CASE STUDY

E-Clay ex-situ stabilisation

Bartoline Factory Fire, Beverley

Figure 1 – Chemical plant engulfed in flames.

Development:	Redevelopment of Factory
Consultant:	White Young Green
Developer:	CR. Reynolds (Construction)
End Value:	£5m

Site Overview

Envirotreat were employed to remediate contaminated soils at a site in Beverley, East Yorkshire. The Bartoline Factory occupied a 3.5acre site until May 2003 when a major fire destroyed the building (Figures 1), resulting in ground contamination and the pollution of two nearby watercourses.

The factory was formerly used for the manufacture, storage and distribution of chemicals including solvents and adhesives. Historical use had also resulted in widespread soil contamination across the site, whereas perched groundwater contamination was probably caused by the methods employed to fight the fire. Total Petroleum Hydrocarbons (TPH) was identified as the main contaminant of concern within the made ground and perched groundwater.

In October 2005, the factory was rebuilt on the site and production was continued, see figure 2.

Objective

The remediation strategy for the Beverley site was designed to address the source contamination on-site and indirectly the pathway contamination issues, with the intention of protecting Human Health and the identified groundwater receptors (i.e. The Barmstrum Drain which leads to the River Hull).

Figure 2 – New factory facility

Methodology

Envirotreat employed an *ex-situ* soil mixing strategy to treat in excess of 6,500m^3 of contaminated soils at the Bartoline site.

The works were conducted over a period of 2 months under Envirotreat's Mobile Process Licence (MPL). Specialist technology, materials and supervision were supplied by Envirotreat, whilst C.R. Reynolds (Construction) Ltd supplied all the required plant, and labour for application of the Envirotreat Process.

Envirotreat were requested to undertake the validation of the excavations. The identified contamination was excavated, stockpiled and treated on-site using the Envirotreat E-Clay technology. The treatment operation utilised 2 No. slurry production units and mixing zones.

The slurry production set up comprised two 1000L paddle mixers where the E-Clay reagents were combined together before being pumped across to the mixing zone. Two excavators mounted with a specialist processing bucket attachments (Figure 4) then mixed the E-Clay slurry and contaminated soils.

The processing bucket is a specialist attachment with a rotating blade at the base of the bucket, which facilitates a high degree of mixing. This approach was utilised due to the clayey nature of material requiring treatment.

The soils were mixed in 5m^3 batches to allow known quantities of contaminated soils to be combined with the E-Clay slurry until a homogenous mix was produced. The treated soils were then temporarily stockpiled before being reused on-site as a substitute for imported clean fill, thus preventing the need for off site disposal.

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Figure 3 – Remediation of contaminated material.

Figure 4 – Mixing of clayey soils with E-Clay (grey coloured slurry) using the specialist processing bucket attachment on a conventional excavator.

Validation

Validation was initiated to evaluate the performance of the treatment process. A range of samples were collected and allowed to cure for a nominal period of 7 – 28 days; the samples were then leached and analysed by a UKAS accredited laboratory on behalf of Envirotreat.

Results

Table 1 presents the Maximum Contaminant Level (MCL) of TPH contamination present at the Beverley site prior to remediation and the results of leachate analysis post-treatment. The Site Specific Target Level (SSTL) has been derived from a Groundwater Risk Assessment conducted by Envirotreat that was subsequently agreed by the Environment Agency.

The remediation project was successfully completed under the auspices of the MPL, with the results illustrating that the objective of protecting human health and the groundwater receptors has been achieved.

Sample Ref. No.	Contaminant of concern	Vol (m^3)	TPH conc post treatment (mgl^{-1})
BO10	TPH	50	0.24
BO50	TPH	250	0.25
BO100	TPH	500	<0.1
BO200	TPH	1000	<0.1
BO300	TPH	1500	0.95
BO400	TPH	2000	<0.1
BO500	TPH	2500	<0.1
BO600	TPH	3000	0.22
BO700	TPH	3500	0.35
BO800	TPH	4000	0.19
BO900	TPH	4500	<0.1
BO1000	TPH	5000	<0.1
BO1100	TPH	5500	0.2
BO1200	TPH	6000	0.11
BO1300	TPH	6500	0.28

MCL in Soil Prior to Clean-up = 1,212 $mgkg^{-1}$
SSTL = 6.21mg/l
** SSTL adopted by Envirotreat is derived by Groundwater Risk Assessment.

Table 1 – Summary of treated soils leachate results compared to SSTL derived from the GW Risk Assessment.

The contaminants of concern have been fully addressed with leachate levels falling below the agreed Site Specific Target Levels for TPH, thus allowing the material to be re-deposited on-site (Figure 5).

The scheme was runner-up for the Brownfield Briefing 2005 Award for Best Use of a Chemical System", quoting "for its rapid and cost-effective ex-situ application of E-Clay® technology to stabilise TPH-contaminated material".