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# CASE STUDY

## Ex-Situ / In-Situ E-Clay Stabilisation

**Remediation of Hydrocarbon Contamination, Asbestos and Bitumen Residues**

**Client**

Greenergy

**Main Contractor**

Jones Brothers Henllan Ltd

**Engineering Consultants**

Project Design Engineers www.pde.co.uk

### Site Background & History

The Cattedown Fuel Terminal is situated in the Cattedown area of Plymouth approximately 1.5 km south-east of the city centre. The site is adjacent to the northern bank of the River Plym estuary and is shown in Figure 1 below.

The site is bordered to the west and south by the River Plym and fuel storage tanks, to the east by further fuel terminal infrastructure and by the main site entrance and to the north by a high vertical rock face (supporting the South West Coastal Pathway) and additional fuel terminal infrastructure beyond the rock face.

On acquiring the redundant bitumen storage facility, the client was advised that a previous tenant of the site had demolished a large bitumen storage tank in the 1970's and that the bottom section of the tank remained *in-situ* and was effectively buried on site.

Project Design Engineers [PDE] carried out a site investigation of the area to determine the location / size of the tank base and the nature of any residual material within the tank.

Figure 1 – Cattedown Site – the Tank Location is Shown by a Red Arrow

The tank base was determined to be approximately 1.5m high with an overall diameter of 26m. Trial pits confirmed that the steel tank base had been left *in situ* and that the void space within the tank base had been infilled with various spoil materials. The spoil materials were shown to be contaminated – the nature of the contamination was consistent with previous usage of the site for the production, storage and distribution of bitumen – the prime contaminants of concern were total petroleum and polycyclic aromatic hydrocarbons. The contaminated spoil material is shown in Figure 2 below.

Figure 2 – Contaminated Spoil Material

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**Remediation of Hydrocarbon Contamination, Asbestos and Bitumen Residues**

Envirotreat was commissioned by Jones Brothers (Henllan) Limited [JBHL] to develop a remediation strategy to address the contaminated spoil materials within the tank base (and directly surrounding the tank base) – the total remediation volume was estimated to be circa 1,000m$^3$. The remediation strategy was designed to address potential risks to human health and controlled waters (as identified in the site conceptual model). E-Clay Stabilisation was proposed for the treatment of the tank contents and surrounding soils. The remediation strategy was approved by PDE on behalf of the client.

JBHL subsequently engaged Envirotreat to provide the remediation technology and necessary supervision to enable JBHL to undertake the remediation works. Envirotreat was also engaged by JBHL to obtain the necessary regulatory approvals from Plymouth City Council and the Environment Agency.

### Methodology

Envirotreat produced a Remediation Method Statement summarising the site history and contamination issues, the remediation strategy & technical rationale, environmental protection measured required during the remediation works and agreed validation protocols for the treatment element of the works. The requisite Environmental Risk Assessments and Health & Safety Documentation were also produced.

### E-Clay Stabilisation

The E-Clay Stabilisation works were undertaken using a combination of *ex-situ* and *in-situ* treatment methodologies. The drier materials were excavated and treated *ex-situ*. The wetter materials in the base of the tank were treated *in-situ* as the materials could not be safely excavated – these materials included a significant volume of bitumen residue at the base of the tank.

The *ex-situ* treatment process involved mixing the contaminated materials with the designated E-Clay and cementitious treatment materials in batches of known volume – the treatment was carried out in a mixing bin as shown in Figure 3 below. The E-Clay was added in slurry form and the cementitious materials were added in dry form – the slurry mixing process utilised contaminated water which had accumulated within the tank base – this water was then incorporated into the treatment process negating any requirement for offsite disposal or for additional contaminated water treatment facilities.

Figure 3 – *Ex-Situ* E-Clay Stabilisation of Contaminated Materials


The in-situ treatment process involved the addition of bentonitic materials to absorb excess residual water followed by the addition of the required volume of E-Clay slurry - the slurry was pumped over the tank surface and then mixed with the contaminated materials until a homogenous mass was produced. Cementitious materials were then added to provide the necessary geotechnical improvement to the treated material (this was particularly important in relation to the bitumen residue which exhibited very poor geotechnical properties in an untreated state). The *in-situ* treatment process is shown in Figure 4 below.

Figure 4 – *In-Situ* E-Clay Stabilisation of Contaminated Materials

**Asbestos Containing Materials**

The remediation works were complicated by the discovery of asbestos containing materials [ACM]. These were not identified by the previous site investigations.

Fragmented cement sheeting was initially observed in the excavated stockpiles. In accordance with the agreed protocols (as documented in the Remediation Method Statement) the remediation works were suspended and the excavated materials were quarantined pending qualitative and quantitative analysis (by i2 Analytical [i2]) to determine the nature and concentration of asbestos contained within the stockpiles.

Analysis carried out by i2 confirmed the presence of Chrysotile Asbestos associated with the cement sheeting (as expected) but also identified the presence of potentially more harmful Amosite Asbestos – this form of asbestos is generally associated with unbound insulation material - further investigations identified the presence of insulation board in the perimeter wall of the tank which was considered to be the most likely source of the Amosite Asbestos.

In accordance with the Control of Asbestos Regulations 2012, the works were considered to be notifiable and the HSE was notified accordingly. It was also necessary to revise the Remediation Strategy, the Remediation Method Statement, the Environmental Risk Assessment and Health & Safety Documentation to reflect the presence of ACM. The prime objectives were to identify the environmental and human health risks associated with the presence of asbestos (particularly the amosite form) and the necessary control measures to be implemented to safely complete the remediation works. The revised remediation strategy incorporated the provision of a concrete cap to isolate the treated materials from the surrounding environment. Necessary approvals were obtained from the regulatory bodies prior to recommencing remediation works.

During the suspension of the works it was necessary to implement control measures to prevent the release of asbestos fibres – these measures included covering the critical areas of the site with polythene sheeting – the site perimeter was redefined and appropriate site security was implemented.

The remediation works were recommenced by JHBL under the supervision of Envirotreat. The treated materials were redeposited within the void created by the excavations in the tank base. The necessary control measures were implemented – these included the use of suitable decontamination units and appropriate PPE, wetting down of the treated materials to mitigate potential release of fibres and reassurance air monitoring.

Asbestos fragments were ‘hand picked’ from the stockpiles (where visible). The majority of the asbestos contamination was treated by the stabilisation process thereby binding the fibres into the stabilised mass. A minimal amount (350 Kg) of ‘hand picked’ asbestos was disposed of offsite.

The remediated works were completed by the installation of a concrete slab as a capping layer – this was designed by JHBL with input from Envirotreat. The installed concrete slab is shown in Figure 5 below.

Figure 5 – Installed Concrete Slab (Capping Layer)

**Validation**

Representative samples were taken from the treated batches and combined to form composite samples for validation purposes. Following a suitable period of "curing" the composite samples were leach tested and compared with the designated leachate target criteria. All leachate values were compliant with the target criteria. The treated material was therefore considered suitable for reuse on site as a substitute for imported fill.

**Conclusions**

Envirotreat successfully demonstrated through a comprehensive Validation Report that the overall remediation strategy had been successfully implemented in accordance with the requirements of the Remediation Method Statement.

The prime driver for the remediation works was the protection of human health and controlled waters.