

Cleanup Goals Met Post PetroFix Application

Case Study:
Florida UST Release Site Now
Poised for Closure



Background

Nisey's Bait & Tackle, a former gasoline station located in the Florida Panhandle, was recognized as a petroleum release site more than 30 years ago. The release was reported in 1990, stemming from the property's underground storage tank (UST) system. Property owners of the site later applied and became eligible for state cleanup funds under the Abandoned Tank Restoration Program (ATRP).

Advanced Environmental Technologies, LLC (AET), a leading environmental consulting and engineering firm based in the Southeast, completed a site assessment to define the magnitude and extent of the petroleum hydrocarbon (PHC) contamination at the site in 2002. In 2006, an air sparge/multi-phase extraction (AS/MPE) system was installed, running for several years until suspending its operation due to state budget cuts. A Remedial Action Plan (RAP) was submitted in 2010 to modify the MPE system for reinjection of the treated water. The system ran for two years, was shut down for several years, modified, and restarted in early 2017. While in use, the AS/MPE system provided significant reductions to PHC concentrations, but was unable to meet required cleanup levels. As a result, the system was permanently shut off at the close of 2017.



Remediation

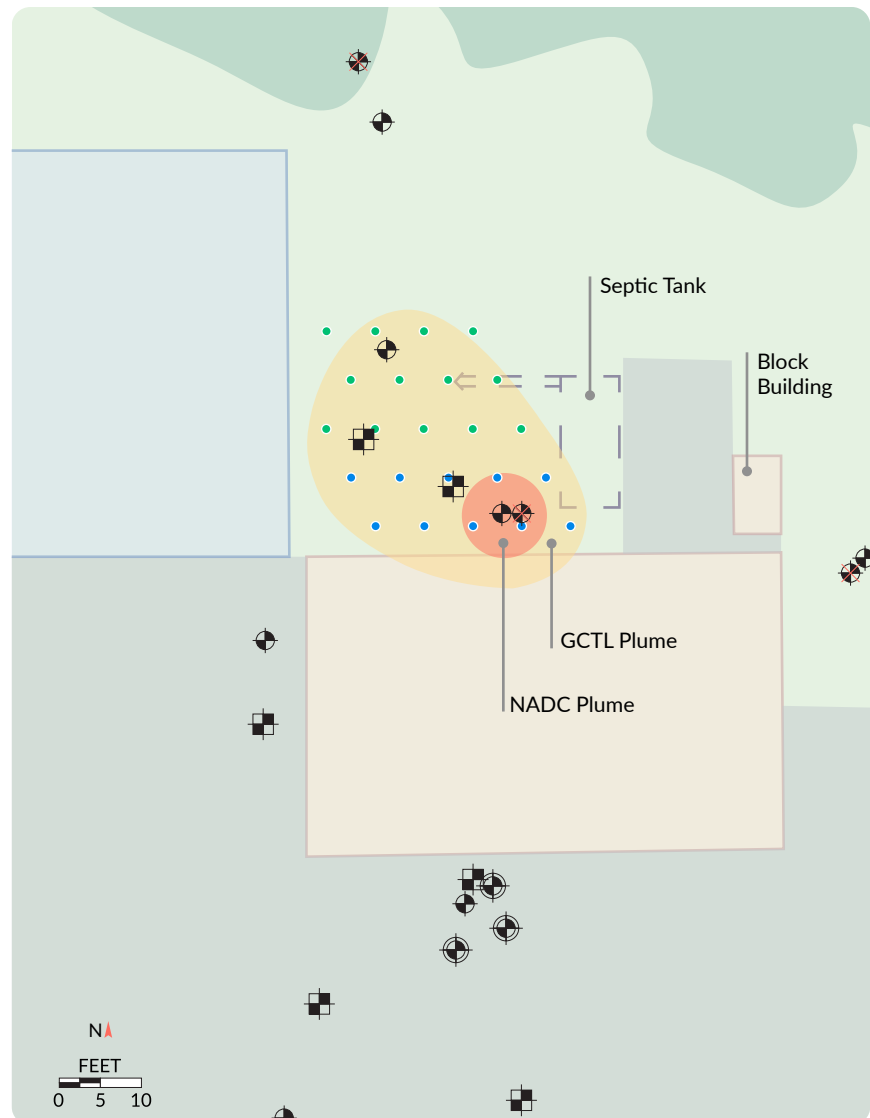
Injecting PetroFix is Lowest Cost, Fastest Route to Site Closure

The AS/MPE system significantly reduced the contaminant mass during its operational lifetime. However, residual PHC contamination remained above the Florida Department of Environmental Protection's (FDEP's) groundwater cleanup target levels (GCTLs), requiring further remediation. The PHC impacts were contained in shallow saturated soils and groundwater in a relatively confined area north of the former station building.

Timeline

- **1990**
Petroleum Release from a leaking UST
- **2002**
AET completes a site assessment to define the extent of the PHC contamination
- **2006**
AS/MPE system installed
- **2010**
Remedial Action Plan submitted to modify MPE system for reinjection of treated water.
- **2017**
AS/MPE system permanently shut down
- **2019**
AET submitted a LSRAP to treat the residual PHC contamination
- **2020**
PetroFix injections completed

- Treatment Area A Injection Point
- Treatment Area B Injection Point
- ⊕ Monitoring Well
- ⊞ Air Sparge Well
- ⊗ Abandoned Monitoring Well
- ⊕ Deep Monitoring Well



After reviewing the available remedial options, AET determined PetroFix[®] Remediation Fluid would provide the most economical and efficient means to reduce concentrations below the GCTLs and achieve site closure through the ATRP. Injection of PetroFix, a field-proven, colloidal activated carbon technology developed for PHC treatment, is a highly targeted and minimally invasive *in situ* approach, requiring low pressure for injection delivery. Since this was an active business, these features were favored for the minimal impact on operations compared to other approaches.

In 2019, AET submitted a Limited Scope RAP (LSRAP) to the FDEP to treat the residual PHC contamination. Following FDEP approval of the LSRAP, AET completed the injection of PetroFix in January 2020.

PetroFix Design Details

Treatment Surface Area	850 square feet
Baseline BTEX Concentration	2,132 µg/L
Injection Points	23
Vertical Treatment Interval	13 feet
PetroFix Quantity	2,400 pounds
PetroFix Injection Volume	9,400 gallons



AET's PetroFix Mixing and Injection Delivery System



Injection of PetroFix using direct push injection methods

Results

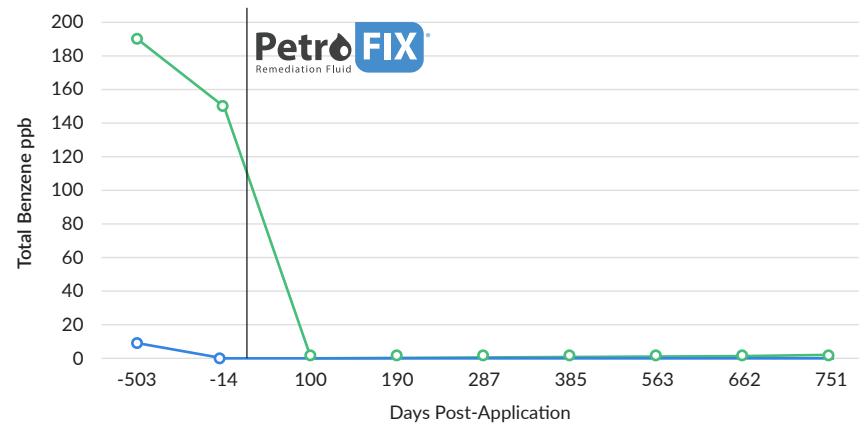
PetroFix Application Quickly Achieves Cleanup Goals and Sustains Reductions for Over Two Years, Poising the Site for Regulatory Closure

AET conducted the first quarterly sampling event three months after the PetroFix treatment. Laboratory results showed that the application had reduced all contaminants below the stringent GCTLs. These complete contaminant reductions have been maintained for over 30 months, with total BTEX reduced from over 2,000 micrograms per liter ($\mu\text{g/L}$) to $1 \mu\text{g/L}$ or less during the entire monitoring period, a 99.95% BTEX reduction.

Benzene Performance Data

Benzene concentrations in groundwater at two most-impacted monitoring wells (MW-10R and OW-1) following the PetroFix application. Results are shown in micrograms per liter or parts per billion (ppb).

Key: MW-10R OW-1



Evidence for the anaerobic biological reduction of the PHCs includes an initial increase, followed by a reduction in sulfate --an electron acceptor additive in PetroFix. Nitrate was also reduced below the baseline concentrations.

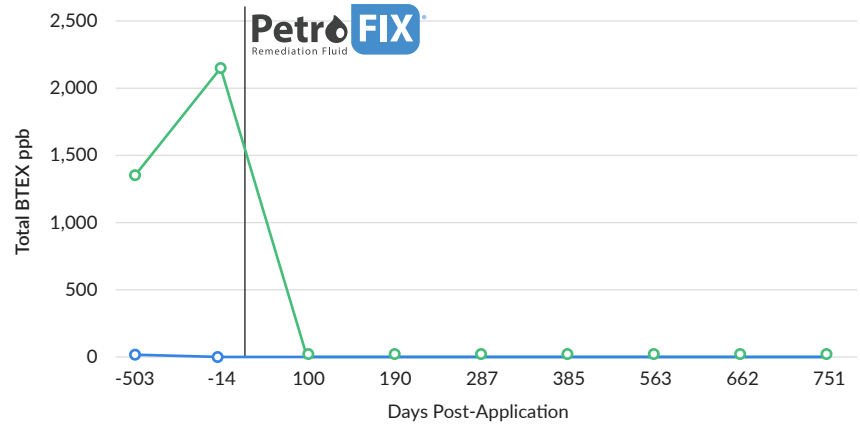
Finally, two Underground Injection Control (UIC) parameters, ammonia and aluminum, had concentrations increase above background concentrations after the injection and were required to be monitored along with other parameters such as sodium and total dissolved solids. Following the PetroFix application, ammonia and aluminum decreased below background concentrations at 2 of 3 wells monitored for UIC parameters within the first year. The final well reached background concentrations at roughly 2 years.

Based on these performance results, the site meets the criteria for ATRP closure and is pending review by the FDEP. The PetroFix application has effectively resolved a release incident that has remained open for over three decades.

BTEX Performance Data

Total BTEX concentrations in groundwater at two most-impacted monitoring wells (MW-10R and OW-1) following the PetroFix application. Results are shown in micrograms per liter or parts per billion (ppb).

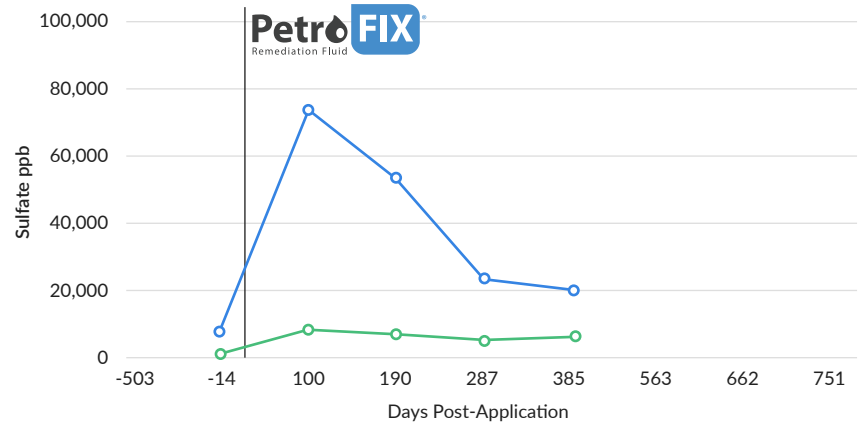
Key: MW-10R OW-1



Sulfate Concentration Data

Sulfate concentrations in groundwater following PetroFix application, providing a line of evidence for anaerobic bioremediation of the PHCs. Results are shown in micrograms per liter or parts per billion (ppb).

Key: MW-10R OW-1



Technology

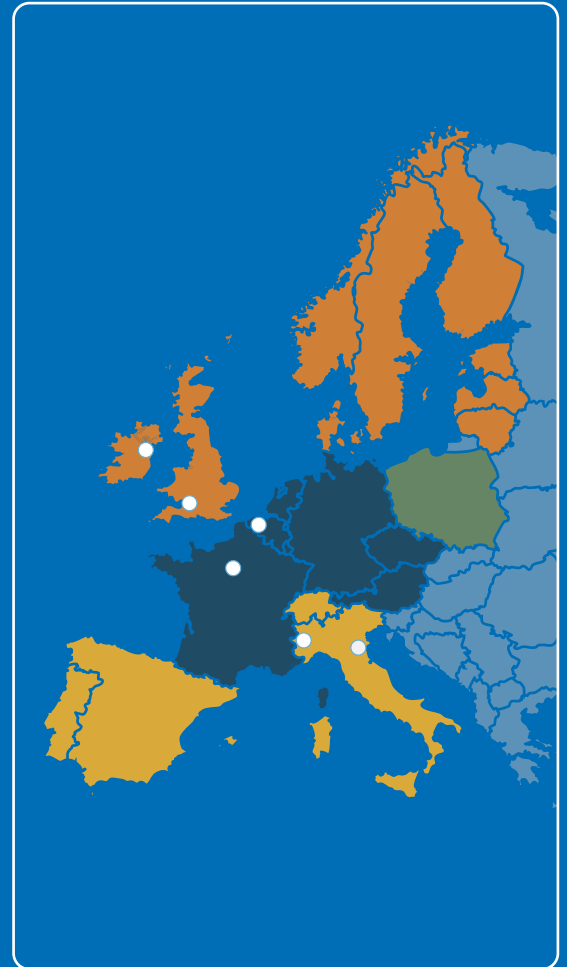
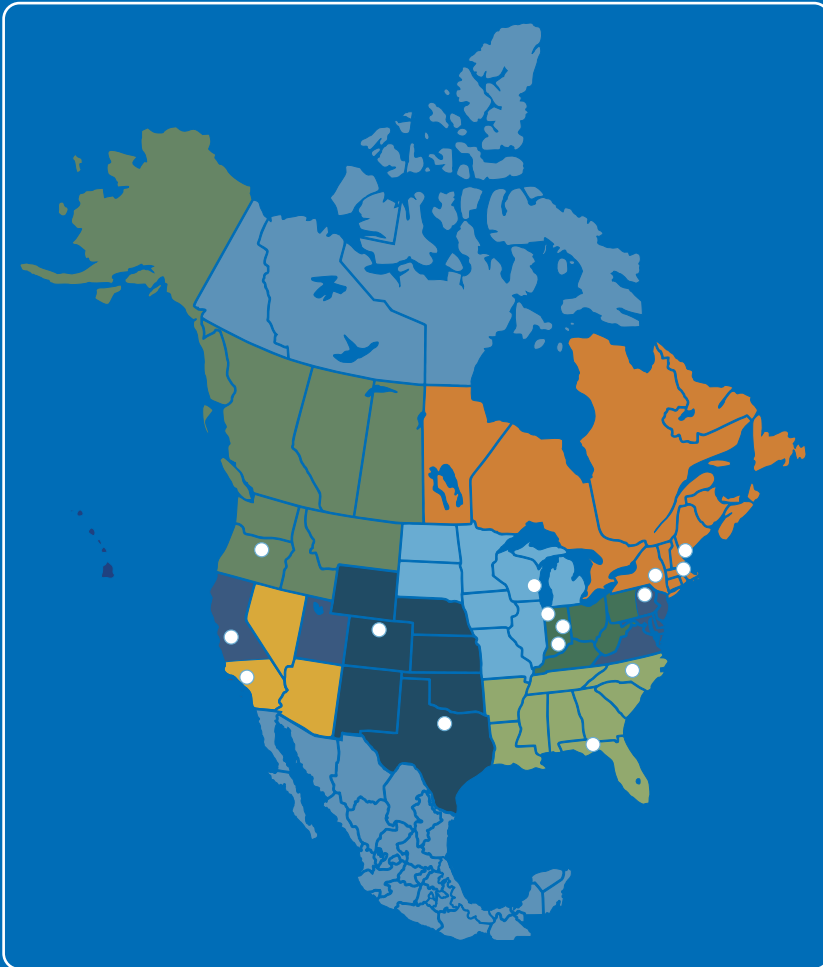


PetroFix is a cost-effective, dual-functioning activated carbon solution designed to remediate petroleum spills and provide immediate results for gas station and UST sites. This safe and effective technology has a dual function: it removes hydrocarbons from the dissolved phase by adsorbing them on to activated carbon particles and then stimulates hydrocarbon biodegradation by adding electron acceptors.

PetroFix is a highly concentrated water-based suspension consisting of micron-scale activated carbon and biostimulating electron acceptors. The environmentally-compatible formulation of micron-scale activated carbon (1-2 microns) is combined with both slow and quick-release inorganic electron acceptors. Practitioners can select between a sulfate and nitrate combination blend (recommended) or sulfate only for the additional electron acceptors required.



We're Ready to Help You Find the Right Solution For Your Site



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