

PetroFix Integral to Site Closure Strategy

Reducing Time and Cost-to-Closure at UST Release Sites



Introduction



BJAAM uses PetroFix to Rapidly Close Petroleum UST Sites

BJAAM – Expert in Securing Funding for UST Site Cleanups in Ohio

BJAAM's success in securing funding for UST cleanups is notable in Ohio. The environmental firm has submitted applications for funding more than \$4M in cleanup costs through the Ohio Abandoned Gas Station Cleanup Grant program, with all receiving approval. Additionally, BJAAM is highly experienced with rules governing insurance funding for corrective actions, effectively working through the Ohio Petro Board to minimize its clients' out-of-pocket expenses

BJAAM Environmental, Inc. (BJAAM) leads the Ohio Valley in providing wide-ranging solutions for impacted properties, delivering rapid regulatory closures and ensuring safe living and working environments for site occupants, neighbors, and surrounding communities.

Established in 1989 at the dawn of federal and state regulations to address petroleum releases from underground storage tanks (USTs), BJAAM is one of the original environmental consulting firms serving the Ohio Valley UST market. Through the years, the company has established itself as a leader in assessing, remediating, and closing UST-contaminated sites.

The company pioneered a streamlined corrective action approach to reduce the time required for achieving site closure, minimizing project costs for its clients. Their approach combines expertly applied Risk-Based Corrective Action (RBCA) with remedial actions and/or institutional controls designed to achieve site-specific target levels (SSTLs) for petroleum contaminants in well-defined areas of concern.



In recent years, BJAAM has utilized PetroFix® Remediation Fluid (PetroFix) to eliminate risks and obtain regulatory closures at UST sites impacted by petroleum hydrocarbons (PHCs). PetroFix aligns with BJAAM's strategy for managing UST sites as a remedial technology, rapidly reducing and sustaining PHC contaminants below cleanup targets to expedite regulatory closures.

Obtaining regulatory approval and funding for proposed remedial actions without delays is fundamental to BJAAM's success. The company's experience, integrity, and cost-conscious approach have established trust with state agencies governing UST corrective actions and injection processes, including the Bureau of UST Regulations (BUSTR) and Petroleum UST Release Compensation Board (Petro Board) and the Ohio Environmental Protection Agency (OEPA) in Ohio, and West Virginia's Department of Environmental Protection (WVDEP). The PetroFix *in situ* treatment approach has gained wide acceptance by these and many other regulatory agencies, proving an effective and low-cost solution to address UST releases.

The case studies included in this multi-site review highlight BJAAM's effective use of PetroFix in supporting their RBCA site closure strategy.





Northeast Ohio

Former Gas Station

Highlights

Contaminants of Concern Benzene—59 µg/L

Cleanup Goal (i.e., SSTL): Benzene—5 µg/L

Geology Clayey Silts

Results Benzene reduced below detection limit (1 µg/L) in treatment area

Status



SSTL Achieved,
No Further Action
Granted

Summary

In response to a UST release, BJAAM completed Tier 1 and Tier 2 Evaluations to define the contamination extent and SSTLs. BJAAM installed and began operating a dual-phase extraction (DPE) system in 2013 and expanded it later, then shut it down in 2019. The DPE system reduced benzene and total BTEX concentrations by more than 90%, with only benzene remaining above the groundwater SSTL near the southern property boundary. To address the residual benzene concentrations in this area, BJAAM developed a revised cleanup plan utilizing the PetroFix Design Assistant. The focused PetroFix injection approach was quickly approved by BUSTR and implemented shortly thereafter.

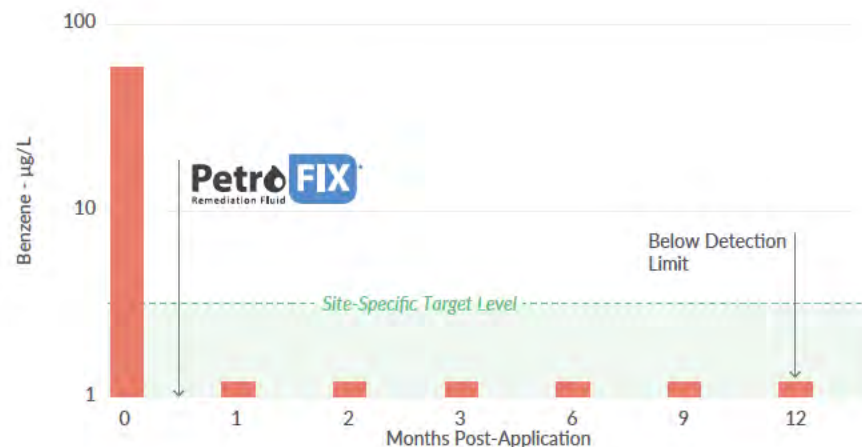
Results

The PetroFix injection reduced the benzene concentration below the 5 µg/L SSTL by the first post-sampling event. The concentrations remained reduced during the year-long performance monitoring period. Based on the PetroFix injection performance results, BUSTR granted the site a No Further Action status.

Results

Benzene Concentrations in TMW-9/9R

Benzene results in TMW-9/9R following PetroFix injection





Central Ohio

Former Gas Station

Highlights

Contaminants of Concern Benzene-408 µg/L

Cleanup Goal (i.e., SSTL) Benzene-135 µg/L

Geology Sandy & Silty Clays

Results >99.9% benzene reduction (below detection limits) in treatment area

Status

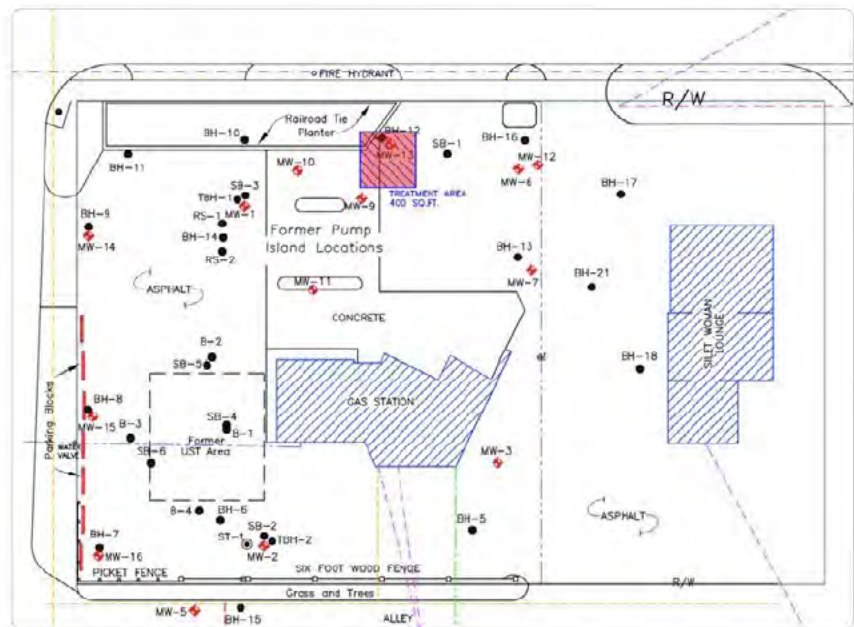


SSTL Achieved,
On Track for Site
Closure

Summary

A release was reported during a 1991 environmental site assessment following UST system removal in 1989. Over the next 30 years, several phases of investigation, natural attenuation/modeling demonstration, and risk assessment were conducted at the site, while property ownership and regulatory jurisdiction changed several times. BJAAM developed SSTLs for the contaminants of concern following the Ohio BUSTR RBCA process. By the end of 2020, only the benzene concentration in groundwater exceeded its SSTL of 135 µg/L.

In 2021, BJAAM submitted a RAP, using the PetroFix Design Assistant to develop a design for reducing benzene in groundwater to below the SSTL. BJAAM completed the PetroFix injection event in February 2022, injecting the material via eleven direct-push injection points installed in the 400 square feet treatment area.



PetroFix injection area - Central Ohio former gas station

Results

The PetroFix injection reduced benzene below the SSTL (and below detection levels) in the targeted area within 30 days and over two subsequent events. Based on these results, the site is on track to be granted closure by BUSTR as the performance monitoring period ends in 2023.



Northeast Ohio

Former Gas Station

Highlights

Contaminants of Concern Benzene-17-95 µg/L
MTBE-78-184 µg/L

Cleanup Goals Benzene-130 µg/L
MTBE-20 µg/L

Geology Silty Clays Overlie Shale

Results MTBE reduced below cleanup goal. Benzene reduced below 5 µg/L in one treatment area, remaining elevated in another. Subsequent modeling demonstrates no exposure risk from benzene remaining in one monitoring well.

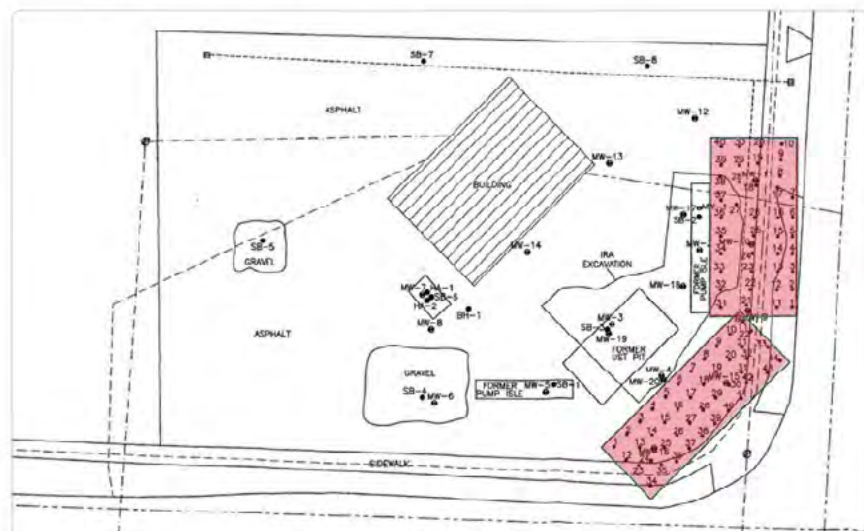
Status



No Further Action
Granted

Summary

A Phase 1 Environmental Site Assessment was completed in 2016, revealing a former UST system removed from the site in 1983. BJAAM conducted a BUSTR Tier 1 Evaluation in 2017 and, in 2018, completed an Interim Response Action which included the removal of 554 cubic yards of soil impacted by the former UST operations. Following the excavation, residual benzene and methyl-tert-butyl-ether (MTBE) remained above preliminary action levels (i.e., drinking water levels) in groundwater. In 2019, BJAAM completed the PetroFix injections as part of a Remedial Action Plan to reduce the benzene and MTBE concentrations in two areas where the residual impacts remained. A total of 84 direct-push injection points were used for the treatment.



PetroFix injection plan – Brook Park, Ohio

Results

The treatment sharply reduced the contaminant levels and markedly shrunk the impacted area. MTBE concentrations were reduced below the drinking water action level, while benzene exceeded the drinking water action level in a single monitoring well. BJAAM utilized BUSTR’s Tier Evaluation Process, performing fate & transport modeling to demonstrate the lack of a complete exposure pathway for the remaining benzene levels. Based on these results, BUSTR granted the site a No Further Action status in 2020.



Northwest Ohio

Active Gasoline Station

Highlights

Contaminant of Concern MTBE-5,680 µg/L

Cleanup Goal (i.e., SSTL) MTBE-2,494 µg/L

Geology Silty Clays

Results >99.9% MTBE Reduction in treatment area

Status



SSTL Achieved, On Track for Site Closure

Summary

This active gas station site in Northwest Ohio first reported a PHC release in the early 1990s during a product dispenser upgrade and later during a station upgrade in 2010. Ensuing investigations revealed benzene, MTBE, and benzo(b)fluoranthene concentrations in groundwater above BUSTR's Tier 1 Action Levels. Following a Tier 2 Evaluation and modeling to develop SSTLs, BJAAM submitted a Remedial Action Plan to treat MTBE, the only chemical exceeding an SSTL. The remedy involved mobile DPE events and the installation of Oxygen Release Compound® (ORC) socks into select monitoring wells. Although some concentration reductions were observed following these remedial efforts, MTBE remained elevated in an area adjacent to the former UST cavity. Consequently, BJAAM proposed the *in situ* injection of PetroFix, using the Design Assistant for developing a targeted treatment to remediate MTBE below its SSTL. The approach was approved by BUSTR and the Petro Board and implemented by BJAAM soon after.

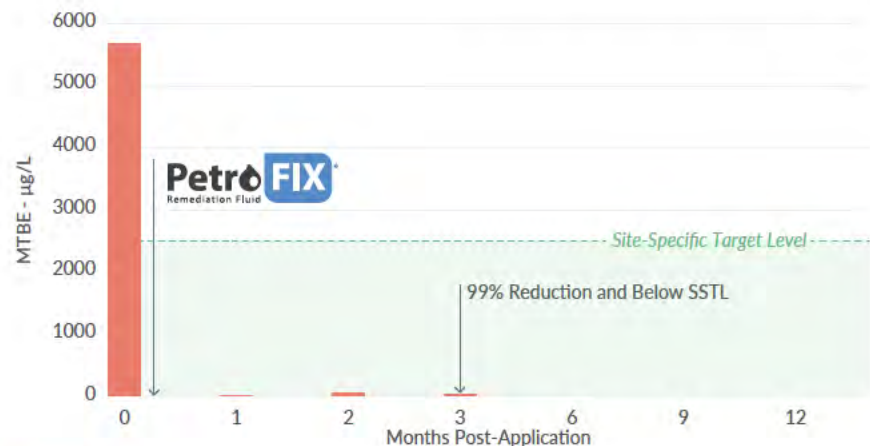
Results

MTBE Concentrations in MW-5

MTBE Performance results in MW-5 following PetroFix injections.

99% Reduction of MTBE

Maintained 3 months post-application



Results

The PetroFix injection resulted in a 99% reduction of MTBE (the target chemical) maintained through three monitoring rounds. Benzene was also reduced by 94%, well below its SSTL. The site will soon be eligible for No Further Action Status if current trends continue.



Northern West Virginia

Former Gas Station

Highlights

Contaminants of Concern Benzene-9-34 µg/L

Cleanup Goal Benzene-5 µg/L

Geology Backfill Aggregates
Overlie Silts

Results Benzene reduced below 1 µg/L in both treatment areas

Status

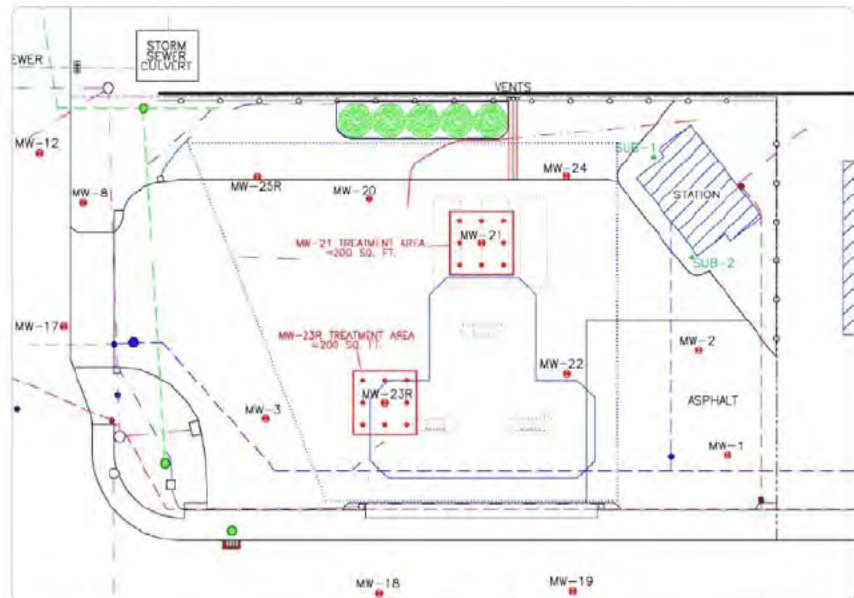


Cleanup Goal Achieved, No Further Action Required

Summary

The site is a former gasoline station in northern West Virginia with a remediation history that includes the operation of a DPE system, excavation & disposal of 1,800 tons of petroleum-contaminated soils during UST removal, and installation of ORC filter socks in targeted remediation wells. These efforts significantly reduced the PHC impacts. However, benzene concentrations remained in two areas above WVDEP's five µg/L action level.

In February 2021, BJAAM submitted a revised Corrective Action Plan (CAP) for the site, incorporating its own PetroFix designs for treating the two benzene-impacted areas, aided by the online Design Assistant. BJAAM completed the PetroFix injections soon after WVDEP approval.



PetroFix injection areas at former gasoline service station in northern West Virginia

Results

By the first post-application monitoring event in August 2021, benzene concentrations dropped below the action level in both areas, remaining reduced through one year of monitoring. Based on these results, the WVDEP issued the No Further Action Required letter in November 2022.



Southwest West Virginia

Active Gas Station

Highlights

Contaminants of Concern Benzene-7 µg/L

Cleanup Goal Benzene-5 µg/L

Geology Clayey Sands

Results Benzene reduced below 1 µg/L in treatment area

Status

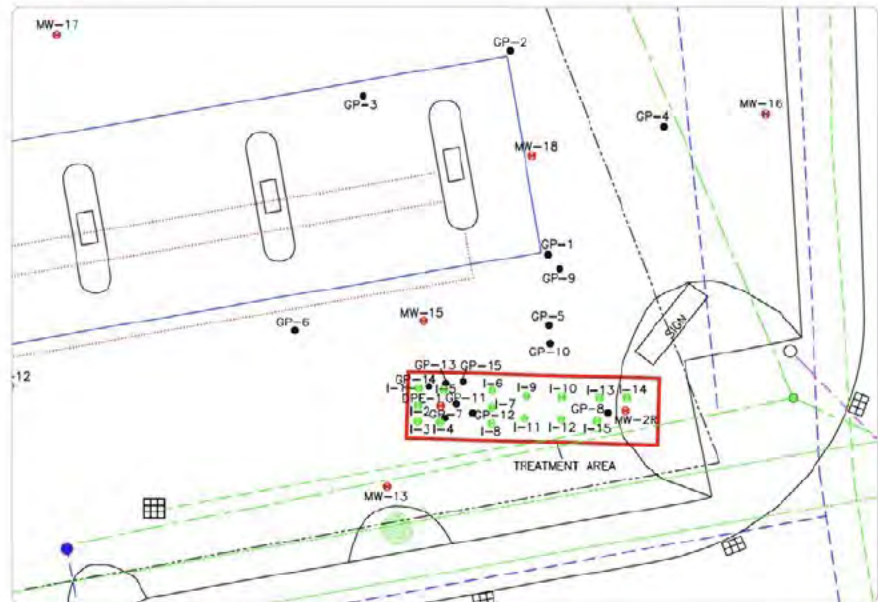


Cleanup Goal Achieved, No Further Action Required

Summary

In 2014, BJAAM initiated mobile DPE events to remediate a PHC release at this active gas station site. Numerous multi-day DPE events were completed through 2019, along with associated remediation performance monitoring. The remediation efforts were largely successful, leaving only a small area near the site's southeast corner where benzene concentrations remained above the WVDEP's drinking water action level of 5 µg/L.

BJAAM proposed PetroFix, developing its own injection design for treating the remaining benzene-impacted area. The remedy was approved by WVDEP and implemented by BJAAM in 2021. The treatment was completed via fifteen direct-push injection points drilled to 16 feet below the ground surface.



PetroFix injection area at Huntington, WV gasoline station.

Results

The PetroFix treatment reduced the benzene concentrations to below detection limits (and the WVDEP action level) by the first post-injection monitoring event (i.e., 30-day event). Concentrations have remained non-detect for one year, meeting the site closure criteria. The WVDEP issued a No Further Action Required letter in early December 2022.



Conclusions

BJAAM's expertise in using the RBCA process under multiple state agencies, combined with PetroFix's effectiveness at rapidly achieving target cleanup goals, has expedited the resolution of long-open UST release sites.

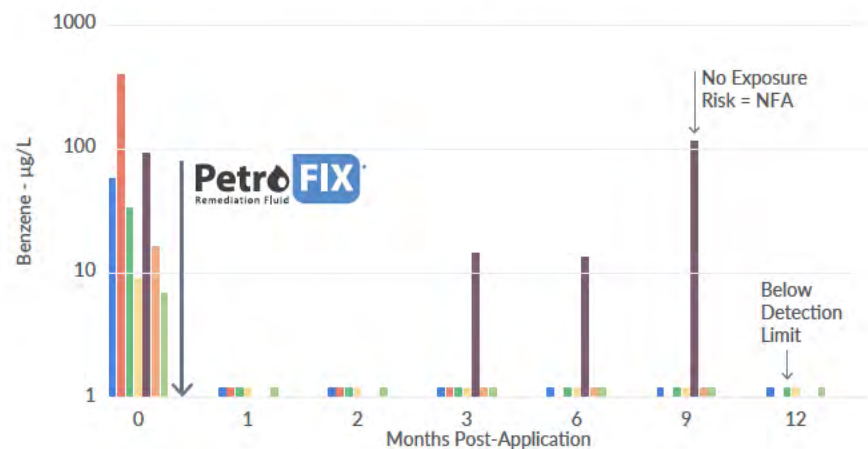
The single-injection PetroFix treatments achieved the cleanup targets (i.e., drinking water action levels or SSTLs) for either benzene or MTBE in nine out of ten monitoring wells used to track performance in the treatment areas. In most treatment areas, contaminants have been reduced and sustained below the laboratory detection limits. At the one treatment area where the benzene SSTL was not achieved, BJAAM conducted an additional evaluation revealing no complete risk exposure pathways, and the site was granted closure.

Results

Benzene Reduced Below Detection Limits By PetroFix in Six Out of Seven Monitoring Wells

Monitoring wells used to monitor benzene performance at BJAAM UST sites treated with PetroFix.

- NEOH-TMW-9/9R
- COH-MW-13
- NWV-MW-21
- NWV-MW-23R
- NEOH-MW-10
- NEOH-MW-11
- SWWV-DPE-1



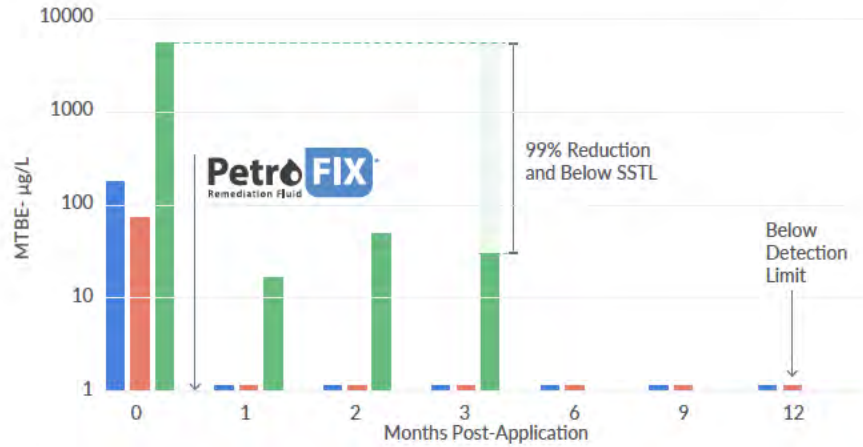
Results

MTBE Concentrations - All Sites

MTBE Performance results at all sites following PetroFix injections.

- NEOH-MW-15
- NEOH-MW-16
- NWOH-MW-5

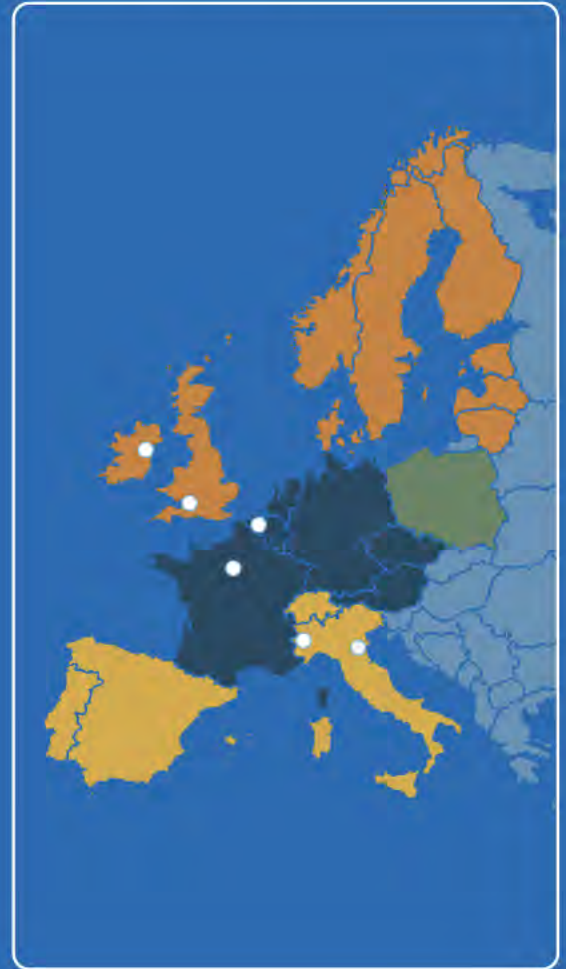
NWOH-MW-5 is in early stage of performance monitoring (3 months) at time of publishing



Based on the results, BJAAM has achieved site closures (i.e., NFA status) at four sites, and the remaining two will soon be eligible for site closure if current performance trends continue. These outcomes have led to significant cost savings for BJAAM's clients and instilled confidence in the UST regulatory agencies that correctly applied PetroFix *in situ* treatments can consistently achieve site closure goals.



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



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