

Developer / Client

Confidential

Environmental Consultants

masonevans 
geo-environmental consultants

Site Background & History

The site comprised of a small parcel of land forming part of the old town gasworks. Mason Evans Partnership [MEP] carried out site investigations which confirmed the presence of significant contamination associated with historical use of the site as a gas works. The prime contamination source was identified to be wastes deposited within a gas holder which was located partly on the site and partly on the adjacent site. The identified contaminants of concern were Total Petroleum Hydrocarbons, BTEX, Polycyclic Aromatic Hydrocarbons (primarily Naphthalene and Benzo(a)Pyrene), cyanide and ammonia.

The developer / client was seeking planning permission to develop the site for residential end use. Effective remediation of the site was necessary to satisfy the requirements of SEPA and to enable discharge of planning conditions in relation to contamination issues.

Various remediation options were considered and precluded on the basis of cost and/or inability to achieve site remediation criteria. Working closely with MEP, Envirotreat developed a remediation strategy for the site which was commercially viable and addressed the remediation requirements for the site, both in terms of groundwater / surface water and human health protection.

The typical contamination encountered on site is shown in Figure 1.

Figure 1 – Typical Gas Works Waste Encountered



The site is located within close proximity to a Ramsar Site, a Special Area of Conservation, an important bird area as well as two SSSI sites. The site is bordered by a substation to the north, the tidal Kinness Burn directly adjoining the site to the east, a builder's merchant to the south and school grounds to the west.

The Kinness Burn discharges into the bay 500m from the site and is the prime surface water receptor. The groundwater on the site was also considered to be a receptor. Site end users and site workers were also considered to be receptors.

MEP identified gross contamination within the gas holder to the depth of the bedrock - it was believed that the gas holder was constructed directly on the bedrock. Contamination was also identified across the site as a whole.

Remediation Strategy

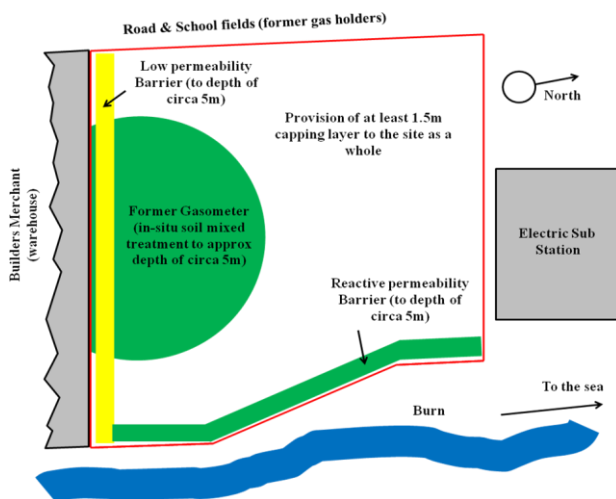
An integrated remediation approach was proposed to address the identified environmental and human health risks.

The strategy comprised of four key elements:

1. Installation of a low permeability barrier to prevent re-contamination of the site from the section of the gas holder located under the builder's merchant site.
2. In-situ E-Clay stabilisation of contaminated soils within the gas holder.
3. Installation of a E-Clay Permeable Reactive Barrier along the eastern boundary to protect the Kinness Burn from residual contamination on site.
4. Installation of a suitable capping layer to address human health risks.

The overall remediation strategy is shown in Figure 2.

Figure 2 – Schematic Representation of the Adopted Remediation Strategy



Methodology

Envirotrear produced a site specific working plan for the site summarising the site history, the identified contamination issues, the proposed remediation strategy / technical rationale and the required environmental protection measures for the remediation works.

Following a consultation period with SEPA, approval was obtained to undertake the proposed remediation works utilising Envirotrear's Mobile Plant Licence. Site specific leachate target criteria were derived using RTM / P20 modelling and agreed with SEPA for the treatment of E-Clay stabilised soils and for the treatment of the site as a whole.

The works were undertaken by Envirotrear within a two week period. The low permeability wall was installed initially by in-situ soil mixing – this was necessary to protect the site from recontamination. The contaminated soils within the former gas holder were stabilised by in-situ soil mixing utilising a designated mix formulation of E-Clay and cementitious materials. The E-Clay Permeable Reactive Barrier was installed by in-situ soil mixing.

The site post remediation is shown in Figure 3. The installation of the capping layer was to be undertaken as part of the site development works (as part of the raised level requirements for flood protection).

Figure 3 – Site Post Remediation (looking east)



Validation

The works were undertaken in line with SEPA “Land Remediation and Waste Management Guidelines”, Section 4 “On-Site Treatment and Subsequent Use”.

It was agreed that the suitability of the treated material for reuse on site would be confirmed by compliance with risk based derived leachate target values.

The treated materials were seen as a necessary part of the works - the material would replace the potential requirement to import virgin fill (to return the site to pre-remediation formation levels).

The material was identified as having a specific purpose with any deficit of material resulting in the necessity to import fill.

The proposed remediation strategy was also agreed with Fife Council on the basis that it was designed to be non-polluting with the aim of providing protection to the identified receptors.

Following a suitable “full curing” period representative samples were taken of the low permeability barrier and the stabilised material within the gas holder. The agreed sampling frequency for the gas holder was one sample per 250m³ of treated soils.

The barrier sample was submitted to a laboratory for permeability testing and the core samples of the gas holder were submitted to a laboratory for leachability testing for agreed contaminants of concern. The results are shown in Tables 1 and 2.

Conclusions

The results were acceptable to SEPA / Fife Council and demonstrated that the integrated remediation strategy had been successfully implemented.

The prime driver for the remedial works was the protection of groundwaters / surface waters and, in particular, the protection of the Kinness Burn from the potential risk of contamination. The remediation works also enabled the site to be developed by discharge of relevant planning conditions.

The site was subsequently redeveloped for residential use as shown in Figure 4 below.

Table 1- Leachate Results and Comparison with Risk Based Derived Remediation Criteria

	Leachate Target Criteria (ug/l)	Leachate Results (ug/l)
Ammonia	30,400	609
Lead	1,360	1.4
Cyanide	200	<50
Benzo(a)Pyrene	100	<0.1
Naphthalene	480	52
TPH	600*	422

Table 2 -Triaxial Permeability Testing Results (Low Permeability Wall)

	Specification	Triaxial Permeability of Low Permeability Barrier
Triaxial Permeability	Less than 1×10^{-6} m/s	5.6×10^{-10} m/s

Figure 4 – Residential Development



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