REGENESIS®

Rapid Hydrocarbon Remediation at an Industrial Site in Northern Italy

PetroFix minimizes site disruption, allowing redevelopment to go ahead

Highlights

Site Type:
Former Industrial facility in an urban environment in Northern Italy

Project Driver:
Offsite migration risk, planned redevelopment

Contaminants:
Up to 4,000 micrograms per liter (µg/L) TPH, including heavy aliphatic hydrocarbons and BTEX (i.e., benzene, toluene, ethylbenzene and xylenes).

Treatment:
Sorption-enhanced biodegradation

Technologies:
PetroFix® colloidal activated carbon injections

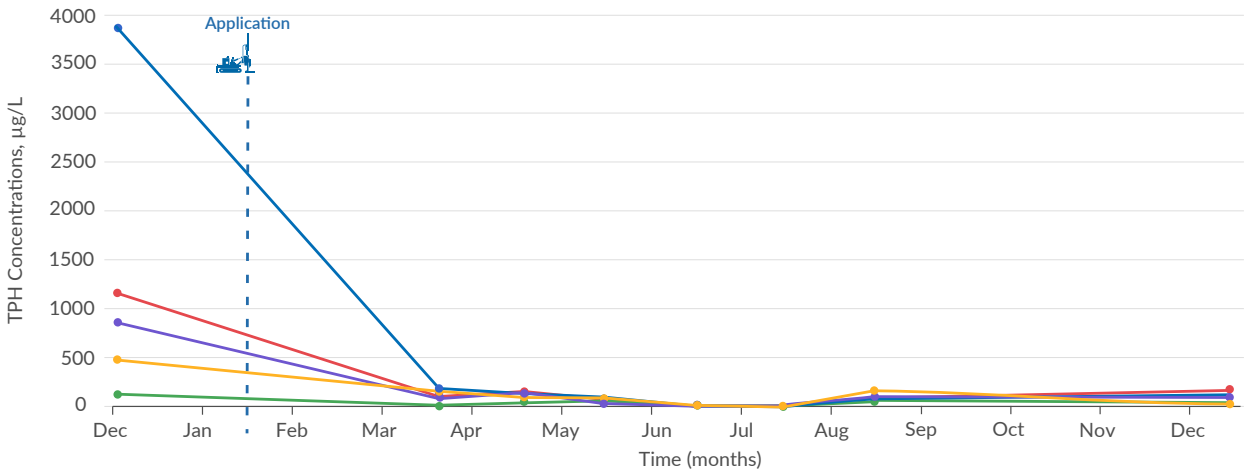
Geology:
Sand and gravel with some silt

Summary

A vacant industrial site in an urban area in Northern Italy, contaminated by total petroleum hydrocarbons (TPH) from underground storage tanks, was effectively remediated using PetroFix colloidal activated carbon technology. The project required substantial and rapid reductions of TPH to allow for planned site redevelopment. Following the application, significant contamination reduction was achieved within months, meeting stringent regulatory standards. These results highlight the utility of PetroFix in complex, urban environments requiring rapid and non-disruptive remediation solutions.

Results

- **Achieved concentrations below regulatory levels within weeks, with reductions observed in both treated and surrounding areas.**



Project Background

A former industrial facility in an urban area of Northern Italy had been abandoned since the early 1990s, When the site was slated for redevelopment, it was found to be heavily contaminated by TPH contaminants from underground storage tanks (USTs) which had leaked diesel fuel. The USTs were subsequently removed from the site in 2015. Contaminants consisting primarily of heavy aliphatic hydrocarbons had however already migrated beyond the site boundary, moving through a highly permeable, fast-moving aquifer. And over the years, the contamination had spread out, creating a significant challenge for redevelopment.

Migration of the contaminant plume through the aquifer beyond the site boundary posed an unacceptable environmental risk, requiring a careful assessment of the most effective remediation strategies. Residual light non aqueous phase liquids (LNAPL) was observed as a measurable sheen in the source area (i.e. former tank farm).

Remedy Selection/Rationale

Given the urban environment, it had been determined that removing the entire column of potentially contaminated soil was unnecessary, as urban users of the area would not be exposed to harmful vapours. A risk analysis was conducted by environmental consultant **Studio Planeta**, showing that reducing the effective infiltration of contaminants in this area was crucial to minimizing the environmental risk to the groundwater. Based on Studio Planeta's analysis, the focus of the remediation efforts was placed on treating the groundwater alone, with the scope of avoiding offsite migration. The residual contamination in the unsaturated soil

was managed using the results of the risk analysis, allowing for a more targeted approach.

The primary challenge was to treat the contaminants effectively without hindering redevelopment plans. Since the site was located in a commercial redevelopment zone, remediation had to be executed swiftly and efficiently making way for the site's future use. This ruled out traditional methods like pump and treat, which would take too long and be too expensive due to the high aquifer permeability and large volumes to pump. In addition, installing a fixed treatment plant in this urban area without surveillance would likely be subject to damages and theft. Excavation was also deemed impractical under the active site redevelopment conditions. Excavating to remove contaminated soil would have been disruptive and would have required support for excavation walls. Contamination at the boundary of the site would have posed further logistical challenges.

PetroFIX® Remediation Fluid

A key feature of the PetroFix technology is its <2-micron particle size. Unlike granular or powdered activated carbon, which can only be injected under high pressure resulting in uneven and uncontrolled distribution, PetroFix can be injected at low pressure and dispersed evenly throughout the aquifer. This ensures more accurate targeting of the petroleum contaminants, enhancing treatment efficiency.

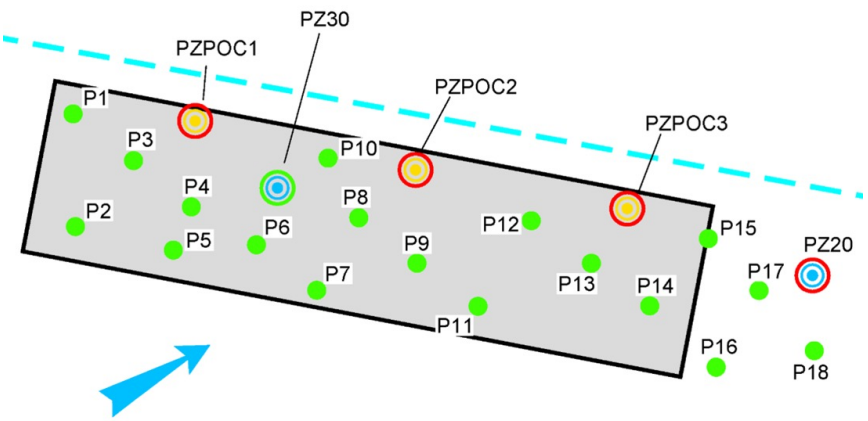
These factors, coupled with the economic benefits, led to Studio Planeta's selection of PetroFix, a proven technology for rapidly remediating hydrocarbons in similar conditions. PetroFix would be applied to the source area to swiftly eliminate contaminants from the dissolved phase, while supplying electron acceptors (such as sulfate and nitrate) to promote biodegradation. This, in turn, would significantly enhance the natural attenuation of the broader hydrocarbon plume and effectively reduce the offsite migration risk to acceptable levels. Essentially, this approach transforms the former leaking tank farm into an underground biofilter.

Application

REGENESIS Remediation Services injected PetroFix into the contaminated aquifer using an injection well array positioned across the former tank farm footprint.

Figure 1 Application Area

Schematic showing PetroFix injection (green points) and monitoring well (PZ-#) locations. Blue arrow indicates groundwater flow direction, and light blue dashed line indicates property boundary towards a public street.



PetroFix was injected into the wells under low pressure, avoiding disruption of the aquifer matrix and ensuring a more uniform distribution of the treatment. The treatment targeted both the soil and groundwater contamination, particularly focusing on the deeper aquifer zones where the contamination had migrated. Inflatable packers were used during the injection to isolate discrete treatment zones for accurate targeting and dosing adjustments.

Bound to the subsurface soils, the activated carbon particles in PetroFix adsorb the hydrocarbons in the dissolved phase, effectively halting further contaminant movement. This increases the contact time between the contaminants and microbes, allowing biodegradation to occur to completion.

Monitoring wells were placed both inside and outside the treated area to evaluate the effectiveness of the remediation and the ongoing recovery of the aquifer.

Above: Inflatable packers were used for isolating discrete vertical injection zones during the application of PetroFix.

Below: Onsite PetroFix staging area

Results

The PetroFix application has led to the following successful outcomes:

Rapid Contamination Reduction

TPH concentrations dropped significantly by the first monitoring event, approximately five weeks post-application, reducing below the regulatory levels at all compliance points. Monitoring results confirmed that the contamination levels were consistently reduced over time.

Enhanced Natural Attenuation

Post-injection monitoring shows a consistent reduction in contaminant concentrations over several months. Monitoring was conducted regularly, with significant decreases in hydrocarbons observed even in piezometers located outside the treatment area at >30 m distance, suggesting the success of the intervention in preventing further migration of the plume.

The Redox and pH have also been monitored and data shows their values remained unchanged (compared to prior application) and stable over time.

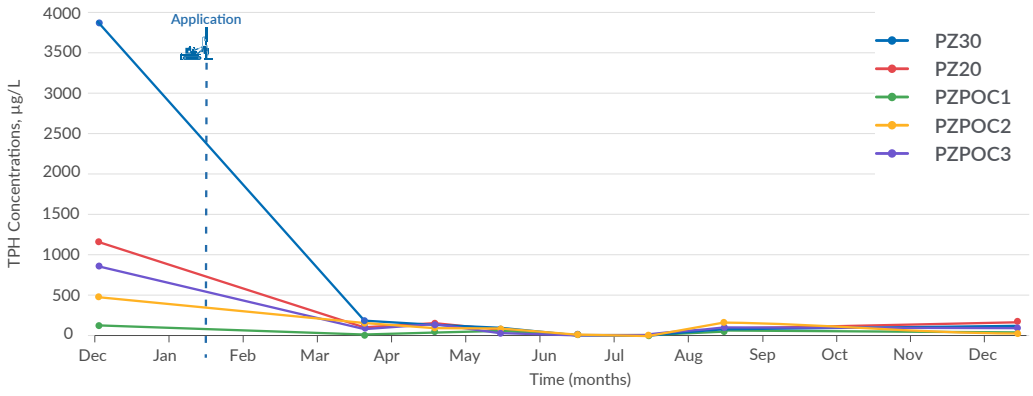
Regulatory Compliance

The stability of the redox and pH was of high importance in this project, given the stringent Italian regulatory setting and the fact that the soil in the area is naturally rich in metals.

The remediation met all regulatory requirements, with concentrations of hydrocarbons dropping below the legal thresholds set by local environmental authorities. The successful compliance was crucial for enabling the site's redevelopment and ensuring long-term environmental protection.

Figure 2 TPH Concentrations

TPH Concentrations inside and downstream of the PetroFix treatment area



Conclusion

The treatment approach outlined exemplifies the advantages of PetroFix in addressing petroleum hydrocarbon contamination in complex urban environments. The technology delivered fast, effective results, significantly reducing contamination within a few months while ensuring the aquifer's long-term stability.

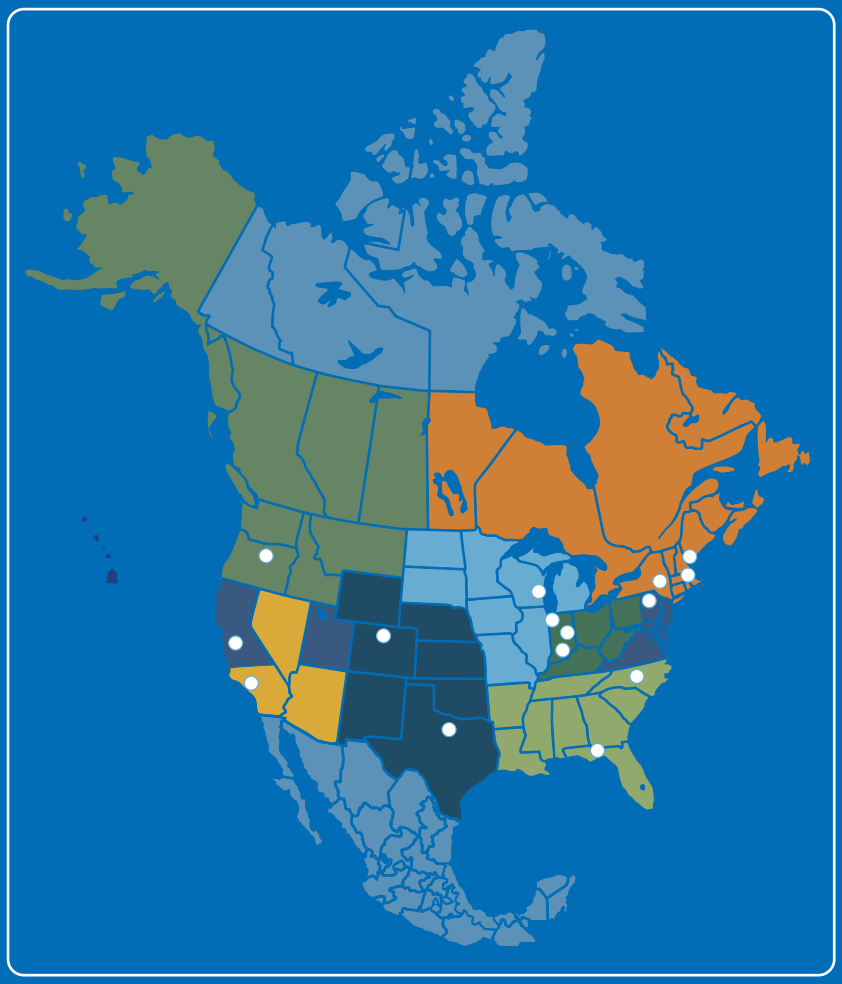
This non-invasive technology will not impede the planned redevelopment of the site, highlighting the value of PetroFix in urban and environmentally sensitive areas where both remediation and future site use need to be balanced.

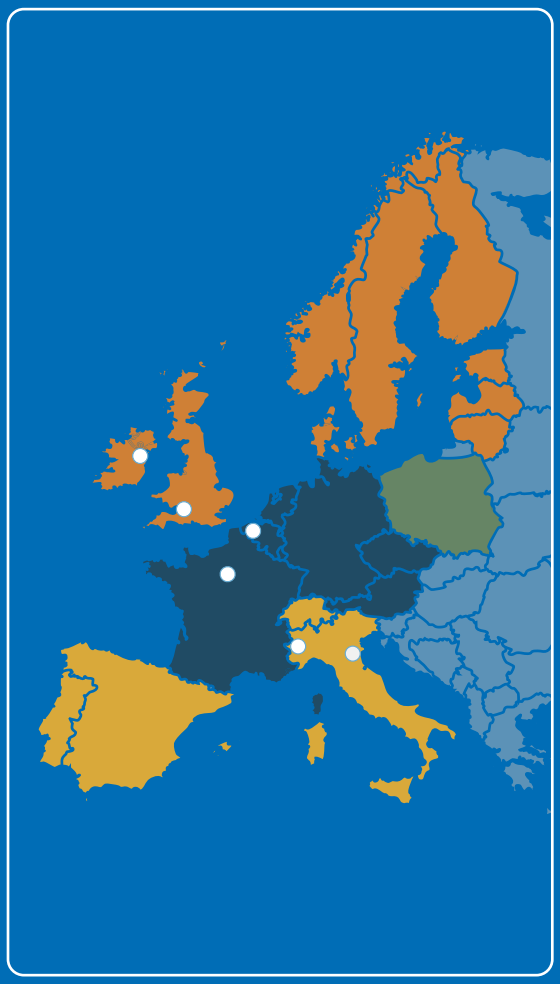
Project Contact

Studio Planeta

Gabriella Pogliano
Senior Geologist and Associate
+39 011 9103450
gabriella.pogliano@studioplaneta.it

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





Global Headquarters

info@regenesis.com

1011 Calle Sombra
San Clemente, CA 92673 USA

Ph: (949) 366-8000
Fax: (949) 366-8090

Europe

europe@regenesis.com

Bath, United Kingdom
Ph: +44 (0) 1225 61 81 61

Dublin, Ireland
Ph: +353 (0) 9059 663

Torino, Italia
Ph: +39 338 8717925

Ieper, België
Ph: +32 (0) 57 35 97 28

REGENESIS®