REGENESIS®

SourceStop Reduces PFAS by >99% Below Belgian Factory

Innovative pilot test project is first of its kind in Europe

Highlights

Site Type:
Textile Manufacturing Facility (diffuse PFAS source area)

Project Driver:
Proof of concept pilot test to demonstrate reducing PFAS leaching into sand layer containing groundwater

PFAS in Soil:
Up to 220 µg/kg, mostly comprising 6:2FTS-10:FTS and C4-C9 carboxylic acids (no PFOS)

PFAS in Groundwater:
Up to 11,000 ng/L, mostly comprising 6:2FTS-10:FTS and C4-C9 carboxylic acid (no PFOS)

Treatment:
Enhanced chemical adsorption application into capillary and saturated zones

Technologies:
SourceStop - Liquid

Site Geology:
Heterogeneous mixture of clay and sand with peat

Summary

SourceStop® - Liquid, a colloidal activated carbon (CAC) technology, was applied as a proof-of-concept pilot test to reduce PFAS migration beneath a source area at a West Flanders, Belgium textile manufacturing facility. Over five months of monitoring, total PFAS concentrations in groundwater decreased by more than 99%, demonstrating an effective strategy for eliminating PFAS leaching into groundwater below this and other PFAS source areas.

Results

- **>99% decrease in groundwater PFAS concentrations**

Shallow Wells Screened in the Capillary Zone

Well 7003a	
Location	Inside injection grid
Screen Depth	0.5 - 1.5 m
Total PFAS Concentration	11,000 ng/L

Well 7005a	
Location	Outside (adjacent) injection grid
Screen Depth	0.5 - 1.5 m
Total PFAS Concentration	10,000 ng/L

Average total PFAS in shallow wells: 10,500 ng/L

Deep Wells Screened in the Groundwater

Well 7003b	
Location	Inside injection grid
Screen Depth	3-4 m
Total PFAS Concentration	770 ng/L

Well 7005b	
Location	Outside (adjacent) injection grid
Screen Depth	4-5m
Total PFAS Concentration	160 ng/L

Average total PFAS in deep wells: 465 ng/L

Background

PFAS leaches into groundwater beneath source area on industrial facility

A textile manufacturing facility in Belgium used per- and polyfluoroalkyl substances (PFAS) in its manufacturing process. Over time, spills and leaks led to the accumulation of PFAS in the shallow soil, which eventually leached into the groundwater, forming a diffuse PFAS plume. The primary PFAS detected in the subsurface were fluorotelomers (6:2, 8:2, and 10:2 FTS) and C-4 to C-9 carboxylic acids, including perfluorooctanoic acid (PFOA). Perfluorooctanesulfonic acid (PFOS) was not detected in either soil or groundwater.

The site's subsurface geology is heterogeneous, with an upper layer of sand and loamy clay that transitions to predominantly clay at a depth of 1.5 meters. Beneath this dense clay is a saturated sand layer containing peat, which begins around 3 meters deep. A capillary zone extends into the clay above the confined, saturated sand. These subsurface conditions are typical for this region of Belgium.

PFAS concentrations in the soil decrease rapidly with depth and are primarily retained within the clay layer. However, some contamination has migrated vertically, leaching into the lower sand layer. Nested shallow and deep groundwater monitoring wells revealed that liquid-phase PFAS concentrations are more than 20 times higher in the capillary fringe compared to the underlying groundwater.

Understanding these conditions, REGENESIS was contracted to develop a pilot test plan to demonstrate that further PFAS leaching into the groundwater could be rapidly mitigated.

Pilot Test

SourceStop applied to prevent PFAS Leaching

SourceStop is applied using the Spin Injector while samples are collected from monitoring wells to assess subsurface distribution.

A field-scale pilot test was carried out for treating the capillary zone and the underlying, saturated sand layer. SourceStop Liquid, a colloidal activated carbon (CAC) technology designed for penetrating and permanently coating impacted soils in PFAS source areas, was applied to the identified PFAS source area onsite to achieve the following remedial objectives:

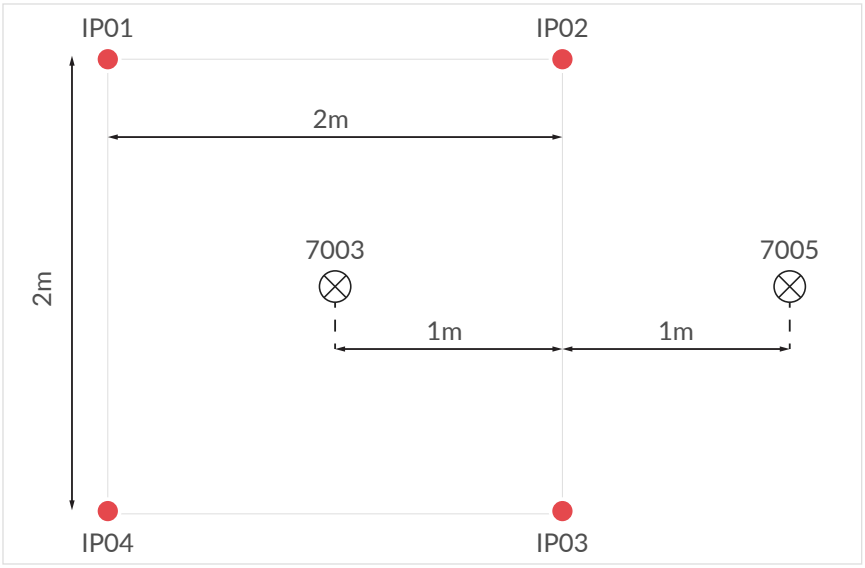
1. Demonstrate that SourceStop can immediately remove PFAS in the dissolved phase and prevent further leaching of PFAS into groundwater over time.
2. Assess and optimize the application of SourceStop within the heterogenous soils using Injectis' proprietary Spin Injection Technology.

The design of the pilot test application included four injection points, spaced 2 metres apart in a square pattern. A shallow/deep monitoring well cluster (7003a/b) was installed at the centre of the injection array, with a second well pair (7005a/b) located 1 metre outside of it. Figure 1

Figure 1

Pilot Test Layout

SourceStop pilot test layout, showing four application points (IP01-IP04) and remediation performance well clusters (7003 and 7005).



Approximately 4000 litres of diluted SourceStop Liquid amendments were applied between 19th and 20th February 2024. Following the injection of SourceStop, groundwater samples were collected from the shallow and deep nested wells over four sampling events spanning five months.

Results

SourceStop reduces PFAS in groundwater by >99%

Following the application of SourceStop, the total PFAS in groundwater was reduced by an average of 89% within the first month, with a continued steady decline reaching >99% reductions for all PFAS over five months Figure 2 and Figure 3. The pilot test has demonstrated broad effectiveness in rapidly removing both short- and long-chain carboxylic acids and fluorotelomers from the dissolved phase.

Figure 2 PFAS Concentrations

PFAS concentrations in shallow/deep monitoring well clusters inside and outside of SourceStop injection grid.

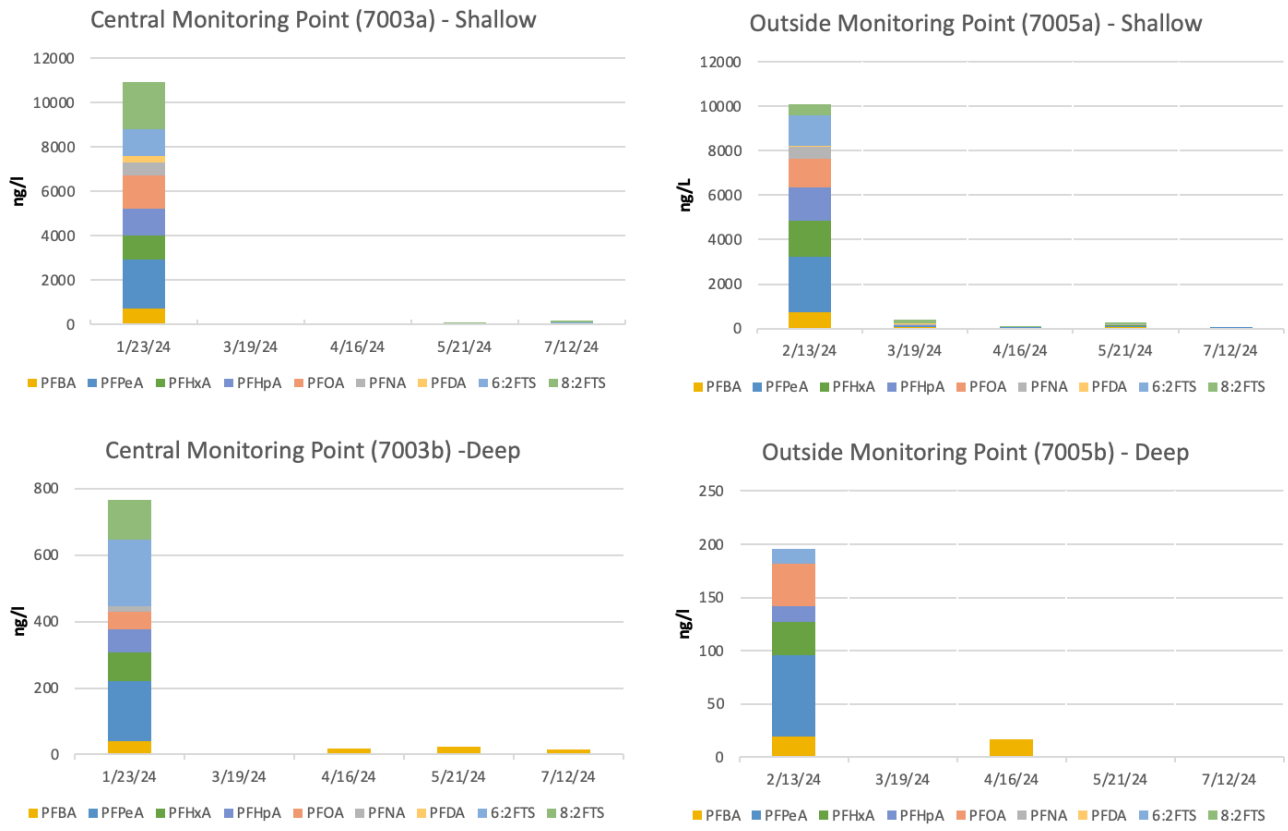
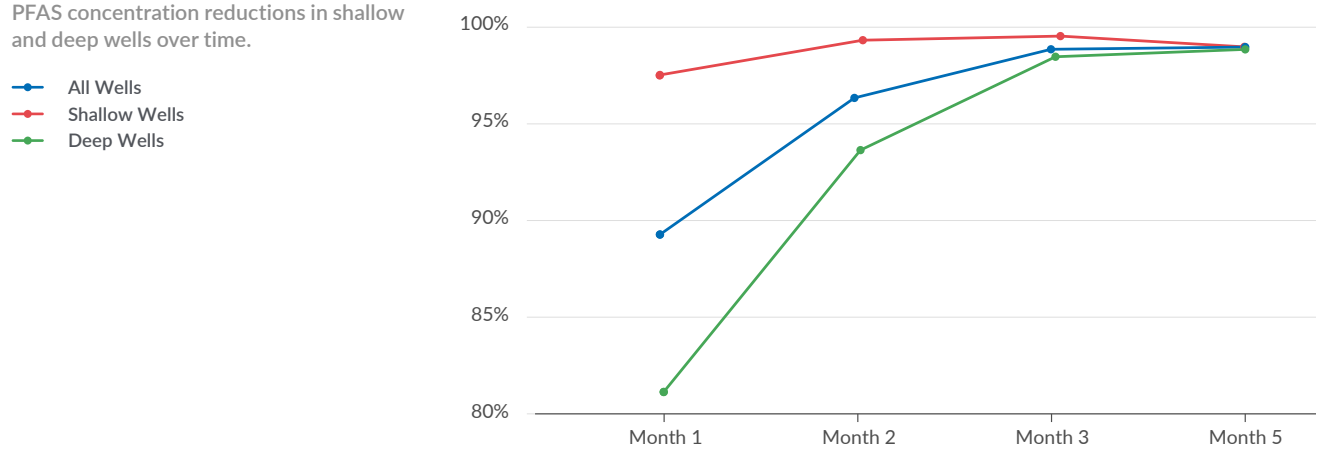


Figure 3

Percent Total PFAS Reductions

PFAS concentration reductions in shallow and deep wells over time.



Conclusion

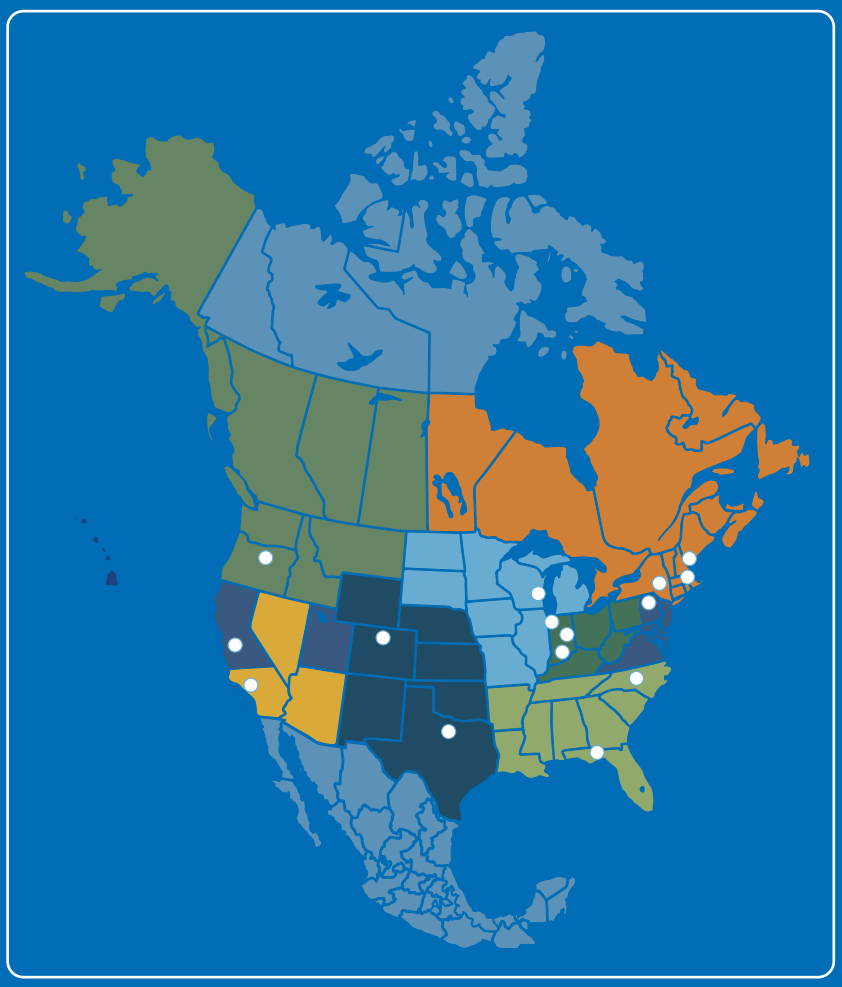
Ongoing monitoring is being completed to review performance against seasonal groundwater changes, however the large reductions in contaminant concentration are expected to be maintained. SourceStop has established a new equilibrium in the treatment zone, reflecting a high degree of controlled PFAS adsorption, with almost no dissolved-phase PFAS. Therefore, this pilot test demonstrates that PFAS leaching can be effectively controlled in an industrial source area, where high PFAS concentrations in the soil would otherwise serve as a reservoir for prolonged groundwater contamination and plume formation. This highly innovative *in situ* PFAS remediation approach is the first of its kind in Europe, with the potential for widescale application across similarly impacted sites on the continent.

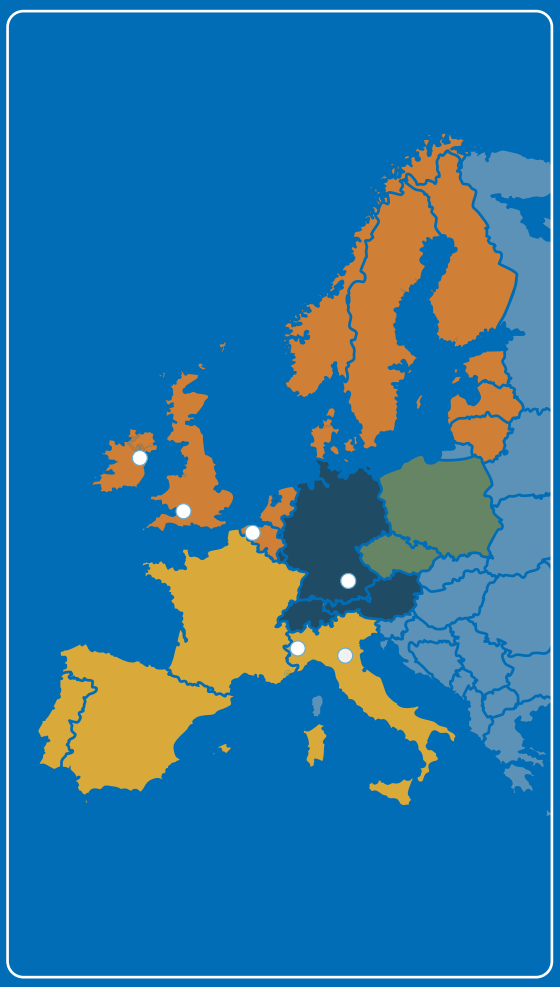
Next Steps

Monitoring will continue and the results and information gathered will enhance the design of the full-scale application, offering a better understanding of the anticipated outcomes and associated costs. The full-scale remediation plan is targeted for completion in the first half of 2025.

REGENESIS®

We're ready to help you find the right solution for your site





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