



**Plate 1** – Tar impacted soils at Middleton.

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**CONSULTANT:** Entec

**CONTRACTOR:** BAM Nuttall

### Site Overview

The site occupies an area of 0.4 hectares and borders the River Irk. The site was contaminated due to its historical use as a former gasworks and as such was contaminated with pollutants including Total Petroleum Hydrocarbons (TPH), Polycyclic Aromatic Hydrocarbons, phenol and ammonium.

### Objective

The overall remediation strategy was designed to address the contamination source and indirectly the pathway issues, with the intention of protecting both human health and groundwater receptors. The objective was to chemically stabilise the 'contaminated' soils using a combination of cementitious products and proprietary E-Clay. The Envirotreat process was selected based on a number of criteria, most importantly the ability of Envirotreat to apply its E-Clay capability using an in-situ approach. Logistical constraints prohibited the more conventional ex-situ approach being utilised in all areas across the site, however certain wastes were treated ex-situ.

The remediation strategy for the Middleton site comprised a two stage approach. The first phase of the project involved the in-situ treatment of an area

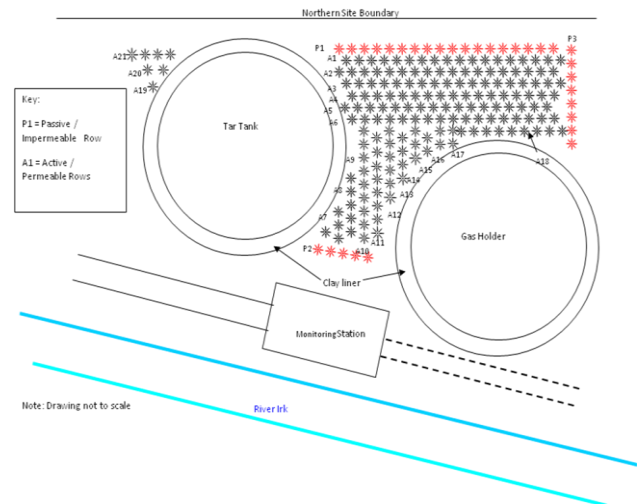
between the tar tank and one of the gasholders. The area identified was thought to have been impacted by tar leaking from an old storage tank. This stage involved the installation of approximately 200 overlapping soil-mixed columns, drilled to a depth of 8 metres (below ground level) in the contaminated area outside of the tar liquor tank. The second phase involved more conventional ex-situ treatment of contaminated materials taken from inside the tank.

### Methodology

Envirotreat employed an in-situ soil mixing strategy to remediate over a 1000m<sup>3</sup> of contaminated soils at the site.

The works were conducted over a period of 6 weeks under Envirotreat's Mobile Treatment Licence (MTL). Specialist technology, materials, supervision plus all the required plant and labour were supplied by Envirotreat Limited.

The in-situ process allows for the remediation of contaminated soils to take place without the need for the contaminated soils to be excavated. The process involved the use of a Continuous Flight Auger to install soil mixed columns to a depth of 8m (see figure 1)



**Figure 1** – Diagram showing overlapping column design.

A slurry production unit was used to produce the E-Clay slurry for both phases of the works. During the in-situ application the slurry was pumped through the hollow stem of the auger (Plate 2). The auger was drilled into the ground whilst continually injecting the

treatment slurry until the desired depth of the column was reached, at which point the pumping was halted and the auger reversed.



Plate 2 – Continuous Flight Auger installing soil mixed column.

By reversing the auger, the column was effectively mixed twice and the amount of spoil brought to the surface reduced to a minimum. The process was then repeated utilising the overlapping column design illustrated in Figure 1.

The ex-situ phase of the works involved excavation of the contaminated soils, E-Clay slurry was mixed in a mixing bin containing a pre-determined volume of contaminated soils. The soils were mixed in 5m<sup>3</sup> batches to allow known quantities of both contaminated soils and E-clay slurry to be combined until a homogenous mix was produced. The treated soils were then temporarily stockpiled before being replaced in the tar liquor tank (Plate 3). Approximately 750m<sup>3</sup> of contaminated materials were treated at this site.

### Validation

Independent analysis of the process was carried out, post treatment. A range of samples were taken from both phases of the works. The samples were then analysed by an accredited laboratory and reported directly to the client.

### Results

Contaminant of concern (Remediation Target Level)	Typical Un-treated (mg/l <sup>-1</sup> )	Treated (average in-situ (mg/l <sup>-1</sup> ))	Treated (average ex-situ (mg/l <sup>-1</sup> ))
Ammonia	228	7.3	0.1
Naphthalene	30	0.4	0.4
TPH (7.5mg/l <sup>-1</sup> )	72	0.4	1.0
PAH (1.8mg/l <sup>-1</sup> )	660	2.6	3.6
Phenol	717	0.3	<0.1

Table 1 – Summary of treated soils leachate results compared to the Site Specific Target Level.

Table 1 presents the Remediation Target Level and leachate results (both treated and untreated) for both the in-situ and ex-situ samples taken at the Corporation Street site. Hydrocarbon contamination was identified as the main contaminant of concern on this site, in particular Total Petroleum Hydrocarbons (TPH) and Polycyclic Aromatic Hydrocarbons (PAH). The Remediation Target Level was agreed between Envirotreat Limited and the client's Consultant Engineer as this was a Voluntary Remediation project.

The results illustrate that the objectives of protecting human health and the identified groundwater receptors were achieved. The contaminants of concern were fully addressed, with leachate levels falling below the agreed Site Specific Target Levels for TPH and PAH.



Plate 3 – Placement of treated soils into tar tank.