CASE STUDY

Ex-situ Bioremediation

Smith Street, Scunthorpe

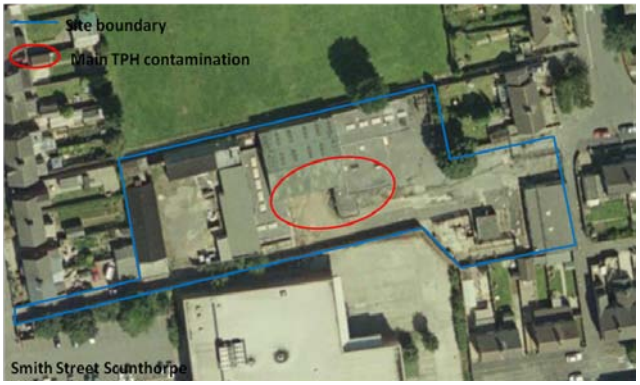

Plate 1 Site Layout

Development:	Residential development.
Consultant:	Humberside Materials Laboratory Ltd
Developer:	MFM Developments

Site Overview

The Smith Street site is situated in Scunthorpe, Lincolnshire. Historically, the site had been utilised as a commercial vehicle sales centre and repair garage. These activities featured fuel pumps with associated under and above ground storage tanks. At some point, there was believed to have been a release of fuel from one of the above ground storage tanks. The contamination encountered was attributed to the previously mentioned activities and included, Total Petroleum Hydrocarbons (TPH) and Polycyclic Aromatic Hydrocarbons (PAH).
Envirotreat proposed a bioremediation and advanced stabilisation / solidification (using E-Clay Technology) as effective remediation strategies.

Objective

The overall remediation strategy was designed to address the source and indirectly the pathway contamination issues in order to protect the identified groundwater and human health receptors. The remedial operation involved the *ex-situ* bioremediation treatment of the identified contaminants of concern to the agreed Site Specific Target Levels (SSTL), which are summarised in Table 1. The SSTL were derived based on a site-specific risk assessment approach.

Contaminant of Concern	SSTL (mg/kg^{-1})
TPH C_6 to C_{10}	26
TPH C_{10} to C_{20}	996
TPH C_{20} to C_{40}	29,800
Naphthalene	0.3

Table 1 Site Specific Target Levels

The treatment of contaminated soil enabled compliance with the identified SSTL through the degradation of the identified target pollutants within the soils. The treatment operation was designed to fully recover the waste soils in order to produce a raw material suitable for reuse on site in accordance with predefined and agreed criteria.

Methodology

The remediation strategy involved two phases; a pre-treatment phase and the remediation works. The pre-treatment stage involved the excavation and mechanical screening of the contaminated soils, which were then stockpiled prior to treatment. Due to site size constraints, all of the contaminated material required excavation to free up an area, which was then prepared as a base for the treatment operation. All soils awaiting treatment were stockpiled near the vicinity of the treatment zone and the underlying ground protected against run-off, and cross contamination by the use of an impermeable membrane and bund. The actual treatment stage involved the construction of a biopile where the contaminated materials were mixed with specific soil conditioners to promote bio performance.

The specific amendments designed for the site were based on the contaminant concentration identified in the intrusive site investigation reports and resulted in the addition of nutrients, micro-organisms, moisture and air to the biopile.

The biopile (Plate 2) was constructed on a network of pipes which initially drew air through the biopile (contaminated emissions being treated prior to release where necessary). Thereafter flow direction was changed and fresh air introduced to the biopile, this was monitored throughout to promote optimal performance.

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Plate 2 Biopile construction

Other key parameters were monitored during the works and included temperature, oxygen & carbon dioxide levels, colony forming unit numbers, pH and nutrient levels. The biopile was covered during remediation with a breathable membrane to optimise the treatment process.

Plate 3 Complete biopile prior to covering

Following successful treatment of the contaminated material, the soil was reused on site as specified in the remediation strategy.

The treated material underwent composite sampling for each 250m^3 of material treated.

A total of 1500m^3 of impacted material underwent treatment. Sampling and analysis was carried out by an external laboratory and based on total concentrations.

Results

The treatment operation was designed to reduce the concentrations of the identified contaminants through their degradation by micro-organisms. The results presented in this report demonstrate that this was achieved, with the final contaminant concentrations being reduced by over 80%, to below the Site Specific Target Levels (SSTL). Achieving the SSTL's resulted in the project being signed off by the Environment Agency and the treated material being suitable for re-use on-site (Plate 4).

Contaminant of Concern	Batch Ref. (mg/kg^{-1})					
	1	2	3	4	5	6
TPH C_6 to C_{10}	1.2	<1	1.2	<1	3.9	5.5
TPH C_{10} to C_{21}	490	560	500	150	180	170
TPH C_{21} to C_{40}	180	180	130	140	85	99
Naphthalene	0.2	<0.1	<0.1	0.2	<0.1	0.1

Plate 4 Redeposition of the treated material.