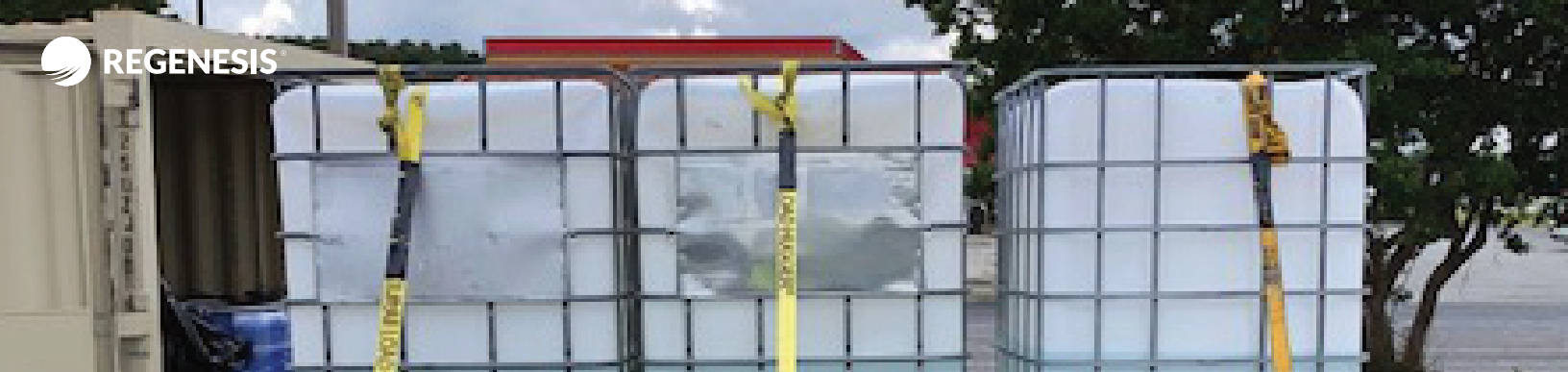


# NFA STATUS ACHIEVED AT VIRGINIA GAS STATION SITE

CASE STUDY:  
PetroFix Application Reduces  
BTEX, Naphthalene, and  
TPH-GRO Concentrations





## Site Details

Contaminants of Concern	Benzene Toluene Ethylbenzene Xylenes TPH-GRO Naphthalene
Treatment Interval	13-20 ft. bgs
Geology	Silty Sand
Total Direct Push Points	153
Total Amount of PetroFix Applied	15,200 lbs.



Uni-Tech Drilling injects PetroFix Remediation Fluid into the soil using a GeoProbe

## Overview

# Groundwater Remediation Plan to Eliminate Contaminants from Underground Storage Tank

As a result of a reported release during routine maintenance at a retail fueling center (gas station), the Virginia Department of Environmental Quality (VADEQ) required the owner of the fueling center to conduct a Site Characterization Assessment. Sovereign Consulting Inc. (Sovereign) was retained to conduct the assessment which necessitated installing a total of seven (7) 2-inch diameter groundwater monitoring wells around and down-gradient of the underground storage tank (UST) location as part of a state-mandated Site Characterization Assessment.

During the initial monitoring well gauging, approximately two feet of light non-aqueous phase liquid (LNAPL) was identified in the monitoring well down-gradient to the UST and two inches of LNAPL identified in the side-gradient monitoring well. Sovereign conducted monthly LNAPL (gasoline) recovery until the monitoring wells were free of LNAPL for three consecutive gauging cycles.

Sovereign was then retained to demolish the fueling center and remove the 25,000-gallon gasoline UST and the associated fueling system which represented the source of the contamination. Due to the predominantly sandy site soils and depth to groundwater, no contamination, odors or elevated PID levels were noted during the UST removal. Therefore, no soil excavation was conducted during the UST removal.

Once the source of contamination (UST) and the free-product was addressed, Sovereign worked with REGENESIS to formulate and execute a groundwater remediation plan.

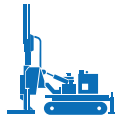
## Timeline

# Remediation Efforts Using PetroFix Result in Case Closure by VADEQ



### February 2018

Installation of initial groundwater monitoring wells



### March 2018

Remedial Investigation of groundwater to delineate dissolved-phase VOCs



### April-October 2018

LNAPL Recovery Program



### May 2018

Installation of additional monitoring wells to further delineate plume



### June 2018

Submission of the Site Characterization Report Addendum to VADEQ



### August 2018

UST and fueling system removal and fuel center demolition by Sovereign



### May-June 2019

Injection of PetroFix using GeoProbe



### June-December 2019

Post-treatment groundwater sampling and quarterly reporting to VADEQ



### December 2019

Pollution Complaint Case closure by DEQ





## Treatment

# PetroFix Groundwater Treatment Led to Rapid Decrease in Contamination

### Site Goal:

The treatment goal was not to remove the entire extent of dissolved VOCs in site groundwater. The treatment approach was designed to achieve a significant reduction in the VOC contamination in the groundwater, to prevent the further down-gradient migration of the plume and to enhance natural biodegradation of any remaining dissolved phase hydrocarbons.

### Application Strategy:

**Step 1:** Single application of PetroFix downgradient of the plume to create a 100-foot subsurface treatment barrier to prevent the further migration of the dissolved phase plume. The barrier consisted of 40 injection points placed in two (2) staggered rows of 20 injection points with five (5) foot horizontal spacing.

**Step 2:** Single application of PetroFix into the source area using an injection grid of 33 points with a six (6) foot horizontal spacing centered around MW-06.

**Step 3:** Single application of PetroFix to the migrating plume area using 80 injection points with six (6) foot horizontal spacing.

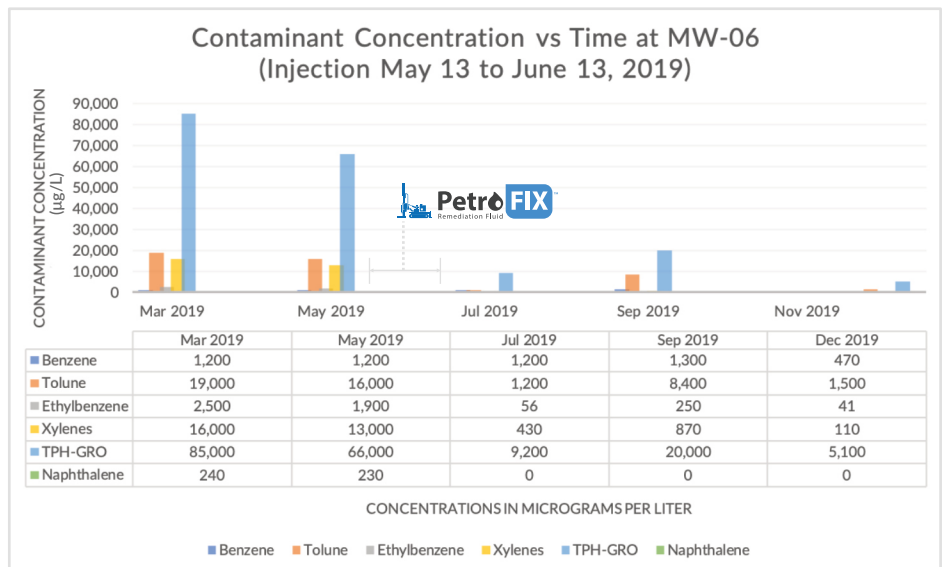
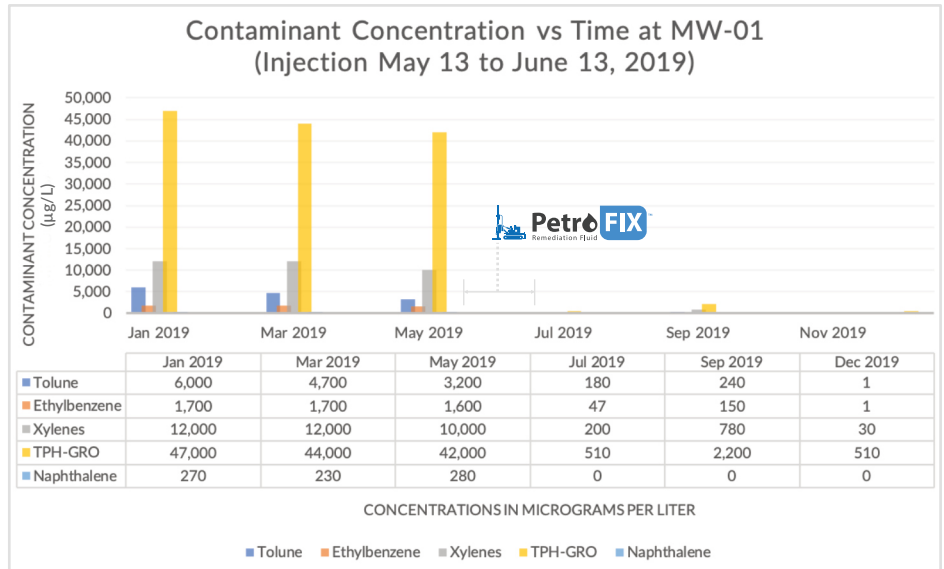
Sovereign worked with REGENESIS to develop a treatment plan. Using the estimated release volume, chemical constituents, geologic information from the drilling logs, the estimated mass of the dissolved contamination was calculated. Each groundwater gauging and sampling event was used to develop site plume models and to generate a basic site conceptual model. This model resulted in identifying three project goals. First, treat the source area where the former UST was located. Second, treat the plume that was migrating downgradient from the source area. And third, create a subsurface barrier or treatment curtain to prevent migration of the plume to the down-gradient horizontal control (i.e., clean) monitoring well.

Due to the high levels of dissolved hydrocarbons in the groundwater, an application of PetroFix with an electron acceptor additive was recommended to reduce the dissolved phase mass in the source and treatment areas. Next, the treatment area, number of delivery points, horizontal point spacing, vertical treatment interval and PetroFix dose was formulated. This resulted in the application of 15,200 pounds of PetroFix in the three project areas. PetroFix and the additive were mixed with a large volume of water and injected with a GeoProbe to treat a thirteen (13) foot vertical interval at 153 delivery points over a three to four week period. Following the injections, PetroFix was observed in the monitoring wells in the treated areas which confirmed its distribution throughout the subsurface soils.

Unlike other groundwater treatment materials, PetroFix was utilized due to its dual function – it quickly removes hydrocarbons from the dissolved phase by absorbing them onto the activated micro-carbon particles and the electron acceptors promote hydrocarbon biodegradation *in situ* to encourage continued remediation. This combination resulted in a rapid decrease in contamination in weeks as opposed to months as determined through monitoring well groundwater sampling and the corresponding concentration curves for each chemical of concern.



## Results



## Site Closure Achieved After Successful PetroFix Application

The remediation approach using PetroFix successfully reduced the BTEX, naphthalene and TPH-GRO concentrations sufficiently for the VADEQ to close the case. The duration of the PetroFix treatment and the corresponding groundwater sampling program was less than a year to closure.



## Technology

### PetroFix Remediation Fluid



PetroFix 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.





## The Consultant

### Sovereign Consulting Inc.

Sovereign Consulting Inc. (Sovereign) is a full-service environmental consulting firm working with commercial, industrial and municipal clients to solve their most challenging environmental challenges to help them reduce their long-term environmental liabilities and the associated financial risk. Sovereign provides Licensed Site Remediation Professional (LSRP) support, site assessment and characterization, and soil/groundwater remediation design, construction and O&M services to a wide-range of clients including the retail petroleum industry, legacy chemical facilities and transportation terminal clients.

Visit [www.sovcon.com](http://www.sovcon.com) to learn more.



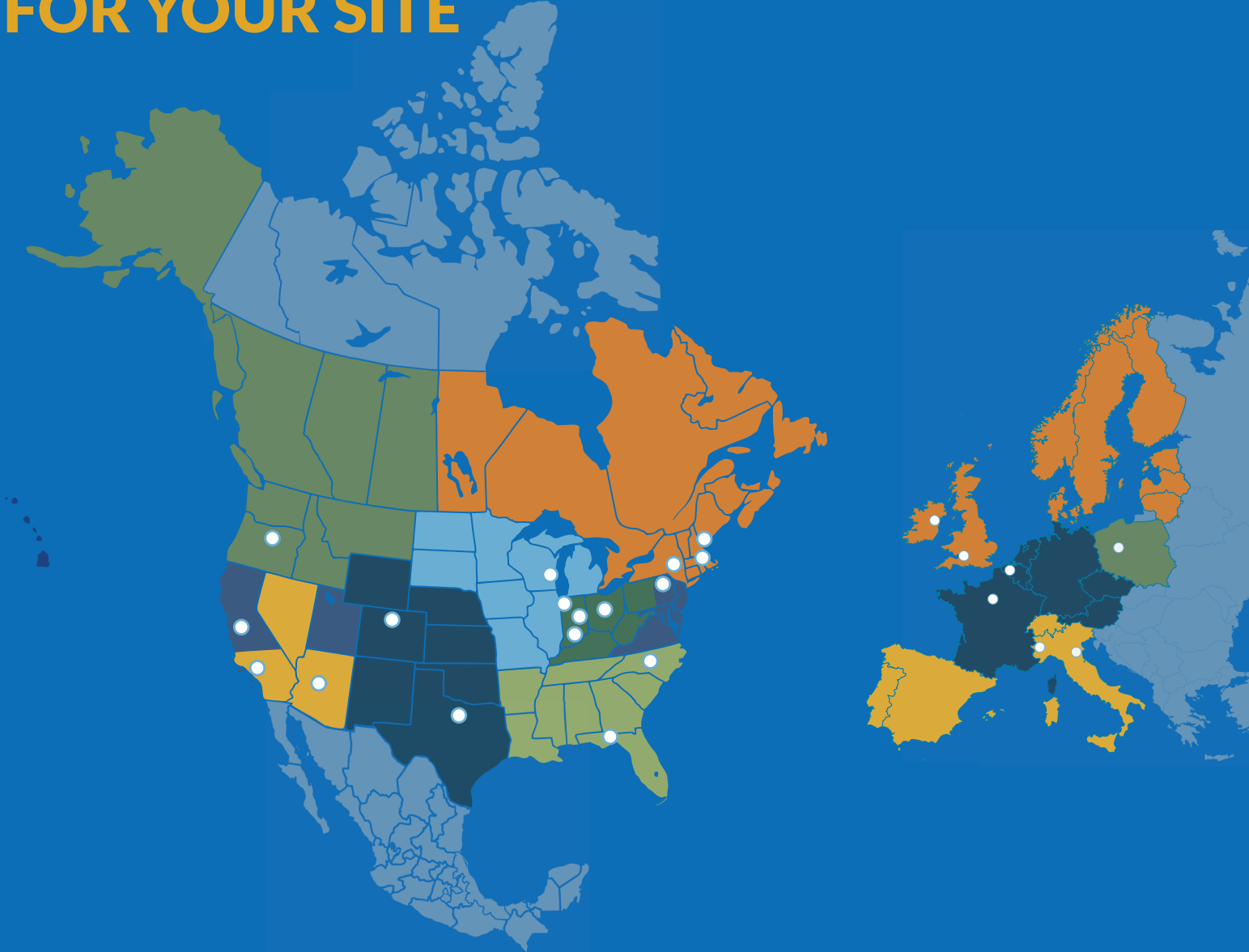
### About the Project Manager

#### Greg Janiec

Mr. Janiec is a Senior Project Manager at Sovereign and has over thirty years of environmental experience managing disaster response, site assessment and characterization and site remediation projects across the country. Currently, he is focused on assisting commercial clients with Phase II Environmental Site Assessments, fueling center demolition and UST removal and soil/groundwater remediation supporting property divestment and acquisition; and supporting redevelopment clients with environmental issues associated with EPA grant-funded Brownfields projects.

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