



## Rapid, Effective Remediation of Free Product at an Active Rail Depot, UK Augmented Pump and Treat, ISCO and ENA completed under rail lines microbe application on surface.



### Summary

The site is located in the south of England at a train care depot, where trains have been stored, repaired, cleaned and refueled for over 20 years. A large number of fuel spill incidents (both historic and recent) have occurred over the years, centered on a fuel filling point.

Site investigations have revealed that these spillages have caused an area of the site to become highly contaminated. This includes the existence of a layer of fuel (Light Non-Aqueous Phase Liquid (LNAPL)), floating on top of the ground-water. This LNAPL was up to 2m thick in the source area, with an associated plume of dissolved petroleum hydrocarbon contamination migrating under the adjacent railway station towards residential properties offsite.

Further plume delineation and detailed quantitative risk assessment (DQRA), showed that the contamination presented a risk to offsite receptors and a potential liability to the site owner, making voluntary remediation advisable.

### Remediation Details

**Site Type:**

Rail Care Depot

**Project Driver:**

Voluntary remediation

**Remediation Approach:**

Reduction in contaminant mass and associated risk

**Technologies:**

P&T augmented with WMTS active Oxidizing Agent and Advanced®

### Geology

X	Made ground
X	Gravel
	Sand
	Silt
	Clay

### Medium

X	Groundwater
	Saturated Soil
	Vadose Zone

### COC

COC Concentration Levels: Free product

Treatment Level:  
2-6m BGL

Treatment Area:  
1,000m<sup>2</sup>

Remediation Cost:  
£500k



X	Petro HCs / BTEX
X	Petro LNAPL
	Chlorinated VOCs
	Metals

### Remedial Design and Application

We were asked by the Railway Function, Waste Management Total Solutions (WMTS), to provide a suitable remediation strategy to address the LNAPL and provide treatment of the wider plume. The remediation had to be effective, whilst allowing for the considerable access constraints of the site, including active train tracks, continued operation of the fuelling point, limited work hours, subsurface services and the necessarily rigorous health and safety requirements of working on or near the line and adjacent to a conductor rail of this busy site (Personal Track Safety (PTS) scheme).

Our approach comprised an intensive 6-month treatment programme to remove LNAPL, reduce adsorbed contaminant mass in the smear zone and then apply a treatment to enhance the degradation of the residual dissolved phase contamination. As the site still actively fuels trains, the validation monitoring has been coupled with improved fuel handling, spill response and monitoring practices.



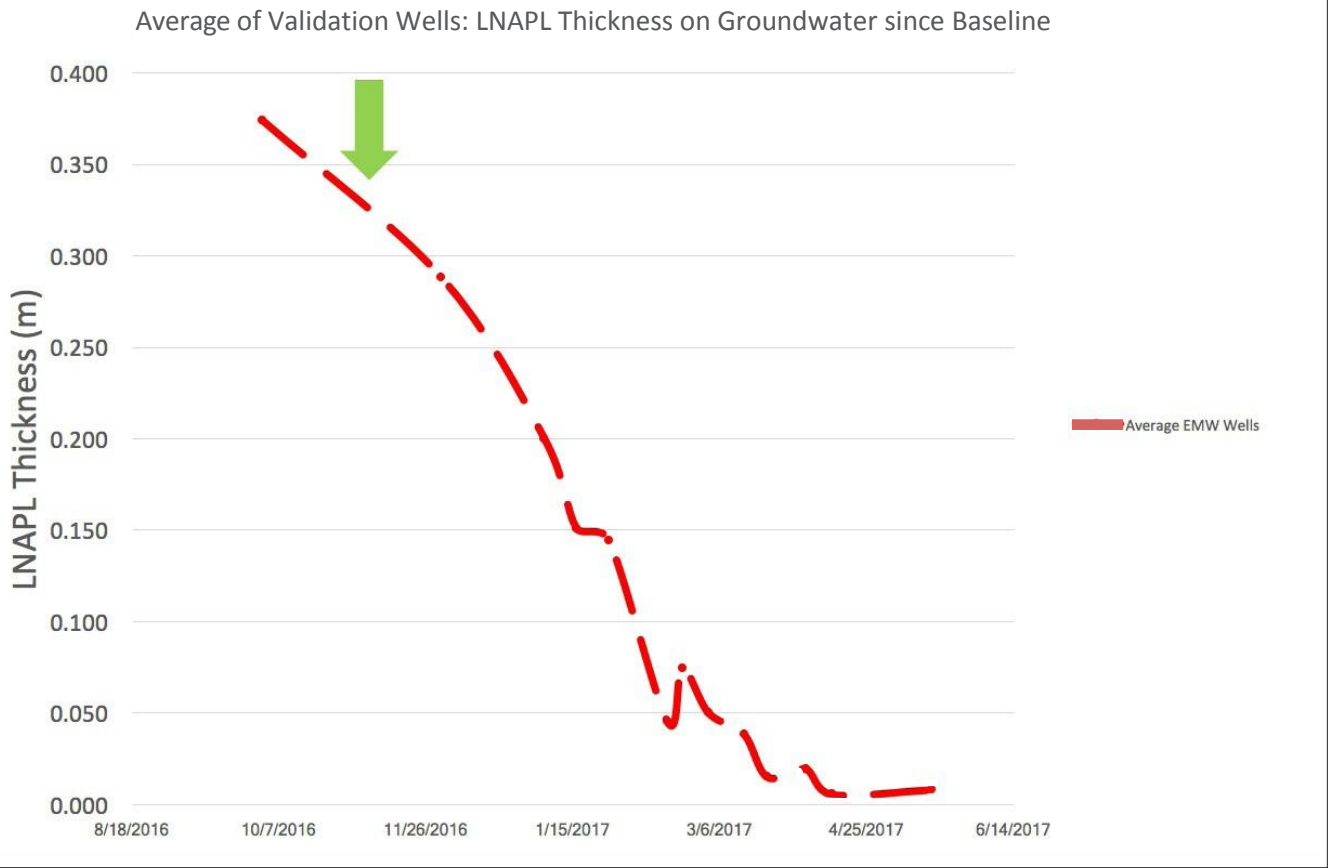
The first phase comprised the installation of a pump and treat (P&T) system enhanced with active oxidizing agent in order to rapidly remove the LNAPL and adsorbed contamination in the smear zone. 18 treatment wells and 10 monitoring wells were installed across the target area: along the access road, the fuel point and within the four foot and six foot of the rail.

The P&T system was operated for a month in order to remove the easily-accessible LNAPL. Following this, the pumps were switched off, active oxidizing agent was injected into the treatment wells and left in situ for one week. WMTS active oxidizing agent a temporary and localised desorption-event in the subsurface, moving soil-bound Total Petroleum Hydrocarbons (TPH) from the smear zone into the groundwater, where it can then be removed by pumping. This has the effect of making the P&T system significantly more effective:

- Removing more contamination over time;
- Removing a much greater amount of contamination for the same time and cost of a typical P&T system;
- Reducing the active pumping period onsite; and
- Avoiding rebound following shut-down of the system.



After one week, desorbed contaminant mass was observed in the monitoring wells and the P&T system was switched back on. After two weeks of pumping, the process was repeated. The graph below shows how the LNAPL thickness is reduced during pumping and increases due to enhanced desorption during Wmts active oxidizing agent applications. It can be seen that the 'rebound' caused by each consecutive active oxidizing agent injection is lower than the prior one, indicating a reduction in adsorbed contamination following each event.



Once four active oxidizing agent's applications had been completed and the rebound pumped out, the LNAPL and adsorbed contamination had been significantly reduced. This allowed the P&T system to be switched off and the residual contamination to be addressed using In Situ Chemical Oxidation (ISCO) and Enhanced aerobic Natural Attenuation (ENA).

Our oxygen active agents was applied to provide rapid degradation, by ISCO, of a portion of the residual sheen and dissolved phase contamination. Our agents use a

controlled oxidant release and a built-in catalyst to provide prolonged (4-5 week) surface-mediated chemical oxidation of groundwater contamination. This allows for a powerful ISCO treatment while maintaining safe site/working conditions, i.e. without increased temperature or pressure in the subsurface. WMTS active oxidizing agent does not damage subsurface services and footings and so is ideal to use on an active facility such as this.

Additional oxidant was applied at the same time as our active oxidizing agent, in order to accelerate the natural biological degradation of the residual dissolved phase contamination. Advanced agent has a patented Controlled Release Technology that ensures the available oxygen in the product is released over a 9 to 12 month

period without any loss to the atmosphere. This creates and maintains the ideal conditions for the growth of an aerobic biomass that will degrade the residual dissolved phase contamination at a rate of 10-100 times that of typical natural attenuation.

### Conclusion

WMTS worked closely with the Site Owner, Regulator, Waste Water Undertaker, Consultant and P&T specialist in order to provide a holistic approach to the site. The remediation strategy addressed the liability associated with historic and recent contamination, targeting LNAPL, adsorbed and dissolved phase contamination on the site.

The treatment comprised the integrated solution of an augmented system combined with in situ remediation, which provided:

- Rapid and effective removal of LNAPL;
- Temporary desorption and removal of secondary source area;
- Significant reduction in groundwater concentrations;
- A cost effective solution;
- No disruption to site operations.



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## Supporting Measure Emergency Spill Cleanup or extended needs term remediation program

### microbe treatment with application and treatment on surface

The heart of the Microbial Remediation Process offered by WMTS is a process where Microbes Eat Oil. The microbes in the product are cultivated, not genetically engineered, to eat oil and other organic substances such as paraffin, grease, creosote effluent and aromatic hydrocarbons. They convert oil, petrol and diesel fuel to harmless, naturally occurring products environmentally safe for human, animal, plant and aquatic life.

This effective and cost competitive program of application developed for clean up, remediation or longer term maintenance by WMTS, consists of applying two main components; a mixed culture of naturally occurring hydrocarbon digesting microbes; a liquid formula with bio-catalyst and nutrients via back pack spray.



Our product and application can be introduced to petroleum-based contamination via fine spray ensuring the Microbes will track the migration path of the oil and digest the oil in situ. This will ensure that the correct environment is maintained for the Microbes to promote growth and efficiency.

The remediation program will visually enhance present ballast and soil conditions, offer remediation for surface contamination with new spills and offer in situ short/long term cost effective remediation and or maintenance by capping further contamination, enabling vastly reduced contamination levels and control measurers implementation through our varied and proven application protocols.