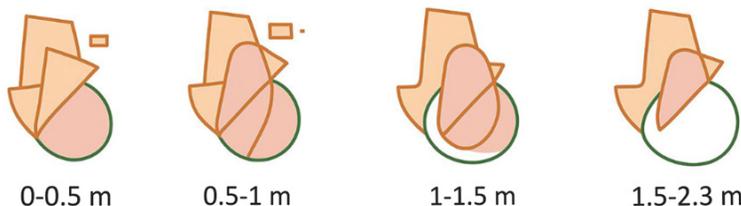


NORTH AMERICA'S FIRST FULL SCALE PFAS REMEDIATION: IN-SITU SOIL STABILIZATION & STORM WATER SWALE TREATMENT

Due to historical use of aqueous film forming foams (AFFF) at defense sites, several Air Force Bases in North America have significant contamination with per- and polyfluoroalkyl substances (PFAS). This site designed a dual treatment system to use soil incineration for highly contaminated areas and in-situ soil stabilization with FLUORO-SORB® Adsorbent. Additionally, an unexpected storm water swale that formed on site was rapidly addressed with a REACTIVE CORE MAT® Composite Geotextile Mat containing FLUORO-SORB® Adsorbent.



Green = New FFTA footprint (Virgin backfill)
Red = Soil for Destruction (PFOS >0.54 mg/kg)
Orange = Soil for Stabilization and Reuse (PFOS ≥ 0.14 mg/kg and ≤0.54 mg/kg)

PROJECT DETAILS

In-situ soil stabilization & storm water swale remediation

LOCATION

North America

PRODUCTS USED

FLUORO-SORB® 200 Adsorbent

CHALLENGE:

Soil contamination due to previous AFFF storage and utilization is an issue at defense sites across North America. This site required several remediation approaches due to extremely high concentrations of PFAS from 0.33 - 10,300 ng/g in 19,000 tons of soil. Additionally, unseasonal rainfall created a storm water swale on site which required a remediation solution that could be rapidly deployed.

SOLUTION:

Phase 1: Laboratory mixing and leaching evaluations

In addition to superior PFAS adsorptive affinity, the ideal fixant needed to be easily applied by mixing mechanically with the ex-cavated soil. Rapid delivery and uniform application at the appropriate dosages was desired. Only commercially available fixants that were available in sufficient quantities to complete the project in calendar year 2021 were considered. To identify the fixant, a treatability study was completed in the laboratory of a leading engineering consulting firm by staff experienced in PFAS soil stabilization.

Two commercially available products were tested: FLUORO-SORB® 200 Adsorbent and a proprietary blend of aluminum hydroxide and granular activated carbon (AIOH/GAC). The stability of PFAS in the treated soil was determined using 120 hour water leaching tests, as well as with semi-dynamic leaching via the United States Environmental Protection Agency (US EPA) Leaching Environmental Assessment Framework (LEAF) Method 1314, where doses of fixant from 0.5-5% were evaluated.

Phase 2: Full-Scale Remediation In-Situ

The conclusion of the treatability test was that 2% by weight dose of FLUORO-SORB® Adsorbent was sufficient to reduce PFAS leaching. In addition to stabilization, incineration of soil was employed in the highest contamination areas.

Note: The results of the treatability study are specific for the site soils tested and results should not be extrapolated to other sites. Additionally, the results of the treatability study should not be used to make forward-looking projections about full-scale site performance, which must be verified over time with groundwater monitoring.

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RESULT:

Phase 1: Laboratory mixing and leaching evaluations

As presented in Table 1, FLUORO-SORB® Adsorbent was highly effective at reducing the leachability of a variety of PFAS from the site soil. For PFOS, leaching was reduced by 99.8% for the required weight dose. In comparison, the 0.5% AIOH/GAC fixant reduced PFOS leaching by 54.8%. It took 4-5% of the AIOH/GAC fixant to achieve the same reduction in leaching as 0.5% FLUORO-SORB® Adsorbent for PFOS and the average of all PFAS tested (Table 1). Notably, roughly 10x more of the AIOH/GAC fixant was required to reach the same treatment efficiency as FLUORO-SORB® Adsorbent in this soil.

Reduction in Leaching				
Fixant Weight %	PFOS		Average for All PFAS Tested	
	FLUORO-SORB® Adsorbent	AIOH/GAC Fixant	FLUORO-SORB® Adsorbent	AIOH/GAC Fixant
0.5%	99.8%	54.8%	88.9%	46.3%
1%	99.9%	84.0%	92.7%	67.8%
2%	100.0%	94.2%	92.6%	80.2%
3%	100.0%	96.1%	94.1%	84.0%
4%	100.0%	98.3%	93.9%	89.0%
5%	100.0%	98.2%	95.3%	89.8%

Table 1. Leaching reduction from laboratory mixing trials with FLUORO-SORB® Adsorbent and the AIOH/GAC fixant. Superior removal was observed with FLUORO-SORB® Adsorbent than the alternative fixant at all doses. 2% of FLUORO-SORB® Adsorbent achieved over 92% reduction of all PFAS and 100% PFOS reduction.

Phase 2: Full-Scale Remediation In-Situ

In the field, both the REACTIVE CORE MAT® Composite Geotextile Mat containing FLUORO-SORB® Adsorbent and the granular FLUORO-SORB® Adsorbent used in-situ had strong remediation performance, with greater than 2 orders of magnitude of PFAS reduction. The REACTIVE CORE MAT® Composite Geotextile Mat was easily deployed and provides consistent remediation of upwelling groundwater and fluctuations in stormwater. Monitoring of groundwater and stormwater on this site is continual but the remediation approach exceeded the contractors expectations and continues to manage PFAS leaching on site.



Figure 1. (Left) REACTIVE CORE MAT® Composite Geotextile Mat containing FLUORO-SORB® Adsorbent used to line a storm water swale which formed due to unseasonal rainfall during the excavation process. (Right) Excavations of soil in 70-ton batches for mixing with FLUORO-SORB® Adsorbent or for incineration.

*For all data and report information provided, Copyright remains with His Majesty the King in right of Canada (2023) and all Intellectual Property is owned by Canada. Data for this case study was obtained from SLR Consulting (Canada) Ltd.

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