PetroFIX™ Remediation Fluid

PetroFix Ground Protection Demonstration
For Sub Surface Spill Response and Preventative Applications

Issue

Wherever petroleum hydrocarbons are being stored or handled, there is the potential for leaks or spillages. While the area of the ground immediately impacted by the loss event may be small; migration of the oil through soil and groundwater can rapidly increase the scale of the issue. This can lead to more wide-spread and costly environmental and human health risk as well as off-site liabilities for the site owner.

Traditional oil spill response technologies focus on surface treatment and may not always be effective because a spill may have infiltrated below surface level before it has been observed.

In the case of an underground storage tank (UST), an oil leak cannot be visually observed and will not become apparent until the quantity of oil in the tank is measured. If a loss has been observed or suspected, then it may not always be practical to complete a site investigation or to risk assess the potential impact. This is exacerbated when there have been a number of incidents over time at a busy facility.

Unfortunately, the result is that many spills and leaks often go untreated. This ultimately provides an increased liability to the site owner and an excess cost when full-scale remediation is required.

PetroFIX™ Remediation Fluid

Proposed Remedy

A simple, safe and cost-effective method of minimising the scale of the impact of fuel spills or leaks is to apply PetroFix™ before or after an incident has occurred. PetroFix is a liquid form of activated carbon and nutrients that creates an underground filter to:

- Immediately adsorbs the oil, prevent its spread;
- Kick starts natural attenuation of the contamination.

The biological degradation on the surface of the PetroFix regenerates sorption sites allowing treatment of further contaminant influxes. This means that a single application can provide decades of protection.

PetroFix can be applied:

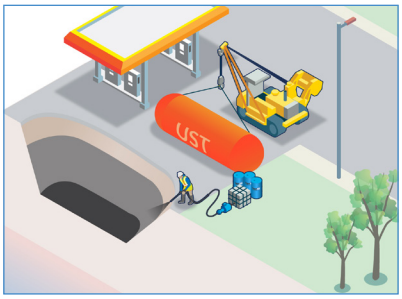
A) Preventatively

- Pre-applying PetroFix by spraying it on surfaces onto which fuel may leak e.g. inside large atmospheric surface tank, bunds, rail ballast, pipe and tank bedding (Fig 1 & 2).
- Converts the surface of the aggregate to highly adsorbent activated carbon.
- When drips, spills or leaks occur, the oil is bound up and the environmental risk is reduced (Fig. 3).

B) Sub-Surface Spill Response

- PetroFix can easily be applied into the subsurface using hollow injection rods and a simple pump.
- The spill area can be targeted to slow the spread of the contamination and;
- Immediately downgradient of the spill at the site boundary to prevent plume development and protect key receptors.

PetroFix need not replace physical bunding or an oil spill response, but provides security that should a leak occur, the development of the plume will be restricted, the contamination attenuated, and cost minimised (Fig. 4 & 5).



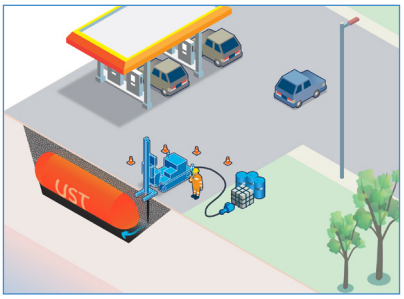


Fig. 1 PetroFix application to excavation during UST replacement
Fig. 2 PetroFix injection into tank bedding on active site

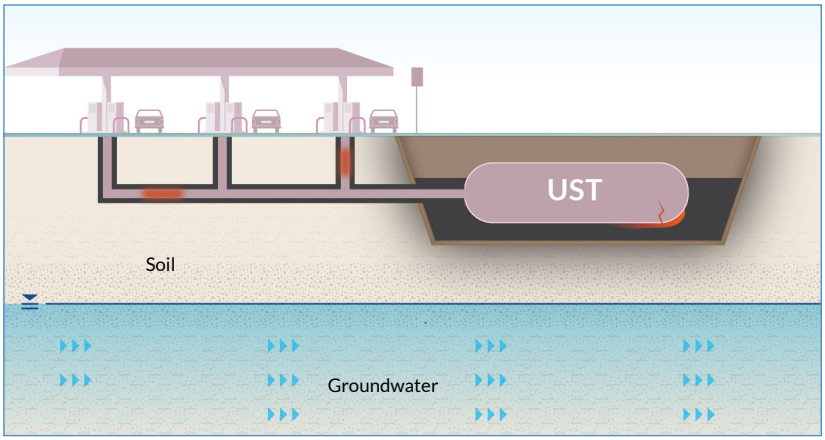


Fig. 3 The PetroFix turns the tank and pipe bedding into an activated carbon filter that can reduce the impact of potential leaks

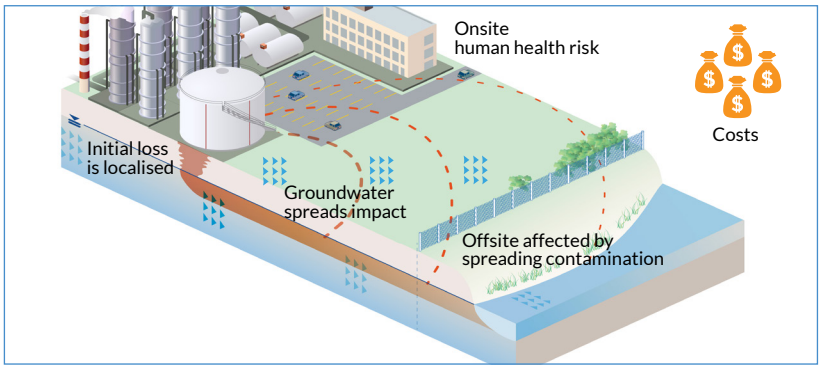


Fig. 4 Effect on the subsurface after a spill or leak

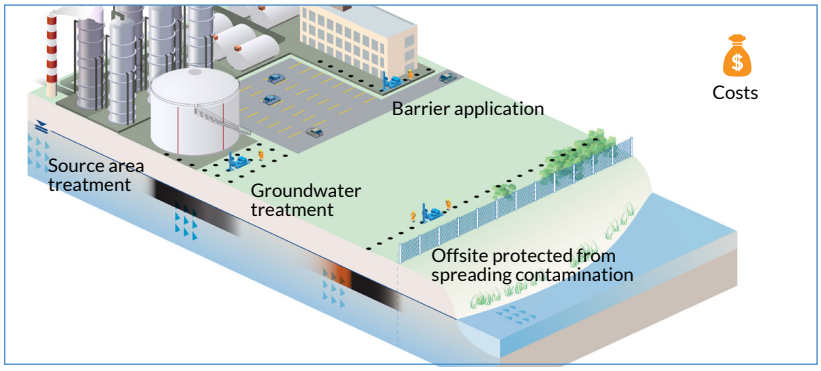


Fig. 5 Subsurface spill response options using PetroFix

PetroFix Remediation Fluid

What is PetroFix?

PetroFix is a highly concentrated water-based suspension consisting of micron-scale activated carbon and biostimulating electron acceptors designed to capture and remediate petroleum hydrocarbons. The product is a liquid suspension, eliminating any concern about carbon dust, and is safe, fast, and easy to apply.

The material is applied as a diluted liquid which makes surface distribution easy by simple pouring or spraying using a variety of pumps and nozzles. The small size of the PetroFix activated carbon particles allows it to easily penetrate and entirely coat aggregate bedding and natural soils in order to capture spilled hydrocarbons.

Experiment

To demonstrate the efficacy of PetroFix as a topically-applied sorbent of diesel range organics (DRO) in an industrial oil spill setting, a laboratory column study was performed. Two identical columns (60 cm x 4.8 cm) were constructed using well-defined sands and loams to emulate a superficial hard-standing or ballast underlain by top soil. The column components from bottom to top included:
1) a lower main body of 75:25 fine sand:sandy loam;
2) a layer of 50:50 fine sand:sandy loam to mimic the top organic-rich layer of soil below the ballast; and,
3) a layer of fine and course sand at the very top representing the hard-standing or ballast of the railroad.

The treated column was dosed with 29.4g of a 50% PetroFix solution applied to the top of the column, representative of a recommended field dose. Both columns were gravity flushed top-down with tap water for 24 hours, mimicking rainfall, to infiltrate the PetroFix into the soil column before the contaminant was applied. The columns are shown in Figure 6, with the PetroFix treatment being visibly apparent to have infiltrated over half of the column and no PetroFix eluted from the bottom of the column. The columns were fed tap water under gravity flow from top to bottom to emulate a natural flux of water through the top few layers of soil and ongoing 'spills' of neat diesel slugs were added at regular intervals to each column.

The water level was kept below the top layer of sand and gravel to ensure all diesel reached at least the top layer of soil. Throughout the experiment, all the effluent was collected from both columns and sent at regular intervals for DRO analysis at a certified laboratory.

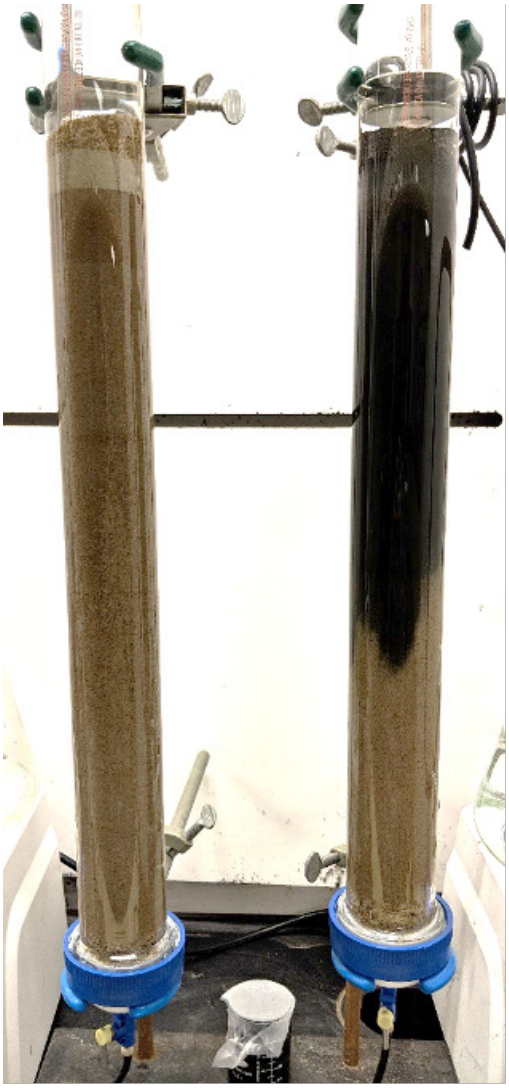


Fig 6. The control (left) and PetroFix-treated (right) columns used in the study to demonstrate the ability of PetroFix to capture small diesel spills.

Results

In total, 14 slugs of diesel were added to each column at an average mass of 0.18g/slug for a total mass of 2.6g diesel added to each column.

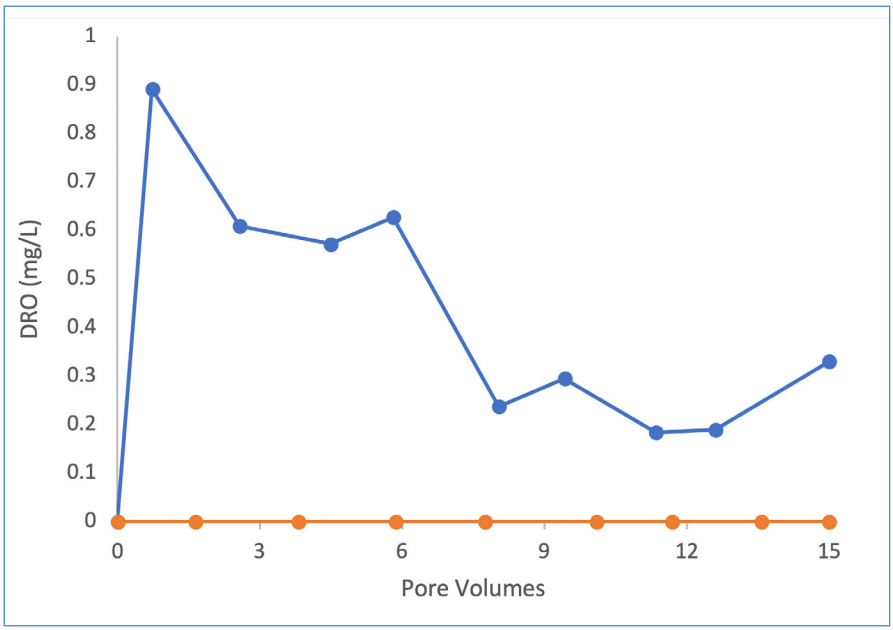


Fig. 7. DRO concentrations measured in the effluent of the control (blue) and PetroFix-treated (orange) columns. Zero-value data points represent non-detect measurements (reporting limit = 50µg/L).

Once applied to the column, the diesel quickly migrated through the control column and eluted within the first pore volume. The DRO continued to elute from the control for the duration of the experiment at concentrations ranging between 200µg/L and 900µg/L.

In contrast, the PetroFix-treated column had no detectable (< 50µg/L) levels of DRO eluting from the column for 15 pore volumes. The concentrations of DRO measured in the effluent of each column are depicted graphically in Figure 7.

Conclusions

This study demonstrated the ability of PetroFix to prevent the migration of DRO spills when topically-applied in a granular/aggregate-type setting. These data indicate that PetroFix can decrease the environmental risk associated with contaminant migration into an aquifer that is possible with surface and sub-surface spills and leaks. PetroFix can be used in both a preventative manner, as was conducted in this study, as well as for sub-surface spill-response to prevent plume development and isolate the contaminants within a small area.

PetroFix is optimised for all petroleum-based contaminants and similar results to the present study are also expected for gasoline and fuel oil (longer chain) organics. While not demonstrated within the scope of this experiment, PetroFix will stimulate the biodegradation of the target contaminants, regenerating adsorption sites and thereby prolonging the efficacy of the treatment.

REGENESIS®

Corporate Headquarters
1011 Calle Sombra, San Clemente CA 92673 USA
Tel: +1 949.366.8000

Europe
Email: europe@regenesis.com
Tel: +44 (0)1225 61 81 61