CASE STUDY

E-Clay Ex-situ Stabilisation

Former Gas Works - Port Glasgow

Figure 1 Site overview

Completion Date:	November 2008
Consultant:	Envirocentre
Main Contractor:	RJT

Site Overview

The site of concern occupied part of the former Inchgreen Gas works. The plot is adjoining the Southern banks of the Clyde estuary sandwiched between the Kingston Yard site and the Inchgreen Dock. The site is irregular shaped (relatively flat) parcel of land of about 0.8ha in area.

The gasworks were established on the island of Inchgreen in October 1873 and by 1896 the plant included three in ground tank gasholders and gas manufacturing facilitates. A forth gasholder was constructed between 1913 and 1920 to the North West of the site

Objective

The general principle of the overall remediation works was to address contamination issues associated with the sites history. The main contaminants of concern were identified as arsenic, cadmium, nickel, lead, Total Petroleum Hydrocarbons (TPH), Polycyclic Aromatic Hydrocarbons (PAH) and cyanide

The proposed end use for the site is to be a combined private residential housing and flatted accommodation.

Figure 2 Evidence of contamination associated with a former gas holder.

The potential receptors to the contamination identified on site include the adjacent River Clyde, major Aquifer and associated groundwater and site workers during construction phase & end users once the site has been redeveloped.

The outline proposal was to enable maximum re-use of material on site. Envirotreat were considered preferential on the basis of its advanced stabilisation capabilities and overall cost. It was estimated that a 'dig & dump' option would have cost approximately £1.5 million, whereas Envirotreat were able to stabilise most of the contaminated material onsite for £700,000.

Methodology

The strategy involved the ex-situ stabilisation of approximately 9,500m^3 of contaminated soils. The E-Clay specifically designed for this was a modified reactive inorgano-organoclay, primarily focusing on the effective treatment of the contaminants of concern. With the addition of cementitious materials the physical properties of the treated material are improved and play an important role in the curing process. The objective to produce a chemically and physically stabilised treated mass for deposition as a substitute for imported material.

The strategy involved producing 150m^3 treatment pads of contaminated soils. These pads were sprayed with E-Clay slurry (by means of a slurry spreader), prior to mixing with a Wirtgen which also incorporated the addition of the *cement at the same time.*

Surface and perched groundwater contamination issues were addressed by carbon treatment prior to discharge into the Clyde.

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Figure 3 WIRTGEN blending E-Clay and contaminated material.

Following validation treated materials were placed in a single area to the North West of the site (next to the Clyde), which was not to be developed and was to become a landscaped area. This overall remediation approach further minimised future liabilities.

Validation

EnviroCentre had a constant presence on-site throughout the project in order to continuously monitor the progress of the remedial works.

The validation of the remediation process was the responsibility of Envirotreat Limited. The procedure for validation of treated contaminated soils was one of combined samples of the 150m³ treated batches (after suitable curing periods within the stockpile). These samples were then submitted to leachability testing using the CEN 12457 methodology at an UKAS accredited laboratory. The samples were tested for TPH (split), PAH (speciated), phenol, cyanide, ammonia, heavy metals and BTEX (benzene, toluene, ethylene and xylene). The results of these leachability tests were compared with the pre-agreed target standards determined by EnviroCentre to verify achievement of the treatability work. Once validated the treated materials were replaced as outlined above.

Results

Results obtained to date suggest that treatability targets have been achieved.

Table 1 shows leachate criteria to which soils were tested, DQRA determined by EnviroCentre.

Table 1 EnviroCentre DQRA.

Matrix	Units	Leachate Treatment Target
Cyanide (free)	mg l^{-1}	0.5
Ammonia (free)	mg l^{-1}	1.2
Arsenic	µg l^{-1}	120
Cadmium	µg l^{-1}	30
Chromium (total)	µg l^{-1}	180
Lead	µg l^{-1}	300
Mercury	µg l^{-1}	3.6
Nickel	µg l^{-1}	240
TPH aliphatic >C5-C6	µg l^{-1}	181,000
TPH aliphatic >C6-C8	µg l^{-1}	181,000
TPH aliphatic >C8-C10	µg l^{-1}	3,620
TPH aliphatic >C10-C12	µg l^{-1}	3,620
TPH aliphatic >C12-C16	µg l^{-1}	3,620
TPH aliphatic >C16-C21	µg l^{-1}	3,620
TPH aliphatic >C21-C35	µg l^{-1}	
TPH aromatic >C6-C7	µg l^{-1}	12
TPH aromatic >C7-C8	µg l^{-1}	120
TPH aromatic >C8-C10	µg l^{-1}	3,620
TPH aromatic >C10-C12	µg l^{-1}	12,100
TPH aromatic >C12-C16	µg l^{-1}	12,100
TPH aromatic >C16-C21	µg l^{-1}	1,090
TPH aromatic >C21-C35	µg l^{-1}	1,090
Naphthalene	µg l^{-1}	1,000
Anthracene	µg l^{-1}	0.24
Fluoranthene	µg l^{-1}	0.024
Benzo[a]pyrene	µg l^{-1}	6
Benzene	µg l^{-1}	12
Toluene	µg l^{-1}	480
Ethyl benzene	µg l^{-1}	240
m- & p-Xylene	µg l^{-1}	360
o-Xylene	µg l^{-1}	
Phenols (total)	mg l^{-1}	2

In all 65 (9,525m^3) batches of contaminated soils were treated over a period 7 weeks.