

PetroFix Estimated to Save \$1 Million Compared to Long-Term Monitoring

Successful Application Places Washington UST Site on Track for Closure





Background

Site Enters Voluntary Cleanup Program to Address Legacy Petroleum Release

The site is a former service station and bulk petroleum plant in Sunnyside, Washington, where petroleum hydrocarbons were discovered leaking from underground storage tanks (USTs) in the late 1990s.



West Central Environmental Consultants (WCEC), an environmental consulting company highly experienced in addressing petroleum-contaminated sites, investigated the site and observed light non-aqueous phase liquids (LNAPL or free product). In response, WCEC completed interim remedial measures, including excavating grossly impacted soils and installing a free product recovery system.

WCEC completed further remedial investigation over the next several years. *In Situ* remediation activities began in the early 2000s with the injection of oxygen enhancing amendments to stimulate biologically-mediated aerobic oxidation of petroleum hydrocarbons. Investigation and oxidation injections were expanded to address other impacted site areas in phases.

Although the oxygen enhancement injections reduced the hydrocarbon mass, soil and groundwater contamination remained, including MTBE (methyl-tert-butyl-ether) concentrations exceeding the Washington Department of Ecology's action level.

The site entered the Washington Department of Ecology’s Voluntary Cleanup Program (VCP) in 2018. Soon after, WCEC completed further investigation to define the contaminant plumes onsite and offsite. During this investigation, MTBE (i.e., methyl tert-butyl ether) was detected in groundwater above regulatory standards in an offsite well (MW-5). As a result, eliminating MTBE contamination offsite became the primary remedial driver for the site.

Based on the investigation results and the accumulated site knowledge, WCEC developed a Remedial Alternatives Analysis (RAA), identifying injection of PetroFix® Remedial Fluid as the most appropriate remedial approach to address groundwater contamination in the residual source zone and downgradient areas. PetroFix was estimated to be more cost-effective while presenting a better chance of achieving the groundwater cleanup objectives for MTBE and the other petroleum hydrocarbon contaminants.

PetroFix Approach Saves Over \$1 Million
WCEC Remedial Alternative Analysis

WCEC performed a remedial alternative analysis evaluating three options:

Remedy Considered	Cost Estimate	Limitations	Determination
Excavation and Oxygen/Carbon Slurry Amendment Application	\$133,061*	Not likely to achieve remedial objectives (excavation would not address offsite impacted areas)	Excluded
Monitoring Only (35-year term)	\$1,244,545	High cost, may not achieve remedial objectives	Not Selected
PetroFix Injections	\$99,235*	Does not fully address potential impacted soils in vadose zone (but still likely to achieve remedial objectives).	Approach Implemented

*Includes two years of groundwater monitoring at an estimated cost of \$24,000/year

The excavation/amendment addition option was not likely to achieve the remedial objectives and was excluded from consideration. Monitoring only and PetroFix injections were the two remaining remedial approaches that could achieve these objectives.

Based on a monitoring period of 35 years and an annual 2.5% cost adjustment for inflation, implementing a monitoring only plan would result in a total life cycle cost of over \$1.2 million. In contrast, the PetroFix injection and associated performance monitoring costs for two years are under \$100,000. At only 8% of the cost of a monitoring only approach, PetroFix saves more than \$1 million for this project.

Remedial Application

WCEC Completes Application Successfully Over One Week

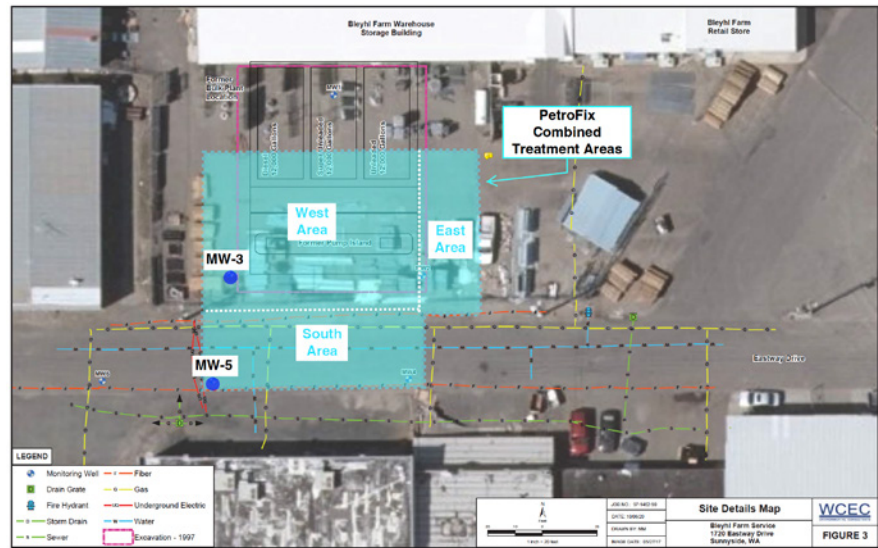
PetroFix Remedial Design Summary

Treatment Area	5,100 square feet
Geology	Gravel fill material over silty sand
Application Method	Direct push injection
Injection Points	126
Injection Spacing	6 feet (approximate average)
Injection Interval	Ranging from 4 to 10 feet below ground surface
PetroFix Applied	4,620 lbs*
Volume Applied	5,000 gallons (approx.)

*Includes 220 pounds of electron acceptor

WCEC designed the remedy using the PetroFix Design Assistant™, backed by REGENESIS technical support. In total, three treatment areas were specified, encompassing approximately 5,100 square feet. The injection design comprised a grid array pattern with an injection point spacing of approximately 5 feet modified to accommodate the numerous underground utilities in the treatment area. The vertical target zone was in the upper 10 feet of the subsurface.

In late February through early March 2020, WCEC conducted the PetroFix injection. The injection slurry was prepared onsite in a 275-gallon polyethylene tote using the prescribed mixing ratios. Approximately 40 gallons of PetroFix solution was injected into each boring using direct push injection tooling connected to a triple diaphragm pump. A total of 4,400 total pounds of PetroFix™ and 220 pounds of electron acceptor were injected into 126 points.



Site Plan View Map Depicting PetroFix Treatment Area

Results

PetroFix Achieves Rapid and Sustained MTBE Reductions Below Cleanup Objectives

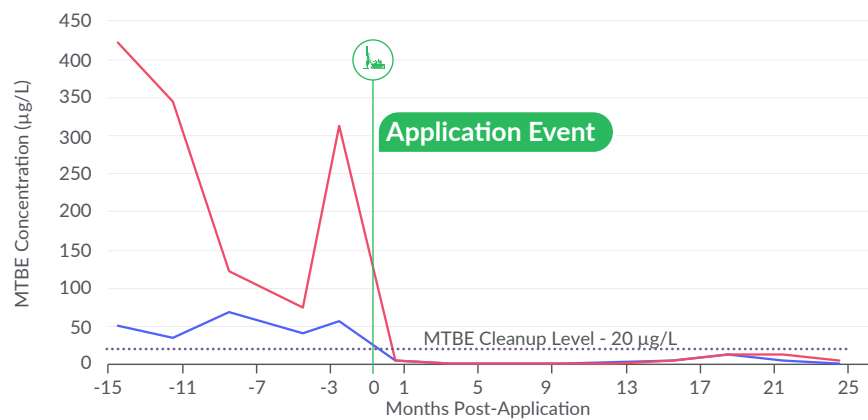
Within 30 days of the PetroFix application, MTBE concentrations were reduced below the 20 micrograms per liter (ug/L) regulatory cleanup level for MTBE at the property boundary (represented by MW-3) and offsite (MW-5) across the roadway. MTBE has remained below this level for two years. All other chemicals of concern, including benzene and total petroleum hydrocarbons, have also been maintained below their groundwater cleanup levels in site monitoring wells for six consecutive quarterly events. Based on these results, the site will soon be eligible for closure through the VCP.

With the site on track to achieve regulatory closure, PetroFix presents a clear business case to speed up remedial timeframes and reduce life-cycle project costs drastically.

Remediation Performance

MTBE Concentrations

- MW-5
- MW-3



About the Consultant

WCEC



WCEC is a multidisciplinary environmental consulting firm incorporated in 1990 and employs over 70 persons in Missoula and Billings, Montana, Morris and New Hope, Minnesota, and Fargo, North Dakota. WCEC provides a full range of environmental consulting services, emergency spill response services, and industrial waste services. Offering a progressive approach to environmental consulting, WCEC merges traditional, professional services with contractual services to provide clients with all aspects of environmental solutions. WCEC's ability to complete contract services allows for lower cost, greater quality control and less liability for clients. As leaders in the industry, WCEC works aggressively to be a sole source provider and serve as a vital resource to communities.



Technology

Petrofix Remediation Fluid



PetroFix Remediation Fluid is a concentrated, water-based, activated carbon suspension specifically designed to treat PHC plumes stemming from bulk storage, gas station and UST spills. Safe, fast, effective and easy-to-apply, PetroFix is designed to specifically sorb and biodegrade petroleum hydrocarbons (PHC), diesel, BTEX, MTBE, and TPH-G. Composed of a mix of micron-scale activated carbon and electron acceptors to promote biodegradation, PetroFix offers an in-situ approach designed specifically for sites where PHC levels are above regulatory standards for complete remediation, at the lowest total cost-to-closure. PetroFix can also be applied to excavation sites.





Composition/Information on Ingredients		In Case of Fire	Signal Word
Chemical name	CAS Number	In case of fire use carbon dioxide, water resistant foam, dry chemical, water spray or water fog as extinguishers.	None
Water	9732-18-5	First Aid	Hazard Statement
Colloidal Activated Carbon $10 \mu\text{m}$	7440-44-0	Inhalation	The product does not meet the criteria for classification.
Calcium sulfate dihydrate	10101-41-4	Move to fresh air. Call a physician if symptoms develop or persist.	In Case of Emergency
Proprietary Additives		Skin contact	For Hazardous Materials or Spilled Safety Sheets, CHEMTRIX, Inc. has the technical support, 1-800-875-6222 or 1-800-333-3333.
Precautionary Statement		Wash off with soap and water. Get medical attention if irritation develops and persists.	For all other inquiries contact PFX 360.000 or visit www.regenesis.com
Prevention		Eye contact	See Safety Data Sheet (SDS) for more information.
Observe good industrial hygiene practices.		Rinse with water. Get medical attention if irritation develops and persists.	Net Weight: 400 lbs (181.4 kg)
Response		Ingestion	Lot Number
Wash hands after handling.		Rinse mouth. Get medical attention if symptoms develop.	
Storage			
Store away from incompatible materials.			
Disposal			
Dispose of waste and residues in accordance with local authority requirements.			

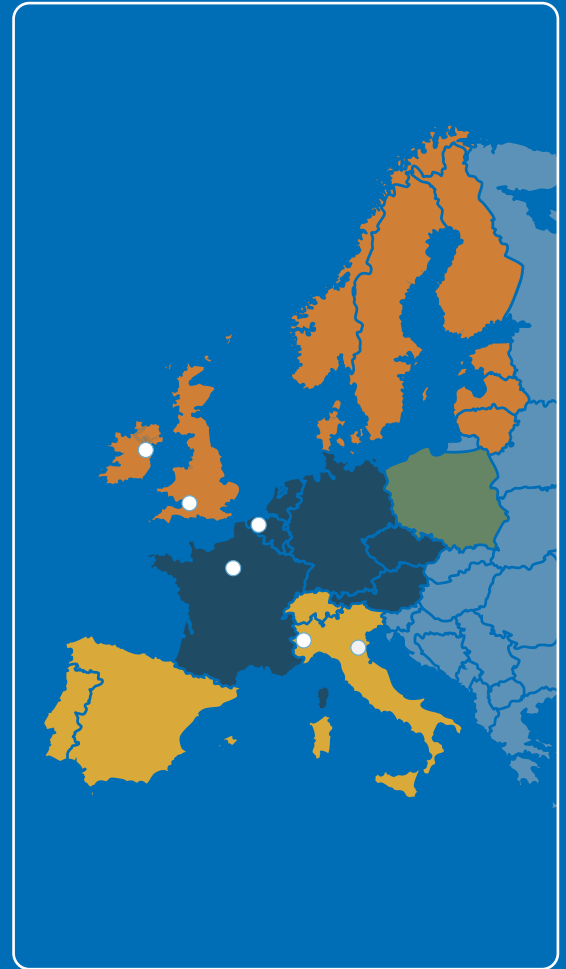
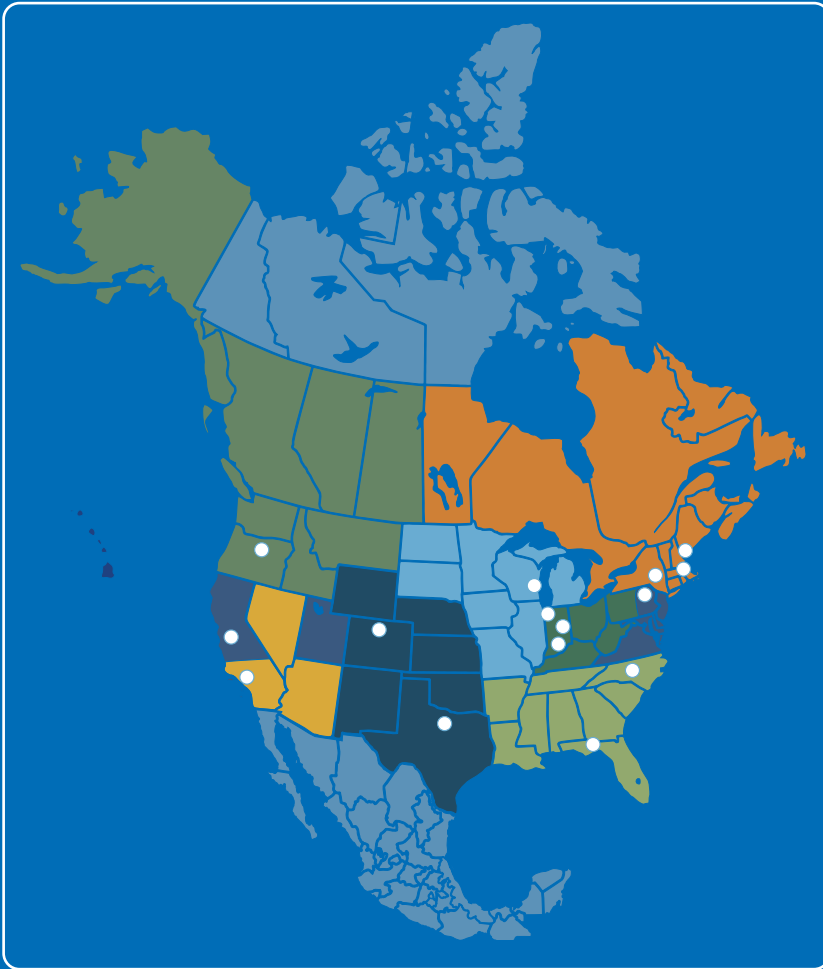


www.regenesis.com 1-949-366-8000

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



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