

**LAND OFF HOYLE MILL ROAD,
BARNSELY**

**METHOD STATEMENT (REVISED):
GEO-ENVIRONMENTAL ASPECTS OF
SITE RECLAMATION, ENABLING &
REMEDIATION**

BARRATT SHEFFIELD

**S5/028a (Rev 2)
November 2006**

abatt consulting engineers

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FOR
BARRATT SHEFFIELD**

Project No:
S5/028a

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METHOD STATEMENT (REVISED)

**GEO-ENVIRONMENTAL ASPECTS OF SITE RECLAMATION, ENABLING &
REMEDICATION**

HOYLE MILL ROAD, BARNSELEY

1.0 INTRODUCTION

The method statement should be read in conjunction with the following:

- Phase I & II Geo-environmental Investigation (S5/028a) – Abatech International Ltd. - September 2005.

1.1 Site Location and Description

The site is located on Hoyle Mill Road, Barnsley, at NGR 436860mE, 405830mN (approximate site centre) as shown on the appended site location plan (Figure S5/028a/001).

The site comprises three distinct parcels, which all lie below the level of surrounding land. These are: the main J.C. Snell workshop and car parking in the west and centre of the site and two parcels of un-surfaced ground to the north and east. The combined overall area is approximately 1.32ha (approximately 3.3 Acres).

Western and Central Area

The western part of the site primarily comprises tarmac car parking and vehicular access to the car and heavy goods vehicle servicing bays, which lie within the garage/workshop areas of the buildings and occupy the central part of the site. These buildings are a combination of brick and portal frame construction. The buildings, which are interconnected, comprise vehicle workshops, stores and parts departments, offices and a spray-booth, accessed by various roller shutter doors.

Northern and Eastern Areas

The northern part of the site comprises rough unsurfaced ground, used for parking vehicles on and a heavily overgrown and wooded section to the far north-west. Typically, the ground slopes gently down towards the east. A

now disused sales unit, formerly used by J.C. Snell 'Vans', occupies land adjacent to the northern-most site entrance. Land immediately adjacent to this unit is heavily vegetated. An extensive area covered with Japanese Knotweed is present in the north and north-east of the site.

The eastern section of the site also comprises rough flat unsurfaced ground, being used for the storage of scrap car parts and other waste and the burning of scrap materials. Adjacent to the far eastern boundary articulated trailer units are parked-up and it is understood that Barnsley Community Transport use the site to park vehicles overnight.

The boundaries to the site comprise a mixture of poorly maintained iron railings along Hoyle Mill Road, brick walling and palisade fencing. Around the eastern part of the site wooden panel fencing is present, which has mesh reinforcement attached to it.

1.2 Summary of Site History

The history of the site has been documented by Ordnance Survey plans, these dating back to 1892 (reference should be made to Abatech Geo-environmental Investigation, S5/028a, September 2005).

Historical Ordnance Survey plans indicate that the site was first occupied by a brickworks, which are shown to have been largely demolished by 1906. Limited development at the site appears to have been carried out until the early 1930's, at which time only a few small buildings have been constructed.

A 'large' building is shown on the 1961 Ordnance Survey plan, which is shown to have been extended by 1974. This building is labelled as a 'garage'. To the north and east of the garage is a strip of land labelled as a refuse tip.

From the 1987 Ordnance Survey plan, three buildings are identified to be present at the site. These comprise the garage, a building (garage showroom) on the western boundary and a small building in the woods to the north.

1.3 Phase II Investigation

1.3.1 Site Works

Site investigation works were carried out between 17 and 19 August 2005 and comprised the excavation of eleven trial pits (TP1-TP11) and eight window sampler boreholes (WS1-WS8).

1.3.1.1 Investigation Rationale

Drilling and trial pit positions (as shown on the appended drawing S5/028a/002) were selected on the basis of the desk study and walkover, which identified that access around the site was limited. Intrusive works were therefore largely carried out in open spaces at the site, since articulated trailer units and buses were stored in the eastern part of the site and car parking occupied the western and northern parts of the site. Constraints were also placed on the investigation given the location of active service runs. An area of the site could also not be investigated due to the dense undergrowth that was present at the time of the works (refer to the appended drawing S5/028a/003).

Drilling works were carried out inside the buildings, as they were less disruptive to the day-to-day workings of the site. Drilling positions were however constrained by the operational activities of the site (i.e. vehicle movements, parts storage, equipment, office spaces etc).

1.3.1.2 Sampling Strategy

Site investigation works were carried out in general accordance with guidelines prescribed in BS:10175 (2001). Samples of soil were taken from the site on the basis of non-targeted sampling, with the spacing between the investigation locations being approximately 20-25m (as required for main investigations). The chosen spacing was considered adequate and consistent with the objectives of the investigation, given that the site is to be redeveloped for residential end-use with gardens and areas of soft landscaping. Made ground soils across the site were relatively homogeneous in nature, and therefore samples of soil taken for analysis are considered to be representative of the general contamination status of the site.

1.3.2 Ground Conditions

1.3.2.1 Made Ground

The ground investigation encountered made ground across the whole of the site, which had been used to raise ground levels.

Made ground typically comprises a dark brown slightly clayey gravelly soil matrix with many bricks, much stone and concrete, some glass, ceramic, plastic and other inert debris. Some burnt shale was proven in trial pit TP5 throughout the vertical profile of the pit. Made ground in all of the trial pit excavations, and some of the window sample holes, was observed to be very unstable (refer to appended investigation logs and drawing S5/028a/002).

Although variations in thickness were observed, based on the findings of the ground investigation the made ground appears to be typically 1.5m to 2.0m deep across the western section of the site (beneath the hard-paved car park), but becoming deeper towards the northern boundary, beneath the workshops/offices and the eastern boundary, where they were proven to be on average about 3.0m to 4.0m deep. Slightly deeper areas of made ground were encountered beneath the footprint of the existing buildings (to about 4.5m bgl), whilst slightly shallower depths around the eastern perimeter (to between about 2.0m and 3.0m deep). In some of the holes, the vertical extent of the made ground materials was not proven, extending to depths greater than the reach of the excavator (about 4.5m).

1.3.2.2 Natural Ground

The underlying natural strata were found to comprise cohesive materials associated with the near surface weathering of the Middle Coal Measures sandstone. The Coal Measures strata, which comprised clay containing angular fragments of sandstone, were typically proven to be about 2.0m thick before less weathered sandstone was encountered.

On the basis of the standard penetration tests carried out in the window sampler holes, the clays may be described as firm to stiff, becoming increasingly stiff with depth. The underlying natural clayey soils are generally considered to have a safe bearing capacity of at least 125kN/m², although

some softer pockets of clay and sand have been proven in some of the investigation locations at a depth of about 4.0m to 5.0m bgl.

1.4 Environmental Assessment

Made ground materials which are present at the site have most probably, in part, come from the demolition of historic brick-works buildings, which once occupied the site, as well as from other local sources (e.g. the former glass works buildings to the north) and the wider area. Materials may also be derived in part from the historic railway line which ran along the northern boundary. Residue from these types of industrial works often contain elevated concentrations of heavy metals, phytotoxic contaminants as well as some organic and hydrocarbon type contaminants.

Based on the findings of recent laboratory testing and risk assessment, the principal contaminants of concern to human health at the site have been identified as arsenic and PAH. Some elevated concentrations of the phytotoxic contaminant, zinc, as well as chromium have also been proven within the made ground materials, but these are considered to pose less of a risk.

Total petroleum hydrocarbons (TPH) concentrations in excess of the Tier 1 screening level of 500mg/kg were detected at three of the six investigation locations (TP03, 0.5m – 3,712mg/kg; TP05, 0.5m – 1,256mg/kg and WS07, 0.8m – 1,020mg/kg), being identified within the made ground materials which underlie the northern and eastern car parking areas. Speciated TPH analysis indicated that the TPH comprises a mixture of both aliphatic and aromatic hydrocarbons, most probably associated with the localised leakage of fuels, such as diesel, from heavy goods vehicles/buses that are parked at the site. The TPH 'fingerprint' suggests that the hydrocarbons are degraded, since the heavier molecular weight organics (between C12 and C35) remain in the host soils.

In accordance with BRE Special Digest 1 it is considered that Class DS2/ACEC-AC2 sulphate conditions should be assumed where concrete comes into contact with made ground.

1.5 Options Appraisal

1.5.1 Preamble

On the basis of laboratory soils testing and subsequent risk assessment, it is considered that arsenic and PAH present an unacceptable risk to human health at the site given the pollutant linkages that exist. Sporadic elevated concentrations of 'degraded' hydrocarbons have also been identified at the site. A summary of the relevant pollution linkages that require remediation are given in the following table. Those linkages given below comprise all risks identified at the site, being established either at the time of the Phase I study (e.g. the requirement for radon protective measures), or following completion of site works/laboratory testing (e.g. measures protective of human health for contaminated soils).

Pollutant Linkages (Qualitative)

SOURCE	PATHWAY	TARGET (RECEPTOR)	COMMENTS	RISK LEVEL
Metals/ Metalloids In soils (primarily arsenic)	Direct ingestion (active) Inhalation (passive)	Site users	End use is assumed to be residential with private gardens and landscaped areas	MODERATE
As above	Topsoil in landscaped borders	Vegetation	As above	LOW to MODERATE
Organic Compounds In soils (primarily PAH including BaP, but some TPH)	As above (plus skin contact)	Site users	Mainly a short-term exposure risk to ground workers	MODERATE
Ground Gas (carbon dioxide and methane)	Subsurface soils/strata via services and buildings	Site users	Potential for CO ₂ and CH ₄ to migrate into properties	LOW
Radon	Subsurface soils/strata via services and buildings	Site users	Potential for radon gas to migrate into properties	LOW to MODERATE

Notes: LOW / MODERATE / HIGH - Risk level is assigned a low/moderate/high qualitative value, based on assessed requirement for action in context of Part II EPA 90;

1.5.2 Options Appraisal (Overview)

In accordance with guidelines presented in the Contaminated Land Report (CLR) 11, Model Procedures for Management of Land Contamination (Environment Agency, September 2004), the following options appraisal has been carried out to determine the most effective method of managing the site and the identified pollutant linkages given above. As defined in Chapter 3 of CLR11:

"... there may be a number of ways to reduce or control unacceptable risks, all of which have advantages and limitations in any particular case. The role of options appraisal is to establish, taking all the circumstances of the site into account, which options (either singularly or in combination) offer the best overall approach to remediation for the site as a whole."

1.5.3 Remediation Objectives

As defined in CLR 11, there are a number of objectives that the remediation strategy needs to achieve. In this instance, the following pertinent objectives that relate to the reduction/control of the risks associated with one or more of the linkages, have been identified:

Remediation Objectives

Objectives:	Reasons:
1. The degree to which risks need to be reduced/controlled	To ensure protection of human health.
2. Practicability of implementing and, where needed, maintaining the strategy	To ensure remediation can be carried out effectively.
3. Technical effectiveness of the strategy in reducing identified risks	To ensure remediation methods employed are suitable for identified risks.
4. Cost effectiveness	To ensure financial viability in terms of risk posed by identified contaminant(s).
5. Compliance	To ensure remediation complies with current legislation.

1.5.4 Remediation Options

The following section identifies remediation options that could be utilised to effectively manage the identified pollutant linkages, given that the site is to be redeveloped for residential end-use with private gardens and areas of soft-landscaping.

In determining the most effective remediation option(s) for a site, consideration needs to be given to a number of techniques, stating (where appropriate) the suitability and limitations of each chosen method. On the basis of the identified pollutant linkages and remediation objectives, the following options have been considered.

Remediation Options

Contaminant Source	Metals/ Organics in Soil (including PAH/TPH)	Metals/ Metalloids in Soil (e.g. Arsenic)	Organic Compounds in Soil (i.e. PAH)	Organic Compounds in Soil (i.e. TPH)	Ground Gases	Radon
Pollutant Linkage	Plant uptake by vegetation	Direct ingestion/inhalation by end users	Direct ingestion/inhalation by end users inc skin contact	Direct ingestion/inhalation by end users inc skin contact	Migration into properties	Migration into properties
Options						
Excavation with Disposal	Inherent PAH contamination in made ground soils. Removal of all soils would be required. Not practicable or cost effective	Inherent As contamination in made ground soils. Removal of all soils would be required. Not practicable or cost effective	Inherent PAH contamination in made ground soils. Removal of all soils would be required. Not practicable or cost effective	Subject to further risk assessment, excavation could be used to manage localised areas of impacted near surface soils (with follow-up validation)	NA	NA
In-situ or Ex-situ Treatment	Not practicable or cost effective	NA	Not practicable or cost effective	Soil washing or another remediation technique could be used to mitigate the need for disposal	NA	NA
Capping (including break-layer)	Capping comprising 600mm (to include 100mm stone break layer, 300mm subsoil and 200mm inert topsoil	Capping comprising 600mm (to include 100mm stone break layer, 300mm subsoil and 200mm inert topsoil	Capping comprising 600mm (to include 100mm stone break layer, 300mm subsoil and 200mm inert topsoil	Would benefit from capping layer where residual TPH contamination exists (below 500mg/kg)	NA	NA
Membrane	Terram type geotextile may be used at base of capping layer rather than hardcore (additional 100mm subsoil to capping layer would be needed)	Terram type geotextile may be used at base of capping layer rather than hardcore (additional 100mm subsoil to capping layer would be needed)	Terram type geotextile may be used at base of capping layer rather than hardcore (additional 100mm subsoil to capping layer would be needed)	As for arsenic and PAH capping requirements	If required, membrane to be specified in accordance with current guidance, following completion of site works	E.g. 1200 gauge membrane or similar. Design to be agreed with NHBC and/or Building Control prior to development

Table contd...

Justification	Arsenic and PAH contamination is widespread across the site in made ground soils. Removal of soils from site is not practicable. Therefore a capping system is required in private garden areas/soft landscaping for the protection of plants	Arsenic is widespread across the site in made ground soils. Removal of soils from site is not practicable. Therefore a capping system is required in private garden areas/soft landscaping for the protection of human health	PAH contamination is widespread across the site in made ground soils. Removal of soils from site is not practicable. Therefore a capping system is required in private garden areas/soft landscaping for the protection of human health	Carry out further risk assessment prior to remediation (if/where required). Validation to assess residual contaminant concentrations. Capping for arsenic/PAH contamination would assist further in the long-term protection of human health	Only physical means of preventing ground gas migration	Only physical means of preventing radon gas migration
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NA – Not applicable

Following completion of the options assessment, it is considered that the most effective remedial technique to address the contamination risks posed by arsenic and PAH impacted soils is to utilise a capping system. Risk assessment using the RSK/ENSR/NHBC (2004) software (Cover Systems for Land Regeneration), coupled with the mean value testing carried out in accordance with Appendix A, CLR 7 indicates that a capping thickness of 600mm would be required (subject to confirmation from the EHO).

A break layer, comprising either 100mm hardcore, or a geotextile type material, would be needed at the base of the capping layer to prevent inadvertent penetration of the underlying contaminated soils. However, where a geotextile is used, the loss of the stone break layer (i.e. 100mm) would need to be made up by an additional 100mm of subsoil material (i.e. 400mm rather than 300mm) to achieve the overall 600mm capping requirement.

Where hydrocarbon contaminated soils (e.g. that derived from fuels) have been identified (at three discrete locations), it is considered that the combination of excavation and the 600mm capping layer will address the long-term risk posed by such contamination. The need for the excavation of soils would however be subject to results of further risk assessment. Where excavated soils impacted with hydrocarbons will need to be removed from site, validation testing to assess residual contaminant concentrations will be required. In the short-term, risk to construction workers is considered to be the only risk where additional protective measures will be required. In this instance, site hygiene precautions, such as washing hands before eating, should be followed, together with appropriate PPE.

Ground gases, comprising carbon dioxide and methane, may be present at the site. At this stage it is considered that a geomembrane will be required (such as a 1200 gauge membrane), being taped and sealed at all service entries/exits and across cavity trays. Gas monitoring will however be needed at the site to fulfil the requirements of the Local Authority (see Section 6.1, Further Work, below). However, basic radon precautions are needed at the site, which typically comprise the use of 1200 gauge membranes. Confirmation of the design of radon protective measures should however be sought from the NHBC and/or Building Control prior to construction.

A summary of the most appropriate remediation option(s), for each relevant pollution linkage, is given in the following table.

Remediation Options (Most Appropriate)

Contaminant Source	Metals/ Organics in Soil (including PAH/TPH)	Metals/ Metalloids in Soil (e.g. Arsenic)	Organic Compounds in Soil (i.e. PAH)	Organic Compounds in Soil (i.e. TPH)	Ground Gases	Radon
Pollutant Linkage	Plant uptake by vegetation	Direct ingestion/inhalation by end users	Direct ingestion/ inhalation by end users inc skin contact	Direct ingestion/ inhalation by end users inc skin contact	Migration into properties	Migration into properties
Remediation Option	Inert Soil Capping with break layer	Inert Soil Capping with break layer	Inert Soil Capping with break layer	Further risk assessment, or localised remediation with validation Subject to approval from the EHO Capping to provide additional protective measures in the long-term	Membrane (type to be confirmed should gas precautions be needed)	Membrane (design to be confirmed)
Remediation Objectives met?	Yes	Yes	Yes	Yes	Yes	Yes

* Validation works will be required to assess the nature and concentration of residual TPH contamination following excavation (see Section 6.2, Validation) from areas currently identified as contaminated (refer to appended drawing S5/028/003).

1.6 Remediation Strategy & Scope of Works

The enabling/remedial works are to be undertaken in a number of phases, as outlined below (the order such phases of work are to be carried-out/completed is however dependent upon the programme of works and is given as a guide only):

Phase I

- The removal of all existing structures (asbestos materials where encountered are to be removed for disposal by a licensed waste carrier. Asbestos containing materials to be removed from site should be identified during a Level 3 assessment prior to site works being started);
- The removal of all existing hard-standing (concrete and tarmac where encountered), all existing sub-structures/pits associated with the garage/workshops and the removal of all ground slabs, old foundations and any other underground obstructions to their full depth. It is proposed to crush and re-use some, or all, of these materials below roads and areas of hard-standing (the tarmac may also be reused beneath areas of hard-standing, subject to approval by the EHO), subject to proposed ground levels. Further localised excavations may be required during demolition to check for buried obstructions;
- The identification and delineation of localised areas of TPH impacted soils (refer to Section 1.5.4). Subject to the results of further risk assessment at the time of development, where these are not acceptable in relation to the proposed specific remedial target concentrations, they will be removed from site, or remediated (excavations to be reinstated with clean imported materials, refer to Section 6.2 below). Should further currently unidentified contamination sources be exposed during site clearance works, these areas will also be subject to risk assessment/remediation;
- The removal or treatment of Japanese Knotweed, which has been identified within the car parking area to the north/north-east, by a licensed contractor. Approval should be sought from the Environment Agency for the proposed treatment method.

Phase II

- The removal of pits associated with the storage of waste oils from within the main garage area, with associated validation (where appropriate);
- As and where appropriate, further physical investigation, sampling and testing may also be required to assess the degree and extent of any contamination in the vicinity of the waste oil tanks, subject to an inspection of the tanks and ground conditions following their removal, or other areas of the site where contamination is encountered during the enabling works;
- If 'free product' or grossly contaminated soils are encountered during the works they shall be removed to a licensed landfill site following testing to assess the degree of contamination.

Phase III

- This will involve the construction of a soil capping in gardens and landscaped areas, the works to be carried out on an ongoing plot by plot basis during construction;
- The proposed overall capping layer is to comprise an inert soil layer 600mm thick (including 200mm of clean inert topsoil). The capping thicknesses stated are subject to the approval of the EHO (it may be possible to use a reduced capping layer in soft landscaped areas in agreement with the EHO/NHBC);
- A geomembrane, or hardcore break layer, is required at the base of the capping layer, to prevent digging down into potentially contaminated soils;
- Capping materials will need to be tested at source to confirm their chemical status and ensure that they are fit for purpose (refer to Section 6.2, Validation, for further details), with laboratory test certification being provided/submitted to the EHO prior to importation to site.

Phase IV

- On-site validation of capping thicknesses, including topsoil, placed in private gardens and public open space (refer to Section 6.2, Validation, for further details);
- Production of a validation report, following completion of the remediation works.

1.7 Remedial Target Values

Proposed remedial targets will address principally the risk to end-users from arsenic and PAH contamination which is present within the made ground soils at the site. Although subject to further risk assessment, the existing localised hydrocarbon burden may need to be remediated. Validation testing would be required in accordance with details given in Section 6, should remediation be carried out.

If during redevelopment of the site previously unidentified contamination is encountered, where validation testing is carried out test results shall be compared against the following threshold values, with further QRA being carried out to establish appropriate remedial actions (subject to EHO approval) should it be required:

Contaminant	'Target' criteria* (mg/kg)
Arsenic	20
Cadmium	1-8*(pH dependent)
Chromium (Total)	130 ^{^^}
Lead	450
Mercury	8
Nickel	50
Selenium	35
PAH (Total)	40**
Benzo[a]Pyrene	1.5 [#]
Phenol	150 [^]
Toluene	7 [^]
Ethylbenzene	21 [^]
TPH	500 [°]

* Target criteria determined as the Soil Guidance Values (SGV's) with reference to CLEA for sandy soils;

[^]SGVs are based on 2.5% SOM as defined in CLR10;

^{^^}SGV assumes Chromium is present as Chromium(VI);

Tentative non-validated SGV based on an assessment of TOX Report 2, Benzo[a]Pyrene (EA, 2002);

** Dutch Intervention Value adopted;

- Upper Bound Values for copper and zinc not calculated as they are not considered to typically present a risk to human health;

° Professional judgement.

1.8 General Considerations

On the basis of the history of the site, the results of the ground investigations and the scope of works proposed, the made ground soils are unlikely to generally contain a significant quantity of near-surface anthropogenic materials (e.g. glass, metal) which might present a physical risk to future occupiers. However, if during the enabling works/scarification exercise significant quantities of glass, metal or other anthropogenic materials are encountered within near surface soils, the capping thickness may need to be reviewed in liaison with the EHO. Additional protective measures comprising the placement of a geotextile 'marker layer' may also be required in this instance.

1.9 Public Relations/Public Awareness

Public relations issues in the first instance are to be addressed by Barratt Sheffield, with the assistance of Abatech International Ltd.

2.0 SITE SAFETY

2.1 Introduction

Over and above the standard health, safety and welfare requirements, specific health and safety requirements will address the issues related to identified contamination hazards.

The Project Manager on site will retain the Health and Safety Documents. The document, 'Protection of workers and the general public during the development of contaminated land' will also be held on site. The guidance, standards and legislation followed will include the CDM Regulation (1994), HSW Act (1974) and COSHH Regulations (1988).

2.2 Site Establishment

2.1.1 Site Establishment

The following procedures will be adopted for site establishment, the scope dependent upon the character, extent and location of contaminant sources:

1. Areas of suspected contamination will be designated as 'dirty' and suitably fenced off. Warning signs will be fastened to the fence to warn of the potential dangers;
2. In accordance with the safety management systems, no person will be allowed to enter the site before reporting to the Main Office. All personnel and visitors will be first inducted concerning the site safety rules and potential hazards, and then issued as necessary with the appropriate personal protective equipment (PPE), prior to entering the works area;
3. Appropriate hygiene facilities will be provided within the site by the Principal Contractor. All personnel entering or leaving any designated 'dirty' working area(s) will have to use the facilities, taking the appropriate courses of action as stated on forms enclosed with the site briefing package, to be provided.

2.3 Hazards Posed by the Principal Contaminants

The principal contaminants of concern that may be encountered in the made ground soils will include inorganics (metals/metalloids) and aliphatic/aromatic hydrocarbons (including PAH).

Hydrocarbons

In general, low-density hydrocarbon liquids have a high solvent power and can cause defatting and irritation of the skin. Contact with skin may also cause acneform eruptions and an allergic response. Repeated skin contact may produce localised or systemic effects such as weight loss, changes to blood forming tissue (pyrene), headaches and nausea. Note that the latter are considered being a risk resulting from prolonged and continuous exposure.

Exposure risk from inhalation is limited to more volatile compounds e.g. BTEX. These compounds are likely to be volatilised, leached and biodegraded with relative ease, but may also be present in high concentrations within the near-surface contamination due to their relatively high mobility.

Asbestos (ACMs found on site)

This issue is principally one associated with buildings and infrastructure demolition, since no asbestos containing materials have been identified in the soils. However, there is the possibility of asbestos cement sheeting debris being present at the site.

Asbestos is a chemically and biological inert substance and does not present a health risk in a bound and undisturbed condition. The risk posed to health arises from the inhalation of fibres potentially released to air on physical disturbance of asbestos products.

There are three respiratory diseases that have been directly linked to exposure to asbestos. These are listed below:

- Asbestosis;
- Lung Cancer, and;
- Mesothelioma.

Asbestosis

Asbestosis is a fibrosis or hardening of the lung tissue, causing it to lose its elasticity with consequent impairment of lung function. The fibres penetrate the delicate lining of the alveoli in the lung. The constant damage causes the

build-up of scar tissue, which impairs gaseous exchange within the lung. The disease is progressive and is related to exposure. It is not caused by occasional, accidental or environmental exposure. Symptoms can appear after typically 5 years exposure but more usually between 10 to 12 years exposure. More strict legislation and tighter safety controls have resulted in a decline in the number of deaths attributed to asbestosis.

Lung Cancer

Lung cancer has been identified as being caused principally by cigarette smoking. However, in 1947, a link was made when it was noted in a factory inspector's report of the excess of lung cancers among asbestos factory workers. The cancer usually occurs in the upper bronchi and is related to exposure. There is also a strong synergistic effect with tobacco smoke, in that the occurrence is fifty times greater in smokers, as compared with non-smokers. The disease usually takes between 10 to 20 years to develop. Unlike asbestosis, lung cancer is marginally treatable in its early stages, in that diseased tissue can be removed.

Mesothelioma

Mesothelioma is a rare cancer of the lining of the chest cavity (the pleura), or of the lining of the abdomen (the peritoneum). It causes severe pain on breathing and is untreatable surgically, because it forms a tree-like structure. The cancer is therefore invariably fatal, with a survival period of not usually more than two years at most and often within months of diagnosis. The disease is caused by amphibole asbestos i.e. crocidolite, amosite etc. as it is believed that the sharp needle like fibres cause the damage.

Chrysotile was not thought to cause mesothelioma because its fibres are not needle-like. However chrysotile is contaminated with approximately 1% of tremolite (amphibole asbestos), which is needle-like. It is important to note that the occurrence of Mesothelioma is not dose related. It can be caused by occasional, accidental or environmental exposure, and has a 'latency period' of 25–30 years but may be longer. Because of this long latency period, the incidence of mesothelioma related deaths are expected to increase.

2.4 Safe Working Procedures

2.4.1 Dirty and clean areas

Parts of the site may need to be sub-divided into clean and dirty areas, dependent upon the distribution of sources of contamination that may be encountered. If designated dirty, the working area(s) will be fenced. Access/egress into dirty areas will be restricted to a single controlled gate.

2.4.2 Hygiene facility

A formal dedicated hygiene facility may be required and should be located in such a way as to form the only access \ egress into 'dirty' area(s) from the clean area.

Immediately outside the hygiene unit, located in the dirty area, will be a boot wash facility. Personnel entering the hygiene unit will use this facility and must ensure that all contaminated material is washed from their footwear before exiting the unit.

The hygiene facility will ideally require three internal areas, allowing personnel to move sequentially through them as they progress from the dirty to the clean area and *vice versa*. The first compartment, leading to the dirty area will be used for the storage of contaminated equipment. The central compartment will provide site personnel with a high standard of washing facilities. This facility as a minimum will include hot and cold washing facilities, including shower units. The final compartment, leading to the clean area will be used for the storage of ordinary clothing.

The unit will be, as a minimum, serviced and decontaminated on a daily basis and be an appropriate size for the site works.

2.4.3 Personal protective equipment (PPE)

The Contractor will ensure that all workers are provided with **and use** the appropriate equipment in the dirty area work zone. Full training on the use of such equipment will be provided.

A minimum level of equipment required in the dirty area may include: disposable overalls, Wellington boots, goggles, gauntlets or gloves, face masks and filters, to conform with HSE approved lists.

First aid and safety equipment will be available within restricted zones for use in emergency. In addition, hard hats and reflective jackets will be provided and worn on site at all times.

Site visitors (who wish to access dirty areas) will wear as a minimum: disposable paper suits, hardhat, Wellingtons (puncture resistant), luminous jacket and have a dust /vapour mask available.

2.4.4 Site induction

All site personnel will be informed and fully trained through a signed induction procedure in relation to the potential hazards of the site regarding contamination and on-site safety procedures.

2.4.5 Safety officer/first aid personnel

A Safety and First Aid Officer will be on site at all times and will have experience of working on sites of a similar nature and be fully conversant with reaction procedures.

3.0 SITE ORGANISATION

3.1 Vehicle Access & Site Control

All vehicles as they exit the dirty area will use an appropriate vehicle cleaning facility. If mud or dust spreads onto the public highway and/or into the associated highways drainage system, the contractor will undertake the cleaning of such to the Highway Departments' satisfaction.

A suitable vehicle cleaning facility will be provided. The disposal of wastewater produced by this will be undertaken after consultation with, and approval from, the relevant parties.

4.0 REMEDIATION WORKS

4.1 Enabling Works and Site Establishment

Formal risk assessments will be carried out prior to the start of works and will be reviewed in relation to any additional potential hazards encountered on the site. Together with the safety management system, this will form the basis for safe operation of the site.

4.1.1 Minimum Overall requirements

1. The site induction required for all personnel to be employed on the site, will include specific instruction on:
 - working with construction plant – in particular the Safety Management System requires that no machine is to operated unsupervised; no machine is to be approached from the blind side;
 - identification of hazards and necessary precautions – particularly the presence of toxic substances believed to be present in the site, including solids liquids and gases;
 - procedures for reporting and making safe potential hazards if encountered;
 - the use of personal protective equipment;
 - entry into excavations/chambers with particular regard to safe entry and egress, support and gas hazard;
 - avoidance of ingestion of contaminants through skin contact, vapour, smoking or eating.

2. All personnel will be issued with personal protective equipment (PPE) prior to the start of work. This may include disposable overalls, rubber gloves, boots and facemasks as required. Sufficient supplies will be maintained on the site such that these can be readily replaced if and when they become contaminated;
3. Adequate supplies of appropriate cleaning agents, e.g. eyewash, will be maintained on site and staff will be instructed in their correct use;
4. All operations will be carried out under the supervision of suitably qualified and experienced personnel. Suitable personnel will be available during the excavation to identify and assess any specific contamination issues that may arise;
5. All machine drivers will hold the appropriate certificate(s);
6. High visibility yellow jackets will be worn at all times. Personnel will wear ear defenders when appropriate, such as when operating plant;
7. All mobile plant will operate with yellow flashing lights and reversing warning sirens;
8. All plant and vehicles used on site to transport fill and other materials will have upward facing exhaust pipes;
9. A vehicle 'wash-down' facility may need to be installed at the entrance to the works 'dirty' area.

4.2 Excavation of Contaminated Soils

General Requirements

- a) The area(s) identified as potentially contaminated and requiring excavation and stockpiling will, if necessary, be marked out on the site. These will then be fenced off with appropriate signage;
- b) The prepared area(s) to be used for assessing or stockpiling contaminated material will be suitably constructed, demarcated and fenced off. Prior to deposition of soils this will be validated as suitable by The Engineer.

Measures to deal with surface water runoff and its removal/disposal will be submitted to the Environment Agency by the Contractor, via the Engineer;

- c) Designated haulage route(s) will be marked on site;
- d) To facilitate identification of contamination, suitably trained personnel will supervise and closely monitor ongoing excavations for contamination assessment. Contaminated and potentially contaminated soils will be transported directly to the appropriate stockpile area(s).
- e) When excavating within the areas identified as containing contaminated material, all materials will be regarded as contaminated until inspection/assessment procedures have been completed;
- f) Any significant pockets of 'free product' (fuels) encountered will be contained *in situ* where possible, prior to removal/treatment/disposal, as appropriate.

4.3 Removal of Underground Obstructions, Buried Tanks, Pipework and Foundations

This section describes the procedures to be adopted for the excavation of unknown or unrecorded structures, potentially containing free by-product and/or grossly contaminated backfill, **if encountered**. In the present case it is unlikely that significant underground structures will be encountered, although it is likely that old drains and some old pipework potentially containing contamination may be encountered.

During the course of works, staff that will be supervising the general works operations shall be supplemented with engineers who are competent in site investigation/demolition and/or remediation, who will be in attendance to advise on matters of contamination. Where evidence of substructures are uncovered, a series of procedures will be implemented. The objectives are as follows:

- To safeguard the health of site staff, the general public and to protect the environment, minimising the risk of pollution;

- To enable any structure(s) encountered to be excavated in a controlled manner, facilitating recording of structure dimensions, form of construction and materials used in their construction;
- To enable the contents of the structure(s) to be dealt with in an appropriate and timely manner, with options and actions for storage/disposal on- or off-site taken following good practice and exercising professional judgement.

The types of structures potentially containing by-product include the following:

- Steel/iron cased vessels (above ground or underground storage tanks) either vertically or horizontally orientated. These may be set within concrete, brickwork or composite substructures;
- Concrete, brickwork or composite (e.g. plastic or timber) tanks/chambers, of various dimensions and shapes (typically circular or rectangular in plan view) associated with historic uses of the site;
- Pipework and conduits constructed of various materials. These may form inter- or intra-connections with the above mentioned structures.

Note: structures, where encountered, may contain contamination that they may not have been designed/constructed to hold. It is therefore important to accurately record the juxtaposition of all structures encountered, to try to establish spatial/process relationships amongst them during the course of the works. This may assist in predicting where additional structures might be encountered during further excavation and the potential extent and degree of associated contamination, both within the structures and surrounding them in made ground and more importantly potentially in underlying natural soils and groundwater.

Concrete/masonry structures - idealised procedure

- Delineate the extent of the structure in plan, without disturbing the structure's integrity (Note: this is to be carried out for newly identified structures);
- Excavate test pits adjacent to the structure, to assess the depth and integrity of the 'wall(s)' and to assess whether the structure's integrity has

been compromised during decommissioning/previous use of the site. The 'test' excavations should be aligned such that they will minimise the risk of damage to or leakage from the structure. They should be backfilled immediately following their completion;

- Selectively break out, probe and excavate within the structure to establish content (this may require ongoing excavation, which should be carried out working carefully on plan in as uniform a series of layers as possible);
- Where contaminated arisings are excavated for assessment purposes, they should be placed adjacent to the structure in a manner and with safeguards (e.g. ground liner) such that they will not increase the risk of environmental pollution or compromise the health of site personnel (site staff will carry out appropriate environmental monitoring during the course of excavation and appropriate action taken as necessary to safeguard the health of site personnel);
- On completion of the assessment/excavation of the 'solid' contents an assessment will be made regarding treatment of 'liquid' contents and appropriate action taken as necessary;
- Following the complete removal of the structure contents the structure will be inspected (from surface) for attached ingress/egress conduits/pipes. Valved or flanged pipe work will not be disturbed until an appropriate assessment has been carried out, which may entail further controlled excavation outside the structure;
- Upon validation of the completion of the excavation within the structure, the structure walls and base will be removed, and treated as appropriate.

Steel/iron vessels and pipework

These will require specific and prescribed actions to be taken following procedures laid down for the decommissioning/treatment and disposal of USTs.

5.0 ENVIRONMENTAL MONITORING

5.1 Groundwater

Shallow groundwater was not encountered and is not considered, on the basis of the site investigation, to be likely to be a significant receptor. However, where and if necessary, groundwater monitoring will be undertaken. If undertaken, the monitoring will be carried out by Abatech and submitted to the Environment Agency. The scope and frequency of monitoring would be agreed between Abatech International Ltd and the Environment Agency.

5.2 Surface Water

The nearest surface water course is the River Dearne, which lies approximately 500m to the north-east of the site. Impact on the River Dearne associated with redevelopment of the site is not anticipated. Monitoring of the River Dearne is therefore not proposed.

5.3 Dusts and Vapour

Uncontrolled earthworks activities have the potential to generate levels of airborne dust that may be perceived by the general public as a nuisance.

The main activities that are most likely to generate dust are:

- general earthworks;
- traffic along haul roads;
- stockpiling of material;
- movement of uncovered lorries off site;
- crushing and screening.

The best available techniques will be employed to minimise and control dust nuisance during the development works. These include:

- locating dust-generating activities away from sensitive receptors;
- minimising the transportation and handling of materials;
- maintaining an adequate supply of water for damping down,
- providing dust suppression equipment, where necessary; and
- crushers and screens (if used) to have own separate dust suppression.

Dust levels may be monitored at designated positions on the site boundary via semi-permanent stations, to assess the generation of nuisance dust.

If appropriate, the dust samples will be collected and tested for contamination by metals/metalloids, in addition to total dust. The test results should be available within seven working days of sampling. The trigger level for action will be a value of one-fortieth of the occupational exposure levels (OEL) shown in the following table, based on an 8hr exposure period:

Substance	OEL (mg/m ³)
Arsenic	0.1
Cadmium	0.025
Chromium	0.05
Copper	1
Mercury	0.025
Nickel	0.1
Lead	0.15
Zinc	5
Total inhalable dust	10

The 'trigger levels' below identify circumstances when additional dust suppression measures may need to be considered. The strategy will follow the general principal of source/pathway/receptor and be as follows:

- a) Normal conditions. The Site Engineer, or other nominated person, will instruct the Contractor to prevent adverse dust emissions and monitor site performance using dust-monitoring equipment;
- b) Critical conditions when the meteorological readings indicate that the wind direction is between 000° and 100°, and operations are being carried out within 250m of occupied residential properties, and the wind speed is in excess of 5m/sec when averaged over each 30 minute period.

If the critical conditions outlined above are confirmed, supervisory staff will consider the need for additional dust control measures to be taken. Where no such measures are considered necessary, for example during periods of heavy rainfall, the reasons will be recorded in the monitoring log book to be

held on site. Additional measures will be recorded in the monitoring logbook to be held on site. Additional measures may include:

- restricting vehicle speed limit to 10mph on haulage roads;
- consideration of moving site activities to alternative locations;
- additional use of dust suppression equipment.

If these or other measures fail to prevent adverse dust emission, the site operations causing the dust generation shall cease.

Where excavations are carried out in areas of known contamination, additional measures may need to be taken to prevent the release of contaminated dust into the atmosphere.

The emission of organic vapours during the excavation, handling and removal of contaminated material could cause health problems for operational staff. Site personnel will be instructed to take note of abnormal odours and report all incidences to the Site Engineer. Organic vapours will be monitored with a PID at the place of excavation and if necessary at the site perimeter to assess the atmospheric flux. In the event that grossly contaminated material is temporarily stockpiled, sheeting to cover the stockpile will be available to reduce the risk of odorous emissions, if this is considered necessary.

All dust monitoring results and other relevant data will be regularly recorded. These records will be held on site. Any complaints received during the works will be logged and also recorded, together with the results of any follow-up, complaint investigation and corrective action, which is implemented.

The results of monitoring will be available for inspection by the Local Environmental Health Officer.

5.4 Noise

Uncontrolled earthworks activities have the potential to generate levels of noise that may be perceived by the general public as a nuisance. In the context of the subject site, noise is not considered to be likely to present a significant environmental impact, although further enquiries may need to be made with the EHO.

6.0 FURTHER WORKS & VALIDATION

6.1 Further Works

Two aspects of work remain at the site, which will need to be completed prior to the construction of properties. These are:

- On the basis of current site investigation activities, there remains an area to the north-west (refer to appended drawing S5/028/003) which has not been investigated. The nature, extent and chemical composition of made ground and underlying natural soils has therefore not been proven. Prior to, during or following completion of demolition works (but before the construction of houses begins), investigation of this parcel of land will be required. Works should be carried out in accordance with current site investigation practice/procedures, with the results of the investigation being submitted to the EHO;
- At the time of writing, gas monitoring had not been carried out at the site. To fulfil the requirements of the EHO therefore, gas monitoring to assess the presence of methane, carbon dioxide, hydrogen sulphide and oxygen depletion will need to be carried out. Should the need arise, monitoring for Volatile Organic Carbon will also be carried out. Should this monitoring identify the requirement for gas protection measures, proposals will need to be submitted to the EHO for approval, prior to the development of any properties at the site. Critical threshold concentration criteria will be alarmed and action taken as necessary to safeguard the health of site personnel.

6.2 Validation

Given that remediation measures are required at the site for the protection of human health, there is the requirement to submit a validation report to show that remediation measures have been completed and that contamination issues have been successfully addressed. Following completion of the remediation works therefore, a validation report will be submitted to the EHO for approval (copies to be made available to the NHBC where necessary).

The form and content of this document will largely be determined following completion of the works, although to ensure that the remediation works are carried out in accordance with best practice/current guidelines, the following information will need to be recorded as a minimum (where applicable):

- Site records (to include drawings showing excavation positions and waste carrier tickets) demonstrating the movement of any contaminated soils off-site. Where excavations are opened for the removal of contaminated soils (e.g. TPH, or other areas identified as being contaminated during site works), samples will be taken from the sides and base of each excavation to determine residual contaminant concentrations (results to be compared against threshold values given above in Section 1.7). Testing should be carried out for a general suite of contaminants including speciated PAH and TPH;
- Records identifying any on-site/in-situ remediation works with drawings, soil volumes, laboratory test results/risk assessment data and any other pertinent information;
- Documentation including laboratory test certificates relating to the importation of materials. Materials imported to site should be initially tested at source, with certification being submitted to the EHO prior to importation. However, following importation, testing will be required to check the validity of the materials supplied. Testing should be carried out at the following intervals:

Import	Soil Testing Frequency^{^*}
• Hardcore break layer materials (if used instead of geotextile)	1 sample / 5 plots
• If site-won crushed concrete is used in the break layer, this should also be tested (in agreement with the EHO)	1 sample / 5 plots
• Subsoil materials used in the construction of the capping	1 sample / 5 plots

Table Contd....

• Topsoil materials used in the construction of the capping	1 sample / 5 plots
• Capping thickness (subsoils and topsoil) check (600mm combined thickness)	Every plot (including POS**)

^ Chemical testing to comprise a general suite of contaminants (metals/metalloids) and speciated PAH as a minimum;

* In rear garden areas;

** Capping in Public Open Space (POS) may be reduced in thickness, subject to further discussion with the EHO.

APPENDICES