

NATIONAL BREAST IMAGING ACADEMY (NBIA), WYTHENSHAWE HOSPITAL REMEDICATION STRATEGY

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CONTENTS

1 Introduction 1

1.1 Requirements of the Remediation Strategy 1

1.2 Definitions 2

1.3 References 2

2 Ground Conditions 3

2.1 Made Ground 3

2.2 Bollin Mudstone Member 3

2.3 Observed Potential Contamination 3

2.4 Groundwater 3

3 Ground & Groundwater Contamination 4

3.1 Ground Contamination 4

3.2 Ground Gas 4

3.2.1 Dissolved Methane 4

4 Conceptual Site Model 6

5 Remedial Works 7

5.1 Remedial Action 1 – Contamination and Asbestos Management During Construction 7

5.2 Remedial Action 2 – Engineered Capping 8

5.3 Remedial Action 3 – Ground Gas Protection Measures 8

5.3.1 Gas Membrane Specification 8

6 Specification for Site Won and Imported Soils 10

6.1 Sourcing of Materials 10

6.1.1 Off-Site Sources 10

6.1.2 On-site Sources 10

6.2 Imported Topsoil 10

6.3 Imported Subsoil 10

6.4 Chemical Composition of Soils 10

7 Strategy for Handling Potentially Contaminated Soils and Contaminative Incidents on Site 12

7.1 Contaminated Soils 12

7.2 Contaminative Incidents 12

7.3 Unexpected Contamination & Watching Brief 12

7.4 Health & Safety 13

7.4.1 Contractor Method Statements 13

7.5 Environmental Controls 13

7.5.1 Surface Water Run-Off 13

7.5.2 Airborne Particles/Vapour/Odour 13

7.5.3 Control of Spillage	14
8 Verification	15
8.1 Verification of Clean Capping/Growing Media	15
9 Reporting	17

FIGURES

<i>Figure 1 – Site Location Plan</i>	1
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TABLES

Table 1 – Positive Asbestos Identification Results	4
Table 2 – Potential Contaminant Linkages	6
Table 3 - Environmental Chemistry Testing Frequency for Soils	11
Table 4 - Environmental Chemistry Analysis Suite for Soils	11

APPENDICES

Appendix A – Drawings & Specifications	
Appendix B – Screening Criteria for Imported Materials	

1 INTRODUCTION

This Remediation Strategy has been prepared by Curtins for DAB Projects, on behalf of Manchester University NHS Foundation Trust (the Client) to provide guidance with respect to remedial requirements for the proposed development site at Nightingale overflow car park adjacent to the Nightingale Centre, Wythenshawe Hospital, Southmoor Road, Manchester, M23 9QZ.

It is understood that the current proposals are a National Breast Imaging Academy (NBIA) comprising the construction of a single storey building adjacent to the existing Nightingale Centre located to the east. A link corridor will provide access to both buildings.

The site has been characterised through a desk-based Phase 1 Geo-Environmental Assessment (Ref. 1) and a Phase 2 Ground Investigation report (Ref. 2) undertaken by Curtins in 2023.

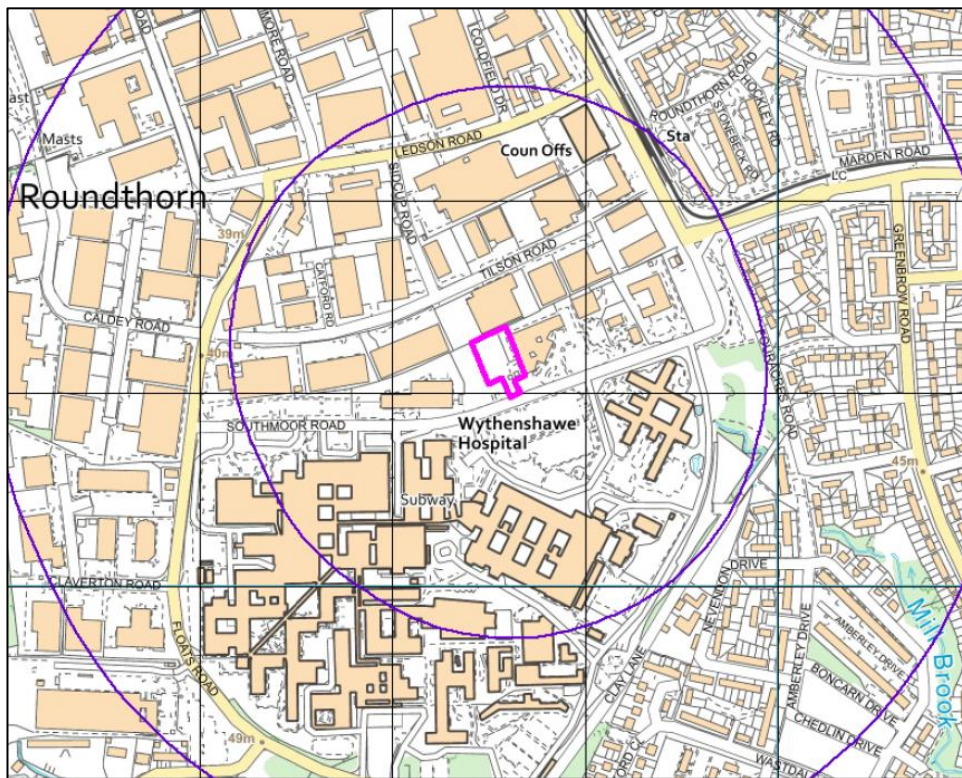


Figure 1 – Site Location Plan

The site hereby known as 'NBIA Wythenshawe', is located adjacent to the Nightingale Centre, Wythenshawe Hospital, Southmoor Road, Manchester, M23 9QZ. A site location plan is presented in *Figure 1* with the site boundary outlined in Pink.

The development site is irregular in shape and occupies approximately 0.22 Ha of land. The site is currently in use as an overflow carpark for the adjacent Nightingale Centre, with gravel hardstanding and a grass verge around the northern and eastern perimeter. Further carparking is along the western boundary and there is a small wooden fence and a parking barrier along the southern boundary. Access to the site is via Southmoor Road to the south of the site.

1.1 Requirements of the Remediation Strategy

The Remediation Strategy is to account for the following;

- A description of the materials likely to be encountered by the developer and their contractor/sub-contractors;
- Proposals for excavations with respect to the materials likely to be encountered;
- Revised risk ratings associated with ground contamination and primary pollutant linkages remaining;

072094-CUR-XX-XX-T-GE-00004-P01

Remediation Strategy

National Breast Imaging Academy (NBIA), Wythenshawe Hospital

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- Recommendations for the specification of imported soils where used in areas of soft landscaping;
- Recommendations for appropriate PPE;
- Recommendations for managing asbestos appropriately during construction;
- Recommendation for provision of a soil contamination and asbestos contamination watching brief during demolition, remediation, earthworks and construction works and a strategy for handling potentially contaminative incidents; and
- Proposals for the verification of remedial measures, including a regime for verification and chemical analysis of imported soils.

1.2 Definitions

In this document the following definitions apply:

Contractor Refers to the appointed contractor responsible for undertaking the remediation works.

Site Manager Refers to a representative of the appointed contractor resident on site.

Engineer Refers to a suitably qualified representative from Curtins, who would not normally be resident on site.

1.3 References

The Remediation Strategy has been prepared with reference to the following existing reports;

- **Reference 1:** Curtins (2023) Phase 1 Preliminary Risk Assessment, National Breast Imaging Academy (NBIA), Ref 072094-CUR-00-XX-RP-GE-001-P02
- **Reference 2:** Curtins (2023) Phase 2 Ground Investigation Report, National Breast Imaging Academy (NBIA) Ref. 072094-CUR-XX-XX-T-GE-00002-P01
- **Reference 3:** Curtins (2023) Letter Report for Wythenshawe Hospital NBIA, Manchester, Initial Waste Classification of Soils, Ref. 072094-CUR-XX-XX-T-GE-00003-P01

2 GROUND CONDITIONS

The following sections present a summary of the ground conditions identified during the Curtins intrusive ground investigation.

2.1 Made Ground

Made Ground was encountered in all exploratory borehole locations from ground level to depths of between 0.85m and 4.60m bgl.

Made Ground was encountered in all exploratory borehole locations from ground level to depths of between 0.85m and 4.60m bgl. The Made Ground varied between Cable Percussion Boreholes, Hand Pits, and the Foundation Pit.

Within the Cable Percussion borehole locations, the Made Ground typically comprised a light grey concrete and limestone gravel underlain by cohesive silty, sandy, gravelly clay with gravel consisting of man-made materials such as concrete, brick, plastic, fabric, glass underlain by dark greyish brown slightly silty, slightly sandy, brown mottled grey slightly gravelly clay, identified as a reworked Glacial Till.

Within the Hand Pit locations, the Made Ground typically comprised grass over dark brown/black very clayey, gravelly sand (topsoil) underlain by greyish brown slightly sandy, very gravelly, cobbly clay, with gravel and cobbles consisting of man-made materials such as concrete, plastic, glass and, brick.

Within the Foundation Pit, the Made Ground comprised dark grey tarmac underlain by yellowish brown sandy gravel, at the base of which was the buildings foundation (0.32m bgl).

2.2 Bollin Mudstone Member

Bedrock deposits of the Bollin Mudstone were encountered in all Cable Percussion borehole locations from beneath the Made Ground from depths of between 4.30m and 4.60m bgl. The bedrock deposits generally comprised dark greyish brown to light grey competent mudstone bedrock. In BH02, weathered bedrock was encountered at 4.60m – 4.80m bgl, recovered as brown/orange very clayey, gravelly sand.

The base of the superficial material was not encountered.

2.3 Observed Potential Contamination

Pockets of wood and other organic material was noted within BH01 between 4.00m and 4.30m bgl.

In BH03 a band of dark brown/black organic material containing hay/relic plant matter with a strong organic odour was noted within Made Ground (Reworked Glacial Till) between 3.40m and 3.90m bgl and this may be indicative of former ground level.

2.4 Groundwater

Groundwater was encountered within BH01 at 0.80m bgl, within BH02 at 4.80m bgl and, within BH03 at the base of the borehole.

3 GROUND & GROUNDWATER CONTAMINATION

3.1 Ground Contamination

As part of the Curtins 2023 Ground Investigation (Ref. 2) a total of nine samples of Made Ground were obtained and scheduled for soil chemical analysis. The chemical analysis suite included a broad range of potential contaminants of concern including heavy metals and non-metals, cyanide, PAHs (USEPA 16), TPHs and asbestos.

A band of dark brown/black organic material with a strong organic odour was noted within the Made Ground between 3.40m and 3.90m bgl within BH03. No other visual and olfactory evidence of contamination was observed.

With respect to the Commercial end-use of the site, no exceedances were recorded.

Two samples had a positive result for asbestos containing materials (ACMs) which was identified as Chrysotile and Amosite as loose fibres and board in HP01, and loose fibres in HP02. Asbestos quantification was undertaken on the positive identifications, and both samples contained <0.001% asbestos as summarised in Table 1.

Table 1 – Positive Asbestos Identification Results

Exploratory Hole I.D.	Depth (m bgl)	Strata	Asbestos Type	Quantification (% w/w)
HP01	0.60m bgl	Made Ground	Chrysotile & Amosite – Loose Fibres & Board	<0.001
HP02	1.00m bgl	Made Ground	Chrysotile & Amosite – Loose Fibres	<0.001

3.2 Ground Gas

A total of five monitoring visits have been completed during the Phase 2 Ground Investigation (Ref.2). Monitoring has been undertaken in a range of atmospheric conditions, including rising and falling barometric state. It is considered that a representative dataset has been obtained.

Maximum methane (CH₄) concentrations were recorded of 80.4% within BH02 on the third monitoring visit. High methane and carbon dioxide concentrations decreased slightly through long monitoring periods (up to 40 minutes) however they remained significantly elevated. Maximum carbon dioxide (CO₂) concentrations were recorded of 41.3% in BH03 on the fifth monitoring visit.

The assessment, in accordance with BS8485:2019 determined a hazardous gas flow rate (Q_{hg}) of 0.928 l/hr for carbon dioxide and 2.010 l/hr for methane. Using the Q_{hg} for methane as the gas screening value (GSV) for the site, the site was classified as a Characteristic Situation 3 (CS-3) gas regime, for which gas protection measures are required.

3.2.1 Dissolved Methane

During gas monitoring visits, it became apparent that there were significantly elevated concentrations of methane and carbon dioxide within the monitoring wells. In order to assess whether the groundwater contained within the monitoring wells was a source of methane production, two water samples were collected and sent for laboratory analysis.

The sample from BH02 returned a reading of 409 µg/l for Dissolved Methane (CH₄), whereas BH01 was not recorded above the detection limit. VPH testing on both samples did not return any results above the detection limit. Low concentrations (409µg/l) were recorded in a perched water sample from BH02, where no organic material was recorded in the exploratory hole log.

The low concentrations of Dissolved Methane found in BH01 and BH02 do not indicate that dissolved methane within shallow perched water is a likely source of ground gas generation, or the cause of elevated methane and carbon dioxide concentrations recorded during the ground gas monitoring program.

It is therefore recommended that, in accordance with the ground gas risk assessment (Section 8.2.1), CS-3 gas protection measures are installed for the proposed development.

4 CONCEPTUAL SITE MODEL

A Conceptual Site Model (CSM) for the site has been developed as part of the Curtins site investigation(s) that was undertaken at the site and considered based on the current works proposed.

The CSM details a number of pollutant linkages at the site, however, based on the risk assessments undertaken, the potential contaminant linkages (PCLs) listed in *Table 2* were identified as requiring remediation to enable the safe re-development of the site.

Table 2 – Potential Contaminant Linkages

PCL	Sources	Receptor	Risk	Potential Pathway	Remediation Recommended
1	Made Ground soils containing concentrations of asbestos fibres/ containing materials	Site end-users	Moderate/ Low	Direct contact and dermal uptake, soil and dust ingestion, dust & migration inhalation	Appropriate PPE to be provided to construction and maintenance workers. Should unexpected contamination be observed during demolition/ construction, works should be stopped with advice obtained from an appropriate specialist.
2		Construction and maintenance workers	Moderate/ Low	Direct contact and dermal uptake, soil and dust ingestion, dust & migration inhalation	Allow for provision of a suitable thickness of clean and inert cover in all areas of soft landscaping as part of future development works
3	Elevated concentrations of soil gas (CO ₂) identified in site soils beneath proposed apartments	Site end-users	High	Vertical and horizontal migration through the superficial and bedrock deposits	Characteristic Situation 3 (CS-3) Gas Protection Measures

Section 7.0 presents a strategy for handling unexpected contamination or contaminative incidents. It is further recommended that watching brief/periodic site visits are undertaken by a Geo-Environmental Engineer to record any unexpected contamination as outlined in Section 7.3.

5 REMEDIAL WORKS

With reference to the conceptual site model and the potential contaminant linkages detailed in Table 4 remedial actions are recommended in order for the site to be brought up to a condition that is deemed 'suitable for use'. Recommendations are also made for further works:

- **Remedial Action 1:** Appropriate PPE for all construction workers and suitable asbestos management measures.
- **Remedial Action 2:** Engineered capping to serve as physical barrier between Made Ground and site surface in soft landscaped areas preventing direct contact, dermal uptake and limiting the derivation of dust.
- **Remedial Action 3:** Provision of gas protection measures within all proposed buildings on site.

5.1 Remedial Action 1 – Contamination and Asbestos Management During Construction

Under current health and safety legislation, employers are required to carry out their own appropriate risk assessments and mitigation to protect themselves and their employees, other human receptors and the environment from potential contamination. Such risks must be adequately mitigated by law, specifically the Construction Design Management (CDM) Regulations, 2015 which require that potential risks to human health and the environment from construction activities are appropriately identified and all necessary steps taken to eliminate / manage that risk.

It has been assumed that any future construction works on site will be undertaken in compliance with these requirements to address PCL1 (*Table 2*).

CL:AIRE have published guidance to aid in the classification of remediation works on Asbestos Containing Soils (ACS) compliant with Control of Asbestos Regulations 2012 (CAR). This is detailed in CL:AIRE (2016) "Control of Asbestos Regulations 2012 - Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials: Industry Guidance.

Any works with asbestos containing soils are required to determine their classification in accordance with Control of Asbestos Regulations 2012. The specialist groundworks contractor is therefore to designate the works based on the investigation results but utilising their own additional testing and delineation if they deem it to be required. Subsequently the specialist groundworks contractor is to compile a method statement to establish an appropriate management, monitoring and supervisory procedure for the movement of soils as part of the required cut and fill (earthworks) operations. The specialist remediation contractor is to be responsible for management and record keeping as detailed in their method statement document.

Where, from the site investigations, materials are known to contain asbestos fibers good practice (JIWG CAR-Soil and CAR 2012) prescribes such material to be segregated to ensure materials would not cross-contaminate other soils and to reduce the risk of further fiber release to site workers.

Section 3.1 should be consulted together with Curtins Phase 2 Ground Investigation(s), Exploratory Hole Location Plan Drawing and Exploratory Hole Logs for the locations, depths and type of asbestos identified during the Ground Investigation.

Materials containing asbestos >0.1% w/w would be classed as hazardous waste.

Good practice prescribes that any fragments or asbestos containing materials where identified should be picked where possible and to be kept separated in line with those from any soil arisings. This is typically carried out by picking visible fragments at the point of excavation. Such operations are carried out by suitably qualified staff, wearing disposal overalls (type 5/6), gloves and fine dust (FPP3) masks in combination with adoption of dust suppression techniques and monitoring or other applicable methods as recommended by the Asbestos Management Specialist. The qualified staff are to be trained in the identification of asbestos at source. The qualification and competencies of all operatives undertaking monitoring and calibration documentation of equipment should be provided to the Engineer.

Existing Made Ground containing asbestos should not be crushed or in any way treated due to risk of asbestos fibre release. It may be possible to use Made Ground soils as general fill subject to in situ trial tests and where managed appropriately by the Method Statement compiled by the Asbestos Management Specialist.

Any asbestos containing materials are identified at ground level should be picked where possible and disposed of in a suitable waste management facility.

5.2 Remedial Action 2 – Engineered Capping

The primary PCL identified at the site relates to the direct contact, dermal uptake, soil and dust ingestion and inhalation of asbestos fibres in soil and soils and soil derived dust (PCL 2, Table 2).

The potential for exposure to asbestos fibres is highest within soft landscaped areas where receptors (maintenance staff and public) at the site are most likely to come in contact with the contaminated Made Ground soils.

Hardstanding, including the building footprints, vehicular tarmac, pedestrian tarmac and concrete and block paving are considered sufficient to break the potential contaminant linkage, PCL 2, detailed in Table 2 and therefore no specific remediation measures, above activities required for construction, are considered necessary if and where these are installed at the site.

For all soft landscaped areas, a clean cover layer is recommended. It is therefore recommended that verified clean capping is incorporated in general soft landscaping areas.

Given the proposed commercial end use, the following depths of clean cover layers are proposed:

- 450mm depth – Turfed areas
- 450mm depth – Shrubs and herbaceous planted areas
- 600mm depths – Hedges
- 900mm depth – Tree Pits

This is to be made up of a minimum 150mm imported topsoil, with sufficient subsoil quantities to achieve proposed depths. Additionally, a high visibility warning geotextile break layer is to be installed beneath the clean cover system.

This is anticipated to provide adequate protection of human health with consideration of likely exposure and is in accordance with Manchester City Council's Planning & Contaminated Land Technical Guidance (2021) and should be incorporated in all proposed soft landscaped areas.

5.3 Remedial Action 3 – Ground Gas Protection Measures

The primary Potential Contaminant Linkage (PCL) identified at the site relates to the acute risk of explosion and/or asphyxiation of property and end-users through the vertical and horizontal migration of hazardous gases (asphyxiating) from soil gas sources as identified in PCL3 (Table 2) into proposed buildings on site.

Based on the findings of the ground gas monitoring undertaken as part of Curtins 2023 Ground Investigation (Ref. 2) methane was identified as the primary hazardous gases. It is considered that the site should be classified as Characteristic Situation 3 (CS-3) and therefore ground gas protection measures are required to mitigate the risk to the property and end-users.

It is recommended that the building type is classified as *Type C Commercial* building, in accordance with BS;8485:2015 +A1:2019 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.

On this basis, a **minimum protection score of 3 points** should be achieved in non-ventilated areas as a minimum, in accordance with BS 8485. A minimum of two types of protection are required from i) a structural barrier, ii) ventilation measures, iii) gas membrane.

5.3.1 Gas Membrane Specification

Where a gas resistant membrane is adopted, it must meet all the following criteria:

- i) Sufficiently impervious to methane and carbon dioxide with a methane gas transmission rate <40.0 ml/day/m²/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method);

- ii) Capable after installation of providing a complete barrier to the entry of the relevant gas;
- iii) Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions;
- iv) Sufficiently strong to withstand in service stresses (e.g. due to ground settlement if placed below a floor slab);
- v) Sufficiently strong to withstand the installation process and following construction activities until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, and dropping tools);
- vi) Chemically resistant to degradation by other contaminants that might be present; and
- vii) Verified in accordance with CIRIA C735.

If the above criteria are met (as set out within BS8485) then a gas resistant membrane, that is correctly installed and verified, can achieve *2 points*.

It is recommended that an appropriately experienced and qualified workforce is employed to install gas protection systems. Installers should hold relevant qualifications such as Cskills Awards L2 NVQ diploma for the installation of gas membranes.

Any changes to the proposed protection measures outlined above should be made with reference to BS 8485.

It is recommended that an appropriately experienced and qualified workforce is employed to install gas protection systems. Installers should hold relevant qualifications such as Cskills Awards L2 NVQ diploma for the installation of gas membranes.

6 SPECIFICATION FOR SITE WON AND IMPORTED SOILS

This section outlines the required chemical testing specification that the imported or re-used site soils used in soft landscaping areas must meet to satisfy Remedial Action 2, along with a chemical testing specification. This does not cover general fill materials as it is anticipated this will be covered within an earthwork specification.

6.1 Sourcing of Materials

6.1.1 Off-Site Sources

It is anticipated that materials may be imported to the site for use in replacing topsoil in the vicinity of WS02 and TP104. It is strongly recommended that materials are sourced from reputable suppliers and comprise materials that have been suitably processed to produce standardised materials.

It is not recommended that materials are imported directly from 'donor' development sites. Imported material will also require verification testing to ensure suitability for reuse, and it is strongly advised that the Contractor undertake their own independent verification testing if accepting material from a third party, rather than relying on supplier reports.

It is anticipated that crushed hardcore stone and brick may be imported for use in earthworks such as in construction of piling mat or haul roads.

6.1.2 On-site Sources

Based on the findings of the Ground Investigation, it is considered highly unlikely that the shallow Made could be considered 'uncontaminated', 'clean' or 'suitable' material for re-use as a subsoil or topsoil in soft landscaped areas due to the presence of asbestos fibres at a number of locations across the site, as well as due to the physical natures of the existing site soils.

Further analysis of soils where asbestos is removed from the site surface will be required to determine its suitability for re-use. The additional analysis should be undertaken following hand picking of all visible suspected and confirmed asbestos containing materials, prior to re-use.

6.2 Imported Topsoil

Imported Topsoil will invariably be required and should be supplied and placed in accordance with the Architects' specification but generally it is anticipated that all topsoil will be a minimum of 150mm thick in proposed soft landscaped areas, or an equivalent thickness where topsoil is removed in the vicinity of WS02 and TP104. Where topsoil is imported, it is to be 'Multipurpose' in accordance with BS 3882:2015 'Specification for Topsoil and Requirements for Use'.

The topsoil should also be confirmed to be 'suitable for use' as per the analysis outlined in *Section 6.4*.

6.3 Imported Subsoil

Where imported subsoil is required as part of the growing medium this can be cohesive or granular but should be free-draining and confirmed to be 'suitable for use' as per the analysis outlined in *Section 6.4* and compliant with BS 8601:2013 'Specification for subsoil and requirements for use'.

6.4 Chemical Composition of Soils

All materials used in capping should not contain concentrations of contaminants that present an unacceptable risk to the health of future site occupants or off-site receptors.

The Contractor shall be responsible for demonstrating that imported material is 'clean' and therefore suitable for use as part of the engineered capping or else as fill material. This will include the recovery of samples for laboratory testing from both the material source and verification testing of material following delivery to site. The required testing frequencies for materials source types are detailed below. Other sources may be applicable, however testing frequencies shall be confirmed with the Engineer prior to acceptance.

Table 3 - Environmental Chemistry Testing Frequency for Soils

Impacted Soils	Testing Frequency
Imported Topsoil/Subsoil (Greenfield/ Manufactured)	At Source: One sample for every 200m³ imported is to be tested by the supplier in accordance with Clause 5 of BS 3882:2015 or to the landscape architect's / architect's / client's specification. On-site Verification: one sample every 200m³ used (or a minimum of 3 No. samples, whichever is greater).
Imported Topsoil/Subsoil (Remediated/ Brownfield/ Unknown)	At Source: One sample for every 150m³ imported is to be tested by the supplier in accordance with Clause 5 of BS 3882:2015 or to the landscape architect's / architect's / client's specification. On-site Verification: one sample every 150m³ used (or a minimum of 3 No. samples, whichever is greater).
Re-used / Site Won Inert constituents of Made Ground	On-site Verification: one sample every 100m³ used (or a minimum of 6 No. samples, whichever is greater).
Re-used / Site Won Natural Soils	On-site Verification: one sample every 100m³ used (or a minimum of 3 No. samples, whichever is greater).

The environmental chemistry testing requirements and frequency are as Table 3 & Table 4. Additions to the suite and frequency of sampling may be required based on the source of imported materials. For example, if the imported Topsoil is not naturally sourced, e.g., recycled soil, further chemical determinants may be added to the chemical analysis suite at the discretion of the Engineer.

Table 4 - Environmental Chemistry Analysis Suite for Soils

Suite Reference	Environmental Chemistry Analysis
Greenfield, Brownfield or Manufactured Soils	Total metals: Arsenic, cadmium, chromium, chromium VI, lead, mercury, selenium, copper, nickel, zinc, water soluble boron; pH Soil Organic Matter Asbestos Screening Polycyclic Aromatic Hydrocarbons by GC-MS (Detection Limit 0.1mg/kg for each compound) Total Petrol Hydrocarbons (Full TPHCWG analysis – aromatic/aliphatic split, Detection Limit 0.01mg/kg for each banding C5 to C10 and 1mg/kg for bandings above C10)

Assessment criteria: Concentrations of the above determinants shall not exceed the 'Residential without Home Grown Produce' screening criteria (contained within Appendix B).

Definition of 'clean': Where ALL concentrations are less than these values the soils shall be defined as 'clean'. No asbestos shall be detected in soils described as 'clean'.

Soil organic matter (SOM): A review of the thresholds may be made for specific soil sources whereby the Soil Organic Matter ranges.

7 STRATEGY FOR HANDLING POTENTIALLY CONTAMINATED SOILS AND CONTAMINATIVE INCIDENTS ON SITE

7.1 Contaminated Soils

Surplus soils to be removed from site, which have been identified as unsuitable for re-use should be loaded onto a lorry, covered securely, and transported directly to the landfill facility.

Where stockpiling is unavoidable, the stockpile should be located on an impermeable membrane and be covered also with a low permeability membrane at the end of each working day. Where soils are wet when excavated, measures should be taken to ensure there is no runoff from the soils onto the surrounding soils.

Duty of Care: Under his duty of care, the Principal Contractor shall ensure the proper and safe disposal of waste from each site after it has been passed on to another party. In this respect details of the landfill facility to be used and the company disposing of the waste with regard to hazardous and non-hazardous waste shall be provided to the Site Manager. Copies of Consignment Notices for special waste and Waste Transfer Notes for hazardous and non-hazardous waste shall be kept on site for review by Curtins Consulting.

7.2 Contaminative Incidents

It is possible, however unlikely, that some below ground features / structures exist that have not been recorded on plans and have not been encountered during the ground investigation works. It is possible that unknown/unrecorded substructures (e.g. fuel tanks) may exist which if ruptured may release materials that could contaminate the surrounding soils and groundwater (petroleum hydrocarbons, solvents, for example). In the unlikely event that this occurs an outline strategy is detailed below.

Where such a tank/pipework is damaged during excavation and the contents are released into the surrounding soil, the tank/pipework should be immediately pumped dry into another suitable container and a trench with a low permeability base formed around the tank/pipework to prevent seepage laterally and to collect the contaminant. Where groundwater is encountered in the trench, it should be pumped into a suitable container and tested for the contaminant. All soils affected shall then be tested and removed from site as appropriate.

Where the damage is caused to the underside of a tank and seepage is vertical, the contaminants may present a risk of polluting the groundwater. In this instance and subject to the findings of a risk assessment boreholes may be required to prove and intercept the contaminant. The contaminant will then be pumped into suitable containers.

The procedure outlined in *Section 7.3* should also be adhered too and the Engineer shall approve all proposals for such remediation.

7.3 Unexpected Contamination & Watching Brief

In the event that material is revealed on the site of a nature that does not accord with the previously observed and recorded descriptions, including the potential presence of previously uncharacterised asbestos contamination, the following procedure is to be complied with.

1. Cease and make safe all excavations in this location and report observations to the Site Manager.
2. The Site Manager is to notify the Engineer.
3. Under guidance of the qualified Engineer take representative samples of the suspect materials and forward to a suitably accredited laboratory for analysis.
4. Carlisle City Council's Contaminated Land Planning Officer and if relevant the Environment Agency are to be kept fully informed of any such occurrences. Contaminated Land Planning Officer must agree the strategy for dealing with unexpected contamination before works continue in that area.
5. Await Engineers instructions with respect to re-commencement of the works and or removal from of suspect material to a suitably licensed disposal facility (following guidance outlined in Section 8.1 above).

It is recommended that in addition to the above a 'watching brief' for unexpected contamination is undertaken. It is recommended that this includes periodic site visits undertaken by the engineer during the groundworks phase such

072094-CUR-XX-XX-T-GE-00004-P01

Remediation Strategy

National Breast Imaging Academy (NBIA), Wythenshawe Hospital

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during site preparation, removal of contaminated soils from site as well as visiting site as soon as potential contamination is observed by the contractor. Records of any unexpected contamination must be included within the Remediation Completion Report.

7.4 Health & Safety

This section details health and safety requirements associated with contaminated land but does not seek to cover all aspects to be managed by the Contractor under CDM Regulations and detailed in Method Statements.

The works are likely to generate soils, dust, waste asbestos containing materials, groundwater, and other materials that may be a risk such as petroleum hydrocarbons and other related chemicals. The Contractor shall incorporate in its health and safety plan provisions for protecting personnel from physical and chemical hazards associated with these materials. The health and safety plan should also incorporate personnel decontamination requirements and facilities.

7.4.1 Contractor Method Statements

The Contractor is required to prepare method statements relating to the separate tasks highlighted and provide these to the client or Principal Designer along with the Engineer for review prior to the commencement of the related works.

The Contractor shall induct all its employees and subcontractors into the relevant aspects of their health and safety plan and method statements prior to each employee and/or subcontractor commencing works on site.

No works shall commence until the clients' nominated Principal Designer has approved the task specific method statement.

7.5 Environmental Controls

Environmental Controls are the responsibility of the Contractor. However, in general this section details specific requirements for potentially contaminated soils and is not intended to cover all aspects to be managed by the Contractor and detailed within their Method Statements.

Without limiting the Contractor's obligations, it shall be their responsibility to comply with all applicable laws, regulations and rules relating to potential contamination with regard to:

- Surface water run-off.
- Airborne particulates/vapours/odour; including asbestos materials and fibres, and,
- Control of spillages.

Method statements are to be provided to the Engineer and should incorporate the environmental management measures pertaining to the above factors, with further detail given below.

7.5.1 Surface Water Run-Off

The Contractor is responsible for ensuring that site surface water run-off does not leave the site.

The Contractor is to provide for necessary surface water diversion systems as required to keep the construction area free from excess surface or groundwater that may interfere with the works.

All personnel engaged by the Contractor should be trained in response techniques (e.g., use of absorbent materials, etc.) to ensure that any surface water run-off with fuel leakage impact or associated potentially contaminated soil is managed appropriately.

7.5.2 Airborne Particles/Vapour/Odour

The Contractor is responsible for the implementation of dust suppression in work areas, using water or other means of suppression that are not considered harmful to the environment. The Contractor should also set out procedures for the mitigation of any potential odours that may arise from exposed contaminated soils that could affect off-site users (adjacent residents).

An Asbestos Management Plan must be in place during demolition, earthworks and construction works, to inform procedures and mitigation measures to be implemented during excavation and removal of asbestos containing materials.

7.5.3 Control of Spillage

During the phase of works, any type of spillage (including fabricating, hydraulic oils, fuels and/or other materials) should be immediately contained, removed, and disposed of, with any further surrounding areas cleaned.

8 VERIFICATION

Validation visits shall be undertaken by an appropriately qualified environmental engineer throughout the construction phase to ensure that the requirements of the Remediation Strategy have been implemented at the site. This includes periodic visits/watching brief during groundworks. It is anticipated records of the following will be taken during the below phases of work:

- Placement of the requisite depth/s of clean capping material in required areas of proposed soft landscaping;
- Verification of capping materials via chemical laboratory analysis;
- Documentation of general works including records from watching brief, asbestos management procedures during the works and records of contaminative incidents and any unexpected contamination;
- Installation of gas protection measures.

All associated documentation pertaining to the above will be supplied to the Engineer and incorporated within a Completion Report.

Confirmatory analysis is required to confirm the suitability of any imported material, the results of which will be included within the Completion Report. Any additional, confirmatory testing will also be included herein.

Verification through either hand excavated trial pits or comparison of reduced and final level surveys will all be included within the Completion Report to confirm the provision of a requisite depth of clean capping.

Verification through either hand excavated trial pits or comparison of reduced and final level surveys will all be included within the Completion Report to confirm the provision of replaced topsoil.

The frequency and timing of visits by Curtins shall be determined following confirmation of the construction phase programme and the chosen protection elements.

To verify the gas protection measures, it is assumed that the following will be undertaken:

- An appropriately experienced and qualified workforce is employed to install gas protection systems. Installers should hold relevant qualifications such as Cskills Awards L2 NVQ diploma for the installation of gas membranes.

The following verification records should therefore be obtained by the specialist installer contractor/on site staff:

- Photographic log of installation and testing if undertaken, of gas protection measures (ventilation/gas membrane).
- Internal inspection and verification records including any discrepancies and non-conformities in accordance with CIRIA C735.

The above records should be reviewed by an independent third party/Curtins which should include visits to site to provide a secondary visual verification.

Where specialised installation staff are not used a revision to this plan/schedule will likely be required and validation visits potentially increased.

8.1 Verification of Clean Capping/Growing Media

Confirmatory analysis outlined previously is required to verify the suitability of any imported and site won topsoil, and where required, subsoil. Evidence that the specified depth of capping/growing media has been provided will be required.

On completion of the required capping layer within soft landscaping areas (with minimum 150mm thick topsoil), a program of hand dug exploratory pits will be undertaken by an independent third party/Curtins to clearly identify the combined thickness of the topsoil and sub soil layer provided.

The pits shall be excavated to the base of the imported material to prove the existence of the demarcation membrane.

A photographic record of the hand excavated trial pits would also be required, clearly showing the recorded depth of the clean and inert capping. A number of trial pits would be required across the development site, with as a minimum 3no. undertaken across the site.

9 REPORTING

A Completion Report will be required on completion of the works confirming that the remedial works have been completed satisfactorily. The report will contain information including the following:

- Confirmation that the capping has been installed as specified within the various proposed soft landscaped areas, including capping thickness validation records and photographs
- Confirmation of imported capping materials suitability for soft landscaped areas including environmental chemistry testing results;
- Confirmation that re-used topsoil where ACMs have been removed is asbestos free.
- Records of treatment works undertaken on contaminated soils.
- Records of waste transfer notes and consignment notes for contaminated material disposed of off-site.
- Details and documentation of asbestos management measures utilised during the works;
- Confirmation that the remediation has been undertaken satisfactorily and in accordance with the Remediation Statement;
- Confirmation that the remediation objective has been achieved (see *Section 5.0*);
- Details of any unexpected contamination encountered on site and appropriate measures taken to respond; and,
- Revised conceptual model showing no potentially significant contaminant linkages remain at the site.
- Confirmation that the gas protection system has been installed as specified and the required points of protection are met, verified through a visual inspection with associated photographic record. This should include inspection and review of site records on the ventilation measures and or gas membrane; and
- Specification and details of the gas membrane used where applicable.

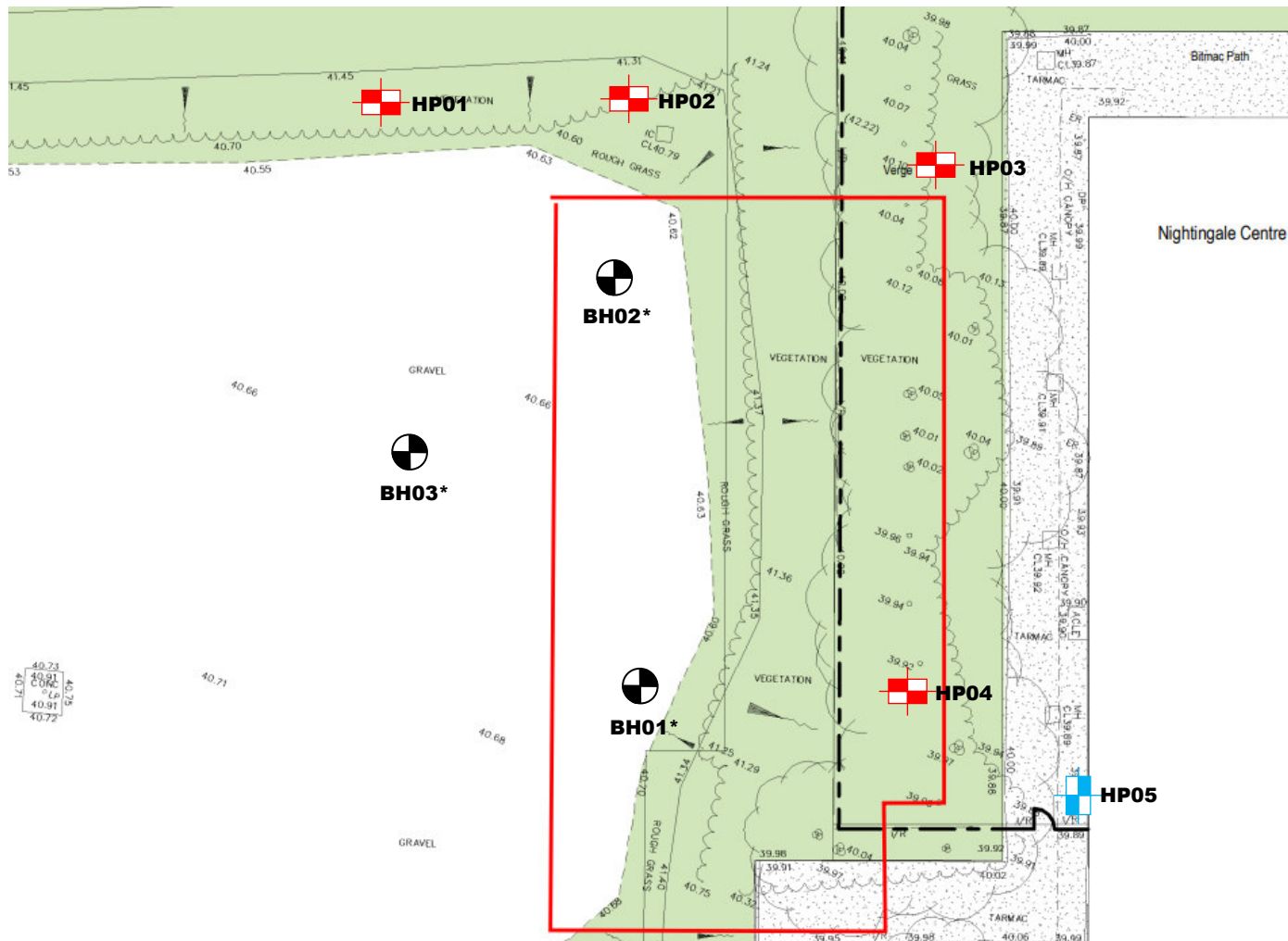
It should be noted that the above list does not include the requirements of an Earthworks Completion report and/or Materials Management Completion report (where soils are re-used under an MMP) which are also likely to be required in addition to the above remediation completion report.

APPENDICES

Appendix A – Drawings & Specifications

Appendix B – Screening Criteria for Imported Materials

Appendix A - Drawings & Specifications



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Civils & Structures • Transport Planning • Environmental • Infrastructure • Geotechnical • Conservation & Heritage • Principal Designer
Birmingham • Bristol • Cambridge • Cardiff • Douglas • Dublin • Edinburgh • Glasgow • Kendal • Leeds • Liverpool • London • Manchester • Nottingham

Project:
NBIA Wythenshawe Hospital

Status:
DRAFT

Drawing Title:
Exploratory Hole Location
Plan

Drawn By: LW	Checked By:
Designed By: LW	Date: 20/04/2023
Scale: NTS	

Project No: Originator: Zone: Level: Type: Discipline: Category/Number: Rev:

072094-CUR-00-XX-DR-GE-001-P01

GENERAL NOTES:

Rev:	Description:	Date:	By:
--			

Appendix B - Screening Criteria for Imported Materials

Adopted Soil Generic Assessment Criteria
Sandy Loam with 6% SOM

Contaminant	Residential WITH home grown produce		Residential WITHOUT home grown produce		Allotments		Commercial		Public Open Space near residential housing POS _{esi}		Public Park POS _{park}	
Metals												
Beryllium	1.7		1.7		35		12		2.2		63	
Boron	290		11000		45		240000		21000		46000	
Cadmium	10	22	85	150	1.8	3.9	230	410	120	220	560	880
Chromium (III)	910		910		18000		8600		1500		33000	
Chromium (VI)	6	21	6	21	1.8	170	33	49	7.7	21	220	250
Lead	200		310		80		2300		630		1300	
Mercury (Elemental)	1.2		1.2		21		58	25.8 ^(vap)	16		30	25.8 ^(vap)
Mercury (Inorganic)	40		56		19		1100		120		240	
Methylmercury	11		15		6		320		40		68	
Nickel	130		180		53		980		230		800	
Vanadium	410		1200		91		9000		2000		5000	
Copper	2400		7100		520		68000		12000		44000	
Zinc	3700		40000		620		730000		81000		170000	
Semi-Metals and non-metals												
Arsenic	32	37	35	40	43	49	640	640	79	79	170	170
Antimony			550				7500		1500		3300	
Selenium	350		600		120		13000		1100		1800	
Inorganic Chemicals												
Cyanide	34		34		34		34		34		34	
Organic Contaminants												
Aliphatic risk banded hydrocarbons - TPH/CWG Method												
EC>5 - EC6	160		160		3900		12000		600000		180000	
EC>6 - EC8	530		530		13000		40000		620000		320000	
EC>8 - EC10	150		150		1700		11000		13000		21000	
EC>10 - EC12	760		770		7300		47000		13000		24000	
EC>12 - EC16	4300		4400		13000		90000		13000		26000	
EC>16 - EC35	110000		110000		270000		1800000		250000		490000	
EC>35 - EC44	110000		110000		270000		1800000		250000		490000	
Aromatic risk banded hydrocarbons - TPH/CWG Method												
EC>5 - EC7	300		1400		57		86000		56000		92000	
EC>7 - EC8	660		3900		120		180000		56000		100000	
EC>8 - EC10	190		270		51		17000		5000		9300	
EC>10 - EC12	380		1200		74		34000		5000		10000	
EC>12 - EC16	660		2500		130		38000		5000		10000	
EC>16 - EC21	930		1900		260		28000		3800		7900	
EC>21 - EC35	1700		1900		1600		28000		3800		7900	
EC>35 - EC44	1700		1900		1600		28000		3800		7900	
Aliphatic + Aromatic EC >44 - EC70	1900		1900		3000		28000		3800		7900	
Aromatic												
Benzene	0.33	0.87	1	3.3	0.07	0.18	95	98	73	140	110	230
Ethyl benzene	350		840		90		2800	[66000]	2800	[25000]	2800	[27000]
Toluene	610		2700		120		4400	[190000]	4400	[56000]	4400	[100000]
Xylene (9)	230		290		160		2600	[32000]	2600	[43000]	2600	[31000]
Phenol	420		520		280		3200	(38000)	3200	(10000)	3200	(93000)
Polycyclic Aromatic Hydrocarbons (PAHs)												
Napthalene	13		13		24		1100		4900		3000	
Aceanaphthylene	920		6000		160		100000		15000		30000	
Acenaphthene	1100		6000		200		100000		15000		30000	
Fluorene	860		4500		160		71000		9900		20000	
Phenanthrene	440		1500		90		23000		3100		6300	
Anthracene	11000		37000		2200		540000		74000		150000	
Fluoranthene	890		1600		290		23000		3100		6400	
Pyrene	2000		3800		620		54000		7400		15000	
Benz(a)anthracene	13		15		13		180		29		62	
Chrysene	27		32		19		350		57		120	
Benzo(b)fluoranthene	3.7		4		3.9		45		7.2		16	
Benzo(k)fluoranthene	100		110		130		1200		190		440	
Benzo(a)pyrene	5		5.3		5.7		77		10		21	
Indeno(123cd)pyrene	41		46		39		510		82		180	
Dibenzo(ah)anthracene	0.3		0.32		0.43		3.6		0.58		1.4	
Benzo(ghi)perylene	350		360		640		4000		640		1600	
Chlorinated Aliphatic Hydrocarbons												
Vinyl chloride	0.017		0.029		0.0058		2.2		7.8		19	
Trichloroethene (TCE)	0.043		0.045		0.16		3.4		79		69	
1,1,1,2 Tetrachloroethane	6.4		8.2		4.4		560		1400		2100	
Tetrachloroethene (PCE)	1.6		1.6		11		130		3400		2500	
1,1,1 Trichloroethane	39		40		240		3000		140000	6392 ^(vap)	100000	6392 ^(vap)
Trans-1,2-Dichloroethene	3.3		3.4		16		260		13000		9100	
Cis-1,2-Dichloroethene	1.5		1.6		3.6		120		3900		3100	
1,2-Dichloroethane (Ethylene Dichloride)	0.31		0.41		0.19		29		310		380	

Notes

- All values above are in mg/kg.
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs.**
- Soil organic matter (SOM) is assumed to be 1% - DEFAULT VALUE.
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE.
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model.
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly.
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³.
- Based on vapour saturation limit as suggested by EA / [] model value.
- Lowest of o-, m- and p-xylene.
- Based on comparison of inhalation exposure with inhalation TDI.
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI.
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only.
- Averaged over and based on lifetime exposure.
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration).
- NA: Not applicable

Contaminant	Residential WITH home grown produce	Residential WITHOUT home grown produce	Allotments	Commercial	Public Open Space near residential housing POS _{esi}	Public Park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11000	45	240000	21000	46000
Cadmium	10 <i>22</i>	85 <i>150</i>	1.8 <i>3.9</i>	230 <i>410</i>	120 <i>220</i>	560 <i>880</i>
Chromium (III)	910	910	18000	8600	1500	33000
Chromium (VI)	6 <i>21</i>	6 <i>21</i>	1.8 <i>170</i>	33 <i>49</i>	7.7 <i>21</i>	220 <i>250</i>
Lead	<i>200</i>	<i>310</i>	<i>80</i>	<i>2300</i>	<i>630</i>	<i>1300</i>
Mercury (Elemental)	1.2	1.2	21	58 25.8 ^(vap)	16	30 25.8 ^(vap)
Mercury (Inorganic)	40	56	19	1100	120	240
Methylmercury	11	15	6	320	40	68
Nickel	130	180	53	980	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32 <i>37</i>	35 <i>40</i>	43 <i>49</i>	640 <i>640</i>	79 <i>79</i>	170 <i>170</i>
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic Chemicals						
Cyanide	34	34	34	34	34	34
Organic Contaminants						
Aliphatic risk banded hydrocarbons - TPH/CWG Method						
EC>5 - EC6	78	78	1700	5900	590000	130000
EC>6 - EC8	230	230	5600	17000	610000	220000
EC>8 - EC10	65	65	770	4800	13000	18000
EC>10 - EC12	330	330	4400	23000	13000	23000
EC>12 - EC16	2400	2400	13000	82000	13000	25000
EC>16 - EC35	92000	92000	270000	1700000	250000	480000
EC>35 - EC44	92000	92000	270000	1700000	250000	480000
Aromatic risk banded hydrocarbons - TPH/CWG Method						
EC>5 - EC7	140	690	27	46000	56000	84000
EC>7 - EC8	290	1800	51	110000	56000	95000
EC>8 - EC10	83	110	21	8100	5000	8500
EC>10 - EC12	180	590	31	28000	5000	9700
EC>12 - EC16	330	2300	57	37000	5100	10000
EC>16 - EC21	540	1900	110	28000	3800	7700
EC>21 - EC35	1500	1900	820	28000	3800	7800
EC>35 - EC44	1500	1900	820	28000	3800	7800
Aliphatic + Aromatic EC >44 - EC70	1800	1900	2100	28000	3800	7800
Aromatic						
Benzene	0.16	0.49	0.035	50	72	100
Ethyl benzene	150	380	39	1200 [35000]	1200 [24000]	1200 [22000]
Toluene	270	1300	51	1900 [110000]	1900 [56000]	1900 [95000]
Xylene (9)	98	120	70	1200 [14000]	1200 [42000]	1200 [23000]
Phenol	290	420	140	1500 (35000)	1500 (10000)	1500 (8300)
Polycyclic Aromatic Hydrocarbons (PAHs)						
Napthalene	5.6	5.6	10	460	4900	1900
Aceanaphthylene	420	4600	69	97000	15000	30000
Acenaphthene	510	4700	85	97000	15000	30000
Fluorene	400	3800	67	68000	9900	20000
Phenanthrene	220	1500	38	22000	3100	6200
Anthracene	5400	35000	950	540000	74000	150000
Fluoranthene	560	1600	130	23000	3100	6300
Pyrene	1200	3800	270	54000	7400	15000
Benz(a)anthracene	11	14	6.5	170	29	56
Chrysene	22	31	9.4	350	57	110
Benzo(b)fluoranthene	3.3	4	2.1	44	7.2	15
Benzo(k)fluoranthene	93	110	75	1200	190	410
Benzo(a)pyrene	5	5.3	5.7	77	10	21
Indeno(123cd)pyrene	36	46	21	510	82	170
Dibenzo(ah)anthracene	0.28	0.32	0.27	3.6	0.57	1.3
Benzo(ghi)perylene	340	360	470	4000	640	1500
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	<i>0.01</i>	<i>0.019</i>	<i>0.0031</i>	<i>1.4</i>	<i>7.8</i>	<i>19</i>
Trichloroethene (TCE)	<i>0.02</i>	<i>0.02</i>	<i>0.072</i>	<i>1.5</i>	<i>78</i>	<i>54</i>
1,1,1,2 Tetrachloroethane	2.8	3.5	1.9	250	1400	1800
Tetrachloroethene (PCE)	<i>0.7</i>	<i>0.71</i>	<i>4.8</i>	<i>55</i>	<i>3300</i>	<i>1900</i>
1,1,1 Trichloroethane	18	18	110	1300	140000 2915 ^(vap)	76000 2915 ^(vap)
Trans-1,2-Dichloroethene	<i>1.6</i>	<i>1.7</i>	<i>7.5</i>	<i>120</i>	<i>13000</i>	<i>7000</i>
Cis-1,2-Dichloroethene	<i>0.78</i>	<i>0.84</i>	<i>1.7</i>	<i>64</i>	<i>3800</i>	<i>2400</i>
1,2-Dichloroethane (Ethylene Dichloride)	<i>0.18</i>	<i>0.24</i>	<i>0.1</i>	<i>17</i>	<i>210</i>	<i>330</i>

Notes

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- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³.
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- Based on a comparison of oral and dermal soil exposure with oral Index Dose only.
- Averaged over and based on lifetime exposure.
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Cadmium	10 <i>22</i>	85 <i>150</i>	1.8 <i>3.9</i>	230 <i>410</i>	120 <i>220</i>	560 <i>880</i>
Chromium (III)	910	910	18000	8600	1500	33000
Chromium (VI)	6 <i>21</i>	6 <i>21</i>	1.8 <i>170</i>	33 <i>49</i>	7.7 <i>21</i>	220 <i>250</i>
Lead	<i>200</i>	<i>310</i>	<i>80</i>	<i>2300</i>	<i>630</i>	<i>1300</i>
Mercury (Elemental)	1.2	1.2	21	58	16	30
Mercury (Inorganic)	40	56	19	1100	120	240
Methylmercury	11	15	6	320	40	68
Nickel	130	180	53	980	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32 <i>37</i>	35 <i>40</i>	43 <i>49</i>	640 <i>640</i>	79 <i>79</i>	170 <i>170</i>
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic Chemicals						
Cyanide	34	34	34	34	34	34
Organic Contaminants						
Aliphatic risk banded hydrocarbons - TPH/CWG Method						
EC>5 - EC6	42	42	730	3200	570000	95000
EC>6 - EC8	100	100	2300	7800	600000	150000
EC>8 - EC10	27	27	320	2000	13000	14000
EC>10 - EC12	130	130	2200	9700	13000	21000
EC>12 - EC16	1100	1100	11000	59000	13000	25000
EC>16 - EC35	65000	65000	260000	1600000	250000	450000
EC>35 - EC44	65000	65000	260000	1600000	250000	450000
Aromatic risk banded hydrocarbons - TPH/CWG Method						
EC>5 - EC7	70	370	13	26000	56000	76000
EC>7 - EC8	130	860	22	56000	56000	87000
EC>8 - EC10	34	47	8.6	3500	5000	7200
EC>10 - EC12	74	250	13	16000	5000	9200
EC>12 - EC16	140	1800	23	36000	5100	10000
EC>16 - EC21	260	1900	46	28000	3800	7600
EC>21 - EC35	1100	1900	370	28000	3800	7800
EC>35 - EC44	1100	1900	370	28000	3800	7800
Aliphatic + Aromatic EC >44 - EC70	1600	1900	1200	28000	3800	7800
Aromatic						
Benzene	0.08	0.3	0.017	28	72	100
Ethyl benzene	65	170	16	520 [17000]	520 [24000]	520 [17000]
Toluene	120	610	22	860 [59000]	860 [56000]	860 [87000]
Xylene (9)	41	53	28	480 [69000]	480 [41000]	480 [17000]
Phenol	180	310	66	760 (31000)	760 (10000)	760 (7600)
Polycyclic Aromatic Hydrocarbons (PAHs)						
Napthalene	2.3	2.3	4.1	190	4900	1200
Aceanaphthylene	170	2900	28	83000	15000	29000
Acenaphthene	210	3000	34	84000	15000	29000
Fluorene	170	2800	27	63000	9900	20000
Phenanthrene	95	1300	15	22000	3100	6200
Anthracene	2400	31000	380	520000	74000	150000
Fluoranthene	280	1500	52	23000	3100	6300
Pyrene	620	3700	110	54000	7400	15000
Benz(a)anthracene	7.2	11	2.9	170	29	49
Chrysene	15	30	4.1	350	57	93
Benzo(b)fluoranthene	2.6	3.9	0.99	44	7.1	13
Benzo(k)fluoranthene	77	110	37	1200	190	370
Benzo(a)pyrene	5	5.3	5.7	77	10	21
Indeno(123cd)pyrene	27	45	9.5	500	82	150
Dibenzo(ah)anthracene	0.24	0.31	0.14	3.5	0.57	1.1
Benzo(ghi)perylene	320	360	290	3900	640	1400
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.0064	0.015	0.0017	1.1	7.8	18
Trichloroethene (TCE)	0.0093	0.0097	0.032	0.73	76	41
1,1,1,2 Tetrachloroethane	1.2	1.5	0.79	110	1400	1500
Tetrachloroethene (PCE)	0.31	0.32	2	24	3200	1400
1,1,1 Trichloroethane	8.8	9	48	660	140000	57000
Trans-1,2-Dichloroethene	0.9	0.93	3.7	69	13000	5600
Cis-1,2-Dichloroethene	0.46	0.5	0.89	38	3800	2000
1,2-Dichloroethane (Ethylene Dichloride)	0.11	0.16	0.054	12	300	300

Notes

- All values above are in mg/kg.
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input
- Soil organic matter (SOM) is assumed to be 1% - DEFAULT VALUE.
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE.
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model.
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly.
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³.
- Based on vapour saturation limit as suggested by EA / [] model value.
- Lowest of o-, m- and p-xylene.
- Based on comparison of inhalation exposure with inhalation TDI.
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI.
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only.
- Averaged over and based on lifetime exposure.
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration).
- NA: Not applicable