



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

TE1604-TE-00-XX-RP-GE-002-V01

VERSION 1

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FINAL

Prepared for:

Northern Powerhouse Land Ltd

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**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : i of vi
Engineer: Adrian Read
Date: 27/05/2022

CONTENTS

1.	INTRODUCTION.....	7
1.1.	Proposed Development	7
1.2.	Previous Reports	7
1.3.	Objectives	7
1.4.	Assumptions.....	8
2.	SITE DETAILS AND DESCRIPTION	9
3.	PREVIOUS INVESTIGATION FINDINGS	10
4.	PRELIMINARY CONCEPTUAL SITE MODEL.....	12
4.1.	Uncertainties.....	12
5.	FIELDWORK.....	14
5.1.	Scope of Ground Investigation.....	14
5.2.	Geoenvironmental Testing	15
5.3.	Geotechnical Testing.....	16
6.	GROUND CONDITIONS	17
6.1.	Strata Descriptions.....	17
6.2.	Obstructions.....	19
6.3.	Visual and Olfactory Evidence of Contamination	19
6.4.	Groundwater Observations During Fieldwork	19
6.5.	Groundwater Monitoring.....	20
7.	PRELIMINARY GEOTECHNICAL ASSESSMENT	21
7.1.	Mining and Quarrying	21
7.2.	Determination of pH and Water-Soluble Sulphate.....	21
7.3.	Geotechnical Parameters.....	22
7.4.	Floors	25
7.5.	Groundworks, Excavation Stability and Groundwater Dewatering	25
7.6.	Pavements and Highways	25
8.	HUMAN HEALTH RISK ASSESSMENT	27
8.1.	Data Interpretation Approach	27
8.2.	Selection of Generic Assessment Criteria (GAC).....	27
8.3.	Human Health Risk Assessment.....	28
8.4.	Utilities	28
8.5.	Construction and Maintenance Workers.....	28
9.	CONTROLLED WATERS RISK ASSESSMENT	29



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : ii of vi
Engineer: Adrian Read
Date: 27/05/2022

9.1.	Introduction	29
9.2.	Controlled Waters Environment Conceptual Site Model Summary	29
9.3.	Soil Leachate Testing.....	29
10.	GROUND GAS RISK ASSESSMENT	31
10.1.	Introduction	31
10.2.	Ground Gas Monitoring Results.....	31
10.3.	Ground Gas Risk Assessment	33
10.4.	Radon Gas	35
11.	REVISED CONCEPTUAL MODEL AND GENERIC QUANTITATIVE RISK ASSESSMENT OF POLLUTANT LINKAGES	36
12.	PRELIMINARY WASTE SOILS CLASSIFICATION AND WASTE DISPOSAL ROUTE DETERMINATION	38
13.	CONCLUSIONS AND RECOMMENDATIONS	39
13.1.	Conclusions	39
14.	REGULATORY APPROVALS	40
15.	REFERENCES.....	41
16.	GLOSSARY OF TERMS	44

TABLES

Table 2.1 Current Site Overview.	9
Table 3.1 Report Review Summary	10
Table 4.1 Preliminary Assessment of Potential Pollutant Linkages.	13
Table 5.1 Scope of Ground Investigation and Rationale	14
Table 5.2 Scope of Monitoring Installations	15
Table 5.3 Schedule of Chemical Testing for Human Health Risk Assessment and Preliminary Waste Soils Assessment.	15
Table 5.4 Schedule of Chemical Testing for Controlled Waters Risk Assessment.	16
Table 5.5 Geotechnical Laboratory Testing Schedule.	16
Table 6.1 Underground Services Summary Table	19
Table 6.2 Field Observations of Groundwater.	20
Table 6.3 Groundwater Monitoring Results Summary	20
Table 7.1 Results of Soil pH Testing and Water-Soluble Sulphate Determination.....	21
Table 7.2 Soil Classification Test Results for Glacial Till.	23
Table 7.3 Dynamic Cone Penetrometer Results.....	25
Table 9.1 Summary of Measured Concentrations of Soil Leachate Potential Contaminants of Concern in Excess of WQS Values	29



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : iii of vi
Engineer: Adrian Read
Date: 27/05/2022

Table 10.1 Ground Gas Monitoring Results Summary	32
Table 10.2 From Table 5.5a CIRIA C665 - Typical/idealised periods of monitoring (after Wilson et al, 2005)	33
Table 10.3 From Table 5.5b CIRIA C665 - Typical/idealised frequency of monitoring (after Wilson et al, 2005)	33
Table 10.4 Initial Worst-Case GSV Calculation	34
Table 11.1 Revised Assessment of Pollutant Linkages.	37

FIGURES

Figure 2.1 Recent Aerial Photograph from Groundsure	9
Figure 9.2 Shear strength from SPT N value vs depth (m bgl)	24



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : iv of vi
Engineer: Adrian Read
Date: 27/05/2022

APPENDICES

Appendix A - Drawings

Appendix B - Exploratory Hole Logs

Appendix C - Geoenvironmental Soil Laboratory Results

Appendix D - Geoenvironmental Groundwater Laboratory Results

Appendix E - Geotechnical In Situ Fieldwork and Laboratory Results

Appendix F - Groundwater and Gas Monitoring Results

Appendix G - Photographs

Appendix H - Groundsure Report

Appendix I - Previous Site Investigation Report (Available as a Separate Document)

Appendix J - Definitions of Terms Used in Qualitative and Quantitative Risk Assessments

Appendix K - Human Health Assessment Criteria

Appendix L - Controlled Waters Risk Assessment

Appendix M - Assessment Criteria Applied for Ground Gas

Appendix N - Chemical and Geotechnical Test Sampling

Appendix O - Complying With Control of Asbestos Regulations 2012



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : v of vi
Engineer: Adrian Read
Date: 27/05/2022

EXECUTIVE SUMMARY

Introduction	Tier Environmental was commissioned by Northern Powerhouse Land Ltd to undertake a Supplementary Ground Investigation for the of the proposed commercial / industrial development at Moss Nook, Heald Green. The purpose of the investigation was to confirm the nature and extent of soil and groundwater beneath the Site for the purposes of an updated environmental and geotechnical assessment. The information was to be updated following completion of a historical Tier Environmental ground investigation in 2012 and 2016 and Preliminary Risk Assessment carried out in August 2021.
Proposed land use	Under current proposals the development will comprise 4 No. warehouse structures/commercial units of ground floor and mezzanine for a total of 1,396m ² floor space, with associated infrastructure, parking and localised soft landscaping at the end of parking bays.
Site location and surrounding land uses	The site is located at Moss Nook, Heald Green, Manchester, M22 5LS within a mixed commercial and residential area. Manchester Airport lies approximately 1km to the south west of the Site, with the surrounding area between the airport and the Site predominantly occupied with associated car parks, hotels and other businesses. A railway line, and Heald Green station, are located approximately 200m to the east of the Site, beyond which the surrounding land use is mainly residential.
Site history	The site is recorded undeveloped agricultural land from 1872, with a tree lined brook on the northern and western site boundaries. By the early 2000s, a road entrance in the southern corner of the Site has been created alongside a development immediately east of the Site. Aerial imagery indicates the Site was used as a temporary compound for site cabins and materials associated with this development. Historically the wider site area is predominantly undeveloped land or small scale residential. A railway is located 50m east by 1935.
Mining and quarrying	The Site is not located within a mining area or an area subject to historic quarrying.
Previous investigations	Tier Environmental completed a ground investigation in April 2012 which comprised drilling of 3 No. Cable Percussive holes; (BH1 to BH3) to a depth of 10.05m bgl, and excavation of 20 No. trial pits (TP1 to TP20) to depths of between 1.20m bgl (TP18) and 4.00m bgl (TP10). A subsequent visit took place in June 2016 comprising 16 No. trial pits within the asbestos impacted area. Upon comparison of soil chemical results against GACs for a commercial/industrial site land use, Tier recorded no exceedances indicating an unlikely risk to current and future site users. 1 No. sample (TP3 at 0.25m bgl) was identified as containing asbestos (chrysotile fibres) during the initial investigation and a second detection of chrysotile fibres was recorded in the Tier 2016 investigation, reported to be <0.001% w/w.
Fieldwork	In total, 6 No. supplementary trial pits (TP101 to TP106) were advanced to depths between 2.00m (TP101) to 3.30m (TP103) and 5 No. window sample boreholes (WS101 to WS105) were conducted to a depth of 5.45m bgl (WS101 to WS105) on 20th and 21st April 2022. 10 No. Dynamic Cone Penetrometer Tests were completed on 5 th May 2022. A subsequent confirmatory groundwater monitoring and ground gas monitoring visit was conducted on 29 th April 2022.
Laboratory testing	Samples of soil and soil leachate were submitted for analysis of a range of metal, other inorganic and organic components including asbestos. Geotechnical testing was scheduled on selected samples. All testing was undertaken at accredited laboratories.
Ground conditions	Made Ground was encountered at depths between 0.35m and 1.10m bgl comprising both cohesive and granular materials with anthropogenic materials including brick, concrete, rare ceramic and plastic, and natural lithologies including sandstone, limestone, quartz, flint, rare coal. Natural soils comprised Glacial Till of predominantly cohesive firm to stiff, locally friable, reddish brown, slightly sandy gravelly CLAY with occasional cobbles of sandstone – the base of this was <u>not</u> encountered at 5.45m bgl. Sand bands were reported at thicknesses ranging from 0.35m to 0.45m from depths ranging between 0.35m and 3.95m bgl at locations in the northwestern and southeastern areas of the Site.
Ground stability	No ground stability concerns were identified.
Foundations and floor slabs	The Glacial Till may provide a consistent platform for construction and shallow pad / strip foundations should be extended through Made Ground soils, wherever they remain. It is considered that foundations should generally extend to around at least 1.50m below current ground level. Calculations based upon SPTs and Plasticity Indices, as well as the results from specified triaxial analysis of undisturbed soil samples suggest that these clays have a shear strength of around 70 kPa at 1.20m bgl and 130 kPa at 2.00m bgl. Although specific foundation sizes cannot be given at the current time, as proposed loads are not available (in accordance with EC7), it is considered that for this type of development, a potential allowable bearing pressure in the region of 125 kN/m ² may be achieved between 1.00m and 2.00m bgl. Areas of soft ground should have deeper foundations on more competent strata.
Sulphate class	It is considered that a Design Sulphate Class of DS-1 and ACEC Class AC-2z is appropriate for buried concrete at the Site.
Contamination – Human Health	No measured soil concentrations of potential contaminants of concern have been reported in excess of Generic Assessment Criteria (GACs) protective of human health appropriate to the proposed land use. On this basis, it is not



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : vi of vi
Engineer: Adrian Read
Date: 27/05/2022

	considered that the site represents a potential risk to end-users based on the results of the supplementary ground investigation alone. It should be noted; however, that an isolated sample of asbestos was reported previously at TP3 during previous Tier Environmental ground investigations, located in the north-eastern part of the Site which under current proposals will be capped by the proposed building (Units 1 and 2).
Contamination – Controlled Waters	The superficial deposits are classed as a Secondary Undifferentiated Aquifer, and the bedrock is classified a Principal Aquifer. The nearest surface water feature is Gately Brook located 40m northeast of the site boundary. The site is not within a Source Protection Zone and there are no potable abstraction records. Tier Environmental have previously determined the risk to controlled waters to be low given the presence of low permeability clay beneath the Site, the results of leachate analysis obtained in 2012 and the general absence of contamination of Made Ground soils. The results of a supplementary controlled waters risk assessment is that no measured leachable concentrations of potential contaminants of concern represent a potentially significant risk to the controlled waters environment.
Gas protection	A Gas Screening Value of 0.005 l/hr has been calculated, derived using the maximum peak recorded carbon dioxide concentration of 5 %v/v and the selected characteristic flow rate of 0.1 l/hr. Assessment of this gas screening value alone places the Site in a Characteristic Situation 1 – Very Low risk scenario in accordance with CIRIA C665 for which ground gas protection measures are not required. The results of the steady carbon monoxide and hydrogen sulphide monitoring has determined that the site does not present a risk from these gases.
Radon Requirements	Basic radon protection measures are not currently required for the proposed development on this Site.
Soakaways	Ground conditions beneath the Site are unlikely to be suitable for soakaways due to the significant cohesive and therefore low permeability ground.
Waste Soils Classification	Basic waste characterisation has demonstrated that all of the samples of the material tested have been classified as non-hazardous waste. The results of WAC testing have demonstrated that Made Ground materials contain TOC levels marginally in excess of the inert waste landfill threshold; however, an inert landfill should be approached as the average TOC concentration across the site are below the inert waste threshold and the materials may therefore be accepted by an inert waste landfill subject to discussion / liaison and subsequent agreement. The previously identified localised asbestos impacted Made Ground at TP103 should be disposed as hazardous waste.
Materials re-use	It is considered that the Made Ground (with the exception of the localised asbestos impacted soil at TP3) and natural soil materials are chemically suitable for re-use in accordance with the CL:AIRE Definition of Waste Code of Practice (DoWCoP). Suitability for re-use would also be subject to confirmation of the geotechnical suitability depending on whether the materials are to be re-used in load bearing areas. This would need to be detailed in a Materials Management Plan in accordance with DoWCoP or, if appropriate / applicable, a U1 Exemption.
Outline Remediation Strategy	The recommendations within the previous Tier Environmental Remediation Strategy have not been impacted by the findings of this supplementary investigation and the following remains pertinent: • General site clearance to include hardstanding, stockpile and vegetation; • Removal and verification of asbestos hotspot identified within the north of the site; • Removal and verification of any previously unidentified areas of contamination, where required; • Backfill of resultant excavations with suitable material.



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 7 of 45
Engineer: Adrian Read
Date: 27/05/2022

1. INTRODUCTION

Tier Environmental was commissioned by Northern Powerhouse Land Ltd to undertake a Land Contamination Risk Management (LCRM) Ground Investigation for an area of land referred to as Moss Nook, located at Heald Green, Manchester, M22 5LS (the "Site").

The title of this report is in accordance with that described in the Land Contamination Risk Management guidance (available at <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>) which has superseded CLR 11:

Stage 1:

- LCRM Tier 1 Preliminary Risk Assessment Report
- LCRM Tier 2 Generic Quantitative Risk Assessment Report

1.1. Proposed Development

Under current proposals the development will comprise 4 No. warehouse structures/commercial units of ground floor and mezzanine for a total of 1,396m² floor space, with associated infrastructure, parking and localised soft landscaping at the end of parking bays, as presented in Appendix A. As such, in accordance with the 'Updated technical background to the CLEA model' (Environment Agency, 2009) and 'Suitable 4 Use Levels' (LQM / CIEH 2015) the proposed generic land use for this development is Commercial / Industrial.

1.2. Previous Reports

Tier Environmental have previously completed the following reports for the site:

- A Geoenvironmental Appraisal of Land at Moss Nook, Heald Green, by Tier Environmental (Ref: T/12/1105/GA v 1.1, dated September 2012)
- A Remediation Strategy for Land at Moss Nook, Heald Green, by Tier Environmental (Ref: T/12/1105/RS, dated June 2012)
- An Asbestos Assessment for Land at Moss Nook, Heald Green, by Tier Environmental (REF: T/12/1105/GA/L01, dated July 2016)
- Preliminary Risk Assessment Report For Moss Nook, Heald Green, Manchester by Tier Environmental (Ref: TE1604-TE-00-XX-RP-GE-001-V01, dated 17th August 2021)

1.3. Objectives

Taking into account the proposed development of the Site, the objectives of this appraisal were:

- To reproduce the previous report findings;
- To reproduce the Preliminary Conceptual Site Model derived during the recent Preliminary Risk Assessment (Ref: TE1604-TE-00-XX-RP-GE-001-V01, dated 17th August 2021);
- To determine current ground and groundwater conditions following a possible site strip and temporary use of the land during the development of land to the east of the Site (as indicated on aerial photography in 2013);
- To conduct delineation of asbestos previously identify in one area of the Site;
- To determine the current day potential risks to human health and the wider environment;
- To determine potential risks posed to the Site from hazardous ground gases and / or vapours;



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 8 of 45
Engineer: Adrian Read
Date: 27/05/2022

- To provide a preliminary waste soils classification.
- Provide preliminary outline remedial measures to manage any identified risks.
- To provide preliminary geotechnical parameters to inform floor slab and foundation recommendations.

1.4. Assumptions

The following assumptions are made in this report:

- It is assumed that ground levels will not change significantly from those described in this report or as shown on proposed development drawings. If this is not the case, then amendments to the recommendations made in this report may be required.
- The ground investigation has been designed with due consideration of known or suspected constraints (including underground services and access constraints).
- Any references to observations of suspected asbestos-containing materials are for information only and should be verified by a suitably qualified asbestos specialist and/or confirmed by laboratory analysis.
- The use of the term 'Topsoil' within this report is based on a visual identification only and that these materials have not been classified in accordance with BS3882:2015.
- The use of the terms 'shallow' and 'deep' within this report (from a geotechnical perspective) assume *typically* between ground level to circa 3.00m below ground level (bgl) for 'shallow' and greater than 3.00m bgl regarded as 'deep';
- The comments and opinions presented in this report are based on the findings of the desk study, previous ground investigations, ground conditions encountered during more recent intrusive investigation works performed by Tier Environmental and the results of tests carried out within one or more laboratories. There may be other conditions prevailing on the Site which have not been revealed by this investigation and which have not been taken into account by this report.
- Responsibility cannot be accepted for any conditions not revealed by this investigation. Any diagram or opinion on the possible configuration of the findings is conjectural and given for guidance only. Confirmation of intermediate ground conditions should be undertaken if deemed necessary.

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SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 9 of 45
Engineer: Adrian Read
Date: 27/05/2022

2. SITE DETAILS AND DESCRIPTION

Table 2.1 Current Site Overview.

Site name	Moss Nook, Heald Green
Site address	Moss Nook, Heald Green, Manchester, M22 5LS. A site location plan is included as Drawing No. TE1604-TE-XX-DR-GE-001-V01 within Appendix A
National Grid Reference (NGR)	384218 385901
Approximate Site area	0.42 ha
Site shape	The Site is irregular in shape
Current land use on the Site	The Site currently comprises unoccupied scrubland. There are no existing structures or areas of hardstanding. Access is afforded by a road from the south east; the site is fenced along its perimeter. A mound of material is located in the centre of the site. Underground service drawings have not been provided to Tier Environmental; however, there remains a potential for such features to be present beneath the Site.
Surrounding land uses	The site is set within a mixed commercial and residential area. Manchester Airport lies approximately 1km to the south west of the Site, with the surrounding area between the airport and the Site predominantly occupied with associated car parks, hotels and other businesses. A railway line, and Heald Green station, are located approximately 200m to the east of the Site, beyond which the surrounding land use is mainly residential.
General topography and ground levels	The Site and surrounding area are understood to be relatively flat, at approximately 67m AOD.

An aerial photograph (from the Groundsure report) of the Site and site boundary is shown below. Relevant Site photographs are presented in Appendix G.

Figure 2.1 Recent Aerial Photograph from Groundsure





SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 10 of 45
Engineer: Adrian Read
Date: 27/05/2022

3. PREVIOUS INVESTIGATION FINDINGS

The following previous desk study or site investigation reports pertaining to this Site have been produced by Tier Environmental and are summarised in Table 3.1, below:

- A Geoenvironmental Appraisal of Land at Moss Nook, Heald Green, by Tier Environmental (Ref: T/12/1105/GA v 1.1, dated September 2012)
- A Remediation Strategy for Land at Moss Nook, Heald Green, by Tier Environmental (Ref: T/12/1105/RS, dated June 2012)
- An Asbestos Assessment for Land at Moss Nook, Heald Green, by Tier Environmental (REF: T/12/1105/GA/L01, dated July 2016)

Table 3.1 Report Review Summary

Site history	The site has been shown to have had a very limited development history, with a glass house on the north eastern boundary of the site that has since been demolished.
Potential contaminative features identified	The proximal location of demolition and construction may have resulted in a thin covering of Made Ground across the site. In addition, there are off Site areas of infilled ground which may give rise to ground gas.
Mining and quarrying	The Site is not within an area of historic mining or quarrying.
Fieldwork	The investigation took place between 12th-13th April 2012 and comprised: • Drilling of 3 No. Cable Percussive holes; (BH1 to BH3) to a depth of 10.05m bgl • Excavation of 20 No. trial pits (TP1 to TP20) using a JCB 3CX wheeled excavator to depths of between 1.20m bgl (TP18) and 4.00m bgl (TP10). A subsequent visit took place in June 2016 comprising 16 No. trial pits within the asbestos impacted area.
Laboratory testing	8 No. samples of Made Ground soils were submitted for a standard chemical suite including heavy metals, PAHs, and an asbestos screen. 3 No. samples were submitted for leachate analysis.
Ground conditions	Drift geology of Glacial Till over bedrock of the Sherwood Sandstone Group. The site has been shown to be underlain by a thin veneer of Made Ground to between 0.20-0.60m bgl comprising sandy gravelly Clays with mudstone, limestone and brick, and locally other anthropogenic components of metal, plastics and ceramics. Natural soils comprised of medium to very high strength, low plasticity cohesive Glacial Till to the maximum drilled depths of 10.05m bgl.
Ground stability	Excavations into existing Made Ground and the underlying natural soils should be assumed to be unstable. Based on the results of this investigation, inflows of groundwater into excavations should be expected from the upper 200mm to 300mm of granular soil.
Foundations and floor slab recommendations	It was considered that for the proposed development, a potential allowable bearing pressure in the region of 135 kN/m ² may be achieved between 1.00m and 2.00m bgl. Areas of soft ground should have deeper foundations on more competent strata.
Sulphate class	Testing results show that no specific measures are required for buried concrete structures and concrete should be designed to DS-1 and AC-1s.
Contamination – Human Health	Chemical results were compared with GACs for a commercial end use; all determinands were reported to be below the relevant thresholds indicating Made Ground does not present a potential risk to human health. However, chrysotile asbestos was detected within Made Ground soils in TP3 in the north of the Site at a depth of 0.25m bgl, though no quantification testing was completed. A subsequent delineation exercise recorded an additional asbestos detection of chrysotile fibres at <0.001% w/w within the vicinity of the initial detection. Remediation Statement suggested these impacted soils could be excavated and removed from site with associated verification testing.
Contamination – Controlled Waters	Analytical data from leachate testing have been evaluated against GAC values appropriate to the conceptual model for the site. Those applied for this Site were selected from Freshwater Environmental Quality Standards (EQS) in order to determine the risk posed to the main controlled waters receptors at the site. There were no exceedences of the adopted GACs and, as such, the site is not considered to pose a risk to controlled waters.



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 11 of 45
Engineer: Adrian Read
Date: 27/05/2022

Gas protection	Ground gas monitoring installations were constructed in BH1, BH2 and BH3 with response zones in the Glacial Till. Monitoring comprised measurement of pressure, methane (CH ₄), percent of lower explosive limit (LEL), carbon dioxide (CO ₂), oxygen (O ₂), hydrogen sulphide (H ₂ S) and gas flow rate. No significant concentrations of carbon dioxide or methane were detected and the site was assessed as a Characteristic Situation 1 – Very Low Risk.
Radon Requirements	No radon protection measures are required.
Further works identified	No further works were identified.
Waste Soils Classification	With the exception of the asbestos impacted soils in the north of the site, all soils are considered likely to be suitable as inert waste. The asbestos impacted soils are likely to be classified as hazardous waste.
Materials re-use considerations	No suitable classification testing was completed to enable a preliminary material re-use class in accordance with Series 600.
Remediation Strategy or recommendations	A Remediation Strategy suggested the following works: • General site clearance to include hardstanding, stockpile and vegetation; • Removal and verification of asbestos hotspot identified within the north of the site; • Removal and verification of any previously unidentified areas of contamination, where required; • Backfill of resultant excavations with suitable material;



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 12 of 45
Engineer: Adrian Read
Date: 27/05/2022

4. PRELIMINARY CONCEPTUAL SITE MODEL

Tier Environmental have re-produced the Preliminary Conceptual Site Model included within the Preliminary Risk Assessment (PRA) Report For Moss Nook, Heald Green, Manchester by Tier Environmental (Ref: TE1604-TE-00-XX-RP-GE-001-V01, dated 17th August 2021). This was originally derived based on the information provided in the PRA report and a combined preliminary conceptual site model and conceptual exposure model was developed for the proposed future land use. This summarised the understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors. In assessing the likely contaminants of concern present at the Site, reference was also made to Defra and Environment Agency supporting documentation. In addition, a preliminary qualitative risk assessment was also made of the likelihood of the linkage operating and its potential significance in accordance with CIRIA C552.

The potential pollutant linkages identified and the qualitative risk assessment for these are presented in Table 4.1, below. The terms used in the preliminary qualitative risk assessment are defined in Appendix J.

4.1. Uncertainties

The following uncertainties exist in the preliminary conceptual model:

- The presence of any features unrecorded by the historic maps.
- Any unrecorded geological features.
- Any unrecorded pollution events during the Site's history.



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 13 of 45
Engineer: Adrian Read
Date: 27/05/2022

Table 4.1 Preliminary Assessment of Potential Pollutant Linkages.

Justification/Comments	Source	Potential Contaminants of Concern	Pathway	Receptor	Consequence	Probability	Qualitative Risk Assessment
- The site is recorded undeveloped agricultural land from 1872, with a tree lined brook on the northern and western site boundaries. By the early 2000s, a road entrance in the southern corner of the Site has been created alongside a development immediately east of the Site. Aerial imagery indicates the Site was used as a temporary compound for site cabins and materials associated with this development. - Historically the wider site area is predominantly undeveloped land or small scale residential. A number of small pond features in the surrounding area are recorded to be infilled throughout wider developments. A railway cutting/embankment is developed 50m east by 1935 trending approximately north to south. - The site is underlain by geology of Glacial Till, overlying the Sherwood Sandstone Group (Bedrock). Tier Environmental logs recorded the site to be underlain by Made Ground to between 0.20-0.60m bgl comprising sandy gravelly Clays with mudstone, limestone and brick and natural soils comprised of medium to very high strength, low plasticity cohesive Glacial Till to the maximum drilled depths of 10.05m bgl. - Upon comparison of soil chemical results against GACs for a commercial/industrial site land use, Tier recorded no exceedances indicating an unlikely risk to current and future site users. 1 No. sample (TP3 at 0.25m bgl) was identified as containing asbestos (chrysotile fibres) during the initial investigation and a second detection of chrysotile fibres was recorded in the Tier 2016 investigation, reported to be <0.001% w/w. - The superficial deposits are classed as a Secondary Undifferentiated Aquifer, and the bedrock is classified a Principal Aquifer. The nearest surface water feature is Gately Brook located 40m northeast of the site boundary. The site is not within a Source Protection Zone and there are no potable abstraction records. Tier Environmental have previously determined the risk to controlled waters to be low given the presence of low permeability clay beneath the Site, the results of leachate analysis and the general absence of contamination of Made Ground soils. - There are no historic records of landfill activity on or around site. A Tier Environmental ground gas risk assessment determined that no ground gas protection measures are required. - The Site is not considered to be located within a Radon Affected Area, as less than 1% of properties are above the Action Level.	Made Ground associated with historic land use and development.	Metals, PAHs, Phenols, pH,	Direct contact, ingestion and inhalation of dust Vapour inhalation Dust migration	Future site workers (residential and commercial) Adjacent site users (residential and commercial) Site workers and future maintenance workers	Medium Medium Medium	Unlikely Unlikely Unlikely	Low risk Low risk Low risk
	Asbestos impacted Made Ground soils with TP3 in the north of the site	Asbestos	Inhalation of dust	Adjacent site users (residential and commercial)	Medium	Unlikely	Low risk
				Site workers and future maintenance workers	Medium	Unlikely	Low risk
				Adjacent site users (residential and commercial)	Medium	Unlikely	Low risk
	Asbestos impacted Made Ground soils with TP3 in the north of the site	Asbestos	Inhalation of dust	Future site workers (residential and commercial)	Medium	Likely	Moderate risk
				Adjacent site users (residential and commercial)	Medium	Likely	Moderate risk
				Site workers and future maintenance workers	Medium	Likely	Moderate risk
	Asbestos impacted Made Ground soils with TP3 in the north of the site	Asbestos	Inhalation of dust	Adjacent site users (residential and commercial)	Medium	Unlikely	Low risk
				Future site workers (residential and commercial)	Medium	Unlikely	Low risk
				Adjacent site users (residential and commercial)	Medium	Unlikely	Low risk
	Hazardous ground gases associated with onsite Made Ground	Ground Gases	Migration of ground gas	Future site workers (residential and commercial)	Medium	Unlikely	Low risk
				Adjacent site users (residential and commercial)	Medium	Unlikely	Low risk
				Site workers and future maintenance workers	Medium	Unlikely	Low risk
	Hazardous ground gases associated with onsite Made Ground	Ground Gases	Migration of ground gas/explosion	Buildings and services	Severe	Unlikely	Moderate / Low risk

For definition of the terms used in the qualitative risk assessment, please see Appendix J.



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 14 of 45
Engineer: Adrian Read
Date: 27/05/2022

5. FIELDWORK

The information contained in this report is limited to areas of land accessible during the ground investigation within the Site boundary, as indicated on the Site plan, presented in Appendix A as Drawing No. TE1604-TE-00-XX-DR-GE-003-V01.

Tier Environmental scoped the intrusive ground investigation using guidance presented in:

- BS 10175:2011+A2:2017;
- Land Contamination Risk Management (LCRM) - <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>;
- BS 5930:2015+A1:2020;
- BS EN 1997:2004 and 2007.

Tier Environmental's standard strata description criteria are compliant with the above guidance.

5.1. Scope of Ground Investigation

The ground investigation was conducted on 20th and 21st April 2022, and 5th May 2022, and was supervised by a suitably qualified Tier Environmental engineer. Table 5.1 below provides a summary of the exploratory holes completed and rationale. Exploratory hole locations are presented on Drawing No. TE1604-TE-00-XX-DR-GE-003-V02.

Table 5.1 Scope of Ground Investigation and Rationale

Exploratory Hole Type	Exploratory Hole Reference	Exploratory Hole Depths (m bgl)	Rationale
Trial pits	TP101 to TP106	2.00m (TP101) to 3.30m (TP103)	To confirm the present day shallow ground conditions across the Site, relatively shallow groundwater presence and rate of inflow, stability of excavations, and to enable shallow soil sampling for geotechnical and/or geoenvironmental parameters.
Trial pits	TP104 to TP106	2.80m (TP106) to 3.10m (TP104)	Secondary objective to assess presence / absence of low level asbestos previously identified in this area of the Site.
Window sample boreholes	WS101 to WS105	5.45m (WS101 to WS105)	To confirm the shallow ground conditions beneath the 4 No. proposed units and to augment the information previously obtained from BH2 and BH3 conducted during previous ground investigations, conduct <i>in situ</i> geotechnical tests, facilitate soil sampling for geotechnical and/or geoenvironmental parameters and installation of gas/groundwater monitoring wells.
Dynamic Cone Penetrometer Tests	DCP01 to DCP10	0.40m to 0.95m	To determine in-situ CBR values for the soil profile.

The following constraints were identified during the ground investigation works:

- Identification of a polyethylene water supply pipe at TP101 in a northwest to southeast orientation.



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01

Page No : 15 of 45

Engineer: Adrian Read

Date: 27/05/2022

Table 5.2 Scope of Monitoring Installations

Exploratory Hole Location	Strata Targeted	Slotted Response Zone (m bgl)	Rationale
WS101	Glacial Till	1.00m to 4.80m bgl	To assess present day ground gas concentrations beneath proposed Unit 4
WS102	Made Ground / Glacial Till	0.50m to 4.70m bgl	To assess present day ground gas concentrations beneath the central area of the Site
WS103	Glacial Till	1.00m to 4.10m bgl	To assess present day ground gas concentrations beneath proposed Unit 3
WS104	Glacial Till	1.00m to 4.80m bgl	To assess present day ground gas concentrations beneath proposed Unit 2
WS105	Glacial Till	1.00m to 4.00m bgl	To assess present day ground gas concentrations beneath proposed Unit 1

Trial pits were backfilled with arisings in approximate reverse order and left slightly mounded to allow for future settlement; these are likely to settle below existing ground level with time and be unsuitable for trafficking over.

Depths and accurate descriptions of strata and groundwater observations made during investigation works, together with details of the samples recovered, are presented on the Engineer's exploratory hole records in Appendix B.

5.2. Geoenvironmental Testing

Sampling and QA/QC protocols are presented in Appendix N. Tier Environmental's schedule of chemical laboratory testing is presented in Table 5.3 and Table 5.4. The testing was carried out by Element Materials Technology, a UKAS and MCerts (where appropriate for soils analysis) accredited laboratory.

Human Health and Preliminary Waste Classification Laboratory Testing

Based upon the conclusions of the preliminary risk assessment, Tier Environmental scheduled chemical laboratory testing on selected soil samples. The purpose of the testing was to:

- Determine the concentration and spatial distribution of potential contaminants of concern in the Made Ground;
- Determine the chemical composition and properties of the shallow natural soils;
- Determine the nature and extent of any residual low level asbestos in the vicinity of the previously excavated TP03;
- Undertake a *preliminary* soils waste classification and waste disposal route determination

Table 5.3 Schedule of Chemical Testing for Human Health Risk Assessment and Preliminary Waste Soils Assessment.

Laboratory analysis	Made Ground	Natural Soils (Glacial Till)	Groundwater
Tier Environmental soil suite*	6	2	NA
Asbestos screen	4	0	NA
Waste Acceptance Criteria (WAC)	1	1	NA

*For definition of Tier Environmental analytical suites, please see Appendix N. NA - not applicable.



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 16 of 45
Engineer: Adrian Read
Date: 27/05/2022

Controlled Waters Laboratory Testing

Based upon the conclusions of the preliminary risk assessment and previous ground investigation, Tier Environmental scheduled chemical laboratory testing on selected soil leachate samples. The purpose of the testing was to determine the concentration and spatial distribution of potential leachable contaminants of concern in the Made Ground to augment the controlled waters risk assessment conducted within the original Geoenvironmental Appraisal of Land at Moss Nook, Heald Green, by Tier Environmental (Ref: T/12/1105/GA v 1.1, dated September 2012).

Table 5.4 Schedule of Chemical Testing for Controlled Waters Risk Assessment.

Laboratory analysis	Made Ground	Glacial Till
Tier Environmental leachate suite*	4	1

*For definition of Tier Environmental analytical suites, please see Appendix N. NA - not applicable.

5.3. Geotechnical Testing

Geotechnical laboratory testing was scheduled by Tier Environmental on selected samples as presented in Table 5.5. The testing was performed by Murray Rix, a UKAS accredited laboratory. Test certificates including details of appropriate testing standards are presented in Appendix E and discussed in Section 7, below.

Table 5.5 Geotechnical Laboratory Testing Schedule.

Test	Stratum type	Number of tests	Rationale
1. General			
Moisture content	Glacial Till	2	a) Assist with the determination of consistency of soil with depth. b) Assess desiccation of soils. c) Suitability of materials for reuse within earthworks.
2. Classification			
Atterberg limit	Glacial Till	2	a) Volume change potential. b) Plasticity assessment (comply with Eurocode 7 description) c) Consistency Index. d) Determine soil type (e.g., clay/silt). e) Use as an empirical guide to soil shear strength
Particle size distribution (wet/dry sieve)	Made Ground	1	a) Classify soils for earthworks purposes.
	Glacial Till	1	b) Establish type of soil (comply with Eurocode 7 description).
3. Chemical tests			
pH (soil)	Made Ground	6	Determine correct class of concrete for both natural and made ground with specific tests for sites potentially containing sulphides (e.g., pyrites) or at low pH.
	Glacial Till	2	
Water-soluble sulphate (soil)	Made Ground	6	
	Glacial Till	2	



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 17 of 45
Engineer: Adrian Read
Date: 27/05/2022

6. GROUND CONDITIONS

The following section provides a summary of the ground conditions encountered during the ground investigation including strata profile, obstructions and visual / olfactory evidence of contamination. Exploratory hole logs are provided in Appendix B.

Photographs of ground investigation works are provided in Appendix G.

6.1. Strata Descriptions

Made Ground – MG1

Locations encountered	TP101 to TP106, WS101 to WS105
Depths encountered from top of stratum (range)	From ground level (TP101 to TP106, WS101 to WS105)
Depths encountered to base of stratum (range)	0.35m (TP103) and 0.70m bgl (TP102)
Thickness (range)	0.35m (TP103) and 0.70m bgl (TP102)
Spatial location on site	Widespread
General description	Vegetation over soft dark brown, slightly sandy, gravelly CLAY or clayey gravelly SAND with frequent cobbles of brick and concrete. Gravel is fine to coarse, angular to subrounded of brick, concrete, sandstone, occasional limestone and ceramic and rare plastic and coal. (TOPSOIL).

Made Ground – MG2

Locations encountered	TP102
Depths encountered from top of stratum (range)	0.70m bgl
Depths encountered to base of stratum (range)	0.95m bgl
Thickness (range)	0.25m bgl
Spatial location on site	Southwest
General description	Relict Made Ground Topsoil: Dark brown, slightly sandy, slightly gravelly CLAY. Gravel is fine to coarse, subangular of sandstone and occasional brick.

Made Ground – MG3

Locations encountered	TP101, TP104 to TP106, WS102 to WS104
Depths encountered from top of stratum (range)	0.40m (TP105, TP106) to 0.55m bgl (WS104)
Depths encountered to base of stratum (range)	0.55m (TP106) to 1.10m bgl (TP104)
Thickness (range)	0.15m (TP106) to 0.65m bgl (TP104)
Spatial location on site	Central and eastern / northern parts of the Site



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 18 of 45
Engineer: Adrian Read
Date: 27/05/2022

General description	Soft or firm to stiff, orangish / lightish brown occasionally blackish brown, sandy, gravelly CLAY. Gravel is fine to coarse, angular to subrounded of sandstone, brick, quartz, occasional limestone, flint and coal. Occasional pockets of orangish brown, clayey sand.
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Made Ground – MG4

Locations encountered	WS102
Depths encountered from top of stratum (range)	0.70m bgl
Depths encountered to base of stratum (range)	0.90m bgl
Thickness (range)	0.20m
Spatial location on site	Centre
General description	Grey, fine to coarse, angular GRAVEL of limestone. (Terram at base).

Made Ground – MG5

Locations encountered	TP106
Depths encountered from top of stratum (range)	0.55m bgl
Depths encountered to base of stratum (range)	0.70m bgl
Thickness (range)	0.15m
Spatial location on site	Eastern area
General description	Orangey brown, clayey, gravelly SAND. Gravel is fine to coarse, subangular to subrounded of sandstone, quartz and occasional brick.

Drift Deposits – DD1

Glacial Till - sand	
Locations encountered	TP103 and WS101
Depths encountered from top of stratum (range)	0.35m (TP103) to 0.50m bgl (WS101)
Depths encountered to base of stratum (range)	0.80m (TP103) to 0.90m bgl (WS101)
Thickness (range)	0.40m (WS101) to 0.45m (TP103)
Spatial location on site	Nothwestern and western areas
General description	Orangish or yellowish brown, slightly clayey / clayey, slightly gravelly / gravelly, fine grained SAND. Gravel is fine to coarse, subangular to subrounded of sandstone and occasionally mudstone, quartz and coal.



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 19 of 45
Engineer: Adrian Read
Date: 27/05/2022

Drift Deposits – DD2

Glacial Till - Clay	
Locations encountered	TP101 to TP106, WS101 to WS105
Depths encountered from top of stratum (range)	0.55m to 1.10m bgl
Depths encountered to base of stratum (range)	Base not encountered. Proven to a maximum depth of 5.45m bgl.
Thickness (range)	Base not encountered.
Spatial location on site	Widespread
General description	Firm to stiff, locally friable, reddish brown, slightly sandy gravelly CLAY with occasional cobbles of sandstone. Gravel is fine to coarse, angular to subangular of sandstone, quartz and occasional mudstone. Rare fragments of coal. Locally with bands of sand: - At WS105 between 1.90m and 2.25m bgl (thickness of 0.35m): Medium dense, brown, slightly gravelly, clayey, fine to coarse SAND. Gravel is fine to medium, angular to subrounded of quartz, mudstone and coal. - At WS103 between 3.95m bgl and 4.40m (thickness of 0.45m): Medium dense, clayey, fine to coarse SAND.

6.2. Obstructions

The following potential were encountered during the ground investigation works.

Table 6.1 Underground Services Summary Table

Exploratory Hole Location	Location on Site	Depths recorded from (m bgl)	Depth of Base of Feature (m bgl)	General description and comments
TP101	Central / southern area		1.20	Blue, plastic water pipe struck at approximately 1.20m bgl in Northern pit wall. Pipe diameter of 25mm. Repaired on site.
TP102	Southwestern area		1.10	Land drain strike in Southern pit wall at 1.10m bgl - slight trickle of water stopping after approximately 1 minute.
TP105	Eastern area		0.60	Land drain struck at 0.60m bgl (dry).
TP106	Eastern area		0.70	Land drain stuck at 0.70m bgl (dry).

6.3. Visual and Olfactory Evidence of Contamination

No visual or olfactory evidence of contamination was encountered during the works.

6.4. Groundwater Observations During Fieldwork

Table 6.2 below provides a summary of the groundwater observations during the fieldworks. Further information of groundwater observed is presented in the exploratory hole logs in Appendix B.



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 20 of 45
Engineer: Adrian Read
Date: 27/05/2022

Table 6.2 Field Observations of Groundwater.

Exploratory hole	Strike (m bgl)	Formation	Observations
TP104	2.30m	Glacial Till	Groundwater ingress encountered as slow trickle from western pit wall at 2.30m bgl.
WS103	3.95m	Glacial Till – sand band	-
WS105	1.90m	Glacial Till – sand	-

6.5. Groundwater Monitoring

Table 6.3 below provides a summary of the groundwater monitoring results conducted during the single visit on 29th April 2022.

Table 6.3 Groundwater Monitoring Results Summary

Exploratory hole	Response Zone	Depth range (m bgl)	Formation
WS101	1.00m to 5.00m bgl	1.12	Glacial Till
WS102	1.00m to 4.00m bgl	1.56	Glacial Till
WS103	1.00m to 4.00m bgl	1.15	Glacial Till
WS104	1.00m to 5.00m bgl	0.75	Glacial Till
WS105	1.00m to 4.00m bgl	1.73	Glacial Till



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 21 of 45
Engineer: Adrian Read
Date: 27/05/2022

7. PRELIMINARY GEOTECHNICAL ASSESSMENT

7.1. Mining and Quarrying

The site is not considered to be at risk from shallow mining. Historical plans do not indicate any quarries, clay pits or other extractive industries in the vicinity of the site. Localised workings of shallow strata cannot be wholly discounted but given the historical use of the Site this is considered unlikely.

7.2. Determination of pH and Water-Soluble Sulphate

Representative samples of the soils encountered during the Tier Environmental supplementary ground investigation, were tested to determine their pH and concentrations of water-soluble sulphate (SO_4^{2-}). The results are presented in Appendix C and summarised in the Table 7.1 below. It is assumed that the Site is a brownfield site, and the groundwater is mobile in accordance with BRE SD1.

The conclusion of the assessment is that a DS-1 and ACEC Class AC-2z is appropriate for buried concrete design purposes.

Whilst no evidence of gross hydrocarbon contamination has been observed at the Site, it is a concrete specialist should review the TPH results and ground conditions summary within this report to ensure appropriate concrete design against retardation / degradation due to hydrocarbons.

Table 7.1 Results of Soil pH Testing and Water-Soluble Sulphate Determination.

Exploratory Hole Location	Depth (m bgl)	pH	Water-soluble sulphate (mg/l)	Design sulphate class	ACEC sulphate class
MADE GROUND					
TP104	0.60	6.53	31	DS-1	AC-2z
TP105	0.10	6.34	18.9		
TP106	0.20	7.03	26.5		
WS101	0.30	8.18	17.9		
WS102	0.60	7.67	95.1		
WS103	0.10	6.61	12		
WS104	0.80	6.51	1.6		
WS105	0.50	7.25	49.5		

ACEC - Aggressive Chemical Environment for Concrete (see BRE, 2005).



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 22 of 45
Engineer: Adrian Read
Date: 27/05/2022

7.3. Geotechnical Parameters

Soil Classification

Cohesive Soils

Moisture content and Atterberg Limit testing was undertaken on samples from cohesive superficial material at the site. A summary of the results is shown in Table 7.2 below

In total 2 No. Atterberg Limit Tests were performed on samples of identified cohesive soil. The soils returned results indicating that the clay materials are of low volume change potential.

The results of two particle size distribution tests determined descriptions of the soils as follows along with the Series 600 classifications based on the particle size distributions determined:

- TP103 at 0.9m bgl (Glacial Till, cohesive) - Stiff brown silty sandy CLAY with occasional gravel – Series 600 classification: 2A / 2B;
- TP105 at 1.00m bgl (Glacial Till, cohesive) - Stiff brown silty sandy CLAY with rare gravel – Series 600 classification: 2A / 2B



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 23 of 45
Engineer: Adrian Read
Date: 27/05/2022

Table 7.2 Soil Classification Test Results for Glacial Till.

Exploratory hole	Depth (m bgl)	Stratum	MC (%)	LL (%)	PL (%)	PI (%) (Modified)	Class	Volume Change Potential
WS101	1.20	Glacial Till	12	31	14	13.94	Low plasticity CL	Low volume change potential
WS102	2.00	Glacial Till	13	33	13	16.00	Low plasticity CL	Low volume change potential

ND - Not determined; MC - Moisture content, LL - Liquid limit, PL - Plastic limit, PI - Plasticity index.



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 24 of 45
Engineer: Adrian Read
Date: 27/05/2022

Shear Strength Parameters

Standard Penetration Tests (SPT) were carried out in all of the boreholes. The undrained shear strength of the natural clay strata tested has been estimated using the relationship developed by Stroud, where:

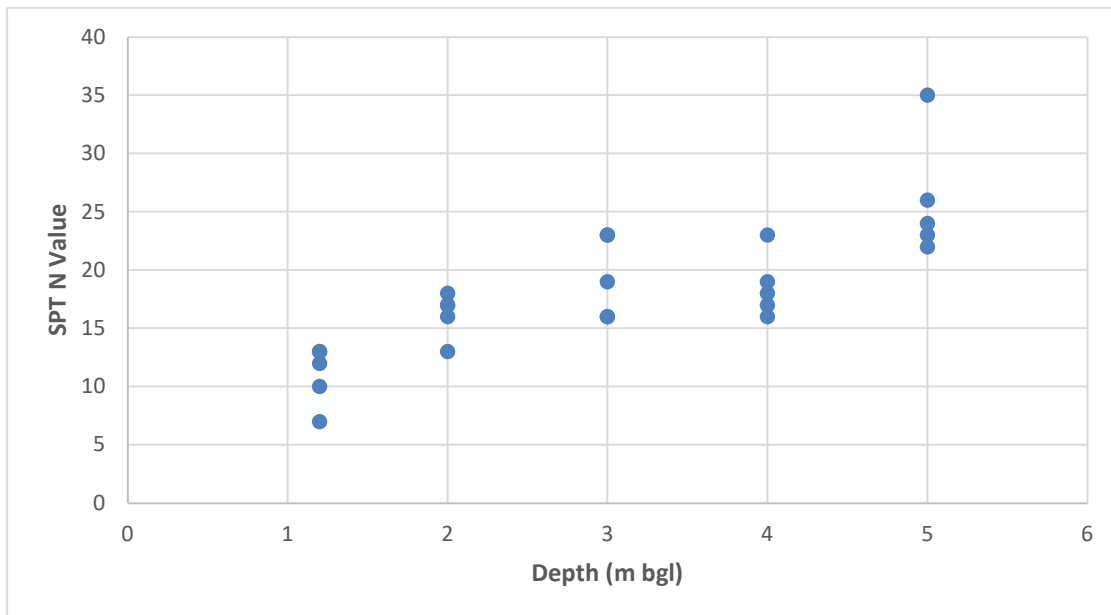
$$C_u = f_1 \times \text{SPT N60 value}$$

The value of f_1 is dependent on the Plasticity Index (I_p). By using the moderately conservative Plasticity Index of 16%, a characteristic value of $f_1 = 6$ has been derived.

Results from 25 No. SPT N values in the natural clay strata suggest that the majority of the material is medium strength and locally low strength (WS102) at a depth of 1.20m bgl and increasing to high strength (locally medium strength at WS103) by 2.00m bgl. Very high strength cohesive materials were reported locally at WS105 at 5.00m bgl.

All of the shear strengths calculated from SPT N values are shown in the figure below, in which they are plotted against depth (m bgl). The test results show a slight variation but an overall increase with depth. From the standard penetration test data, a moderately conservative undrained shear strength of 70kPa at 1.20m bgl, increasing to 130 kPa at 2.00m is assessed for the natural clay strata.

Figure 7.1 Shear strength from SPT N value vs depth (m bgl)



Foundation Recommendations

The site is underlain by a thin veneer of Made Ground which is underlain medium to high strength Glacial Till which is predominantly cohesive.

The Made Ground is not considered to be a suitable founding stratum in its current condition due to potential variability in composition and relative strength. It is considered to have a significant potential to give rise to excessive differential settlement. It is therefore considered that the underlying Glacial Till may provide a consistent platform for construction and shallow pad / strip foundations should be extended through Made Ground soils, wherever they remain. It is considered that foundations should generally extend to around at least 1.50m below current ground level.



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 25 of 45
Engineer: Adrian Read
Date: 27/05/2022

The SPT N values that have been recorded during drilling suggest that the glacial soils are typically of medium to very high strength. Calculations based upon SPTs and Plasticity Indices, as well as the results from specified triaxial analysis of undisturbed soil samples suggest that these clays have a shear strength of around 70 kPa at 1.20m bgl and 130 kPa at 2.00m bgl. Although specific foundation sizes cannot be given at the current time, as proposed loads are not available (in accordance with EC7), it is considered that for this type of development, a potential allowable bearing pressure in the region of 125 kN/m² may be achieved between 1.00m and 2.00m bgl. Areas of soft ground should have deeper foundations on more competent strata.

7.4. Floors

With regard to the design and construction of normal ground bearing floor slabs, it must be noted at the outset, that due to the thickness of Made Ground, unless appropriate measures are taken there will be a risk of significant total and differential settlements, the extent of which will be a matter of chance rather than being assessable by calculation.

The clay soils at shallow depth have been shown to be of medium strength with a low volume change potential. As such, ground bearing floor slabs may be used in the proposed development (it has been assumed that the upper Made Ground will be removed from the site as part of the site preparations).

7.5. Groundworks, Excavation Stability and Groundwater Dewatering

In our opinion, there should be no particular difficulties in excavating the strata indicated in the boreholes and trial pits utilising an appropriate and suitably sized mechanical excavator. Excavations into existing Made Ground and the underlying natural soils should be assumed to be unstable. No man entry into unsupported excavations should be allowed without an appropriate risk assessment. Reference to CIRIA report 097 (1983) should be made to establish suitable means of support or battering of excavation sides.

It is recommended that all excavations to greater than 1.20 metres depth, or for shallower excavations where groundwater is encountered above this level are closely supported, especially where man entry is required. Alternatively, where space permits, the excavations might be battered back to an appropriate angle. Standing groundwater levels of between 0.75 to 1.40m bgl were encountered in the boreholes / trial pits. Should groundwater seepages occur, and water accumulate in shallow excavations it should be able to be removed by pumping from a filtered sump. However, groundwater control by more robust means, such as well pointing, may be required locally.

Great care will need to be taken if reducing groundwater levels to ensure that adjoining nearby buildings, structures and services are not affected.

7.6. Pavements and Highways

10 No. Dynamic Cone Penetrometer Tests were completed across site to determine in-situ CBR values for pavement design. Results have been tabulated below.

Table 7.3 Dynamic Cone Penetrometer Results

Depth Range	Strata	CBR Range (%)
100-250	Made Ground	1.07-6.52
250-500	Made Ground	3.34-8.46
500-750	Made Ground/Till	8.04-17.58



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 26 of 45
Engineer: Adrian Read
Date: 27/05/2022

Results suggest a CBR value of circa 2.50% should be employed for design purposes within the top 250mm, increasing to circa 4.00% to 500mm. A number of results are likely to have been artificially increased by the presence of cobble or other materials within the Made Ground, notably DCP4, 5, 7 and 9 at circa 550mm.

Once the design layout is known and demolition/remediation is complete, then *in situ* testing should be carried out to confirm CBR values.

The design of pavements, highways, embankments should be discussed with the relevant local authority if highways are to be subject to Section 38 agreement.



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 27 of 45
Engineer: Adrian Read
Date: 27/05/2022

8. HUMAN HEALTH RISK ASSESSMENT

Results of chemical analysis are presented in full in Appendix C.

8.1. Data Interpretation Approach

The analytical data obtained were reviewed for completeness and consistency. The data for each sample type was then compiled, screened against the Generic Assessment Criteria (GACs) for a Commercial/Industrial land use and those potential contaminants of concern which were found to exceed the GACs were then subjected to detailed analysis as described below.

Previously, it was possible for results from soil (and leachate) samples to be subject to statistical assessment in accordance with a 2008 guidance document (CL:AIRE / CIEH Guidance on Comparing Soil Contamination Data with a Critical Concentration). This guidance has now been withdrawn and replaced with the following document:

- Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration (CL:AIRE 2020)

The purpose behind statistical assessment is ultimately to determine whether concentrations of contaminants are at levels that present potential risk to the future site users (and the wider environment if the statistical assessment is conducted on leachate test results).

The new guidance places even greater emphasis and reliance on the desk study being carried out first, appropriately detailed sampling strategies, collection and testing of samples for contamination and use of appropriate screening criteria.

The guidance requires an increased number of criteria to be met before a robust statistical assessment can be conducted and introduces the principle of the Central Limit Theorem (CLT); a key tool of statistics that is used in the comparison of confidence intervals with the critical concentration. A common 'rule of thumb' is that the CLT will apply provided your sample size is between 20 and 50.

On this basis, Tier Environmental considers that statistical assessment in accordance with the CL:AIRE 2020 guidance may not be applied in this instance given that the number of samples obtained is below 20 No. for any given identified soil population.

Due consideration of the ground conditions, distinct identifiable populations of soil and proposed development layout has been undertaken and, where appropriate, laboratory results associated with discrete populations or 'hotspots' have been assessed separately.

8.2. Selection of Generic Assessment Criteria (GAC)

In short, for the majority of the contaminants of concern, LQM/CIEH Sutable 4 Use Levels (S4ULs) published in 2015 have been adopted as GACs for a Commercial/Industrial land use; however, further details on the hierarchical approach for the selection of the GACs used as screening criteria for this assessment is provided in Appendix K.

These values are considered as appropriate screening criteria as they incorporate updated assumption exposures derived for the production of C4SLs but within the context of deriving screening criteria above which assessment of the risks or remedial action may be needed (i.e. within the context of the planning regime rather than Part 2A context for which C4SLs were derived).

For those potential contaminants of concern where the selected GAC is dependent on Soil Organic Matter content (SOM), an assumed SOM of 1% has been conservatively selected.



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 28 of 45
Engineer: Adrian Read
Date: 27/05/2022

8.3. Human Health Risk Assessment

No measured concentrations of potential contaminants of concern have been reported in excess of the respective GACs protective of human health for a Commercial/Industrial land use.

Asbestos

Asbestos can be present in soil as fragments of bulk Asbestos Containing Materials (ACMs) (e.g. asbestos cement sheeting) and also as discrete asbestos fibres within the soil matrix. This investigation has carried out assessments to determine whether both bulk fragments and / or fibres are present in the soil at the site. The asbestos assessment commenced on site with inspection of the Made Ground by our suitably qualified supervising engineer for the presence of bulk ACMs.

During the fieldwork no suspected ACMs were identified.

Of the 4 No. of Made Ground samples submitted for asbestos screening, none were reported to contain asbestos.

8.4. Utilities

It is recommended that the results of the chemical testing and details of the proposed remedial works are provided to the appropriate utility companies to determine the necessity for service protection.

8.5. Construction and Maintenance Workers

Contamination may pose a short-term (acute) or long-term (chronic) risk to workers during construction and maintenance. The potential risks must be specifically assessed as part of the health and safety evaluation for the works to be performed in accordance with prevailing legislation. Site practices must conform to the specific legislative requirements and follow appropriate guidance (e.g., HSE, 1991; CIRIA, 1996).

On the basis of the results obtained, the following potential exposure risks to construction and maintenance workers have been highlighted:

Asbestos has not been reported during the recent ground investigation works describe din this report; however, localised chrysotile asbestos was reported during the previous investigations in 2012. If asbestos is identified during future earthworks / construction works at concentrations above 0.001% w/w (i.e. above 'trace' levels), the Control of Asbestos Regulations 2012 should be adhered to. A summary of complying with CAR: risk assessments, licensing and training is provided in Appendix O is provided for reference.



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 29 of 45
Engineer: Adrian Read
Date: 27/05/2022

9. CONTROLLED WATERS RISK ASSESSMENT

9.1. Introduction

In order to assess whether there is a potentially unacceptable risk of pollution of controlled waters, samples of soil leachate have been submitted for laboratory chemical analysis as per the summary presented in Table 5.4 within this report. Analytical data from soil leachate sample testing undertaken by Tier Environmental have been evaluated against Water Quality Standard (WQS) values appropriate to the Conceptual Site Model.

In accordance with Part 2A of the Environmental Protection Act 1990, Tier Environmental has made regard to all of the WQS values that are relevant to the Site and a judgment has been made against the most stringent of those relevant standards. Further details are provided, along with the approach for selection of TPH / BTEX WQS values, in Appendix L.

In some instances, the laboratory method detection limit is greater than the appropriate WQS value. In these instances, only measured concentrations in excess of the laboratory method detection limit have been considered likely to potentially represent a possible significant risk to controlled waters.

For those potential contaminants of concern for which the WQS values are dependent on hardness (e.g. cadmium EQS values), a worst case hardness of ≥ 200 mg CaCO₃/l has been conservatively selected.

9.2. Controlled Waters Environment Conceptual Site Model Summary

The superficial deposits are classed as a Secondary Undifferentiated Aquifer, and the bedrock is classified a Principal Aquifer. The nearest surface water feature is Gately Brook located 40m northeast of the site boundary. The site is not within a Source Protection Zone and there are no potable abstraction records. Tier Environmental have previously determined the risk to controlled waters to be low given the presence of low permeability clay beneath the Site, the results of leachate analysis obtained in 2012 and the general absence of contamination of Made Ground soils.

9.3. Soil Leachate Testing

Table 9.1 below summarises the measured concentrations of contaminants of concern from soil leachate samples at the Site that have been reported in excess of the respective WQS values.

Table 9.1 Summary of Measured Concentrations of Soil Leachate Potential Contaminants of Concern in Excess of WQS Values

Potential Contaminant of Concern	Units	LoD*	WQS	Maximum concentration	No. samples >WQS	Exploratory Hole Location	Depth (m bgl)	Soil Population
Copper	µg/l	<7	1	8	1 of 5	TP102	0.20	Made Ground
Fluoranthene	µg/l	<0.005	0.0063	0.03	2 of 5	TP101, TP102	0.60, 0.20	Made Ground
Benzo(a)pyrene	µg/l	<0.005	0.00017	0.027	1 of 5	TP102	0.20	Made Ground

* LOD= Laboratory Method Limit of Detection

Measured leachable concentrations of copper and fluoranthene have been reported only *marginally* in excess of the WQS protective of the controlled waters environment by up to one order of magnitude. Given the marginal nature of these exceedances, the substantial thickness of low permeability cohesive Glacial Till beneath the Site, the potential for significant dilution within the groundwater beneath the Site, the absence of any widespread



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 30 of 45
Engineer: Adrian Read
Date: 27/05/2022

leachable concentrations of concern, and the marginal nature of the exceedances, it is not considered that the measured leachable concentrations of copper and fluoranthene represent a potentially significant risk to the controlled water environment.

A single isolated measured soil leachate concentration of benzo(a)pyrene has been reported in excess of the respective WQS protective of the controlled waters environment by 2 No. orders of magnitude. Further specific consideration of this reported soil leachate concentration of benzo(a)pyrene concentrations have been made. The EQS values for benzo(a)pyrene are derived assuming bioaccumulation in fish and ultimately consumption of the fish by humans which is an exposure scenario that is unlikely to be viable for this Site given the low permeability nature of the underlying geology and the scale of the nearby brook. It is also noted that the maximum leachable concentration of benzo(a)pyrene is less than the Maximum Allowable Concentration (MAC) EQS for Inland Surface Waters (0.27 µg/l). As such, given this plus the lines of evidence provided above for copper and fluoranthene, it is not considered that the single isolated leachable concentration of benzo(a)pyrene represents a significant risk to the controlled waters environment.



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 31 of 45
Engineer: Adrian Read
Date: 27/05/2022

10. GROUND GAS RISK ASSESSMENT

10.1. Introduction

A previous ground gas risk assessment has been carried out at the Site as detailed in a Geoenvironmental Appraisal of Land at Moss Nook, Heald Green, by Tier Environmental (Ref: T/12/1105/GA v 1.1, dated September 2012). The conclusions of the assessment (based on 4 No. visits in accordance with CIRIA C665) was that the Site represents a Characteristic Situation 1 – Very Low Risk Scenario for which no ground gas protection measures. Despite this, Tier Environmental has conducted an additional ground gas monitoring visit to confirm that the ground gas conditions appear consistent with those previously reported.

The ground gas risk assessment has been undertaken in accordance with the following guidance:

- BS 8485:2015+A1:2019;
- CIRIA C665, 2007;
- Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide Are Present, NHBC, 2007;
- A Pragmatic Approach to Ground Gas Risk Assessment RB17. CL:AIRE, 2012; and,
- Ground Gas Monitoring and 'Worst-Case' Conditions TB17, CL:AIRE, 2018

The ground gas risk assessment has been conducted with full consideration of the viable sources, pathways and receptors included within the Preliminary Conceptual Site Model presented in Section 4.

Ground gas monitoring was conducted in conjunction with groundwater monitoring; however, it should be noted during the gas monitoring was conducted first, prior to any groundwater monitoring works. The monitoring well locations and construction were designed with due consideration of the proposed development layout and preliminary conceptual site model. Further information pertaining to monitoring wells is provided in Table 5.2.

10.2. Ground Gas Monitoring Results

The full ground gas monitoring results from the installations are presented in Appendix F and summarised below:



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 32 of 45
Engineer: Adrian Read
Date: 27/05/2022

Table 10.1 Ground Gas Monitoring Results Summary

Strata targeted by response zone	Monitoring well reference	Maximum peak CH ₄ (%v/v)	Maximum steady state CH ₄ (%v/v)	Maximum peak CO ₂ (%v/v)	Maximum steady state CO ₂ (%v/v)	Lowest O ₂ recorded (%v/v)	Maximum peak gas flow rate (l/h)	Maximum steady state gas flow (l/h)
Glacial Till	WS101	ND	ND	5.0	4.9	15.0	ND	ND
Made Ground / Glacial Till	WS102	0.1	0.1	0.8	0.7	16.4	ND	ND
Glacial Till	WS103	ND	ND	1.8	1.0	19.4	5.8	ND
Glacial Till	WS104	ND	ND	2.8	2.8	18.6	ND	ND
Glacial Till	WS105	0.1	ND	2.1	2.1	20.5	ND	ND

Bold = maximum value reported across all visits.



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 33 of 45
Engineer: Adrian Read
Date: 27/05/2022

10.3. Ground Gas Risk Assessment

Table 10.2 and Table 10.3 demonstrate how, in accordance with CIRIA C665, the periods and frequency of monitoring have been selected for the Site (including the previous ground gas data included in Geoenvironmental Appraisal of Land at Moss Nook, Heald Green, by Tier Environmental (Ref: T/12/1105/GA v 1.1, dated September 2012)).

Table 10.2 From Table 5.5a CIRIA C665 - Typical/idealised periods of monitoring (after Wilson et al, 2005)

		Generation Potential of the Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of development	Low (commercial)	1 month	2 months	3 months	6 months	12 months
	Moderate (flats)	2 months	3 months	6 months	12 months	24 months
	High (residential with gardens)	3 months ¹	6 months	6 months	12 months ¹	24 months

Notes:

1 NHBC guidance also recommends this period of monitoring (Boyle and Witherington, 2007).

2 There is no industry consent over "high", "medium" or "low" generation potential of source.

Table 10.3 From Table 5.5b CIRIA C665 - Typical/idealised frequency of monitoring (after Wilson et al, 2005)

		Generation Potential of the Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of development	Low (commercial)	4	6	6	12	12
	Moderate (flats)	6	6	9	12	24
	High (residential with gardens)	6 ¹	9	12	24 ¹	24

Notes:

1 NHBC guidance also recommends this period of monitoring (Boyle and Witherington, 2007).

2 There is no industry consent over "high", "medium" or "low" generation potential of source.

The total atmospheric pressure range of the ground gas monitoring data included in this report was between 1032mbar and 1033mbar. This range covers high (>1015 mbar) atmospheric pressures. The monitoring event was conducted during a period of falling pressure trends.

Consideration of Groundwater Effects

An assessment has been made to determine whether groundwater levels beneath the Site lie at a shallow depth at, or above, the plain section of the monitoring well or within cohesive strata. In those instances where shallow groundwater is located within the plain section of the monitoring well pipe or within cohesive strata this can result in 'groundwater pumping' or a 'piston effect' where the measured peak (and in some cases steady) flow rates reported at these monitoring well locations are significantly (and artificially) influenced by the pressures formed in the void above the groundwater in the plain section of the pipe or within the pipework installed within cohesive strata, as opposed to being truly representative of the



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 34 of 45
Engineer: Adrian Read
Date: 27/05/2022

ground gas flow rates. In such instances, this scenario can create 'artificial' negative and /or relatively high peak positive readings depending on whether the groundwater levels have increased or decreased in between monitoring events or since installation of the monitoring wells.

The results of the ground gas monitoring within this report have indicates that the measured groundwater level at WS103 may be artificially triggering a peak flow rate of 5.8 l/hr which rapidly dropped to below the detection limit of the instrument .

The results of the ground gas monitoring have been assessed in accordance with the criteria specified for this Site, which were derived as described in Appendix M.

Initial 'Worst-Case' GSV Calculation – Carbon Dioxide and Methane

An initial conservative assessment has been made by calculating a 'worst-case' Gas Screening Value (GSV) for the Site by using:

- the maximum reported methane or carbon dioxide concentration (whichever is highest) from any monitoring well and during any ground gas monitoring visit; and,
- the remaining maximum peak positive flow rate (after any negative flow rates or 'artificially' high flow rates have been discounted as described above) from any monitoring well and during any ground gas monitoring visit

Table 10.4 Initial Worst-Case GSV Calculation

Ground Gas	Maximum Reported Peak Concentration (% v/v)	}	Selected Concentration used in GSV Calculation (% v/v)	X	Maximum Appropriately Selected Gas Flow Rate (l/hr)	=	'Worst case' GSV (l/hr)
Methane (CH ₄)	0.1		5.0		0.1		0.005
Carbon dioxide (CO ₂)	5.0						

CIRIA C665 provides two separate methods to 'characterise' a site that firstly requires the assessor to distinguish between two fundamental development 'situations':

- Situation A** - Any development other than Situation B (e.g. factories, shops, commercial, warehouses, schools, cinemas, sports centres, stadiums, high rise housing, housing with basements, etc) for which the **Modified Wilson and Card 'Characteristic Situation' classification system** is applied; and,
- Situation B** - Low rise building with minimum ventilated under floor void (min 150 mm) for which the **NHBC Traffic light classification system** is applied

In this instance, as the Site is due to be developed as, it shall be regarded as a Situation A scenario for the purposes of the ground gas risk assessment.

Table 10.4 demonstrates that the Site is placed in a Characteristic Situation 1– Very Low Risk scenario on the basis of the 'worst case' GSV alone.

CIRIA C665 indicates that in the event that the reported methane concentrations are 'typically' >1% v/v and/or the reported carbon dioxide concentrations are 'typically' >5% then consideration should be made to increase the determination of the Site to a Characteristic Situation 2 – Low Risk scenario.



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 35 of 45
Engineer: Adrian Read
Date: 27/05/2022

In this instance, as no maximum peak or steady methane or carbon dioxide concentrations have been reported in excess of 1% v/v or 5% v/v respectively (and certainly no 'typical' values in excess of 1% v/v or 5% v/v respectively have been reported), the Site can be reasonably classified as a Characteristic Situation 1 – Very Low Risk scenario for which no basic ground gas protection measures are required. This concurs with the conclusions of the previous ground gas risk assessment of the Site described in Geoenvironmental Appraisal of Land at Moss Nook, Heald Green, by Tier Environmental (Ref: T/12/1105/GA v 1.1, dated September 2012).

Carbon Monoxide and Hydrogen Sulphide

There is no current UK risk assessment guidance available for carbon monoxide and hydrogen sulphide derived from ground gases.

A maximum peak carbon monoxide concentration of 132ppm has been reported which is above the workplace long term exposure limit (30ppm) and the workplace short term exposure limit (200ppm) published by the Health and Safety Executive (EH40/2005 Workplace Exposure Limits) and below the WHO long term (24 hours) indoor exposure guideline value (5.68 ppm). However, in each case (including the results of the previously ground gas risk assessment), none of the steady concentrations exceed any of the above limits.

No hydrogen sulphide concentrations have been reported in excess of the instrument's detection limit (<1ppm).

On this basis, and given the absence of any significant sources of ground gas on or within the vicinity of the Site, it is not considered that the Site represents a risk from either hydrogen sulphide or carbon monoxide.

Considerations for Construction and Maintenance Workers

During engineering and construction activities, the ground gas data indicate that the following aspects are to be considered during the preparation of relevant site H&S plans, method statements and related documents, and appropriate working methods adopted:

- **Carbon dioxide concentrations in ground gas:** The measured CO₂ concentrations in ground gas reported are elevated relative to background levels and could present an asphyxiation risk in excavations and other confined spaces. The Health & Safety Executive has published information defining safe occupational exposure levels for CO₂ and the latest guidance must be consulted to determine whether the ground gas regime necessitates specific precautions during site works.
- **Methane concentrations in ground gas:** The measured methane concentrations in ground gas reported are marginally elevated relative to background levels and could give rise to explosive mixtures in confined spaces. Safe working methods should be adopted to mitigate this risk

10.4. Radon Gas

Less than 1% of properties above the Action Level and as such no radon protection measures are required.



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 36 of 45
Engineer: Adrian Read
Date: 27/05/2022

11. REVISED CONCEPTUAL MODEL AND GENERIC QUANTITATIVE RISK ASSESSMENT OF POLLUTANT LINKAGES

The preliminary combined conceptual site model and conceptual exposure model, developed from the desk study information and presented in Section 4, has been revised in light of the ground investigation and the chemical analysis results presented above in Table 11.1, below.

A revised qualitative risk assessment has also been made of the likelihood of the linkage operating and its potential significance in accordance with CIRIA C552.



SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 37 of 45
Engineer: Adrian Read
Date: 27/05/2022

Table 11.1 Revised Assessment of Pollutant Linkages.

Justification/Comments	Source	Potential Contaminants of Concern	Pathway	Receptor	Consequence	Probability	Qualitative Risk Assessment
- The results of a supplementary ground investigation indicates that no further asbestos has been reported beyond that encountered at TP3 during the original ground investigation and no measured concentrations of any other potential contaminants of concern have been reported in excess of the GACs protective of a commercial / industrial land use. - The results of a supplementary controlled waters risk assessment is that no measured leachable concentrations of potential contaminants of concern represent a potentially significant risk to the controlled waters environment. - The conclusion of the ground gas risk assessment is that the Site is a Characteristic Situation 1 – Very Low Risk Scenario and the Site is not located in a radon affected area. As such, no ground gas protection measures or basic radon protection measures are required.	Asbestos impacted Made Ground soils with TP3 in the north of the site	Asbestos	Inhalation of dust	Future site workers (residential and commercial)	Medium	Likely	Moderate risk
				Adjacent site users (residential and commercial)	Medium	Likely	Moderate risk
				Site workers and future maintenance workers	Medium	Likely	Moderate risk
			Lateral and vertical migration of mobile contaminants	Adjacent site users (residential and commercial)	Medium	Unlikely	Low risk

For definition of the terms used in the qualitative risk assessment, please see Appendix J.



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 38 of 45
Engineer: Adrian Read
Date: 27/05/2022

12. PRELIMINARY WASTE SOILS CLASSIFICATION AND WASTE DISPOSAL ROUTE DETERMINATION

If the Site is to be redeveloped and materials are disposed off Site, the material exported from the Site to Landfill should be hauled by a register waste carrier in accordance with Duty of Care Regulations 1991 and the Hazardous Waste Regulations 2005.

It will be necessary to register the Site in advance of the intended reclamation works with the Environment Agency before disposal to landfill can take place. There will be requirement for the waste producer to provide appropriate Waste Acceptance Criteria (WAC) testing of the Soils for disposal to ensure that the soils are appropriately classified and that the landfill is licensed to receive such soils. A consignment note shall be completed, signed and retained by all parties involved. The consignment note shall state the volume of waste, a physical description of the material and statement of its chemical composition. The waste consignment notes shall be kept by the contractor for a period of at least two years.

Tier Environmental have assessed the chemical results in terms of basic characterisation of soils for waste. This provides a preliminary assessment of whether a material is potentially inert/non-hazardous or hazardous waste, with the final outcome being determined by WAC testing.

Basic waste characterisation has demonstrated that all of the samples of the material tested have been classified as non-hazardous waste. The results of WAC testing have demonstrated that Made Ground materials contain TOC levels marginally in excess of the inert waste landfill threshold; however, an inert landfill should be approached as the average TOC concentration across the site are below the inert waste threshold and the materials may therefore be accepted by an inert waste landfill subject to discussion / liaison and subsequent agreement.

The previously identified localised asbestos impacted Made Ground at TP103 should be disposed as hazardous waste.

Natural soils are likely to be suitable for disposal to an inert waste landfill.



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 39 of 45
Engineer: Adrian Read
Date: 27/05/2022

13.CONCLUSIONS AND RECOMMENDATIONS

13.1. Conclusions

- Made Ground was encountered at depths between 0.35m and 1.10m bgl comprising both cohesive and granular materials with anthropogenic materials including brick, concrete, rare ceramic and plastic, and natural lithologies including sandstone, limestone, quartz, flint, rare coal.
- Natural soils comprised Glacial Till of predominantly cohesive firm to stiff, locally friable, reddish brown, slightly sandy gravelly CLAY with occasional cobbles of sandstone – the base of this was not encountered at 5.45m bgl. Sand bands were reported at thicknesses ranging from 0.35m to 0.45m from depths ranging between 0.35m and 3.95m bgl at locations in the northwestern and southeastern areas of the Site.
- The results of a supplementary ground investigation indicates that no further asbestos has been reported beyond that encountered at TP3 during the original ground investigation and no measured concentrations of any other potential contaminants of concern have been reported in excess of the GACs protective of a commercial / industrial land use.
- The results of a supplementary controlled waters risk assessment is that no measured leachable concentrations of potential contaminants of concern represent a potentially significant risk to the controlled waters environment.
- The conclusion of the ground gas risk assessment is that the Site is a Characteristic Situation 1 – Very Low Risk Scenario and the Site is not located in a radon affected area. As such, no ground gas protection measures or basic radon protection measures are required.
- Basic waste characterisation has demonstrated that all of the samples of the material tested have been classified as non-hazardous waste. The results of WAC testing have demonstrated that Made Ground materials contain TOC levels marginally in excess of the inert waste landfill threshold; however, an inert landfill should be approached as the average TOC concentration across the site are below the inert waste threshold and the materials may therefore be accepted by an inert waste landfill subject to discussion / liaison and subsequent agreement.
- The recommendations within the previous Tier Environmental Remediation Strategy have not been impacted by the findings of this supplementary investigation and the following remains pertinent:
 - General site clearance to include hardstanding, stockpile and vegetation;
 - Removal and verification of asbestos hotspot identified within the north of the site;
 - Removal and verification of any previously unidentified areas of contamination, where required;
 - Backfill of resultant excavations with suitable material;



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 40 of 45
Engineer: Adrian Read
Date: 27/05/2022

14.REGULATORY APPROVALS

The conclusions and recommendations presented above are considered reasonable based on the findings of the site investigation. However, these cannot be guaranteed to gain regulatory approval and, therefore, the report should be passed to the appropriate regulatory authorities and/or other organisations for their comment and approval prior to undertaking any works on site.

It is recommended that conditions placed on any planning permission are discharged prior to commencement of site works.



SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 41 of 45
Engineer: Adrian Read
Date: 27/05/2022

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**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 42 of 45
Engineer: Adrian Read
Date: 27/05/2022

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**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 43 of 45
Engineer: Adrian Read
Date: 27/05/2022

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SUPPLEMENTARY GROUND INVESTIGATION REPORT FOR MOSS NOOK, HEALD GREEN, MANCHESTER

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 44 of 45
Engineer: Adrian Read
Date: 27/05/2022

16.GLOSSARY OF TERMS

ACEC	Aggressive Chemical Environment for Concrete (classification)
aOD	Above Ordnance Datum
bgl	Below ground level
BGS	British Geological Survey
BRE	Building Research Establishment
CBR	California Bearing Ratio (test)
COMAH	Control of Major Accident Hazards (regulations)
Designated location	Site (and the ecosystem on that site) protected under national or international legislation. A potential ecological receptor to be considered as part of the assessment of land contamination. Example designated locations include SSSIs (q.v.), SACs (q.v.), national nature reserves, Ramsar sites and bird special protection areas.
DQA	Data Quality Assessment
DQO	Data Quality Objective
DQRA	Detailed Quantitative Risk Assessment
DWS	Drinking Water Standard
EQS	Environmental Quality Standard
GAC	Generic Assessment Criterion
GQA	General Quality Assessment (Environment Agency)
GSV	Gas Screening Value
HCV	Health Criteria Value
IPPC	Integrated Pollution Prevention and Control (regulations)
K _{ow}	Octanol-water partition coefficient
LEL	Lower Explosive Limit
LL	Liquid Limit
LoD	Limit of Detection (analytical)
LoQ	Limit of Quantification (analytical)
Mean Value Test	Statistical test (described in the CIEH Guidance) to estimate the mean value of a normally distributed population of data at a given level of confidence. Normally for contaminated land assessment, the 95th percentile (referred to as the 95%UCL or US95) is applied as a reasonable but conservative estimate of the mean concentration for comparison with the relevant assessment criteria.
Maximum Value Test	Statistical test (described in the CIEH Guidance) to identify whether an elevated concentration within a normally distributed data set forms part of the underlying population from which it has been sampled or whether it is an outlier (such as a localised area of contamination) that merits further consideration.
MC	Moisture Content
NGR	National Grid Reference
NIHHS	Notification of Installations Handling Hazardous Substances (regulations)
OS	Ordnance Survey
PI	Plasticity Index
PID	Photoionisation Detector
PL	Plastic Limit
ppm	Parts per million
ppmv	Parts per million by volume
QA	Quality Assurance
QC	Quality Control
SAC	Special Area of Conservation
SOM	Soil Organic Matter



**SUPPLEMENTARY GROUND INVESTIGATION
REPORT FOR MOSS NOOK, HEALD GREEN,
MANCHESTER**

Report No : TE1604-TE-00-XX-RP-GE-002-V01
Page No : 45 of 45
Engineer: Adrian Read
Date: 27/05/2022

SPT	Standard Penetration Test
SPZ	Source Protection Zone (see Appendix L)
SSAC	Site-Specific Assessment Criterion
SSSI	Site of Special Scientific Interest
SVOC	Semi-Volatile Organic Compound
TEF	Toxicity Equivalent Factor
TPH	Total Petroleum Hydrocarbons
TWA	Time Weighted Average
US95	95 th percentile estimate of the true mean value of a data population (also known as 95%UCL).
VOC	Volatile Organic Compound

APPENDIX A - DRAWINGS



Legend:

— Site Boundary



Tier Environmental Ltd,
Suite 513, Chadwick House,
Warrington Road,
Birchwood, WA3 6AE

CLIENT: Northern Powerhouse Land Ltd

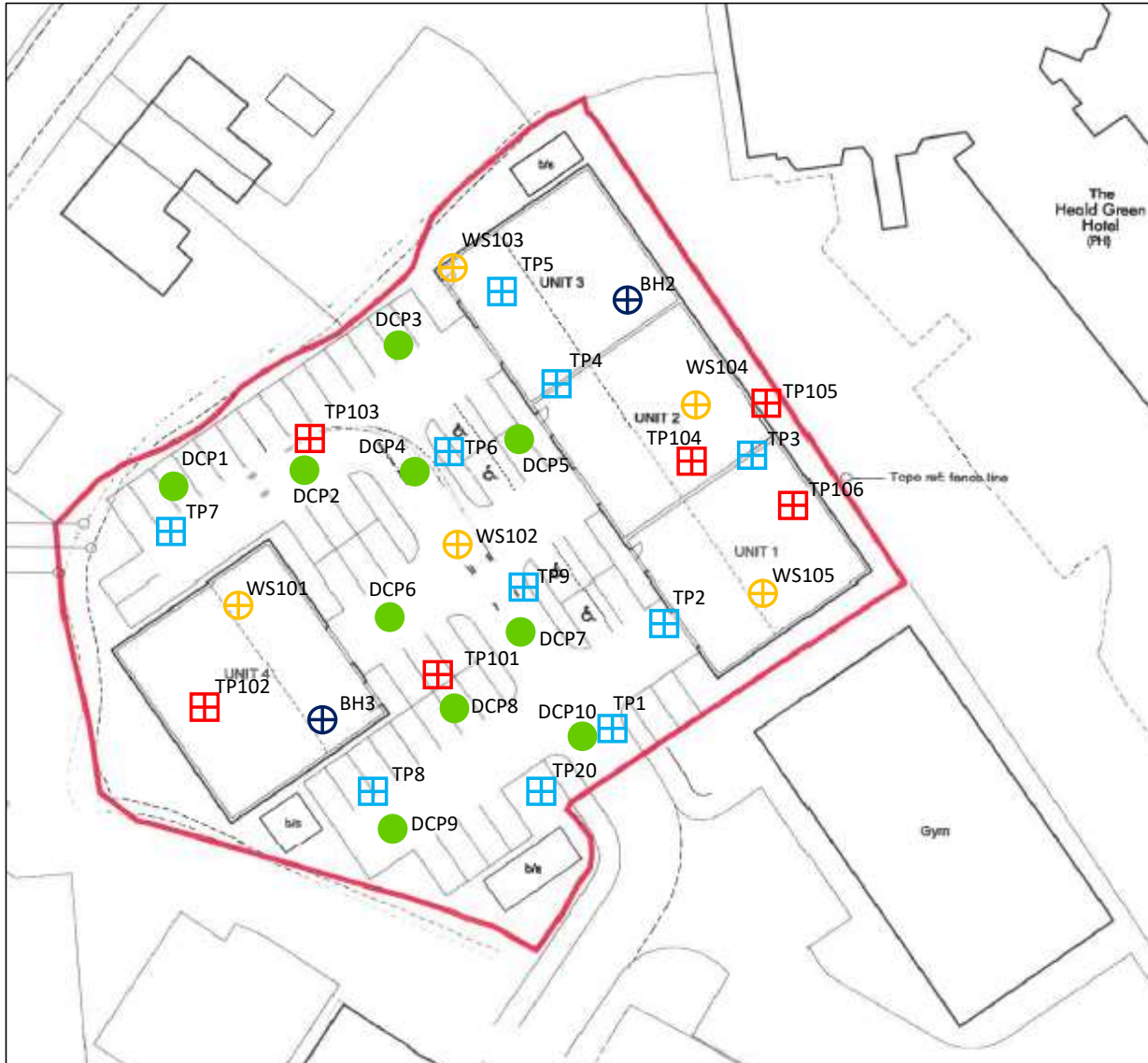
PROJECT TITLE:
Moss Nook, Heald Green, Manchester

DRAWING TITLE:
Site Location Plan

DRAWING REF: TE1603-TE-00-XX-DR-GE-001-V01

AUTHOR: SJM	REVIEWER: AR	SCALE: NTS
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DRAWING DATE: August 2021	DRAWING STATUS: FINAL
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TE1604 – Exploratory Hole Location Plan

2012 Borehole location
2012 Trial Pit location
2022 WS location
2022 TP location
2022 DCP location



Drawing: Exploratory Hole Location Plan
Drawing No.: TE1604-TE-00-XX-DR-GE-003-V02
Scale: DNS
Date: 25/05/2022
Drawn by: ER
Approved by: AR



Accommodation Schedule

Site area - 0.80 acres (0.325 Ha)
All areas GIA

Unit 1	
Ground	236 sq.m
Mezzanine	85 sq.m
TOTAL	321 sq.m

Unit 2	
Ground	239 sq.m
Mezzanine	85 sq.m
TOTAL	324 sq.m

Unit 3	
Ground	236 sq.m
Mezzanine	85 sq.m
TOTAL	321 sq.m

Unit 4	
Ground	310 sq.m
Mezzanine	120 sq.m
TOTAL	430 sq.m

TOTAL	1,396 sq.m
Car parking	47 spaces (1/29.7 sq.m)
Cycle parking in each unit	



Precedent Images



APPENDIX B - EXPLORATORY HOLE LOGS



Trial Pit Log

Trialpit No

TP101

Sheet 1 of 1

Project Name: Moss Nook

Project No.
TE1604Co-ords: -
Level:Date
21/04/2022

Location: Herald Green

Dimensions
(m):

3

Scale
1:25

Client: Tier Consult

Depth
2.00Logged
SE

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES					MADE GROUND: Vegetation over dark brown, slightly sandy, gravelly CLAY with frequent cobbles of brick and concrete. Gravel is fine to coarse, angular to subrounded of brick, concrete, sandstone, occasional limestone and ceramic. (TOPSOIL). MADE GROUND	
	0.60	ES		0.50			MADE GROUND: Light brown, very sandy, slightly gravelly CLAY. Gravel is fine to medium, angular to subrounded of brick, sandstone and quartz. MADE GROUND	
	0.80	ES		0.70			MADE GROUND Firm to stiff, locally friable, reddish brown, gravelly CLAY with occasional cobbles of sandstone. Gravel is fine to coarse, angular to subangular of sandstone and occasional mudstone.	1
				2.00			Blue, plastic water pipe struck at approximately 1.20m bgl in Northern pit wall. Pipe diameter of 25mm. Repaired on site.	
							End of pit at 2.00 m	2
								3
								4
								5

Remarks: 1) Trial pit for geoenvironmental purposes. 2) No groundwater ingress encountered. 3) Terminated due to strike of water pipe (wire) in Northern pit wall.

Stability: Stable.





Trial Pit Log

Trialpit No
TP102
Sheet 1 of 1

Project Name: Moss Nook	Project No. TE1604	Co-ords: - Level:	Date 21/04/2022
Location: Herald Green		Dimensions (m): Depth 3.20	Scale 1:25 Logged SE
Client: Tier Consult		2 0.7	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES					MADE GROUND: Vegetation over dark brown, clayey, gravelly SAND with frequent cobbles of concrete and brick. Gravel is fine to coarse, angular to subangular of brick, concrete, sandstone and ceramic with rare plastic. (TOPSOIL). MADE GROUND	
	0.80	ES		0.70			RELICT MADE GROUND TOPSOIL: Dark brown, slightly sandy, slightly gravelly CLAY. Gravel is fine to coarse, subangular of sandstone and occasional brick.	
	1.00	ES		0.95			MADE GROUND Stiff, reddish brown, occasional mottled grey, slightly sandy, slightly gravelly CLAY. Gravel is fine to medium, subangular to subrounded of sandstone, quartz and occasional mudstone. <i>Land drain strike in Southern pit wall at 1.10m bgl - slight trickle of water stopping after approximately 1 minute,</i>	1
				1.80			Friable, reddish brown, mottled grey, slightly sandy, slightly gravelly to gravelly CLAY. Gravel is fine to medium, angular to subangular of sandstone and occasional mudstone.	2
				3.20			End of pit at 3.20 m	3
								4
								5

Remarks: 1) Trial pit for geoenvironmental purposes. 2) No groundwater ingress encountered. 3) Terminated due to slow progress/maximum reach of excavator.

Stability: Stable.





Trial Pit Log

Trialpit No

TP103

Sheet 1 of 1

Project Name: Moss Nook

Project No.
TE1604

Co-ords: -

Level:

Date

21/04/2022

Location: Herald Green

Dimensions
(m):

2

Depth
3.30

0.7

Scale

1:25

Logged
SE

Client: Tier Consult

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES					MADE GROUND: Vegetation over dark brown, clayey, slightly gravelly SAND with frequent roots and rootlets. Gravel is fine to coarse, subangular of sandstone and occasional brick. (TOPSOIL).	
	0.40 0.45	ES B		0.35			MADE GROUND Orangish brown, slightly clayey, gravelly, fine grained SAND. Gravel is fine to coarse, subangular to subrounded of sandstone.	
	0.90	D		0.80			Firm to stiff, occasionally friable, orangish brown, sandy, slightly gravelly CLAY. Gravel is fine to coarse, subangular to subrounded of sandstone and quartz.	1
				1.15			Stiff becoming friable, reddish brown, mottled grey, sandy, slightly gravelly CLAY. Gravel is fine to coarse, angular to subangular of sandstone with occasional mudstone.	
							Occasional cobbles of sandstone from 2.00m bgl.	2
				3.30			End of pit at 3.30 m	3
								4
								5

Remarks: 1) Trial pit for geoenvironmental purposes. 2) No groundwater ingress encountered. 3) Terminated due to slow progress/maximum reach of excavator.

Stability: Stable.





Trial Pit Log

Trialpit No
TP104
Sheet 1 of 1

Project Name: Moss Nook	Project No. TE1604	Co-ords: - Level:	Date 21/04/2022
Location: Herald Green		Dimensions (m): Depth 3.10	Scale 1:25 Logged SE
Client: Tier Consult		2 0.7	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.45			MADE GROUND: Vegetation over dark brown, sandy, slightly gravelly CLAY. Gravel is fine to coarse, angular to subangular of sandstone, brick and mudstone. Frequent roots and rootlets. (TOPSOIL). MADE GROUND <i>5 No. metal fence posts lying horizontal at Western end of pit at 0.20m bgl.</i>	
	0.60 0.65 0.65	ES B D					MADE GROUND: Firm to stiff, orangish brown, sandy, gravelly CLAY. Gravel is fine to coarse, subangular to subrounded of sandstone, brick, occasional limestone and coal. Occasional pockets of orangish brown, clayey sand. MADE GROUND <i>Land drain strike at 1.00m bgl. (dry).</i>	1
	1.20	ES		1.10			Firm to stiff, reddish brown, mottled grey, sandy, slightly gravelly CLAY. Gravel is fine to medium, subangular of sandstone with rare mudstone. Becoming locally friable from 1.90m bgl.	2
				3.10			End of pit at 3.10 m	3
								4
								5

Remarks:	1) Trial pit for geoenvironmental purposes. 2) Groundwater ingress encountered as slow trickle from Western pit wall at 2.30m bgl. 3) Terminated due to slow progress.	
Stability:	Stable.	



Trial Pit Log

Trialpit No

TP105

Sheet 1 of 1

Project Name: Moss Nook

Project No.
TE1604Co-ords: -
Level:Date
21/04/2022

Location: Herald Green

Dimensions
(m):

2

Depth
3.00

0.7

Scale
1:25Logged
SE

Client: Tier Consult

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES					MADE GROUND: Vegetation over dark brown, slightly gravelly CLAY with frequent rootlets. Gravel is fine to coarse, subangular to subrounded of ceramic and concrete. (TOPSOIL). MADE GROUND	
	0.50	ES		0.40			MADE GROUND: Firm to stiff, orangish brown, sandy, slightly gravelly, reworked CLAY. Gravel is fine to coarse, subrounded to rounded of sandstone and flint. Occasional pockets of orangish brown, clayey sand. MADE GROUND <i>Land drain struck at 0.60m bgl (dry).</i>	
	1.00 1.00 1.00	B D ES		0.90			Firm to stiff, brown, mottled grey, slightly sandy to sandy, gravelly CLAY. Gravel is fine to medium, angular to subangular of sandstone. Becoming occasionally friable past 1.20m bgl.	1
				1.60			Firm to stiff, occasionally friable, brown mottled grey, sandy, gravelly CLAY. Gravel is fine to fine to medium, subangular to subrounded of sandstone and occasional mudstone with rare fine coal. Gravel pockets increasing with depth.	2
				3.00			End of pit at 3.00 m	3
								4
								5

Remarks: 1) Trial pit for geoenvironmental purposes. 2) No groundwater ingress encountered. 3) Terminated due to slow progress.

Stability: Stable.





Trial Pit Log

Trialpit No
TP106
Sheet 1 of 1

Project Name: Moss Nook	Project No. TE1604	Co-ords: - Level:	Date 21/04/2022
Location: Herald Green		Dimensions (m): Depth 2.80	Scale 1:25 Logged SE
Client: Tier Consult		2 0.7	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES		0.40			MADE GROUND (TOPSOIL): Vegetation over, dark brown, sandy, slightly gravelly CLAY, with frequent roots and rootlets. Gravel is fine to coarse, angular to subangular of sandstone, quartz, occasional concrete and glass.	
	0.65	B		0.55			MADE GROUND: Firm, orangey brown, sandy, gravelly CLAY, with frequent pockets of clayey sand. Gravel is fine to coarse, subangular to subrounded of sandstone, occasional brick and quartz.	
	0.80	ES		0.70			MADE GROUND: Orangey brown, clayey, gravelly SAND. Gravel is fine to coarse, subangular to subrounded of sandstone, quartz and occasional brick. Firm to stiff, friable, reddish brown, mottled grey, sandy, slightly gravelly CLAY. Gravel is fine to medium, angular to subangular of sandstone and occasional mudstone and coal.	1
	1.10	ES					Land drain stuck at 0.70m bgl (dry).	
							Rare cobbles of sandstone.	
				2.80			End of pit at 2.80 m	2
								3
								4
								5

Remarks:	1) Trial pit for geoenvironmental purposes. 2) No groundwater ingress encountered. 3) Terminated due to slow progress.
Stability:	Stable.





Borehole Log

Borehole No.

WS101

Sheet 1 of 1

Project Name: Moss Nook

Project No.
TE1604

Co-ords: -

Hole Type
WS

Location: Herald Green

Level:

Scale
1:50

Client: Tier Consult

Dates: 20/04/2022 -

Logged By
ER

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.50			MADE GROUND: Vegetation over, soft, dark brown, slightly gravelly, sandy clay with frequent roots and rootlets. Gravel is fine to coarse, angular to subangular of brick, quartz, sandstone and rare coal. (TOPSOIL).	
		1.00	ES		0.90			MADE GROUND	
		1.20		N=12 (2,3/3,3,3,3)				Yellowish brown, slightly gravelly, clayey, fine to coarse SAND. Gravel is fine to medium, angular to subangular of sandstone, mudstone, quartz and coal.	1
		2.00		N=17 (3,3/3,4,5,5)				TILL Medium, becoming high strength, firm, brown, slightly gravelly, slightly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of sandstone, mudstone and quartz.	2
		3.00		N=23 (4,5/5,6,6,6)				TILL	3
		4.00		N=17 (3,4/4,4,4,5)				Becoming locally friable.	4
		5.00		N=24 (3,5/5,6,6,7)	5.45			End of borehole at 5.45 m	5
									6
									7
									8
									9
									10

Remarks

1) Hand dug pit to 1.2m bgl for service clearance. 2) Terminated at target depth. 3) Installation of 1m plain pipe, 3.8m slotted pipe.





Borehole Log

Borehole No.

WS102

Sheet 1 of 1

Project Name: Moss Nook

Project No.
TE1604

Co-ords: -

Hole Type
WS

Location: Herald Green

Level:

Scale
1:50

Client: Tier Consult

Dates: 20/04/2022 -

Logged By
ER

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.45			0.45			MADE GROUND: Vegetation over, soft, dark brown, slightly gravelly, sandy clay with frequent roots and rootlets. Gravel is fine to coarse, angular to subangular of brick, quartz, sandstone and rare coal.	
		0.60	ES		0.70			MADE GROUND: Soft, blackish brown, gravelly CLAY. Gravel is fine to coarse, angular of brick and mixed natural lithologies.	
		0.80	ES		0.90			RELICT TOPSOIL	
		1.20		N=7 (1,1/1,2,2,2)				MADE GROUND: Grey, fine to coarse, angular GRAVEL of limestone. (Terram at base).	1
		2.00		N=13 (2,3/3,3,3,4)				MADE GROUND Low, becoming high strength, firm, dark brown, slightly sandy, slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of sandstone, quartz and coal.	2
		3.00		N=19 (3,4/4,4,5,6)				TILL	3
		4.00		N=19 (3,4/4,5,5,5)					4
		5.00		N=26 (4,8/8,6,6,6)					5
					5.45			End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1) Hand dug pit to 1.2m bgl for service clearance. 2) Terminated at target depth. 3) Installation of 0.5 plain pipe, 4.2m slotted pipe.





Borehole Log

Borehole No.

WS103

Sheet 1 of 1

Project Name: Moss Nook

Project No.
TE1604

Co-ords: -

Hole Type
WS

Location: Herald Green

Level:

Scale
1:50

Client: Tier Consult

Dates: 20/04/2022 -

Logged By
ER

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES					MADE GROUND: Vegetation over, dark brown, slightly gravelly, slightly clayey, fine to coarse SAND. Gravel is fine to coarse, angular to subangular of brick, sandstone, coal and rare quartz. Frequent rootlets throughout. (TOPSOIL)	
		0.70	ES		0.50 0.75 0.79			MADE GROUND	
		1.20		N=10 (1,2/2,2,3,3)				MADE GROUND: Soft, dark orangish brown, slightly gravelly, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of brick and mixed natural lithologies.	1
		2.00		N=17 (2,3/4,5,4,4)				MADE GROUND Brown, fine to coarse SAND. TILL	2
		3.00		N=16 (3,5/3,4,4,5)				Medium to high strength, firm, dark orangish brown, slightly gravelly, slightly sandy to sandy, occasionally friable CLAY. Sand is fine to medium. Gravel is fine to coarse of sandstone, quartz, rare coal and mudstone. TILL <i>Becoming slightly sandy, mottled grey and friable.</i>	3
		4.00		N=18 (3,4/4,4,5,5)	3.95 4.40			Medium dense, clayey, fine to coarse SAND. TILL	4
		5.00		N=22 (3,5/6,5,5,6)	5.45			High strength, firm, dark brown, slightly gravelly, slightly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of sandstone, mudstone and coal. TILL	5
								End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1) Hand dug pit to 1.2m bgl for service clearance. 2) Terminated at target depth. 3) Installation of 1m plain pipe, 3.1m slotted pipe.





Borehole Log

Borehole No.

WS104

Sheet 1 of 1

Project Name: Moss Nook

Project No.
TE1604

Co-ords: -

Hole Type
WS

Location: Herald Green

Level:

Scale
1:50

Client: Tier Consult

Dates: 20/04/2022 -

Logged By
ER

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.40	ES		0.55			MADE GROUND: Vegetation over, dark brown, slightly gravelly, slightly clayey, fine to coarse SAND. Gravel is fine to coarse, angular to subangular of brick, sandstone, coal and rare quartz. Frequent rootlets throughout. (TOPSOIL)	
		0.80	ES		0.85			MADE GROUND	
		1.20		N=13 (2,2/3,4,3,3)				MADE GROUND: Soft, dark orangish brown, slightly gravelly, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of brick and mixed natural lithologies.	1
		2.00		N=16 (2,2/3,4,4,5)				MADE GROUND Medium to high strength, firm, dark brown, occasionally mottled grey, slightly gravelly, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of sandstone, coal, mudstone and quartz.	2
		3.00		N=16 (3,3/3,4,4,5)				TILL	3
		4.00		N=16 (3,3/3,4,5,4)					4
		5.00		N=23 (3,4/5,5,6,7)					5
					5.45			End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1) Hand dug pit to 1.2m bgl for service clearance. 2) Terminated at target depth. 3) Installation of 1m plain pipe, 3.8m slotted pipe.





Borehole Log

Borehole No.

WS105

Sheet 1 of 1

Project Name: Moss Nook

Project No.
TE1604

Co-ords: -

Hole Type
WS

Location: Herald Green

Level:

Scale
1:50

Client: Tier Consult

Dates: 20/04/2022 -

Logged By
ER

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.40	ES		0.55			MADE GROUND: Vegetation over, dark brown, slightly gravelly, slightly clayey, fine to coarse SAND. Gravel is fine to coarse, angular to subangular of brick, sandstone, coal and rare quartz. Frequent rootlets throughout. (TOPSOIL)	
		0.80	ES		0.80			MADE GROUND	
		1.20		N=13 (2,2/3,4,3,3)				Firm, brown, sandy CLAY. Sand is fine to coarse. TILL	1
					1.90			Medium strength, firm, dark brown, occasionally mottled grey, slightly gravelly, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of sandstone, coal, mudstone and quartz.	2
		2.00		N=18 (3,3/3,5,5,5)	2.25			TILL	
								Medium dense, brown, slightly gravelly, clayey, fine to coarse SAND. Gravel is fine to medium, angular to subrounded of quartz, mudstone and coal.	3
		3.00		N=23 (3,4/5,6,6,6)				TILL	
								High to very high strength, firm, dark brown, occasionally mottled grey, slightly gravelly, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of sandstone, coal, mudstone and quartz.	4
		4.00		N=23 (4,6/6,5,6,6)				TILL	
		5.00		N=35 (4,4/7,11,9,8)	5.45				5
								End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1) Hand dug pit to 1.2m bgl for service clearance. 2) Terminated at target depth. 3) Installation of 1m plain pipe, 3m slotted pipe.



APPENDIX C - GEOENVIRONMENTAL SOIL LABORATORY RESULTS

Tier Environmental
Suite 513, Chadwick House
Warrington Rd
Birchwood
Warrington
WA3 6AE



Attention :	Eve Rowland
Date :	5th May, 2022
Your reference :	TE1604
Our reference :	Test Report 22/6531 Batch 1
Location :	Moss Nook, Heald Green
Date samples received :	21st April, 2022
Status :	Final Report
Issue :	1

Eleven samples were received for analysis on 21st April, 2022 of which eight were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:



Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Tier Environmental
Reference: TE1604
Location: Moss Nook, Heald Green
Contact: Eve Rowland
EMT Job No: 22/6531

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-4	9-12	17-20	33-36	37-40						Please see attached notes for all abbreviations and acronyms		
Sample ID	WS101	WS102	WS103	WS104	WS105								
Depth	0.30	0.60	0.10	0.80	0.50								
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T								
Sample Date	20/04/2022	20/04/2022	20/04/2022	20/04/2022	20/04/2022								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	21/04/2022	21/04/2022	21/04/2022	21/04/2022	21/04/2022						LOD/LOR	Units	Method No.
Arsenic #	10.2	10.4	16.3	9.9	12.5						<0.5	mg/kg	TM30/PM15
Cadmium #	0.2	0.2	0.2	<0.1	0.2						<0.1	mg/kg	TM30/PM15
Chromium #	49.2	55.0	50.7	55.2	54.5						<0.5	mg/kg	TM30/PM15
Copper #	28	33	44	17	39						<1	mg/kg	TM30/PM15
Lead #	63	69	106	10	91						<5	mg/kg	TM30/PM15
Mercury #	0.2	0.3	0.3	0.3	0.4						<0.1	mg/kg	TM30/PM15
Nickel #	21.9	18.3	18.7	30.6	17.7						<0.7	mg/kg	TM30/PM15
Selenium #	1	1	<1	<1	1						<1	mg/kg	TM30/PM15
Total Sulphate as SO4 #	307	626	621	59	566						<50	mg/kg	TM50/PM29
Zinc #	71	73	72	46	75						<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	0.07	<0.04	0.25	<0.04	0.05						<0.04	mg/kg	TM4/PM8
Acenaphthylene	0.05	0.05	0.21	<0.03	0.10						<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	0.10	<0.05	<0.05						<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	0.05	0.22	<0.04	0.06						<0.04	mg/kg	TM4/PM8
Phenanthrene #	0.25	0.41	1.81	<0.03	0.67						<0.03	mg/kg	TM4/PM8
Anthracene #	0.06	0.12	0.44	<0.04	0.20						<0.04	mg/kg	TM4/PM8
Fluoranthene #	0.45	0.87	1.82	<0.03	1.09						<0.03	mg/kg	TM4/PM8
Pyrene #	0.45	0.83	1.91	<0.03	1.10						<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	0.25	0.42	0.86	<0.06	0.61						<0.06	mg/kg	TM4/PM8
Chrysene #	0.27	0.45	1.01	<0.02	0.59						<0.02	mg/kg	TM4/PM8
Benzo(b)fluoranthene #	0.47	0.78	1.30	<0.07	1.02						<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	0.26	0.44	0.82	<0.04	0.61						<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	0.21	0.35	0.51	<0.04	0.42						<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	0.09	0.12	<0.04	0.10						<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	0.21	0.32	0.53	<0.04	0.43						<0.04	mg/kg	TM4/PM8
Coronene	-	-	<0.04	-	<0.04						<0.04	mg/kg	TM4/PM8
PAH 16 Total	3.0	5.2	11.9	<0.6	7.1						<0.6	mg/kg	TM4/PM8
PAH 17 Total	-	-	11.91	-	7.05						<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.34	0.56	0.94	<0.05	0.73						<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.13	0.22	0.36	<0.02	0.29						<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	94	86	83	73	81						<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	-	-	<30	-	<30						<30	mg/kg	TM5/PM8/PM16
MTBE #	-	-	<5	-	<5						<5	ug/kg	TM36/PM12
Benzene #	-	-	<5	-	<5						<5	ug/kg	TM36/PM12
Toluene #	-	-	<5	-	<5						<5	ug/kg	TM36/PM12
Ethylbenzene #	-	-	<5	-	<5						<5	ug/kg	TM36/PM12
m/p-Xylene #	-	-	<5	-	<5						<5	ug/kg	TM36/PM12
o-Xylene #	-	-	<5	-	<5						<5	ug/kg	TM36/PM12
PCB 28 #	-	-	<5	-	<5						<5	ug/kg	TM17/PM8

Element Materials Technology

Client Name: Tier Environmental
Reference: TE1604
Location: Moss Nook, Heald Green
Contact: Eve Rowland
EMT Job No: 22/6531

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-4	9-12	17-20	33-36	37-40						Please see attached notes for all abbreviations and acronyms		
Sample ID	WS101	WS102	WS103	WS104	WS105								
Depth	0.30	0.60	0.10	0.80	0.50								
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T								
Sample Date	20/04/2022	20/04/2022	20/04/2022	20/04/2022	20/04/2022								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	21/04/2022	21/04/2022	21/04/2022	21/04/2022	21/04/2022						LOD/LOR	Units	Method No.
PCB 52 #	-	-	<5	-	<5						<5	ug/kg	TM17/PM8
PCB 101 #	-	-	<5	-	<5						<5	ug/kg	TM17/PM8
PCB 118 #	-	-	<5	-	<5						<5	ug/kg	TM17/PM8
PCB 138 #	-	-	<5	-	<5						<5	ug/kg	TM17/PM8
PCB 153 #	-	-	<5	-	<5						<5	ug/kg	TM17/PM8
PCB 180 #	-	-	<5	-	<5						<5	ug/kg	TM17/PM8
Total 7 PCBs #	-	-	<35	-	<35						<35	ug/kg	TM17/PM8
Total Phenols HPLC	<0.15	<0.15	<0.15	<0.15	<0.15						<0.15	mg/kg	TM26/PM21
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3						<0.3	mg/kg	TM38/PM2
Sulphate as SO4 (2:1 Ext) #	0.0179	0.0951	0.0120	0.0016	0.0495						<0.0015	g/l	TM38/PM2
Total Organic Carbon #	2.09	2.82	4.98	0.27	3.44						<0.02	%	TM21/PM2
ANC at pH4	-	-	0.05	-	0.15						<0.03	mol/kg	TM77/PMO
ANC at pH7	-	-	NDP	-	<0.03						<0.03	mol/kg	TM77/PMO
Loss on Ignition #	-	-	12.3	-	8.5						<1.0	%	TM22/PMO
pH #	8.18	7.67	6.61	6.51	7.25						<0.01	pH units	TM73/PM1

Element Materials Technology

Client Name: Tier Environmental
Reference: TE1604
Location: Moss Nook, Heald Green
Contact: Eve Rowland
EMT Job No: 22/6531

Report : NRA Leachate

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

[illegible]

Mass of sample taken (kg)	-	Moisture Content Ratio (%) =	32.3
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	75.6
Particle Size <4mm =	>95%		
EMT Job No	22/6531	Landfill Waste Acceptance Criteria Limits	
Sample No	20		
Client Sample No	WS103		
Depth/Other	0.10		
Sample Date	20/04/2022		
Batch No	1		
Solid Waste Analysis		Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non- Hazardous Landfill
Total Organic Carbon (%)	4.98	3	5
Loss on Ignition (%)	12.3	-	10
Sum of BTEX (mg/kg)	<0.025	6	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-
Mineral Oil (mg/kg) (EH_CU_1D_AL)	<30	500	-
PAH Sum of 17(mg/kg)	11.91	100	-
pH (pH Units)	6.61	-	>6
ANC to pH 7 (mol/kg)	NDP	-	to be evaluated
ANC to pH 4 (mol/kg)	0.05	-	to be evaluated
Eluate Analysis	10:1 conc ⁿ leached		Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg
	C ₁₀ mg/l	A ₁₀ mg/kg	
Arsenic	<0.0025	<0.025	0.5
Barium	0.006	0.06	2
Cadmium	<0.0005	<0.005	100
Chromium	<0.0015	<0.015	0.04
Copper	0.013	0.13	1
Mercury	<0.001	<0.01	5
Molybdenum	<0.002	<0.02	0.5
Nickel	<0.002	<0.02	10
Lead	<0.005	<0.05	0.4
Antimony	<0.002	<0.02	10
Selenium	<0.003	<0.03	0.5
Zinc	0.005	0.05	50
Chloride	0.5	5	0.06
Fluoride	<0.3	<3	0.7
Sulphate as SO ₄	0.5	5	5
Total Dissolved Solids	<35	<350	0.1
Phenol	<0.01	<0.1	0.5
Dissolved Organic Carbon	5	50	7
			4
			50
			800
			15000
			25000
			10
			150
			500
			1000
			20000
			50000
			4000
			60000
			100000
			1
			-
			-
			500
			800
			1000

Mass of sample taken (kg)	-	Moisture Content Ratio (%) =	29.8
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	77.0
Particle Size <4mm =	>95%		
EMT Job No	22/6531	Landfill Waste Acceptance Criteria Limits	
Sample No	40		
Client Sample No	WS105		
Depth/Other	0.50		
Sample Date	20/04/2022		
Batch No	1		
Solid Waste Analysis		Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non- Hazardous Landfill
Total Organic Carbon (%)	3.44	3	5
Loss on Ignition (%)	8.5	-	10
Sum of BTEX (mg/kg)	<0.025	6	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-
Mineral Oil (mg/kg) (EH_CU_1D_AL)	<30	500	-
PAH Sum of 17(mg/kg)	7.05	100	-
pH (pH Units)	7.25	-	>6
ANC to pH 7 (mol/kg)	<0.03	-	to be evaluated
ANC to pH 4 (mol/kg)	0.15	-	to be evaluated
Eluate Analysis	10:1 conc ⁿ leached		Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg
	C ₁₀ mg/l	A ₁₀ mg/kg	
Arsenic	<0.0025	<0.025	0.5
Barium	0.016	0.16	20
Cadmium	<0.0005	<0.005	0.04
Chromium	<0.0015	<0.015	0.5
Copper	0.009	0.09	2
Mercury	<0.001	<0.01	0.01
Molybdenum	0.004	0.04	0.5
Nickel	<0.002	<0.02	0.4
Lead	<0.005	<0.05	0.5
Antimony	<0.002	<0.02	0.06
Selenium	<0.003	<0.03	0.1
Zinc	0.004	0.04	4
Chloride	0.5	5	800
Fluoride	0.6	6	10
Sulphate as SO ₄	<0.5	<5	1000
Total Dissolved Solids	103	1030	4000
Phenol	<0.01	<0.1	1
Dissolved Organic Carbon	6	60	500

Note:

The LOQ of the Asbestos Quantification is 0.001% dry fibre of dry mass of sample.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

[illegible]

Matrix : Solid

[illegible]

Client Name: Tier Environmental
Reference: TE1604
Location: Moss Nook, Heald Green
Contact: Eve Rowland

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 22/6531

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 22/6531

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	No
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.			AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C-440C)	PM0	No preparation is required.	Yes		AD	Yes

EMT Job No: 22/6531

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	No
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21B	As Received samples are extracted in Methanol: Water (60:40) by reciprocal shaker.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry); WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified			AR	No
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry); WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes

EMT Job No: 22/6531

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.	Yes		AD	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 Second edition (2021)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	No
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM77	Modified DDCEN/TS method 15364:2006. Determination of Acid Neutralization Capacity by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	No
TM170	Determination of Trace Metals by ICP-MS (Inductively Coupled Plasma – Mass Spectrometry): Modified USEPA Method 200.8, Rev. 5.4, 1994; Modified EPA Method 6020A, Rev.1, Feb 2007; Modified BS EN ISO 17294-2:2016	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified			AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

Tier Environmental
Suite 513, Chadwick House
Warrington Rd
Birchwood
Warrington
WA3 6AE



Attention : Eve Rowland
Date : 5th May, 2022
Your reference : TE1604
Our reference : Test Report 22/6655 Batch 1
Location : Moss Nook, Heald Green
Date samples received : 23rd April, 2022
Status : Final Report
Issue : 1

Seventeen samples were received for analysis on 23rd April, 2022 of which nine were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:



Phil Sommerton BSc
Senior Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Tier Environmental
Reference: TE1604
Location: Moss Nook, Heald Green
Contact: Eve Rowland
EMT Job No: 22/6655

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	34-37	42-45	54-57								Please see attached notes for all abbreviations and acronyms		
Sample ID	TP104	TP105	TP106										
Depth	0.60	0.10	0.20										
COC No / misc													
Containers	V J T	V J T	V J T										
Sample Date	21/04/2022	21/04/2022	21/04/2022										
Sample Type	Soil	Soil	Soil										
Batch Number	1	1	1										
Date of Receipt	23/04/2022	23/04/2022	23/04/2022								LOD/LOR	Units	Method No.
Arsenic #	4.6	20.6	15.8								<0.5	mg/kg	TM30/PM15
Cadmium #	<0.1	0.3	0.2								<0.1	mg/kg	TM30/PM15
Chromium #	44.6	53.8	50.9								<0.5	mg/kg	TM30/PM15
Copper #	8	69	45								<1	mg/kg	TM30/PM15
Lead #	8	129	108								<5	mg/kg	TM30/PM15
Mercury #	<0.1	0.7	0.5								<0.1	mg/kg	TM30/PM15
Nickel #	16.6	21.7	19.4								<0.7	mg/kg	TM30/PM15
Selenium #	<1	1	1								<1	mg/kg	TM30/PM15
Total Sulphate as SO4 #	141	634	523								<50	mg/kg	TM50/PM29
Zinc #	25	99	99								<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	0.18	0.17								<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	0.22	0.20								<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	0.16	0.15								<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	0.27	0.22								<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	2.39	1.91								<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	0.57	0.50								<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	2.21	2.09								<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	2.25	2.20								<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	1.26	1.12								<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	1.16	1.15								<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	1.61	1.57								<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	0.99	0.98								<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	0.57	0.64								<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	0.17	0.17								<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	0.62	0.67								<0.04	mg/kg	TM4/PM8
PAH 16 Total	<0.6	14.6	13.7								<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	1.16	1.13								<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	0.45	0.44								<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	81	77	80								<0	%	TM4/PM8
Total Phenols HPLC	<0.15	<0.75 ^{AA}	<0.15								<0.15	mg/kg	TM26/PM21B
Hexavalent Chromium #	<0.3	<0.3	<0.3								<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0310	0.0189	0.0265								<0.0015	g/l	TM38/PM20
Total Organic Carbon #	0.13	5.27	3.87								<0.02	%	TM21/PM24
pH #	6.53	6.34	7.03								<0.01	pH units	TM73/PM11

Element Materials Technology

Client Name: Tier Environmental
Reference: TE1604
Location: Moss Nook, Heald Green
Contact: Eve Rowland
EMT Job No: 22/6655

Report : NRA Leachate

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	6-9	13-16	26-29								Please see attached notes for all abbreviations and acronyms		
Sample ID	TP101	TP102	TP103										
Depth	0.60	0.20	0.40										
COC No / misc													
Containers	V T	V J T	V J T										
Sample Date	21/04/2022	21/04/2022	21/04/2022										
Sample Type	Soil	Soil	Soil										
Batch Number	1	1	1										
Date of Receipt	23/04/2022	23/04/2022	23/04/2022								LOD/LOR	Units	Method No.
Dissolved Arsenic	<2.5	<2.5	<2.5								<2.5	ug/l	TM30/PM14
Dissolved Boron	<12	<12	<12								<12	ug/l	TM30/PM14
Dissolved Cadmium	<0.5	<0.5	<0.5								<0.5	ug/l	TM30/PM14
Dissolved Chromium	<1.5	<1.5	<1.5								<1.5	ug/l	TM30/PM14
Dissolved Copper	<7	8	<7								<7	ug/l	TM30/PM14
Dissolved Lead	<5	<5	<5								<5	ug/l	TM30/PM14
Dissolved Mercury	<1	<1	<1								<1	ug/l	TM30/PM14
Dissolved Nickel	<2	<2	<2								<2	ug/l	TM30/PM14
Dissolved Selenium	<3	<3	<3								<3	ug/l	TM30/PM14
Dissolved Zinc	6	4	4								<3	ug/l	TM30/PM14
PAH MS													
Naphthalene	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}								<0.1	ug/l	TM4/PM30
Acenaphthylene	<0.005 ^{SV}	<0.005 ^{SV}	<0.005 ^{SV}								<0.005	ug/l	TM4/PM30
Acenaphthene	0.016 ^{SV}	<0.005 ^{SV}	<0.005 ^{SV}								<0.005	ug/l	TM4/PM30
Fluorene	0.013 ^{SV}	0.007 ^{SV}	0.009 ^{SV}								<0.005	ug/l	TM4/PM30
Phenanthrene	0.025 ^{SV}	0.026 ^{SV}	0.015 ^{SV}								<0.005	ug/l	TM4/PM30
Anthracene	<0.005 ^{SV}	0.008 ^{SV}	<0.005 ^{SV}								<0.005	ug/l	TM4/PM30
Fluoranthene	0.010 ^{SV}	0.030 ^{SV}	0.005 ^{SV}								<0.005	ug/l	TM4/PM30
Pyrene	0.009 ^{SV}	0.038 ^{SV}	<0.005 ^{SV}								<0.005	ug/l	TM4/PM30
Benzo(a)anthracene	<0.005 ^{SV}	0.016 ^{SV}	<0.005 ^{SV}								<0.005	ug/l	TM4/PM30
Chrysene	<0.005 ^{SV}	0.032 ^{SV}	<0.005 ^{SV}								<0.005	ug/l	TM4/PM30
Benzo(bk)fluoranthene	<0.008 ^{SV}	0.050 ^{SV}	<0.008 ^{SV}								<0.008	ug/l	TM4/PM30
Benzo(a)pyrene	<0.005 ^{SV}	0.027 ^{SV}	<0.005 ^{SV}								<0.005	ug/l	TM4/PM30
Indeno(123cd)pyrene	<0.005 ^{SV}	0.012 ^{SV}	<0.005 ^{SV}								<0.005	ug/l	TM4/PM30
Dibenzo(ah)anthracene	<0.005 ^{SV}	<0.005 ^{SV}	<0.005 ^{SV}								<0.005	ug/l	TM4/PM30
Benzo(ghi)perylene	<0.005 ^{SV}	0.019 ^{SV}	<0.005 ^{SV}								<0.005	ug/l	TM4/PM30
PAH 16 Total	<0.173 ^{SV}	0.265 ^{SV}	<0.173 ^{SV}								<0.173	ug/l	TM4/PM30
Benzo(b)fluoranthene	<0.008	0.036	<0.008								<0.008	ug/l	TM4/PM30
Benzo(k)fluoranthene	<0.008	0.014	<0.008								<0.008	ug/l	TM4/PM30
PAH Surrogate % Recovery	58 ^{SV}	65 ^{SV}	65 ^{SV}								<0	%	TM4/PM30
Total Phenols HPLC	<0.1	<0.1	<0.1								<0.1	mg/l	TM26/PM0
pH	6.80	7.89	7.39								<0.01	pH units	TM73/PM0

Client Name: Tier Environmental
Reference: TE1604
Location: Moss Nook, Heald Green
Contact: Eve Rowland

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Asbestos sub-samples are retained for not less than 6 months from the date of analysis unless specifically requested.

The LOQ of the Asbestos Quantification is 0.001% dry fibre of dry mass of sample.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analyst Name	Date Of Analysis	Analysis	Result
22/6655	1	TP104	0.10	33	Anthony Carman	28/04/2022	General Description (Bulk Analysis)	Brown Soil/Stones
					Anthony Carman	28/04/2022	Asbestos Fibres	NAD
					Anthony Carman	28/04/2022	Asbestos ACM	NAD
					Anthony Carman	28/04/2022	Asbestos Type	NAD
22/6655	1	TP105	0.50	49	Catherine Coles	29/04/2022	General Description (Bulk Analysis)	sand,soil,stone
					Catherine Coles	29/04/2022	Asbestos Fibres	NAD
					Catherine Coles	29/04/2022	Asbestos ACM	NAD
					Catherine Coles	29/04/2022	Asbestos Type	NAD
22/6655	1	TP106	0.60	61	Catherine Coles	29/04/2022	General Description (Bulk Analysis)	sand,soil,stone
					Catherine Coles	29/04/2022	Asbestos Fibres	NAD
					Catherine Coles	29/04/2022	Asbestos ACM	NAD
					Catherine Coles	29/04/2022	Asbestos Type	NAD

Client Name: Tier Environmental
Reference: TE1604
Location: Moss Nook, Heald Green
Contact: Eve Rowland

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 22/6655

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x5 Dilution

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 22/6655

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	No
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	No
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21B	As Received samples are extracted in Methanol: Water (60:40) by reciprocal shaker.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified			AR	No
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes

EMT Job No: 22/6655

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.	Yes		AD	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 Second edition (2021)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	No
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No



Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

- understand the origin of the waste
- select the correct List of Waste code(s)
- confirm that the list of determinands, results and sampling plan are fit for purpose
- select and justify the chosen metal species (Appendix B)
- correctly apply moisture correction and other available corrections
- add the meta data for their user-defined substances (Appendix A)
- check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)



I7YQN-NJ71Q-AWWIS

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in **pale yellow**.

Job name

EMT-22-6531-Batch-1-202205051537

Description/Comments

Project

TE1604

Site

Moss Nook, Heald Green

Classified by

Name: **Adrian Read**
Date: **16 May 2022 10:01 GMT**
Telephone: **01925 818388**

Company: **Tier Environmental**
Chadwick house
Warrington Road,

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification:

CERTIFIED

Course
Hazardous Waste Classification

Date
03 Dec 2020

Next 3 year Refresher due by Dec 2023

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	WS101-20/04/2022-0.30m		Non Hazardous		2
2	WS102-20/04/2022-0.60m		Non Hazardous		4
3	WS103-20/04/2022-0.10m		Non Hazardous		6
4	WS104-20/04/2022-0.80m		Non Hazardous		8
5	WS105-20/04/2022-0.50m		Non Hazardous		10

Related documents

#	Name	Description
1	EMT-22-6531-Batch-1-202205051537.HWOL	.hwol file used to create the Job
2	Example waste stream template for contaminated soils	waste stream template used to create this Job

Report

Created by: Adrian Read

Created date: 16 May 2022 10:01 GMT

Appendices	Page
Appendix A: Classifier defined and non GB MCL determinands	12
Appendix B: Rationale for selection of metal species	13
Appendix C: Version	14

Classification of sample: WS101-20/04/2022-0.30m



Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS101-20/04/2022-0.30m	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				10.2	mg/kg	1.32	13.467	mg/kg	0.00135 %		
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				0.2	mg/kg	1.142	0.228	mg/kg	0.0000228 %		
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				49.2	mg/kg	1.462	71.909	mg/kg	0.00719 %		
		215-160-9	1308-38-9									
4	chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.3	mg/kg	2.27	<0.681	mg/kg	<0.0000681 %		<LOD
	024-017-00-8											
5	copper { dicopper oxide; copper (I) oxide }				28	mg/kg	1.126	31.525	mg/kg	0.00315 %		
	029-002-00-X	215-270-7	1317-39-1									
6	lead { lead chromate }			1	63	mg/kg	1.56	98.268	mg/kg	0.0063 %		
	082-004-00-2	231-846-0	7758-97-6									
7	mercury { mercury dichloride }				0.2	mg/kg	1.353	0.271	mg/kg	0.0000271 %		
	080-010-00-X	231-299-8	7487-94-7									
8	nickel { nickel chromate }				21.9	mg/kg	2.976	65.18	mg/kg	0.00652 %		
	028-035-00-7	238-766-5	14721-18-7									
9	selenium { nickel selenate }				1	mg/kg	2.554	2.554	mg/kg	0.000255 %		
	028-031-00-5	239-125-2	15060-62-5									
10	zinc { zinc chromate }				71	mg/kg	2.774	196.964	mg/kg	0.0197 %		
	024-007-00-3	236-878-9	13530-65-9									
11	pH				8.18	pH		8.18	pH	8.18 pH		
12	naphthalene				0.07	mg/kg		0.07	mg/kg	0.000007 %		
	601-052-00-2	202-049-5	91-20-3									
13	acenaphthylene				0.05	mg/kg		0.05	mg/kg	0.000005 %		
		205-917-1	208-96-8									
14	acenaphthene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9									
15	fluorene				<0.04	mg/kg		<0.04	mg/kg	<0.000004 %		<LOD
		201-695-5	86-73-7									
16	phenanthrene				0.25	mg/kg		0.25	mg/kg	0.000025 %		
		201-581-5	85-01-8									
17	anthracene				0.06	mg/kg		0.06	mg/kg	0.000006 %		
		204-371-1	120-12-7									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
18	fluoranthene	205-912-4	206-44-0		0.45 mg/kg		0.45 mg/kg	0.000045 %		
19	pyrene	204-927-3	129-00-0		0.45 mg/kg		0.45 mg/kg	0.000045 %		
20	benzo[a]anthracene	601-033-00-9	200-280-6		0.25 mg/kg		0.25 mg/kg	0.000025 %		
21	chrysene	601-048-00-0	205-923-4		0.27 mg/kg		0.27 mg/kg	0.000027 %		
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		0.34 mg/kg		0.34 mg/kg	0.000034 %		
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.13 mg/kg		0.13 mg/kg	0.000013 %		
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		0.26 mg/kg		0.26 mg/kg	0.000026 %		
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.21 mg/kg		0.21 mg/kg	0.000021 %		
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
27	benzo[ghi]perylene	205-883-8	191-24-2		0.21 mg/kg		0.21 mg/kg	0.000021 %		
Total:								0.0449 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS102-20/04/2022-0.60m

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS102-20/04/2022-0.60m	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				10.4	mg/kg	1.32	13.731	mg/kg	0.00137 %		
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				0.2	mg/kg	1.142	0.228	mg/kg	0.0000228 %		
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				55	mg/kg	1.462	80.386	mg/kg	0.00804 %		
		215-160-9	1308-38-9									
4	chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.3	mg/kg	2.27	<0.681	mg/kg	<0.0000681 %		<LOD
	024-017-00-8											
5	copper { dicopper oxide; copper (I) oxide }				33	mg/kg	1.126	37.154	mg/kg	0.00372 %		
	029-002-00-X	215-270-7	1317-39-1									
6	lead { lead chromate }			1	69	mg/kg	1.56	107.627	mg/kg	0.0069 %		
	082-004-00-2	231-846-0	7758-97-6									
7	mercury { mercury dichloride }				0.3	mg/kg	1.353	0.406	mg/kg	0.0000406 %		
	080-010-00-X	231-299-8	7487-94-7									
8	nickel { nickel chromate }				18.3	mg/kg	2.976	54.466	mg/kg	0.00545 %		
	028-035-00-7	238-766-5	14721-18-7									
9	selenium { nickel selenate }				1	mg/kg	2.554	2.554	mg/kg	0.000255 %		
	028-031-00-5	239-125-2	15060-62-5									
10	zinc { zinc chromate }				73	mg/kg	2.774	202.513	mg/kg	0.0203 %		
	024-007-00-3	236-878-9	13530-65-9									
11	pH				7.67	pH		7.67	pH	7.67 pH		
12	naphthalene				<0.04	mg/kg		<0.04	mg/kg	<0.000004 %		<LOD
	601-052-00-2	202-049-5	91-20-3									
13	acenaphthylene				0.05	mg/kg		0.05	mg/kg	0.000005 %		
		205-917-1	208-96-8									
14	acenaphthene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9									
15	fluorene				0.05	mg/kg		0.05	mg/kg	0.000005 %		
		201-695-5	86-73-7									
16	phenanthrene				0.41	mg/kg		0.41	mg/kg	0.000041 %		
		201-581-5	85-01-8									
17	anthracene				0.12	mg/kg		0.12	mg/kg	0.000012 %		
		204-371-1	120-12-7									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
18	fluoranthene	205-912-4	206-44-0		0.87 mg/kg		0.87 mg/kg	0.000087 %		
19	pyrene	204-927-3	129-00-0		0.83 mg/kg		0.83 mg/kg	0.000083 %		
20	benzo[a]anthracene	601-033-00-9	200-280-6		0.42 mg/kg		0.42 mg/kg	0.000042 %		
21	chrysene	601-048-00-0	205-923-4		0.45 mg/kg		0.45 mg/kg	0.000045 %		
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		0.56 mg/kg		0.56 mg/kg	0.000056 %		
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.22 mg/kg		0.22 mg/kg	0.000022 %		
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		0.44 mg/kg		0.44 mg/kg	0.000044 %		
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.35 mg/kg		0.35 mg/kg	0.000035 %		
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		0.09 mg/kg		0.09 mg/kg	0.000009 %		
27	benzo[ghi]perylene	205-883-8	191-24-2		0.32 mg/kg		0.32 mg/kg	0.000032 %		
Total:								0.0466 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS103-20/04/2022-0.10m

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name: **WS103-20/04/2022-0.10m** LoW Code: Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				16.3	mg/kg	1.32	21.521	mg/kg	0.00215 %		
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				0.2	mg/kg	1.142	0.228	mg/kg	0.0000228 %		
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				50.7	mg/kg	1.462	74.101	mg/kg	0.00741 %		
		215-160-9	1308-38-9									
4	chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.3	mg/kg	2.27	<0.681	mg/kg	<0.0000681 %		<LOD
	024-017-00-8											
5	copper { dicopper oxide; copper (I) oxide }				44	mg/kg	1.126	49.539	mg/kg	0.00495 %		
	029-002-00-X	215-270-7	1317-39-1									
6	lead { lead chromate }			1	106	mg/kg	1.56	165.34	mg/kg	0.0106 %		
	082-004-00-2	231-846-0	7758-97-6									
7	mercury { mercury dichloride }				0.3	mg/kg	1.353	0.406	mg/kg	0.0000406 %		
	080-010-00-X	231-299-8	7487-94-7									
8	nickel { nickel chromate }				18.7	mg/kg	2.976	55.656	mg/kg	0.00557 %		
	028-035-00-7	238-766-5	14721-18-7									
9	selenium { nickel selenate }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
	028-031-00-5	239-125-2	15060-62-5									
10	zinc { zinc chromate }				72	mg/kg	2.774	199.739	mg/kg	0.02 %		
	024-007-00-3	236-878-9	13530-65-9									
11	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	603-181-00-X	216-653-1	1634-04-4									
12	benzene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-020-00-8	200-753-7	71-43-2									
13	toluene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-021-00-3	203-625-9	108-88-3									
14	ethylbenzene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-023-00-4	202-849-4	100-41-4									
15	xylene				<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		<LOD
	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
16	• pH		PH		6.61 pH		6.61 pH	6.61 pH		
17	naphthalene	601-052-00-2	202-049-5	91-20-3	0.25 mg/kg		0.25 mg/kg	0.000025 %		
18	• acenaphthylene		205-917-1	208-96-8	0.21 mg/kg		0.21 mg/kg	0.000021 %		
19	• acenaphthene		201-469-6	83-32-9	0.1 mg/kg		0.1 mg/kg	0.00001 %		
20	• fluorene		201-695-5	86-73-7	0.22 mg/kg		0.22 mg/kg	0.000022 %		
21	• phenanthrene		201-581-5	85-01-8	1.81 mg/kg		1.81 mg/kg	0.000181 %		
22	• anthracene		204-371-1	120-12-7	0.44 mg/kg		0.44 mg/kg	0.000044 %		
23	• fluoranthene		205-912-4	206-44-0	1.82 mg/kg		1.82 mg/kg	0.000182 %		
24	• pyrene		204-927-3	129-00-0	1.91 mg/kg		1.91 mg/kg	0.000191 %		
25	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	0.86 mg/kg		0.86 mg/kg	0.000086 %		
26	chrysene	601-048-00-0	205-923-4	218-01-9	1.01 mg/kg		1.01 mg/kg	0.000101 %		
27	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	0.94 mg/kg		0.94 mg/kg	0.000094 %		
28	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	0.36 mg/kg		0.36 mg/kg	0.000036 %		
29	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	0.82 mg/kg		0.82 mg/kg	0.000082 %		
30	• indeno[123-cd]pyrene		205-893-2	193-39-5	0.51 mg/kg		0.51 mg/kg	0.000051 %		
31	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	0.12 mg/kg		0.12 mg/kg	0.000012 %		
32	• benzo[ghi]perylene		205-883-8	191-24-2	0.53 mg/kg		0.53 mg/kg	0.000053 %		
33	• polychlorobiphenyls; PCB	602-039-00-4	215-648-1	1336-36-3	<0.035 mg/kg		<0.035 mg/kg	<0.0000035 %		<LOD
34	• coronene		205-881-7	191-07-1	<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
Total:								0.0522 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
-  Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD Below limit of detection
- ND Not detected
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS104-20/04/2022-0.80m

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS104-20/04/2022-0.80m	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				9.9	mg/kg	1.32	13.071	mg/kg	0.00131 %		
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				<0.1	mg/kg	1.142	<0.114	mg/kg	<0.0000114 %		<LOD
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				55.2	mg/kg	1.462	80.678	mg/kg	0.00807 %		
		215-160-9	1308-38-9									
4	chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.3	mg/kg	2.27	<0.681	mg/kg	<0.0000681 %		<LOD
	024-017-00-8											
5	copper { dicopper oxide; copper (I) oxide }				17	mg/kg	1.126	19.14	mg/kg	0.00191 %		
	029-002-00-X	215-270-7	1317-39-1									
6	lead { lead chromate }			1	10	mg/kg	1.56	15.598	mg/kg	0.001 %		
	082-004-00-2	231-846-0	7758-97-6									
7	mercury { mercury dichloride }				0.3	mg/kg	1.353	0.406	mg/kg	0.0000406 %		
	080-010-00-X	231-299-8	7487-94-7									
8	nickel { nickel chromate }				30.6	mg/kg	2.976	91.074	mg/kg	0.00911 %		
	028-035-00-7	238-766-5	14721-18-7									
9	selenium { nickel selenate }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
	028-031-00-5	239-125-2	15060-62-5									
10	zinc { zinc chromate }				46	mg/kg	2.774	127.611	mg/kg	0.0128 %		
	024-007-00-3	236-878-9	13530-65-9									
11	pH				6.51	pH		6.51	pH	6.51 pH		
12	naphthalene				<0.04	mg/kg		<0.04	mg/kg	<0.000004 %		<LOD
	601-052-00-2	202-049-5	91-20-3									
13	acenaphthylene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		<LOD
		205-917-1	208-96-8									
14	acenaphthene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9									
15	fluorene				<0.04	mg/kg		<0.04	mg/kg	<0.000004 %		<LOD
		201-695-5	86-73-7									
16	phenanthrene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		<LOD
		201-581-5	85-01-8									
17	anthracene				<0.04	mg/kg		<0.04	mg/kg	<0.000004 %		<LOD
		204-371-1	120-12-7									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
18	fluoranthene	205-912-4	206-44-0		<0.03 mg/kg		<0.03 mg/kg	<0.000003 %		<LOD
19	pyrene	204-927-3	129-00-0		<0.03 mg/kg		<0.03 mg/kg	<0.000003 %		<LOD
20	benzo[a]anthracene	601-033-00-9	200-280-6		<0.06 mg/kg		<0.06 mg/kg	<0.000006 %		<LOD
21	chrysene	601-048-00-0	205-923-4		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %		<LOD
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %		<LOD
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
25	indeno[123-cd]pyrene	205-893-2	193-39-5		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
27	benzo[ghi]perylene	205-883-8	191-24-2		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
Total:								0.0346 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS105-20/04/2022-0.50m

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS105-20/04/2022-0.50m	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				12.5	mg/kg	1.32	16.504	mg/kg	0.00165 %		
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				0.2	mg/kg	1.142	0.228	mg/kg	0.0000228 %		
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				54.5	mg/kg	1.462	79.655	mg/kg	0.00797 %		
		215-160-9	1308-38-9									
4	chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.3	mg/kg	2.27	<0.681	mg/kg	<0.0000681 %		<LOD
	024-017-00-8											
5	copper { dicopper oxide; copper (I) oxide }				39	mg/kg	1.126	43.91	mg/kg	0.00439 %		
	029-002-00-X	215-270-7	1317-39-1									
6	lead { lead chromate }			1	91	mg/kg	1.56	141.943	mg/kg	0.0091 %		
	082-004-00-2	231-846-0	7758-97-6									
7	mercury { mercury dichloride }				0.4	mg/kg	1.353	0.541	mg/kg	0.0000541 %		
	080-010-00-X	231-299-8	7487-94-7									
8	nickel { nickel chromate }				17.7	mg/kg	2.976	52.68	mg/kg	0.00527 %		
	028-035-00-7	238-766-5	14721-18-7									
9	selenium { nickel selenate }				1	mg/kg	2.554	2.554	mg/kg	0.000255 %		
	028-031-00-5	239-125-2	15060-62-5									
10	zinc { zinc chromate }				75	mg/kg	2.774	208.061	mg/kg	0.0208 %		
	024-007-00-3	236-878-9	13530-65-9									
11	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	603-181-00-X	216-653-1	1634-04-4									
12	benzene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-020-00-8	200-753-7	71-43-2									
13	toluene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-021-00-3	203-625-9	108-88-3									
14	ethylbenzene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-023-00-4	202-849-4	100-41-4									
15	xylene				<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		<LOD
	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
16	• pH		PH		7.25 pH		7.25 pH	7.25 pH		
17	naphthalene	601-052-00-2	202-049-5	91-20-3	0.05 mg/kg		0.05 mg/kg	0.000005 %		
18	• acenaphthylene		205-917-1	208-96-8	0.1 mg/kg		0.1 mg/kg	0.00001 %		
19	• acenaphthene		201-469-6	83-32-9	<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
20	• fluorene		201-695-5	86-73-7	0.06 mg/kg		0.06 mg/kg	0.000006 %		
21	• phenanthrene		201-581-5	85-01-8	0.67 mg/kg		0.67 mg/kg	0.000067 %		
22	• anthracene		204-371-1	120-12-7	0.2 mg/kg		0.2 mg/kg	0.00002 %		
23	• fluoranthene		205-912-4	206-44-0	1.09 mg/kg		1.09 mg/kg	0.000109 %		
24	• pyrene		204-927-3	129-00-0	1.1 mg/kg		1.1 mg/kg	0.00011 %		
25	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	0.61 mg/kg		0.61 mg/kg	0.000061 %		
26	chrysene	601-048-00-0	205-923-4	218-01-9	0.59 mg/kg		0.59 mg/kg	0.000059 %		
27	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	0.73 mg/kg		0.73 mg/kg	0.000073 %		
28	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	0.29 mg/kg		0.29 mg/kg	0.000029 %		
29	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	0.61 mg/kg		0.61 mg/kg	0.000061 %		
30	• indeno[123-cd]pyrene		205-893-2	193-39-5	0.42 mg/kg		0.42 mg/kg	0.000042 %		
31	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	0.1 mg/kg		0.1 mg/kg	0.00001 %		
32	• benzo[ghi]perylene		205-883-8	191-24-2	0.43 mg/kg		0.43 mg/kg	0.000043 %		
33	• polychlorobiphenyls; PCB	602-039-00-4	215-648-1	1336-36-3	<0.035 mg/kg		<0.035 mg/kg	<0.0000035 %		<LOD
34	• coronene		205-881-7	191-07-1	<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
Total:								0.0503 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
-  Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD Below limit of detection
- ND Not detected
- CLP: Note 1 Only the metal concentration has been used for classification

Appendix A: Classifier defined and non GB MCL determinands

■ chromium(III) oxide (worst case) (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database

Data source: <https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806>

Data source date: 17 Jul 2015

Hazard Statements: Acute Tox. 4; H332 , Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Resp. Sens. 1; H334 , Skin Sens. 1; H317 , Repr. 1B; H360FD , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ pH (CAS Number: PH)

Description/Comments: Appendix C4

Data source: WM3 1st Edition 2015

Data source date: 25 May 2015

Hazard Statements: None.

■ acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Acute Tox. 4; H302 , Acute Tox. 1; H330 , Acute Tox. 1; H310 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315

■ acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Aquatic Chronic 2; H411

■ fluorene (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ phenanthrene (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

■ anthracene (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ fluoranthene (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 21 Aug 2015

Hazard Statements: Acute Tox. 4; H302 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ pyrene (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 21 Aug 2015

Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ indeno[123-cd]pyrene (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Carc. 2; H351

▪ **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 23 Jul 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

▪ **ethylbenzene** (EC Number: 202-849-4, CAS Number: 100-41-4)

GB MCL index number: 601-023-00-4
Description/Comments:
Additional Hazard Statement(s): Carc. 2; H351
Reason for additional Hazards Statement(s):
20 Nov 2021 - Carc. 2; H351 hazard statement sourced from: IARC Group 2B (77) 2000

▪ **polychlorobiphenyls; PCB** (EC Number: 215-648-1, CAS Number: 1336-36-3)

GB MCL index number: 602-039-00-4
Description/Comments: Worst Case: IARC considers PCB Group 1; Carcinogenic to humans; POP specific threshold from ATP1 (Regulation 756/2010/EU) to POPs Regulation (Regulation 850/2004/EC). Where applicable, the calculation method laid down in European standards EN 12766-1 and EN 12766-2 shall be applied.
Additional Hazard Statement(s): Carc. 1A; H350
Reason for additional Hazards Statement(s):
20 Nov 2021 - Carc. 1A; H350 hazard statement sourced from: IARC Group 1 (23, Sup 7, 100C) 2012

▪ **coronene** (EC Number: 205-881-7, CAS Number: 191-07-1)

Description/Comments: Data from C&L Inventory Database; no entries in Registered Substances or Pesticides Properties databases; SDS: Sigma Aldrich, 1907/2006 compliant, dated 2012 - no entries; IARC – Group 3, not carcinogenic.
Data source: <http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=17010&HarmOnly=no?fc=true&lang=en>
Data source date: 16 Jun 2014
Hazard Statements: STOT SE 2; H371

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Reasonable case CLP species based on hazard statements/molecular weight and most common (stable) oxide of arsenic. Industrial sources include: smelting; main precursor to other arsenic compounds (edit as required)

cadmium {cadmium oxide}

Reasonable case CLP species based on hazard statements/molecular weight, very low solubility in water. Industrial sources include: electroplating baths, electrodes for storage batteries, catalysts, ceramic glazes, phosphors, pigments and nematocides. (edit as required) Worst case compounds in CLP: cadmium sulphate, chloride, fluoride & iodide not expected as either very soluble and/or compound's industrial usage not related to site history (edit as required)

chromium in chromium(III) compounds {chromium(III) oxide (worst case)}

Reasonable case species based on hazard statements/molecular weight. Industrial sources include: tanning, pigment in paint, inks and glass (edit as required)

chromium in chromium(VI) compounds {chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex}

Worst case species based on hazard statements/molecular weight (edit as required)

copper {dicopper oxide; copper (I) oxide}

Reasonable case CLP species based on hazard statements/molecular weight and insolubility in water. Industrial sources include: oxidised copper metal, brake pads, pigments, antifouling paints, fungicide. (edit as required) Worst case copper sulphate is very soluble and likely to have been leached away if ever present and/or not enough soluble sulphate detected. (edit as required)

lead {lead chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

mercury {mercury dichloride}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

nickel {nickel chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

selenium {nickel selenate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

zinc {zinc chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)



Appendix C: Version

HazWasteOnline Classification Engine: **WM3 1st Edition v1.2.GB - Oct 2021**
HazWasteOnline Classification Engine Version: 2022.103.5089.9622 (13 Apr 2022)
HazWasteOnline Database: 2022.103.5089.9622 (13 Apr 2022)

This classification utilises the following guidance and legislation:

WM3 v1.2.GB - Waste Classification - 1st Edition v1.2.GB - Oct 2021

CLP Regulation - Regulation 1272/2008/EC of 16 December 2008

1st ATP - Regulation 790/2009/EC of 10 August 2009

2nd ATP - Regulation 286/2011/EC of 10 March 2011

3rd ATP - Regulation 618/2012/EU of 10 July 2012

4th ATP - Regulation 487/2013/EU of 8 May 2013

Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013

5th ATP - Regulation 944/2013/EU of 2 October 2013

6th ATP - Regulation 605/2014/EU of 5 June 2014

WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014

Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014

7th ATP - Regulation 2015/1221/EU of 24 July 2015

8th ATP - Regulation (EU) 2016/918 of 19 May 2016

9th ATP - Regulation (EU) 2016/1179 of 19 July 2016

10th ATP - Regulation (EU) 2017/776 of 4 May 2017

HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017

13th ATP - Regulation (EU) 2018/1480 of 4 October 2018

14th ATP - Regulation (EU) 2020/217 of 4 October 2019

15th ATP - Regulation (EU) 2020/1182 of 19 May 2020

The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit)

Regulations 2020 - UK: 2020 No. 1567 of 16th December 2020

The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1540 of 16th December 2020

GB MCL List - version 1.1 of 09 June 2021



Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

- understand the origin of the waste
- select the correct List of Waste code(s)
- confirm that the list of determinands, results and sampling plan are fit for purpose
- select and justify the chosen metal species (Appendix B)
- correctly apply moisture correction and other available corrections
- add the meta data for their user-defined substances (Appendix A)
- check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)



P757A-BEZEN-614IS

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in **pale yellow**.

Job name

EMT-22-6655-Batch-1-202205051511

Description/Comments

Project

TE1604

Site

Moss Nook, Heald Green

Classified by

Name: **Adrian Read**
Date: **16 May 2022 10:02 GMT**
Telephone: **01925 818388**

Company: **Tier Environmental**
Chadwick house
Warrington Road,

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification:

CERTIFIED

Course

Hazardous Waste Classification

Date

03 Dec 2020

Next 3 year Refresher due by Dec 2023

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	TP104-21/04/2022-0.60m		Non Hazardous		2
2	TP105-21/04/2022-0.10m		Non Hazardous		4
3	TP106-21/04/2022-0.20m		Non Hazardous		6

Related documents

#	Name	Description
1	EMT-22-6655-Batch-1-202205051511.HWOL	.hwol file used to create the Job
2	Example waste stream template for contaminated soils	waste stream template used to create this Job

Report

Created by: Adrian Read

Created date: 16 May 2022 10:02 GMT

Appendices

	Page
Appendix A: Classifier defined and non GB MCL determinands	8
Appendix B: Rationale for selection of metal species	9
Appendix C: Version	9

Classification of sample: TP104-21/04/2022-0.60m

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
TP104-21/04/2022-0.60m	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				4.6	mg/kg	1.32	6.073	mg/kg	0.000607 %		
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				<0.1	mg/kg	1.142	<0.114	mg/kg	<0.0000114 %		<LOD
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				44.6	mg/kg	1.462	65.185	mg/kg	0.00652 %		
		215-160-9	1308-38-9									
4	chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.3	mg/kg	2.27	<0.681	mg/kg	<0.0000681 %		<LOD
	024-017-00-8											
5	copper { dicopper oxide; copper (I) oxide }				8	mg/kg	1.126	9.007	mg/kg	0.000901 %		
	029-002-00-X	215-270-7	1317-39-1									
6	lead { lead chromate }			1	8	mg/kg	1.56	12.479	mg/kg	0.0008 %		
	082-004-00-2	231-846-0	7758-97-6									
7	mercury { mercury dichloride }				<0.1	mg/kg	1.353	<0.135	mg/kg	<0.0000135 %		<LOD
	080-010-00-X	231-299-8	7487-94-7									
8	nickel { nickel chromate }				16.6	mg/kg	2.976	49.406	mg/kg	0.00494 %		
	028-035-00-7	238-766-5	14721-18-7									
9	selenium { nickel selenate }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
	028-031-00-5	239-125-2	15060-62-5									
10	zinc { zinc chromate }				25	mg/kg	2.774	69.354	mg/kg	0.00694 %		
	024-007-00-3	236-878-9	13530-65-9									
11	pH				6.53	pH		6.53	pH	6.53 pH		
			PH									
12	naphthalene				<0.04	mg/kg		<0.04	mg/kg	<0.000004 %		<LOD
	601-052-00-2	202-049-5	91-20-3									
13	acenaphthylene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		<LOD
		205-917-1	208-96-8									
14	acenaphthene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9									
15	fluorene				<0.04	mg/kg		<0.04	mg/kg	<0.000004 %		<LOD
		201-695-5	86-73-7									
16	phenanthrene				<0.03	mg/kg		<0.03	mg/kg	<0.000003 %		<LOD
		201-581-5	85-01-8									
17	anthracene				<0.04	mg/kg		<0.04	mg/kg	<0.000004 %		<LOD
		204-371-1	120-12-7									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
18	fluoranthene	205-912-4	206-44-0		<0.03 mg/kg		<0.03 mg/kg	<0.000003 %		<LOD
19	pyrene	204-927-3	129-00-0		<0.03 mg/kg		<0.03 mg/kg	<0.000003 %		<LOD
20	benzo[a]anthracene	601-033-00-9	200-280-6		<0.06 mg/kg		<0.06 mg/kg	<0.000006 %		<LOD
21	chrysene	601-048-00-0	205-923-4		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %		<LOD
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %		<LOD
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
25	indeno[123-cd]pyrene	205-893-2	193-39-5		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
27	benzo[ghi]perylene	205-883-8	191-24-2		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %		<LOD
Total:								0.0211 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: TP105-21/04/2022-0.10m

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
TP105-21/04/2022-0.10m	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	 arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3	20.6	mg/kg	1.32	27.199	mg/kg	0.00272 %		
2	 cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0								
3	 chromium in chromium(III) compounds { chromium(III) oxide (worst case) }	215-160-9	1308-38-9		53.8	mg/kg	1.462	78.632	mg/kg	0.00786 %		
4	 chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }	024-017-00-8										
5	 copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1	69	mg/kg	1.126	77.686	mg/kg	0.00777 %		
6	 lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6								
7	 mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7	0.7	mg/kg	1.353	0.947	mg/kg	0.0000947 %		
8	 nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7								
9	 selenium { nickel selenate }	028-031-00-5	239-125-2	15060-62-5	1	mg/kg	2.554	2.554	mg/kg	0.000255 %		
10	 zinc { zinc chromate }	024-007-00-3	236-878-9	13530-65-9								
11	 pH		PH		6.34	pH		6.34	pH	6.34 pH		
12	naphthalene	601-052-00-2	202-049-5	91-20-3								
13	 acenaphthylene	205-917-1	208-96-8		0.22	mg/kg		0.22	mg/kg	0.000022 %		
14	 acenaphthene	201-469-6	83-32-9									
15	 fluorene	201-695-5	86-73-7		0.27	mg/kg		0.27	mg/kg	0.000027 %		
16	 phenanthrene	201-581-5	85-01-8									
17	 anthracene	204-371-1	120-12-7		0.57	mg/kg		0.57	mg/kg	0.000057 %		

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
18	fluoranthene	205-912-4	206-44-0		2.21 mg/kg		2.21 mg/kg	0.000221 %		
19	pyrene	204-927-3	129-00-0		2.25 mg/kg		2.25 mg/kg	0.000225 %		
20	benzo[a]anthracene	601-033-00-9	200-280-6		1.26 mg/kg		1.26 mg/kg	0.000126 %		
21	chrysene	601-048-00-0	205-923-4		1.16 mg/kg		1.16 mg/kg	0.000116 %		
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		1.16 mg/kg		1.16 mg/kg	0.000116 %		
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.45 mg/kg		0.45 mg/kg	0.000045 %		
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		0.99 mg/kg		0.99 mg/kg	0.000099 %		
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.57 mg/kg		0.57 mg/kg	0.000057 %		
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		0.17 mg/kg		0.17 mg/kg	0.000017 %		
27	benzo[ghi]perylene	205-883-8	191-24-2		0.62 mg/kg		0.62 mg/kg	0.000062 %		
Total:								0.0671 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: TP106-21/04/2022-0.20m

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name: **TP106-21/04/2022-0.20m** LoW Code: Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3	15.8	mg/kg	1.32	20.861	mg/kg	0.00209 %		
2	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0	0.2	mg/kg	1.142	0.228	mg/kg	0.0000228 %		
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }	215-160-9	1308-38-9		50.9	mg/kg	1.462	74.393	mg/kg	0.00744 %		
4	chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }	024-017-00-8			<0.3	mg/kg	2.27	<0.681	mg/kg	<0.0000681 %		<LOD
5	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1	45	mg/kg	1.126	50.665	mg/kg	0.00507 %		
6	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	108	mg/kg	1.56	168.46	mg/kg	0.0108 %		
7	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7	0.5	mg/kg	1.353	0.677	mg/kg	0.0000677 %		
8	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7	19.4	mg/kg	2.976	57.74	mg/kg	0.00577 %		
9	selenium { nickel selenate }	028-031-00-5	239-125-2	15060-62-5	1	mg/kg	2.554	2.554	mg/kg	0.000255 %		
10	zinc { zinc chromate }	024-007-00-3	236-878-9	13530-65-9	99	mg/kg	2.774	274.641	mg/kg	0.0275 %		
11	pH		PH		7.03	pH		7.03	pH	7.03 pH		
12	naphthalene	601-052-00-2	202-049-5	91-20-3	0.17	mg/kg		0.17	mg/kg	0.000017 %		
13	acenaphthylene	205-917-1	208-96-8		0.2	mg/kg		0.2	mg/kg	0.00002 %		
14	acenaphthene	201-469-6	83-32-9		0.15	mg/kg		0.15	mg/kg	0.000015 %		
15	fluorene	201-695-5	86-73-7		0.22	mg/kg		0.22	mg/kg	0.000022 %		
16	phenanthrene	201-581-5	85-01-8		1.91	mg/kg		1.91	mg/kg	0.000191 %		
17	anthracene	204-371-1	120-12-7		0.5	mg/kg		0.5	mg/kg	0.00005 %		

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
18	fluoranthene	205-912-4	206-44-0		2.09 mg/kg		2.09 mg/kg	0.000209 %		
19	pyrene	204-927-3	129-00-0		2.2 mg/kg		2.2 mg/kg	0.00022 %		
20	benzo[a]anthracene	601-033-00-9	200-280-6		1.12 mg/kg		1.12 mg/kg	0.000112 %		
21	chrysene	601-048-00-0	205-923-4		1.15 mg/kg		1.15 mg/kg	0.000115 %		
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		1.13 mg/kg		1.13 mg/kg	0.000113 %		
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.44 mg/kg		0.44 mg/kg	0.000044 %		
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		0.98 mg/kg		0.98 mg/kg	0.000098 %		
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.64 mg/kg		0.64 mg/kg	0.000064 %		
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		0.17 mg/kg		0.17 mg/kg	0.000017 %		
27	benzo[ghi]perylene	205-883-8	191-24-2		0.67 mg/kg		0.67 mg/kg	0.000067 %		
Total:								0.0604 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Appendix A: Classifier defined and non GB MCL determinands

■ chromium(III) oxide (worst case) (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database

Data source: <https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806>

Data source date: 17 Jul 2015

Hazard Statements: Acute Tox. 4; H332 , Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Resp. Sens. 1; H334 , Skin Sens. 1; H317 , Repr. 1B; H360FD , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ pH (CAS Number: PH)

Description/Comments: Appendix C4

Data source: WM3 1st Edition 2015

Data source date: 25 May 2015

Hazard Statements: None.

■ acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Acute Tox. 4; H302 , Acute Tox. 1; H330 , Acute Tox. 1; H310 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315

■ acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Aquatic Chronic 2; H411

■ fluorene (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ phenanthrene (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

■ anthracene (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ fluoranthene (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 21 Aug 2015

Hazard Statements: Acute Tox. 4; H302 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ pyrene (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 21 Aug 2015

Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ indeno[123-cd]pyrene (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Carc. 2; H351

▪ **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 23 Jul 2015

Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Reasonable case CLP species based on hazard statements/molecular weight and most common (stable) oxide of arsenic. Industrial sources include: smelting; main precursor to other arsenic compounds (edit as required)

cadmium {cadmium oxide}

Reasonable case CLP species based on hazard statements/molecular weight, very low solubility in water. Industrial sources include: electroplating baths, electrodes for storage batteries, catalysts, ceramic glazes, phosphors, pigments and nematocides. (edit as required) Worst case compounds in CLP: cadmium sulphate, chloride, fluoride & iodide not expected as either very soluble and/or compound's industrial usage not related to site history (edit as required)

chromium in chromium(III) compounds {chromium(III) oxide (worst case)}

Reasonable case species based on hazard statements/molecular weight. Industrial sources include: tanning, pigment in paint, inks and glass (edit as required)

chromium in chromium(VI) compounds {chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex}

Worst case species based on hazard statements/molecular weight (edit as required)

copper {dicopper oxide; copper (I) oxide}

Reasonable case CLP species based on hazard statements/molecular weight and insolubility in water. Industrial sources include: oxidised copper metal, brake pads, pigments, antifouling paints, fungicide. (edit as required) Worse case copper sulphate is very soluble and likely to have been leached away if ever present and/or not enough soluble sulphate detected. (edit as required)

lead {lead chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

mercury {mercury dichloride}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

nickel {nickel chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

selenium {nickel selenate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

zinc {zinc chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition v1.2.GB - Oct 2021

HazWasteOnline Classification Engine Version: 2022.103.5089.9622 (13 Apr 2022)

HazWasteOnline Database: 2022.103.5089.9622 (13 Apr 2022)



This classification utilises the following guidance and legislation:

WM3 v1.2.GB - Waste Classification - 1st Edition v1.2.GB - Oct 2021

CLP Regulation - Regulation 1272/2008/EC of 16 December 2008

1st ATP - Regulation 790/2009/EC of 10 August 2009

2nd ATP - Regulation 286/2011/EC of 10 March 2011

3rd ATP - Regulation 618/2012/EU of 10 July 2012

4th ATP - Regulation 487/2013/EU of 8 May 2013

Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013

5th ATP - Regulation 944/2013/EU of 2 October 2013

6th ATP - Regulation 605/2014/EU of 5 June 2014

WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014

Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014

7th ATP - Regulation 2015/1221/EU of 24 July 2015

8th ATP - Regulation (EU) 2016/918 of 19 May 2016

9th ATP - Regulation (EU) 2016/1179 of 19 July 2016

10th ATP - Regulation (EU) 2017/776 of 4 May 2017

HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017

13th ATP - Regulation (EU) 2018/1480 of 4 October 2018

14th ATP - Regulation (EU) 2020/217 of 4 October 2019

15th ATP - Regulation (EU) 2020/1182 of 19 May 2020

The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit)

Regulations 2020 - UK: 2020 No. 1567 of 16th December 2020

The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK:

2020 No. 1540 of 16th December 2020

GB MCL List - version 1.1 of 09 June 2021

APPENDIX D - GEOENVIRONMENTAL GROUNDWATER LABORATORY RESULTS

APPENDIX E - GEOTECHNICAL IN SITU FIELDWORK AND LABORATORY RESULTS

TEST REPORT

Client Tier Environmental Ltd

Address Suite 513
Chadwick House
Warrington Road
Birchwood
WA3 6AE

Contract TE1604 -
Moss Nook, Heald Green

Job Number MRN 4346/23

Date of Issue 13 May 2022

Pages 1 of 5

Approved Signatories

S J Hutchings, O P Davies

Notes

- 1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.
- 2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.
- 3 Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation.
- 4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted.
- 5 The results included within the report are representative of the samples submitted for analysis.
- 6 This certificate should not be reproduced, except in full, without the express permission of the laboratory.

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870 FAX 0161 475 0871



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

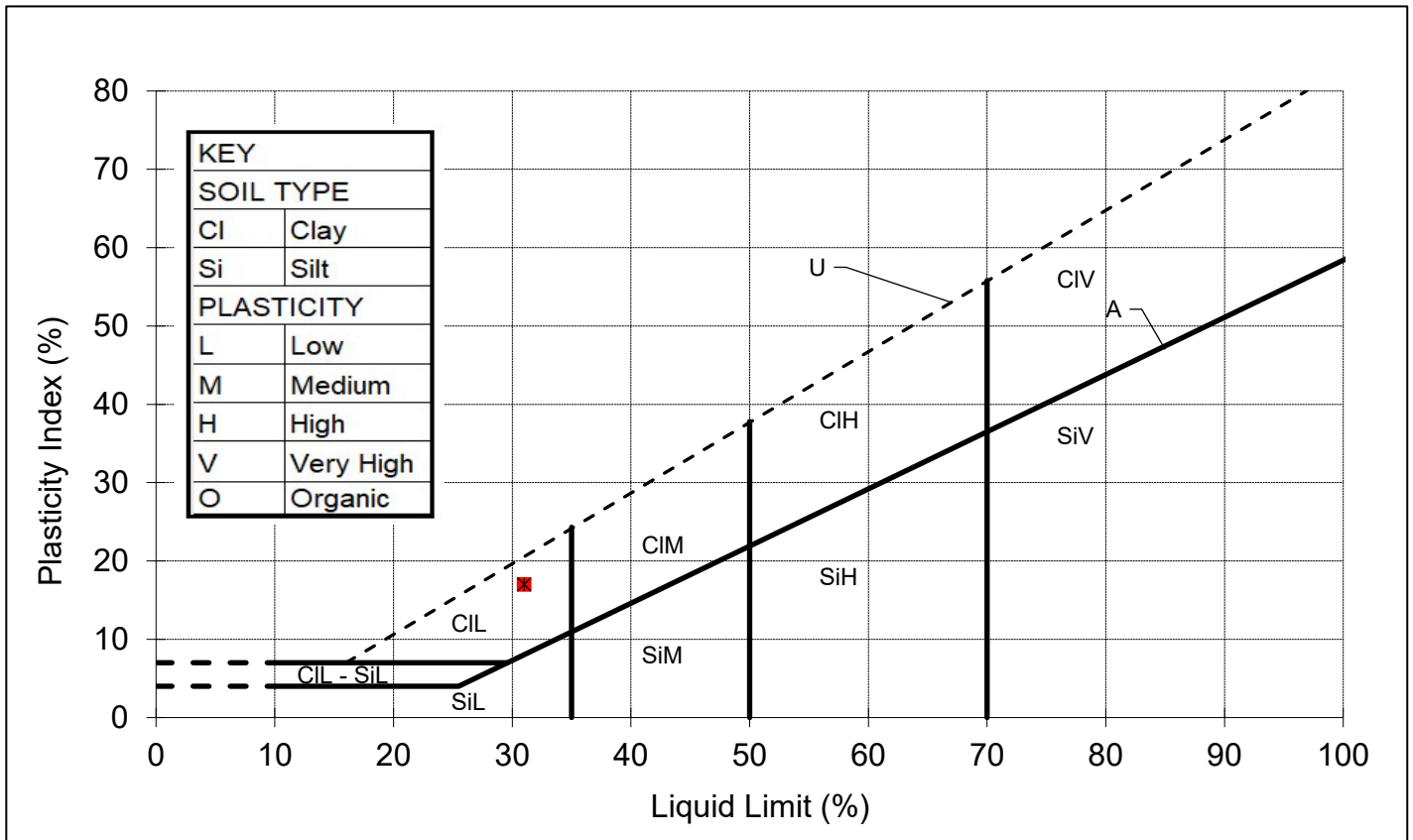
BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Tier Environmental Ltd
SITE	TE1604 - Moss Nook, Heald Green
JOB NUMBER	MRN 4346/23

SAMPLE LABEL	WS101 1.2	DATE SAMPLED	Not advised
SAMPLE No.	111611	DATE RECEIVED	26-Apr-22
DATE TESTED	29-Apr-22	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
12	31	14	17	82



REMARKS

Sample tested after wet sieving

SIGNED

NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

13-May-22

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870 FAX 0161 475 0871



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

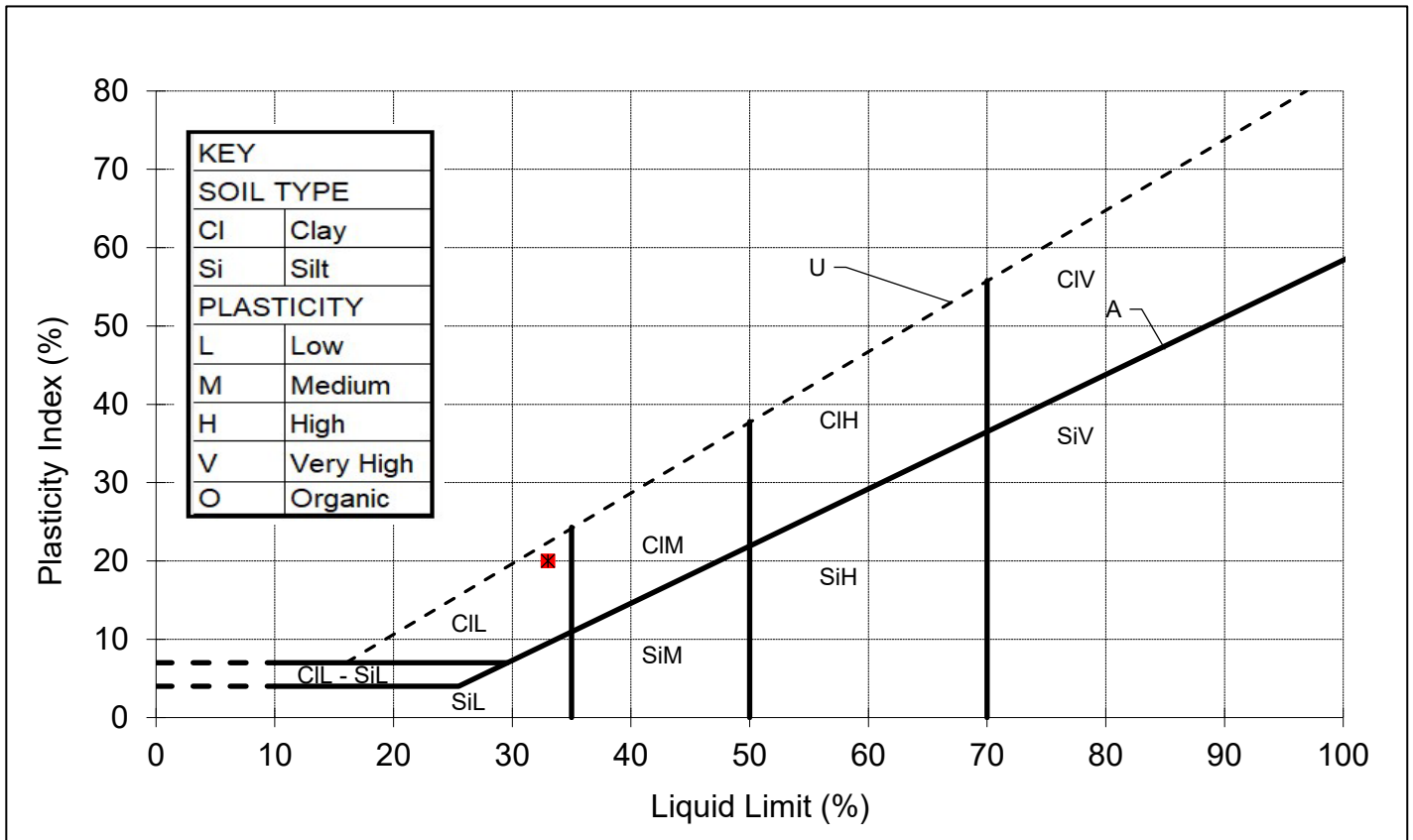
BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Tier Environmental Ltd
SITE	TE1604 - Moss Nook, Heald Green
JOB NUMBER	MRN 4346/23

SAMPLE LABEL	WS102 2	DATE SAMPLED	Not advised
SAMPLE No.	111617	DATE RECEIVED	26-Apr-22
DATE TESTED	29-Apr-22	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
13	33	13	20	80



REMARKS

Sample tested after wet sieving

SIGNED

NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

13-May-22

TEST CERTIFICATE

PARTICLE SIZE DISTRIBUTION

BS 1377: PART 2: Clause 9.2: 1990

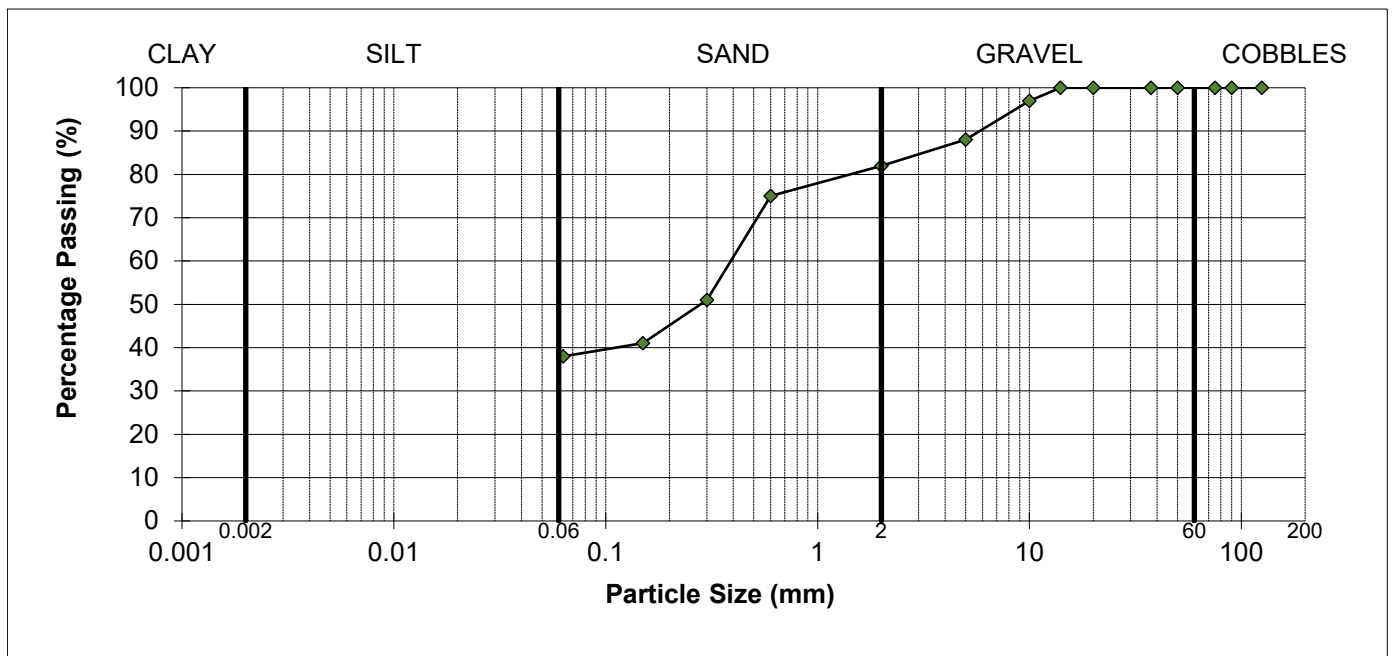
Determination of Moisture Content in accordance with BS 1377: PART 2: Clause 3: 1990 (Oven Dry)

CLIENT	Tier Environmental Ltd
SITE	TE1604 - Moss Nook, Heald Green
JOB NUMBER	MRN 4346/23

SAMPLE LABEL	TP103 0.9	DATE SAMPLED	Not advised
LAB SAMPLE No	111549	DATE RECEIVED	22-Apr-22
DATE TESTED	29-Apr-22	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with occasional gravel
ADVISED SOURCE	Site Investigation Sample

Sieve Size (mm)	% Passing (%)	Specification (%)	Sieve Size (mm)	% Passing (%)	Specification (%)
125	100		10	97	
90	100		5	88	
75	100		2	82	
50	100		0.6	75	
37.5	100		0.3	51	
20	100		0.15	41	
14	100		0.063	38	



REMARKS

SIGNED



NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

13-May-22

TEST CERTIFICATE

PARTICLE SIZE DISTRIBUTION

BS 1377: PART 2: Clause 9.2: 1990

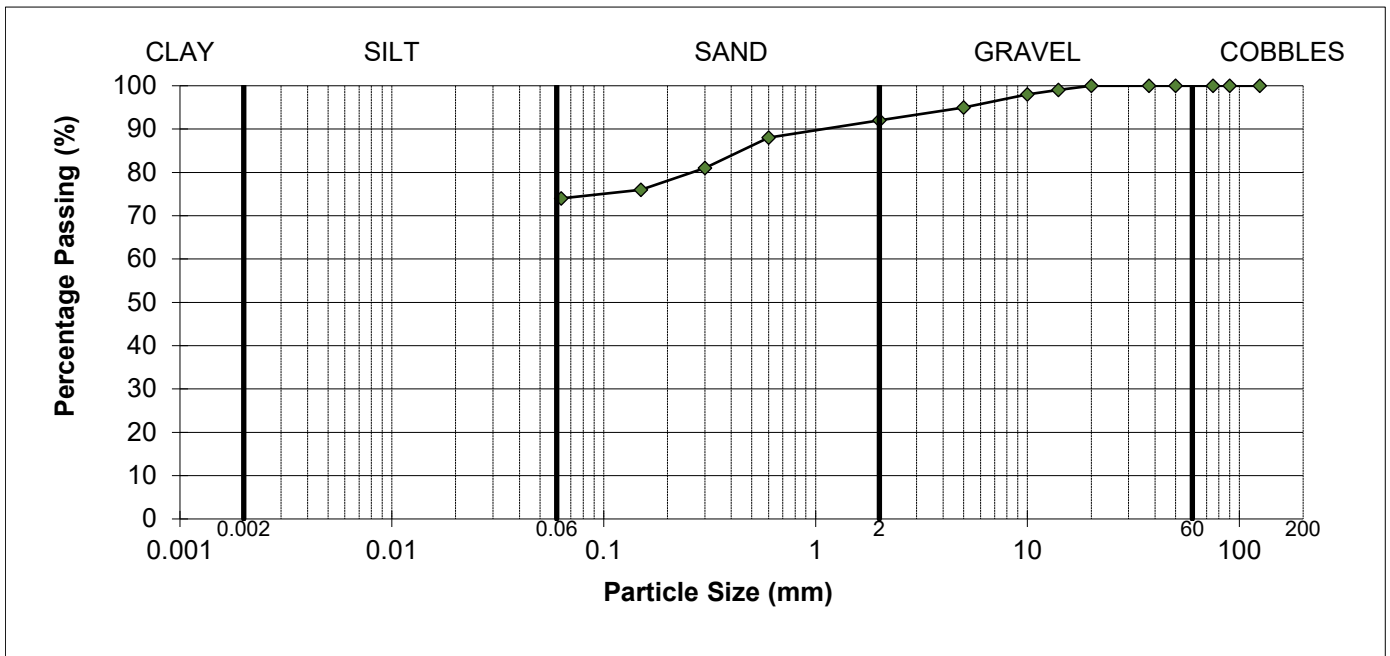
Determination of Moisture Content in accordance with BS 1377: PART 2: Clause 3: 1990 (Oven Dry)

CLIENT	Tier Environmental Ltd
SITE	TE1604 - Moss Nook, Heald Green
JOB NUMBER	MRN 4346/23

SAMPLE LABEL	TP105 1.00	DATE SAMPLED	Not advised
LAB SAMPLE No	111551	DATE RECEIVED	22-Apr-22
DATE TESTED	29-Apr-22	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Sieve Size (mm)	% Passing (%)	Specification (%)	Sieve Size (mm)	% Passing (%)	Specification (%)
125	100		10	98	
90	100		5	95	
75	100		2	92	
50	100		0.6	88	
37.5	100		0.3	81	
20	100		0.15	76	
14	99		0.063	74	



REMARKS

SIGNED



NAME

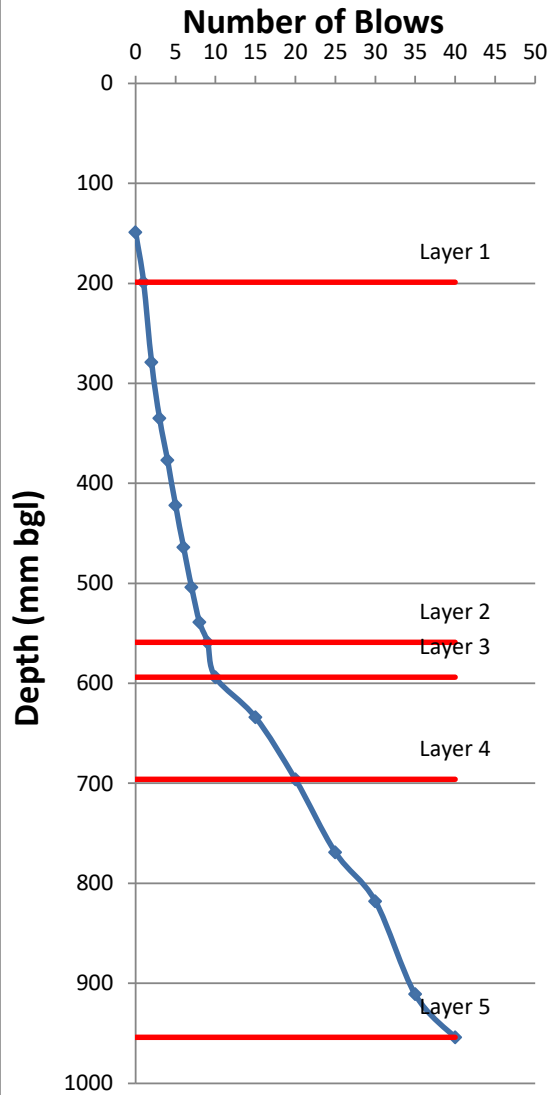
O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

13-May-22

DYNAMIC CONE PENETROMETER RECORD SHEET

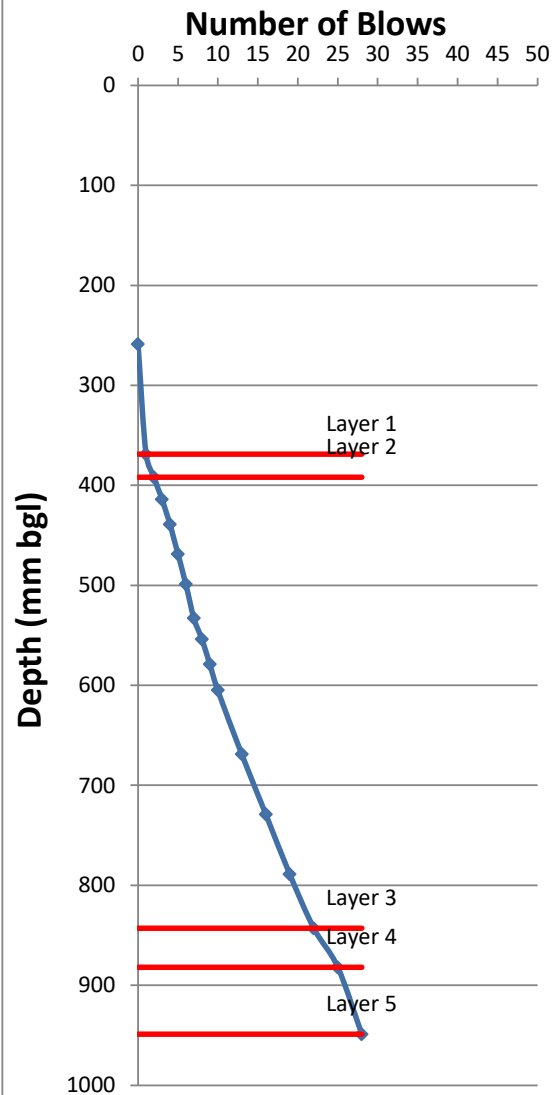
JOB DETAILS	
Job No:	TE1604
Site:	Moss Nook
Location	DCP1
Test Date	04.05.2022
Zero Error mm	1
Cone Angle	60
Layers Removed	0

[illegible]

Based on the Kleyn and Van Heerden Model					
Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	149	199	1	50.00	2.92
2	199	559	9	45.00	3.34
3	559	594	10	35.00	4.60
4	594	696	20	10.20	22.08
5	696	954	40	12.90	16.38

DYNAMIC CONE PENETROMETER RECORD SHEET

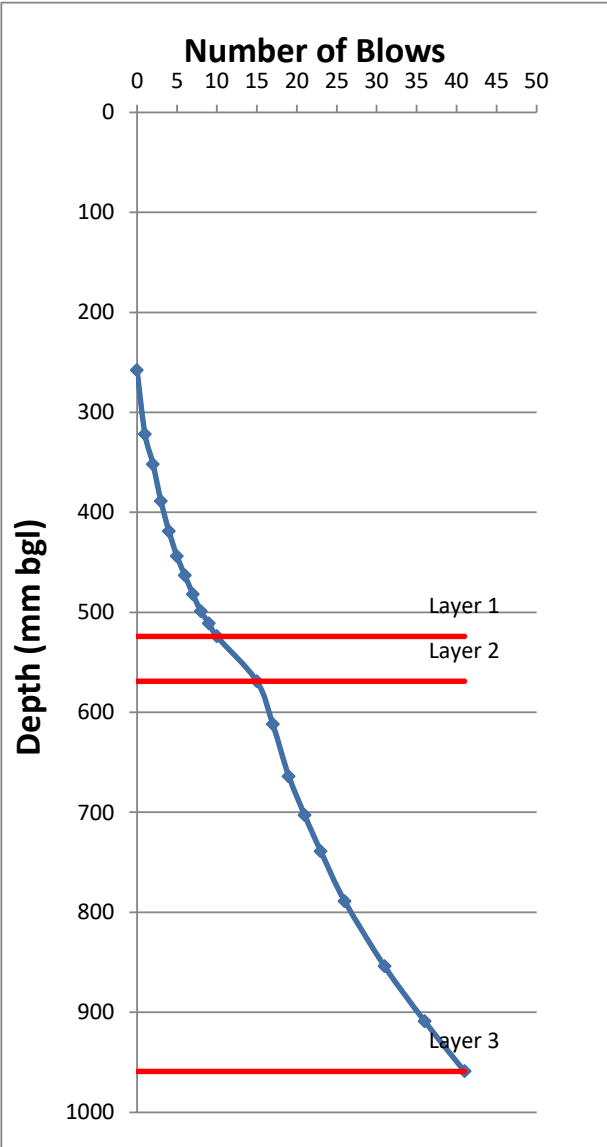
JOB DETAILS	
Job No:	TE1604
Site:	Moss Nook
Location	DCP2
Test Date	04.05.2022
Zero Error mm	1
Cone Angle	60
Layers Removed	0

[illegible]

Based on the Kleyn and Van Heerden Model					
Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	259	369	1	110.00	1.07
2	369	392	2	23.00	7.84
3	392	843	22	22.55	8.04
4	843	882	25	13.00	16.22
5	882	949	28	22.33	8.14

DYNAMIC CONE PENETROMETER RECORD SHEET

JOB DETAILS	
Job No:	TE1604
Site:	Moss Nook
Location	DCP3
Test Date	04.05.2022
Zero Error mm	1
Cone Angle	60
Layers Removed	0

[illegible]

Based on the Kleyn and Van Heerden Model					
Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	258	524	10	26.60	6.52
2	524	569	15	9.00	25.90
3	569	959	41	15.00	13.52
4	959				
5					

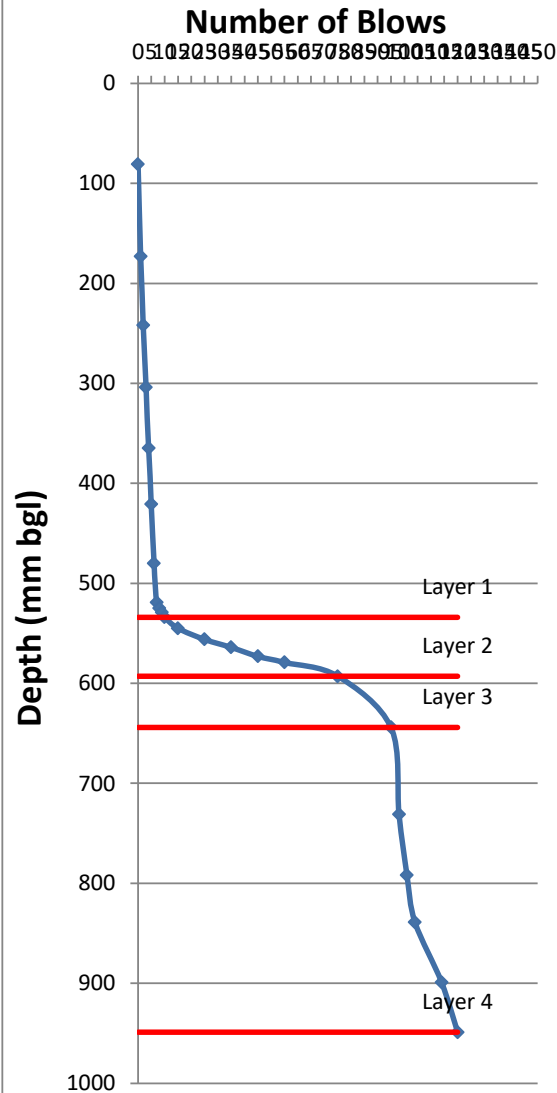
DYNAMIC CONE PENETROMETER RECORD SHEET

JOB DETAILS

Job No:	TE1604
Site:	Moss Nook
Location	DCP4
Test Date	04.05.2022
Zero Error mm	1
Cone Angle	60
Layers Removed	0



No of Blows (Cumulative)	Height (mm)	Depth (mm bgl)
0	82	81
1	174	173
2	243	242
3	305	304
4	366	365
5	422	421
6	481	480
7	520	519
8	526	525
9	530	529
10	535	534
15	546	545
25	557	556
35	565	564
45	574	573
55	580	579
75	594	593
95	645	644
98	732	731
101	793	792
104	840	839
114	900	899
120	950	949

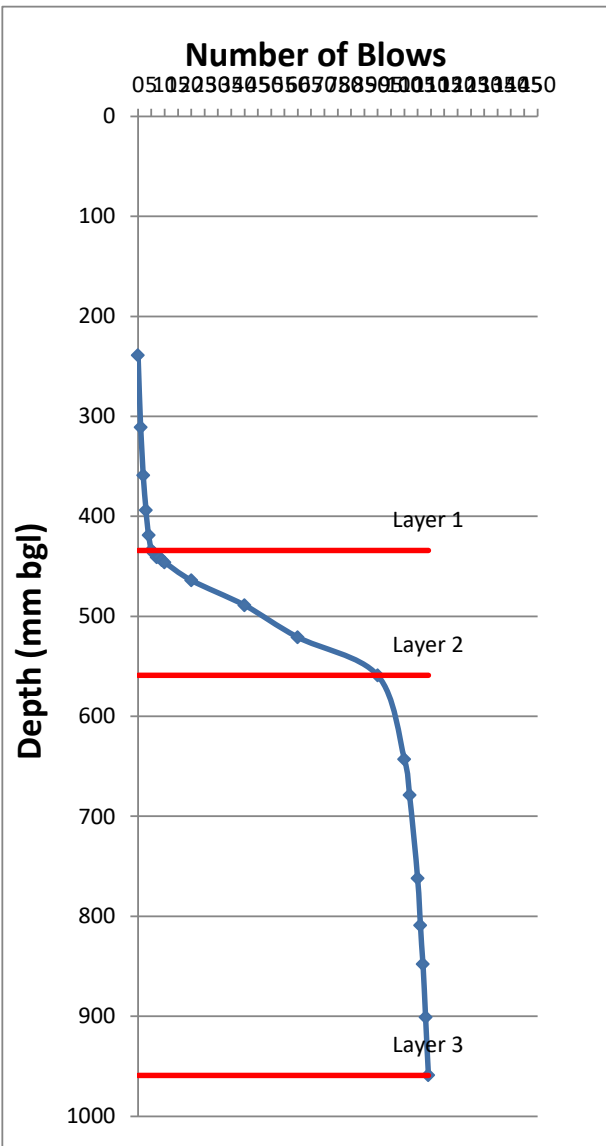


Based on the Kley and Van Heerden Model

Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	81	534	10	45.30	3.31
2	534	593	75	0.91	480.33
3	593	644	95	2.55	128.97
4	644	949	120	12.20	17.58
5	949				

DYNAMIC CONE PENETROMETER RECORD SHEET

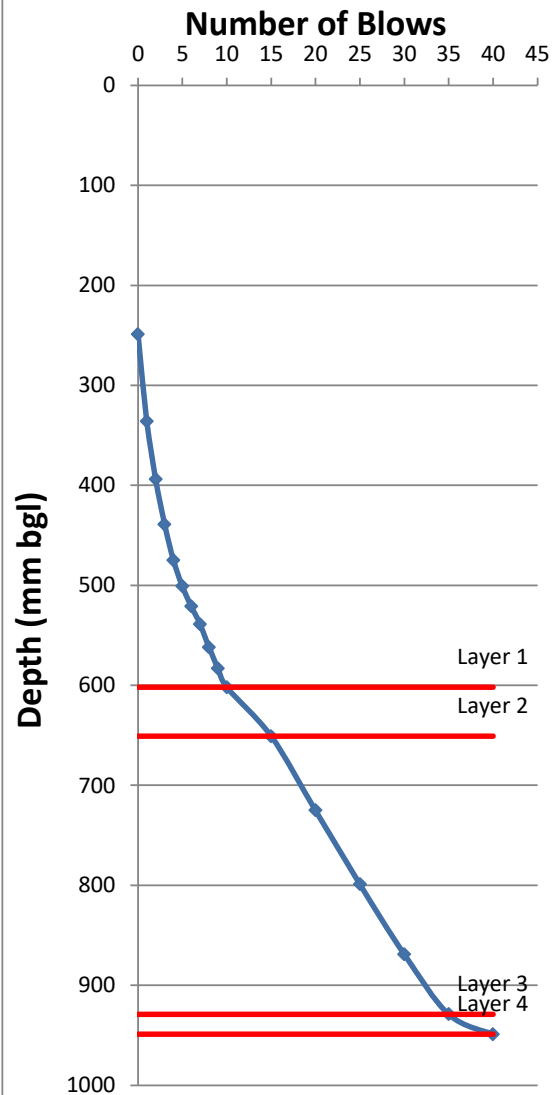
JOB DETAILS	
Job No:	TE1604
Site:	Moss Nook
Location	DCP5
Test Date	04.05.2022
Zero Error mm	1
Cone Angle	60
Layers Removed	0

[illegible]

Based on the Kleyn and Van Heerden Model					
Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	239	434	5	39.00	4.00
2	434	559	90	1.47	259.89
3	559	959	109	21.05	8.78
4	959				
5					

DYNAMIC CONE PENETROMETER RECORD SHEET

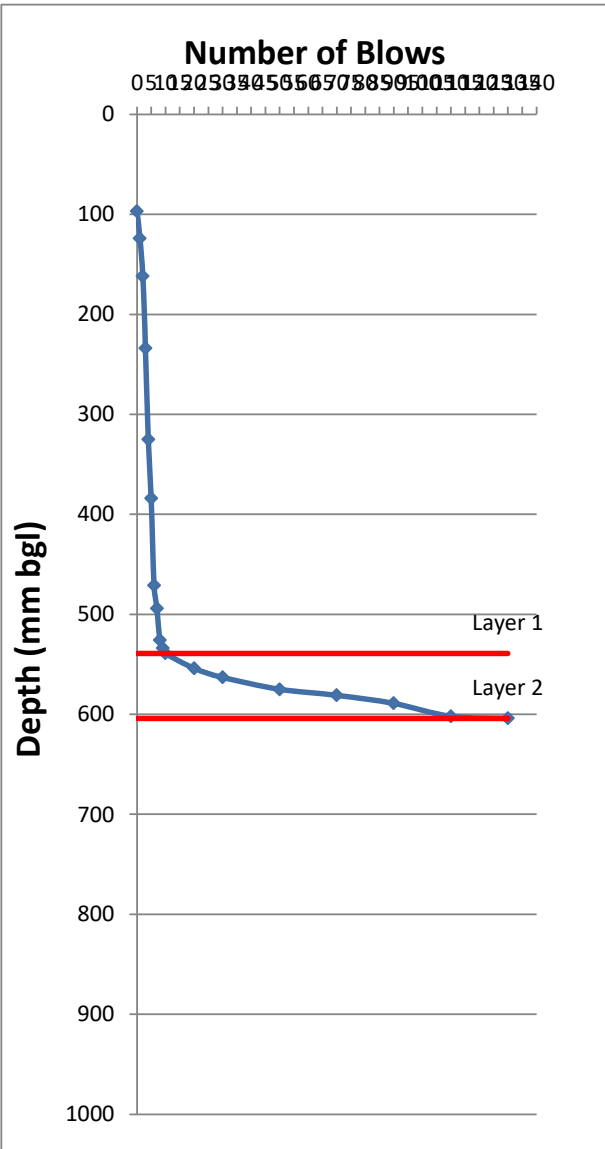
JOB DETAILS	
Job No:	TE1604
Site:	Moss Nook
Location	DCP6
Test Date	04.05.2022
Zero Error mm	1
Cone Angle	60
Layers Removed	0

[illegible]

Based on the Kleyn and Van Heerden Model					
Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	249	602	10	35.30	4.55
2	602	651	15	9.80	23.24
3	651	929	35	13.90	14.89
4	929	949	40	4.00	72.71
5	949				

DYNAMIC CONE PENETROMETER RECORD SHEET

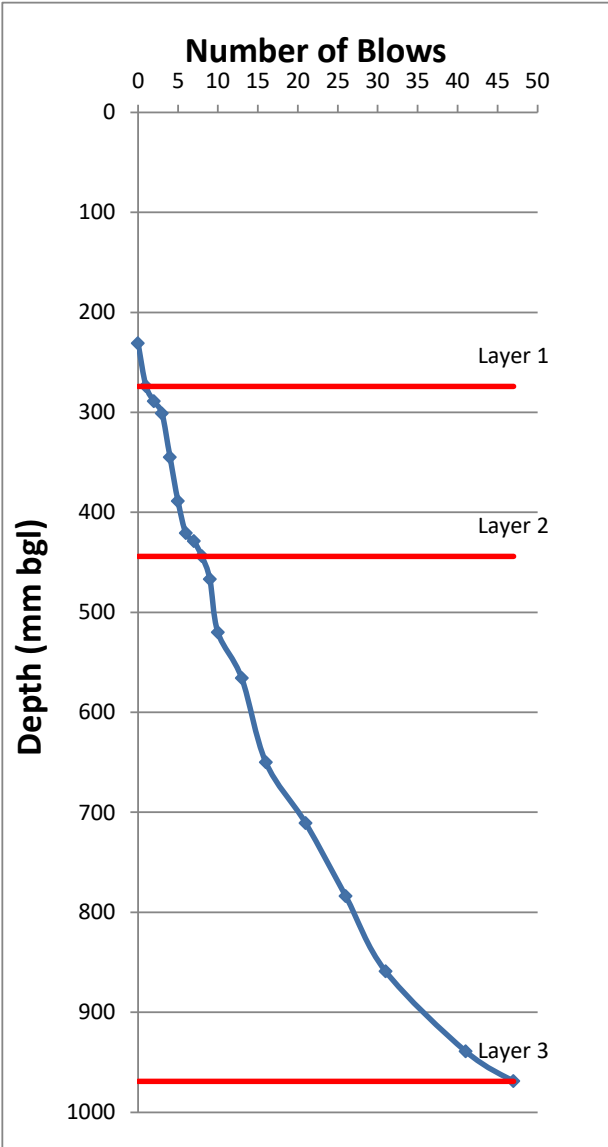
JOB DETAILS	
Job No:	TE1604
Site:	Moss Nook
Location	DCP7
Test Date	04.05.2022
Zero Error mm	1
Cone Angle	60
Layers Removed	0

[illegible]

Based on the Kleyn and Van Heerden Model					
Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	97	539	10	44.20	3.41
2	539	604	130	0.54	926.74
3	604				
4					
5					

DYNAMIC CONE PENETROMETER RECORD SHEET

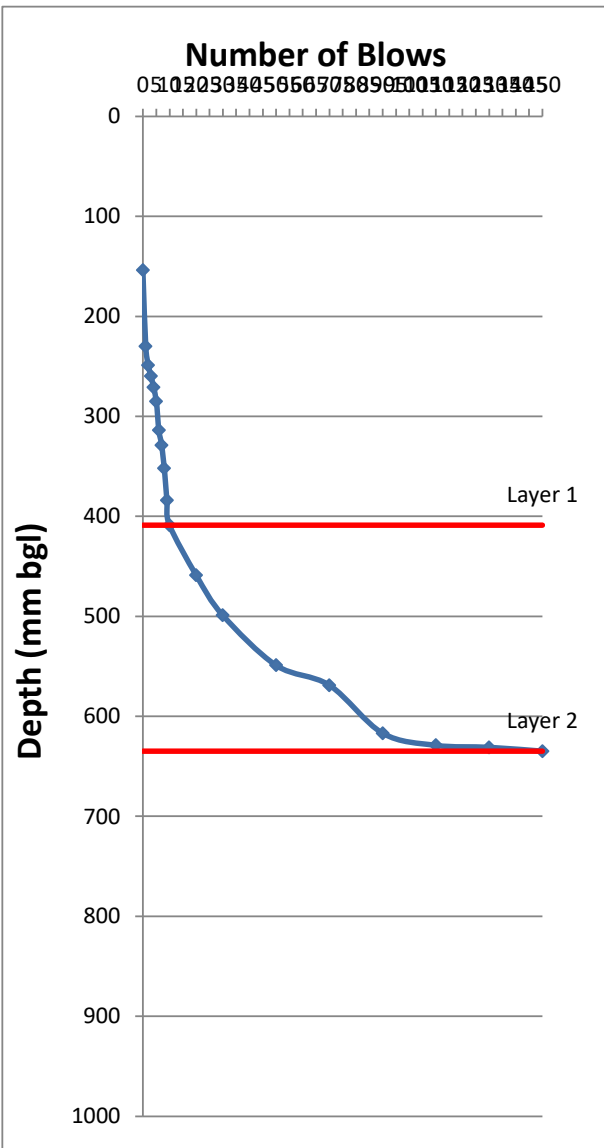
JOB DETAILS	
Job No:	TE1604
Site:	Moss Nook
Location	DCP8
Test Date	04.05.2022
Zero Error mm	1
Cone Angle	60
Layers Removed	0

[illegible]

Based on the Kleyn and Van Heerden Model					
Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	231	274	1	43.00	3.54
2	274	444	8	24.29	7.32
3	444	969	47	13.46	15.51
4	969				
5					

DYNAMIC CONE PENETROMETER RECORD SHEET

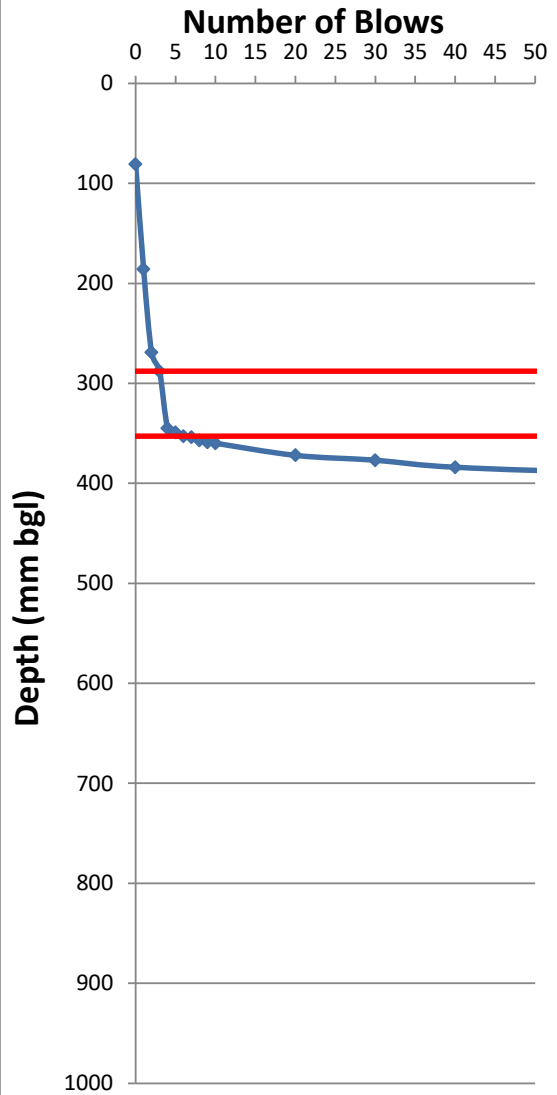
JOB DETAILS	
Job No:	TE1604
Site:	Moss Nook
Location	DCP9
Test Date	04.05.2022
Zero Error mm	1
Cone Angle	60
Layers Removed	0

[illegible]

Based on the Kleyn and Van Heerden Model					
Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	154	409	10	25.50	6.88
2	409	635	150	1.61	230.80
3	635				
4					
5					

DYNAMIC CONE PENETROMETER RECORD SHEET

JOB DETAILS	
Job No:	TE1604
Site:	Moss Nook
Location	DCP10
Test Date	04.05.2022
Zero Error mm	1
Cone Angle	60
Layers Removed	0

[illegible]

Based on the Kleyn and Van Heerden Model					
Layer	Top of layer	Base of Layer	Total blows	DCP (mm / blow)	CBR %
1	81	288	3	69.00	1.94
2	288	353	6	21.67	8.46
3	353				
4					
5					

APPENDIX F - GROUNDWATER AND GAS MONITORING RESULTS

GAS MONITORING ACROSS BOREHOLE LOCATIONS



JOB DETAILS:	Moss Nook, Heald Green	Job No:	TE1604		
Client:	Northern Powerhouse Land Ltd	Visit No:	1	of	1
Site:	Moss Nook	Operator:	Lee Hogg		
Date:	29.04.2022	Project Manager:	Adrian Read		

Monitoring Point	GAS CONCENTRATIONS												FLOW DATA		WELL AND WATER DATA					Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppm)		Hydrogen sulphide (ppm)		Oxygen (%v/v)		Flow rate (l/hr)		Water Depth (mbgl)	Depth of Well (mbgl)	Ground Level (mAOD)	Water Level (mAOD)	Response Zone	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Lowest	Steady	Peak	Steady						
WS105	0.1	ND	2.0	ND	2.1	2.1	50	ND	ND	ND	20.5	20.8	ND	ND	1.12	3.98				High CO took 6 mins to ND
WS104	ND	ND	ND	ND	2.8	2.8	10	ND	ND	ND	18.6	18.7	ND	ND	1.56	4.60				
WS103	ND	ND	ND	ND	1.8	1.0	132	ND	ND	ND	19.4	20.5	5.8	ND	1.15	4.06				High CO took 20 mins to ND
WS102	0.1	0.1	2.0	2.0	0.8	0.7	6	ND	ND	ND	16.4	16.8	ND	ND	0.75	4.55				
WS101	ND	ND	ND	ND	5.0	4.9	ND	ND	ND	ND	15.0	15.0	ND	ND	1.73	4.65				
Max	0.1	0.1	2.0	2.0	5.0	4.9	132.0	ND	ND	ND	20.5	20.8	5.8	0.1	1.73	4.65				
Min	0.1	0.1	2.0	2.0	0.8	0.7	ND	ND	ND	ND	15.0	15.0	0.1	0.1	0.75	3.98				

METEOROLOGICAL AND SITE INFORMATION:	
State of ground:	
Wind:	
Cloud cover:	
Precipitation:	
Barometric pressure (mbar):	
Pressure trend:	
Ground gas meter:	GA2000
Ambient Gas concentration:	

X Dry		Moist		Wet		Snow		Frozen
	Calm	X Light		Moderate		Strong		
	None		Slight		Cloudy	X Overcast		
X None			Slight		Moderate		Heavy	
		1033 Before				1032 After		
		x Falling			Steady		Rising	
CH ₄	ND	CO ₂	0.2%	O ₂	21.4%			

APPENDIX G - PHOTOGRAPHS

APPENDIX H - GROUNDSURE REPORT (AVAILABLE AS A SEPARATE DOCUMENT)

APPENDIX I - PREVIOUS SITE INVESTIGATION REPORT (AVAILABLE AS A SEPARATE DOCUMENT)

APPENDIX J - DEFINITIONS OF TERMS USED IN QUALITATIVE AND QUANTITATIVE RISK ASSESSMENTS

CIRIA C552 Terminology

For the qualitative and quantitative assessment of risks posed by potential pollutant linkages have been undertaken using the risk matrix adapted from CIRIA C552 and outlined in the table below.

	Category	Definition
Potential severity	Severe	Acute (short term) risk to human health, Major pollution of sensitive controlled waters, ecosystems or habitat. Catastrophic damage to buildings or property or crops.
	Medium	Chronic (Medium / long term) risk to human health Pollution of sensitive controlled waters, ecosystems or species, Significant damage to crops, buildings or structures
	Mild	Easily preventable permanent health effects on humans. Pollution of non-sensitive controlled waters. Minor damage to buildings or structures.
	Minor	Easily preventable non-permanent health effects on humans, or no effects. Minor, low level and localised contamination of on-site soil. Easily repairable damage to buildings or structures.
Probability of risk	High Likelihood	Pollutant linkage may be present, and the risk is almost certain to occur , or there is evidence of harm already occurring.
	Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term.
	Low Likelihood	Pollutant linkages may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
	Unlikely	Pollutant linkage may be present but the circumstances under which harm would occur are improbable.

		Potential Severity			
		Severe	Medium	Mild	Minor
Probability of risk	High Likelihood	Very high risk	High risk	Moderate risk	Moderate / low risk
	Likely	High risk	Moderate risk	Moderate / low risk	Low risk
	Low Likelihood	Moderate risk	Moderate / low risk	Low risk	Very low risk
	Unlikely	Moderate / low risk	Low risk	very low risk	Very low risk

APPENDIX K - HUMAN HEALTH ASSESSEMENT CRITERIA

HUMAN HEALTH ASSESSMENT CRITERIA

Context

Contaminated Land is defined under law through Part IIA of the Environmental Protection Act 1990, implemented through Section 57 of the Environment Act 1995 and associated guidance ("Part IIA"). These specify that a "suitable for use" approach is to be applied in the assessment of potentially contaminated land, implemented through a phased programme of site investigation and risk assessment appropriate to the site under consideration.

The assessment of potential risks posed by contaminated land is based upon the assessment of plausible contaminant source - pathway - receptor linkages ("pollutant linkages") for the current and/or proposed future use of the site. The process for the assessment of contaminated land adopted in this report is in line with guidance issued by the Environment Agency Land contamination risk management (LCRM) - GOV.UK (www.gov.uk)

Land contamination can harm:

- human health
- drinking water supplies, groundwater and surface water
- soils
- ecosystems including wildlife, animals and wetlands
- property

It can also affect the current and future land use. Dealing with land contamination helps make the environment clean and safe. Through regeneration it can:

- enhance the health and wellbeing of all
- add to the economic, ecological and amenity value of the area

Use land contamination risk management (LCRM) to:

- identify and assess if there is an unacceptable risk
- assess what remediation options are suitable to manage the risk
- plan and carry out remediation
- verify that remediation has worked

You can use LCRM in a range of regulatory and management contexts. For example, voluntary remediation, planning, assessing liabilities or under the Part 2A contaminated land regime. The Environment Agency expects you to follow LCRM if you are managing the risks from land contamination.

We support the use of the National Quality Mark Scheme (NQMS). You can use it for any type of land contamination report.

Using the NQMS:

- will make sure all legislative requirements and necessary standards related to managing land contamination are met
- can provide increased confidence by submitting reports of the quality we expect
- can result in cost and time savings by 'getting it right first time'

LCRM is made up of 4 guides.

1. LCRM: Before you start.
2. LCRM: Risk assessment.
3. LCRM: Options appraisal.
4. LCRM: Remediation and verification.

We use a staged risk based approach. There are 3 stages, and each stage is broken down into tiers or steps.

Stage 1: Risk assessment

You will use a tiered approach to risk assessment. The 3 tiers are:

1. Preliminary risk assessment.
2. Generic quantitative risk assessment.
3. Detailed quantitative risk assessment.

Stage 1 includes information for intrusive site investigations.

Stage 2: Options appraisal

There are 3 steps to follow.

1. Identify feasible remediation options.
2. Do a detailed evaluation of options.
3. Select the final remediation option.

Stage 3: Remediation and verification

There are 4 steps to follow.

1. Develop a remediation strategy.
2. Remediate.
3. Produce a verification report.
4. Do long term monitoring and maintenance, if required

You must always start with a preliminary risk assessment.

The risk assessment stage is an iterative process. You can do the 3 tiers in order or progress from a preliminary risk assessment to a detailed quantitative risk assessment. As part of a generic or detailed quantitative risk assessment you will need to collect detailed information about the site. This is usually through an intrusive site investigation.

Depending on the level of risk or regulatory requirements, you can proceed from a preliminary risk assessment to the options appraisal stage. If you proceed direct to the options appraisal stage, you still need to collect the detailed site investigation information required by the generic and detailed quantitative risk assessments. This is to confirm that your approach is viable and acceptable.

Following the risk assessment stage, if you conclude that the risks are acceptable, with agreement from the relevant regulator, you can end the process.

If there are unacceptable risks, then remediation or mitigation is required. Follow stages 2 and 3 in order.

In stage 2 options appraisal, you will:

- look at the most feasible options
- produce a shortlist of options
- use evaluation criteria to assess them
- select which ones are the most suitable to take forward to stage 3

In stage 3 remediation and verification, you will produce a remediation strategy, do the remediation and then produce a verification report.

You will decide at the options appraisal stage if long term monitoring and maintenance is the remediation option. You may need to do post-remediation monitoring for further verification.

The risk assessment and subsequent investigation, remediation and verification must address all potential sources of pollutants that may be present on the site (the "hazards"), all receptors that may be harmed by these (e.g., human health, controlled waters, ecological receptors) and the pathways by which the contamination may be transported from the contaminant source(s) to the receptor(s). This is defined within the conceptual model for the site, which represents the characteristics of the site in a form that shows the possible pollutant linkages. As further information becomes available (for example, through site investigation), so the conceptual model will be refined.

Remedial action can be specified at any phase within this assessment process to break the identified pollutant linkage in determining whether or not to undertake further assessment or to undertake remediation, the potential cost-savings arising from a more thorough assessment of the pollutant linkages and more tightly defined remedial strategy must be considered against the direct costs involved in the work and the time that this will take to execute and gain regulatory approval.

A different approach to the statistical appraisal of data is required depending on whether the assessment is being undertaken to assess land as Contaminated Land in accordance with the regulations or whether the assessment is to assess whether the site is suitable for new development in accordance with the Planning regime. The statistical approach to assessment is discussed further in CL:AIRE:2020 "Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration".

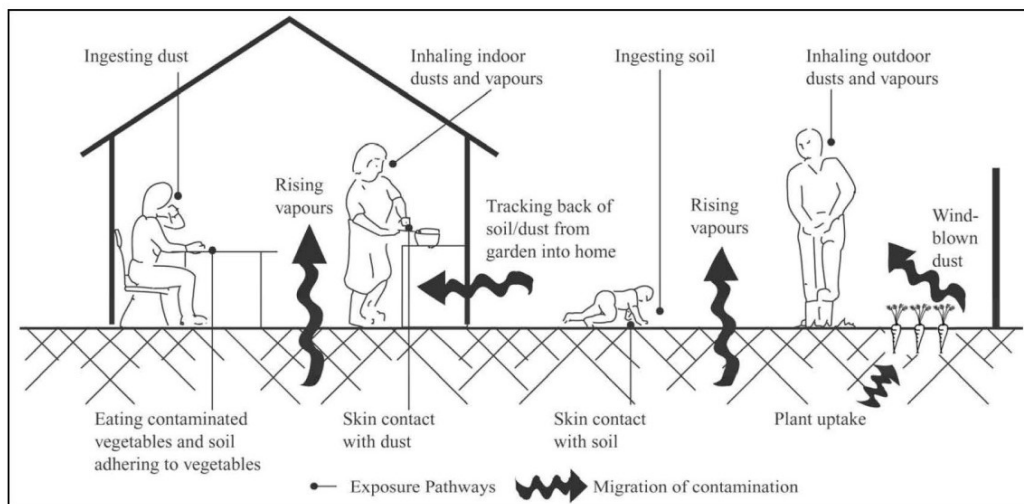
Some form of Detailed Quantitative Risk Assessment (DQRA) will be essential for those cases where appropriate GAC values cannot be established for the contaminant linkages under consideration.

Generic Assessment Criteria for Human Health Risk Assessment

In March 2002, the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (EA) published the Contaminated Land Exposure Assessment (CLEA) Model and a series of related reports and guidance. These were designed to provide a scientifically based framework for the assessment of chronic risks to human health from contaminated land. The initial documents (CLR7 – 10) were withdrawn and replaced with revised guidance issued by the Environment Agency including:

- “Using Soil Guideline Values”; EA, 2009; [Land contamination: using soil guideline values \(SGVs\) - GOV.UK \(www.gov.uk\)](http://www.gov.uk/government/publications/using-soil-guideline-values)
- “Human Health toxicology assessment of contaminants in soil” EA, 2009; <https://www.gov.uk/government/publications/human-health-toxicological-assessment-of-contaminants-in-soil>
- “Update technical background to the CLEA model” 2009; <https://www.gov.uk/government/publications/updated-technical-background-to-the-clea-model>
- CLEA Software (Version 1.05) Handbook 2015; <https://www.gov.uk/government/publications/contaminated-land-exposure-assessment-clea-tool>
- Compilation of Data for priority Organic Contaminants for Derivation of Soil Guideline Values; Science Report SC050021/SR7, 2008; and,
- “Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration”. CL:AIRE:2020 <https://www.claire.co.uk/component/phocadownload/category/9-other-cl-aire-documents?download=745:2020-stats-guidance>

The CLEA model and associated guidance was developed to calculate an estimated tolerable daily intake (TDI) of contaminants for site users given a set of ‘typical’ human health exposure pathways which are detailed in “SR3: Updated technical background to the CLEA model”



(Science Report SC050021/SR3, EA, 2009) and reproduced below.

Ingestion

- Outdoor soil;
- Indoor dust;
- Home grown produce;
- Soil attached to home grown produce.

Dermal Contact

- Outdoor soil;
- Indoor dust.

Inhalation

- Outdoor dust;
- Indoor dust;
- Outdoor vapour;
- Indoor vapour.

It should be noted that the CLEA model does not include an exhaustive list of potential exposure pathways, e.g. certain compounds can pass through plastic water pipes into drinking water supply.

The potential significance of each of the exposure pathways is dependent upon the type of land use and the nature of the contaminant being considered. The CLEA model considers principal 'default' land use scenarios and makes a series of assumptions with regards to building type (where applicable), identification of the critical human receptor group, exposure frequency and duration. The definitions of the principal land use types given in SR3 (EA, 2009) are:

Residential land use;

- A typical residential property consisting of a two-storey terraced house built on a ground-bearing slab of 0.15m thickness with a private garden consisting of lawn, flowerbeds, and a small fruit and vegetable patch. The occupants are assumed to be parents with young children, who make regular use of the garden. The critical receptor is a 0 – 6-year-old female.
- Active exposure pathways are ingestion of outdoor soil, ingestion of indoor dust, ingestion of home grown produce and soil adhering to home grown produce; direct dermal contact with outdoor soil and indoor dust; inhalation of outdoor dust and vapour and indoor dust and vapour

Allotments

- A plot of open space commonly made available by the Local Authority to tenants to grow fruit and vegetables for their own consumption. There are usually several plots to a site and the overall site area may cover more than one hectare. The tenants are assumed to be the parents or grandparents and that young children make occasional accompanied visits to the plots. The critical receptor is a 0 – 6-year-old female and there is no building present on Site.
- Active exposure pathways are ingestion of outdoor soil, ingestion of home grown produce and soil adhering to home grown produce; direct dermal contact with outdoor soil; inhalation of outdoor vapour.

Commercial and industrial land use.

- A typical commercial or light industrial property consisting of a three-story office building (pre-1970) with a ground bearing floor slab at which employees spend most time indoors and are involved in office based or related light physical work. The critical receptor is a working female adult aged 16 – 65 years.
- Active exposure pathway is ingestion of outdoor soil, ingestion of indoor dust; direct dermal contact with outdoor soil and indoor dust; inhalation of outdoor dust and vapour and inhalation of indoor dust and vapour.

Soil Guideline Values

Based on the assumption of each land use type, the EA and DEFRA developed and published Soil Guideline Value (SGV) using the CLEA model for a number of principal contaminants and 'default' end-use scenarios of residential, allotments and commercial/industrial use. The primary purpose of the SGVs is as trigger value for the tolerable daily intake (TDI), below which it can be assumed that the soil does not pose an unacceptable risk to the identified receptor. Where soils contamination is present above this level further assessment may be required. SGVs were developed for the following contaminants:

- Heavy metals and other inorganic compounds: arsenic, cadmium, chromium, cyanide, lead (now withdrawn), mercury, nickel and selenium.
- Benzene, ethylbenzene, toluene and xylenes.
- Phenol.
- Dioxins and dioxin-like polychlorinated biphenyls (PCBs)
- Polycyclic aromatic hydrocarbons (PAHs) – 11 substances

LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment

In addition, in 2009 CIEH through LQM and EIC published generic assessment criteria (GACs) for 82 substances including metals, petroleum hydrocarbons, PAHs and explosive substances for a variety of soil types and the three 'default' land uses – (residential, allotments and commercial end-uses) as described in SR3 (EA, 2009). These have been superseded as described below.

Category 4 Screening Values

In 2013 "SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination" (CL:AIRE 2013) was issued which detailed findings of a research project undertaken by CL:AIRE to set out the framework by which potential Category 4 Screening Levels (pC4SL) may be derived for 6 contaminants of concern, Arsenic, Benzene, Benzo(a)pyrene, Cadmium, Chromium VI and Lead.

This was supplemented in 2014 by "SP1010: Development of Category 4 Screening Levels for the Assessment of Land Affected by Contamination – Policy Companion Document" (DEFRA, 2014). SP1010 proposed several updated toxicology information relating to contaminant behaviour updated assumptions relating to the modelling of human exposure to soil contaminants, derivation of separate C4SLs for residential with the consumption of home grown produce, residential without the consumption of home grown produce, and two new land uses: public open spaces near residential housing (POS resi) and public parks (POS park).

Public Open Space: Residential

- For public open space in close proximity to residential housing and the central green area around which houses are located, as on many housing estates from the 1930s to 1970s. It is also applicable for smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soil with planting. It is considered to be a generally grassed area up to 0.5ha with up to 50% bare soil. The land use is an important resource

for children and the area is near the homes. The critical receptor is a female child age >3 - <9 years old (CLEA age class 4 – 9) as younger children are unlikely to play outdoors unsupervised.

- Active exposure pathways are ingestion of outdoor soil, ingestion of indoor dust; direct dermal contact with outdoor soil and indoor soil derived dust; inhalation of outdoor and indoor dust and inhalation of outdoor vapour.

Public Open Space: Park

- A public park is defined as an area of open space provided for recreational use and usually owned and maintained by the Local Authority. It is anticipated the park could be used for a wide range of activities, including the following:
 - Family visits and picnics;
 - Children's play area;
 - Sporting activities such as football on an informal basis (i.e. not a dedicated sports pitch); and
 - Dog walking.
- The park is modelled as an area >0.5 ha of predominantly grasses open space with no more than 25% of exposed soil.
- The critical receptor is a female child with CLEA age classes 1 – 6.
- Active exposure pathway are: ingestion of outdoor soil; direct dermal contact with outdoor soil; inhalation of outdoor dust and inhalation of outdoor vapour.

Furthermore, the C4SLs are based on a different toxicological benchmark, the 'low level of toxicological concern' (LLTC). This difference in approach was adopted because the C4SLs were primarily intended for use under Part 2A of the EPA 1990 to quickly screen out Category 4 sites where there is "*no risk or that the level of risk posed is low*". SGVs and LQM GACs are based on the more conservative 'minimal or tolerable level of risk' as defined in SR2 (EA, 2009) and were derived for assessment of contamination for the Planning process.

LQM/CIEH Suitable 4 Use Levels (S4ULs)

The publication of the C4SLs resulted in considerable and inconclusive debate about the applicability of the lower level of protection of the C4SL, which are underlain by the LLTC, outside of the Part 2A context for which they were derived. In 2014 LQM/CIEH presented a Suitable 4 Use Levels (S4ULs), which incorporate the updated assumption exposure derived for the production of the C4SLs but within the context of deriving screening criteria above which further assessment of the risks or remedial action may be needed. The S4ULs replace the 82 substances, species and fractions and congeners contained in the previous LQM/CIEH GACs issued in 2009. Additionally, following changes and new land uses proposed in the C4SL research project, S4ULs have also been derived for the majority of substances for which the EA derived SGVs in 2009 with the exception of lead (see below).

Lead

The C4SL for lead provides a technically robust and conservative assessment tool using significantly updated toxicological modelling than the withdrawn SGV and derived in line with current science of lead toxicology.

EIC/AGS/CL:AIRE Soil Generic Assessment Criteria (2010)

In some instances, EIC/AGS/CL:AIRE GACs for certain VOC / SVOC potential contaminants of concern have been used *in lieu* of available LQM / CIEH S4UL values.

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Metals/metalloids																			
Arsenic	37			40			43			640			79			170			LQM (2014)
Beryllium	1.7			1.7			35			12			2.2			63			LQM (2014)
Boron	290			11000			45			240000			21000			46000			LQM (2014)
Cadmium	11			85			1.9			190			120			532			LQM (2014)
Chromium III	910			910			18000			8600			1500			33000			LQM (2014)
Chromium VI	6			6			1.8			33			7.7			220			LQM (2014)
Copper	2400			7100			520			68000			12000			44000			LQM (2014)
Lead	200			310			80			2330			630			1300			C4SL
Mercury (elemental)	1.2			1.2			21			58 (25.8)			16			30 (25.8)			LQM (2014)
Mercury (Inorganic)	40			56			19			1100			120			240			LQM (2014)
Methylmercury	11			15			6			320			40			68			LQM (2014)
Nickel	180			180			230			980			230			3400			LQM (2014)
Selenium	250			430			88			12000			1100			1800			LQM (2014)
Vanadium	410			1200			91			9000			2000			5000			LQM (2014)

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Zinc	3700			40000			620			730000			81000			170000			LQM (2014)
Other																			
Total Sulphate	2,400			2,400			2,400			2,400			2,400			2,400			BRE (2005)
Water Soluble Sulphate (g/l)	0.5			0.5			0.5			0.5			0.5			0.5			BRE (2005)
PAHs																			
Acenaphthene	210	510	1100	3000 (57)	4700(141)	6000 (336)	34	85	200	84000 (57)	97000 (141)	100000	15000	15000	15000	29000	30000	30000	LQM (2014)
Acenaphthylene	170	420	920	2900 (86.1)	4600 (212)	6000 (506)	28	69	160	8300 (86.1)	97000 (212)	100000	15000	15000	15000	29000	30000	30000	LQM (2014)
Anthracene	2400	5400	11000	31000 (1.17)	35000	37000	380	950	2200	520000	540000	540000	74000	74000	74000	150000	150000	150000	LQM (2014)
Benzo(a)anthracene	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	LQM (2014)
Benzo(a)pyrene	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	LQM (2014)
Benzo(b)fluoranthene	2.6	3.3	3.7	3.9	4	4	0.99	2.1	3.9	44	44	45	7.1	7.1	7.1	13	15	16	LQM (2014)
Benzo(g,h,i)perylene	320	340	350	360	360	360	290	470	640	3900	4000	4000	640	640	640	1400	1500	1600	LQM (2014)
Benzo(k)fluoranthene	77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	LQM (2014)
Chrysene	15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	LQM (2014)

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Dibenz(a,h)anthracene	0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.61	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	LQM (2014)
Fluoranthene	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	63	6300	6400	LQM (2014)
Fluorene	170	400	860	2800 (30.9)	3800 (76.5)	4500 (183)	27	67	160	63000 (30.9)	68000	71000	9900	9900	9900	20000	20000	20000	LQM (2014)
Indeno(1,2,3-cd)pyrene	27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	LQM (2014)
Naphthalene	2.3	5.6	13	2.3	5.6	13	4.1	10	24	190 (76.4)	460 (183)	1100 (432)	4900	4900	4900	1200 (76.4)	1900 (183)	3000	LQM (2014)
Phenanthrene	95	220	440	1300 (36)	1500	1500	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	LQM (2014)
Pyrene	620	1200	2000	3700	3800	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	LQM (2014)
Coal Tar (BaP as surrogate marker)	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	LQM (2014)
BTEX and TPH																			
Benzene	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110	LQM (2014)
Toluene	130	290	660	880 vap (869)	1900	3900	22	51	120	56000 vap (869)	110000 vap (1920)	180000 vap (4360)	56000	56000	56000	87000 vap (869)	95000 vap (1920)	100000 vap (4360)	LQM (2014)
Ethylbenzene	47	110	260	83	190	440	16	39	91	5700 vap (518)	13000 vap (1220)	27000 vap (2840)	24000	24000	25000	17000 vap (518)	22000 vap (1220)	27000 vap (2840)	LQM (2014)
Xylene - o	60	140	330	88	210	480	28	67	160	6600 (478)	15000 (1120)	33000 (2620)	41000	42000	43000	17000 (478)	24000 (1120)	33000 (2620)	LQM (2014)

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Xylene - m	59	140	320	82	190	450	31	74	170	6200 (625)	14000 (1470)	31000 (3460)	41000	42000	43000	17000 (625)	24000 (1470)	32000 (3460)	LQM (2014)
Xylene - p	56	130	310	79	180	430	29	69	160	5900 (576)	14000 (1350)	30000 (3170)	41000	42000	43000	17000 (576)	23000 (1350)	31000 (3170)	LQM (2014)
Aliphatic EC 5-6	42	78	160	42	78	160	730	1700	3900	3200 (304)	5900 (558)	12000 (1150)	570000 (304)	590000	60000 0	95000 (304)	130000 (558)	180000 (1150)	LQM (2014)
Aliphatic EC >6-8	100	230	530	100	230	530	2300	5600	13000	7800 (144)	17000 (322)	40000 (736)	600000	610000	62000 0	150000 (144)	220000 (322)	320000 (736)	LQM (2014)
Aliphatic EC >8-10	27	65	150	27	65	150	320	770	1700	2000 (78)	4800 (190)	11000 (451)	13000	13000	13000	14000 (78)	18000 (190)	21000 (451)	LQM (2014)
Aliphatic EC >10-12	130 (48)	330 (118)	760 (283)	130 (48)	330 (118)	760 (283)	2200	4400	7300	9700 (48)	23000 (118)	47000 (283)	13000	13000	13000	21000 (48)	23000 (118)	24000(283)	LQM (2014)
Aliphatic EC >12-16	1100 (24)	2400 (59)	4300 (142)	1100 (24)	2400 (59)	4300 (142)	11000	13000	13000	59000 (24)	82000 (59)	90000 (142)	13000	13000	13000	25000 (24)	25000 (59)	26000 (142)	LQM (2014)
Aliphatic EC >16-35	65000 (8.48)	92000 (21)	11000 0	65000 (8.48)	92000 (21)	110000	26000 0	270000	27000 0	160000 0	1700000	180000 0	250000	250000	25000 0	450000	480000	490000	LQM (2014)
Aliphatic EC >35-44	65000 (8.48)	92000 (21)	11000 0	65000 (8.48)	92000 (21)	110000	26000 0	270000	27000 0	160000 0	1700000	180000 0	250000	250000	25000 0	450000	480000	490000	LQM (2014)
Aromatic EC 5-7	70	140	300	370	690	1400	13	27	57	26000 (1220)	46000 (2260)	86000 (4710)	56000	56000	56000	76000 (1220)	84000 (2260)	92000 (4710)	LQM (2014)
Aromatic EC >7-8	130	290	660	860	1800	3900	22	51	120	56000 (869)	110000 (1920)	180000 (4360)	56000	56000	56000	87000 (869)	95000 (1920)	100000 (4360)	LQM (2014)
Aromatic EC >8-10	34	83	190	47	110	270	8.6	21	51	3500 (613)	8100 (1500)	17000 (3580)	5000	5000	5000	7200 (613)	8500 (1500)	9300 (3580)	LQM (2014)
Aromatic EC >10-12	74	180	380	250	590	1200	13	31	74	16000 (364)	28000 (899)	34000 (2150)	5000	5000	5000	9200 (364)	9700 (899)	10000	LQM (2014)

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Aromatic EC >12-16	140	330	660	1800	2300 (419)	2500	23	27	130	36000 (169)	37000	38000	5100	5100	5000	10000	10000	10000	LQM (2014)
Aromatic EC >16-21	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	LQM (2014)
Aromatic EC >21-35	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)
Aromatic EC >35-44	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)
Aromatic EC >44-75	1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)
VOCs																			
1,2-dichloroethane (1,2-DCA)	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	0.67	0.97	1.7	29	29	29	21	24	28	LQM (2014)
1,1,1-trichloroethane	8.8	18	39	9	18	40	48	110	240	660	1300	3000	140000	140000	140000	57000 (1425)	76000 (2915)	100000 (6392)	LQM (2014)
1,1,2,2,tetrachloroethane	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	270	550	1100	1400	1400	1400	1800	2100	2300	LQM (2014)
tetrachloroethene	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	19	45	95	1400	1400	1400	810 (424)	1100 (951)	1500	LQM (2014)
tetrachloromethane (Carbon tetrachloride)	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	2.9	6.3	14	890	920	950	190	270	400	LQM (2014)
Trichloroethene	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	LQM (2014)
Trichloromethane (chloroform)	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	LQM (2014)

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Chloroethene (Vinyl chloride)	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	LQM (2014)
2,4,6 Trinitrotoluene (TNT)	1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	LQM (2014)
RDX	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000 (18.7)	51000	53000	LQM (2014)
HMX	5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	23000 (0.35)	23000 (0.39)	24000 (0.48)	LQM (2014)
Aldrin	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	LQM (2014)
Dieldrin	0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	LQM (2014)
Atrazine	3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	LQM (2014)
Dichlovos	0.032	0.066	0.014	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	LQM (2014)
Alpha-Endosulfan	7.4	18	41	160 (0.003)	280 (0.007)	410 (0.016)	1.2	2.9	6.8	5600 (0.003)	7400 (0.007)	8400 (0.016)	1200	1200	1200	2400	2400	2500	LQM (2014)
alpha-Hexachlorocyclohexane	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	LQM (2014)
beta-hexachlorocyclohexanes	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	LQM (2014)
gamma-hexachlorocyclohexanes	0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67	69	70	8.2	8.2	8.2	14	15	15	LQM (2014)

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Chlorobenzene	0.46	1	2.4	0.46	1	2.4	5.9	14	32	56	130	290	11000	13000	14000	1300 (675)	2000 (1520)	2900	LQM (2014)
1,2-Dichlorobenzene	23	55	130	24	57	130	94	230	540	2000 (571)	4800 (1370)	11000 (3240)	90000	95000	98000	24000 (571)	36000 (1370)	51000 (3240)	LQM (2014)
1,3-Dichlorobenzene	0.4	1	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	LQM (2014)
1,4-Dichlorobenzene	61	150	350	61	150	350	15	37	88	4400 (224)	10000 (540)	25000 (1280)	17000	17000	17000	36000 (224)	36000 (540)	36000 (1280)	LQM (2014)
VOCs Continued																			
1,2,3-Trichlorobenzene	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	28	102	250	590	1800	1800	1800	770 (134)	1100 (330)	1600 (789)	LQM (2014)
1,2,4-Trichlorobenzene	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	19000	1700 (318)	2600 (786)	4000 (1880)	LQM (2014)
1,3,5-Trichlorobenzene	0.33	0.81	1.9	0.33	0.81	1.9	4.7	12	28	23	55	130	1700	1700	1800	380 (36.7)	580 (90.8)	860 (217)	LQM (2014)
1,2,3,4-Tetrachlorobenzene	15	36	78	24	56	120	4.4	11	26	1700 (122)	3080 (304)	4400 (728)	830	830	830	1500 (122)	1600	1600	LQM (2014)
1,2,3,5-Tetrachlorobenzene	0.66	1.6	3.7	0.75	1.9	4.3	0.38	0.9	2.2	49 (39.4)	120 (98.1)	240 (235)	78	79	79	110 (39)	120	130	LQM (2014)
1,2,4,5-Tetrachlorobenzene	0.33	0.77	1.6	0.73	1.7	3.5	0.06	0.16	0.37	42 (19.7)	72 (49.1)	96	13	13	13	25	26	26	LQM (2014)
Pentachlorobenzene	5.8	12	22	19	30	38	1.2	3.1	7	640 (43)	770 (107)	830	100	100	100	190	190	190	LQM (2014)

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Hexachlorobenze ne	1.8 (0.2)	3.3 (0.5)	4.9	4.1 (0.2)	5.7 (0.5)	6.7 (1.2)	0.47	1.1	2.5	110 (0.2)	120	120	16	16	16	30	30	30	LQM (2014)
Phenol	280	550	1100	750	1300	2300	66	140	280	760 ^{dir} (31000)	1500 ^{dir} (35000)	3200 ^{dir} (37000)	760 ^{dir} (31000)	1500 ^{dir} (35000)	3200 ^{dir} (37000)	760 ^{dir} (31000)	1500 ^{dir} (35000)	3200 ^{dir} (37000)	LQM (2014)
Chlorophenols (excluding pentachlorophen ol)	0.87 (g)	2	4.5	94	150	210	0.13 (g)	0.3	0.7	3500	4000	4300	620	620	620	1100	1100	1100	LQM (2014)
Pentachlorophen ol	0.22	0.52	1.2	27 (16.4)	29	31	0.03	0.08	0.19	400	400	400	60	60	60	110	120	120	LQM (2014)
Carbon Disulphide	0.14	0.29	0.62	0.14	0.29	0.62	4.8	10	23	11	22	47	11000	11000	12000	1300	1900	2700	LQM (2014)
Hexachlorobutadi ene	0.29	0.7	1.6	0.32	0.78	1.8	0.25	0.61	1.4	31	66	120	25	25	25	48	50	51	LQM (2014)

(g) derived based on 2,3,4,6-tetrachlorophenol; dir - based on a threshold protective of direct skin contact with phenol (guideline in brackets based on health effects following long term exposure provided for illustration only); (vap) calculated for vapour phase only. SOM – Soil Organic Matter; (4.5) solubility.

APPENDIX L - CONTROLLED WATERS RISK ASSESSMENT

CURRENT GUIDANCE FOR CONTROLLED WATERS RISK ASSESSMENT

Regulatory Context

Government policy is based upon a “suitable for use approach,” which is relevant to both the current use of land and also to any proposed future use. When considering the current use of land, Part IIA of the Environment Protection Act 1990 (EPA 1990) provides the regulatory regime, which was introduced by Section 57 of the Environment Act 1995, which came into force in England on 1 April 2000. The main objective of introducing the Part IIA regime is to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health, controlled waters or the wider environment given the current use and circumstances of the land. Part IIA provides a statutory definition of contaminated land under Section 78A(2) as:

“any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on, or under the land, that:

(a) Significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) Pollution of controlled waters is being, or is likely to be, caused.”

Part IIA provides a statutory definition of the pollution of controlled waters under Section 78A(9) as:

“the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter”

Controlled Waters are defined Section 104 of the Water Resources Act 1991. In summary, they comprise relevant territorial waters which extend seaward for three miles from the low-tide limit from which the territorial sea adjacent to England and Wales is measured.

The Environment Agency has powers under Part 7 of The Water Resources Act (1991) to take action to prevent or remedy the pollution of controlled waters, including circumstances where the pollution arises from contamination in the land. This is reinforced in The Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) which came into force in early April 2012.

Part IIA introduces the concept of a contaminant linkage; where for potential harm to exist there must be a connection between the source of the hazard and the receptor via a pathway. Risk assessment in contaminated land is therefore directed towards identifying the contaminants, pathways and receptors that can provide contaminant linkages. This is known as the contaminant-pathway-receptor link (CPR or contaminant linkage).

Part IIA places contaminated land responsibility as a part of the planning and redevelopment process, rather than Local Authority or Environment Agency directly, except in cases of very high pollution risk or where harm is occurring. In the planning process, guidance is provided by National Planning Policy Framework (NPPF) of March 2012. The NPPF requires that a site which has been developed shall not be capable of being determined “contaminated land” under Part IIA. Therefore, appropriate risk-based investigation is required to identify the contaminant linkages that can then be assessed, and then mitigated using methods that can be agreed with the planners.

Source Protection Zones

Source Protection Zones (SPZs) are defined by the Environment Agency (for England and Wales), SEPA (Scotland) and the Environment and Heritage Service (Northern Ireland) for groundwater sources such as wells, boreholes and springs that are used for public drinking water supply. The zones show the risk of contamination from activities that might cause groundwater pollution in the area. The size and shape of a zone depends upon subsurface conditions, how the groundwater is removed, and other environmental factors.

SPZs are classified into four categories:

- **Zone 1 (Inner protection zone).** Any pollution that can travel to the abstraction point within 50 days from any point within the zone is classified as being inside Zone 1. This applies at and below the groundwater table. This zone also has a minimum 50 m protection radius around the abstraction point. These criteria are designed to protect against the transmission of toxic chemicals and water-borne disease.
- **Zone 2 (Outer protection zone).** The outer zone covers pollution that takes up to 400 days to travel to the abstraction point, or 25% of the total catchment area, whichever area is the largest. This travel time is the minimum period over which the Environment Agency considers that pollutants need to be diluted, reduced in strength or delayed by the time they reach the abstraction point.
- **Zone 3 (Total catchment).** This is the total area needed to support removal of water from the abstraction point, and to support any discharge from this.
- **Zone of special interest.** This may occasionally be defined as a special case. This is usually where local conditions mean that industrial sites and other potential sources of contamination could affect the groundwater source, even though they are outside the normal catchment area.

Groundwater Vulnerability Assessments

From 1 April 2010 The Environment Agency Groundwater Protection Policy began to use aquifer designations which are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems.

The aquifer designation data is based on geological mapping provided by the British Geological Survey. It is updated regularly to reflect their ongoing programme of improvements to these maps. The maps are split into two different types of aquifer designation:

- Superficial (Drift) - permeable unconsolidated (loose) deposits. For example, sands and gravels.
- Bedrock - solid permeable formations e.g. sandstone, chalk and limestone.

The maps display the following aquifer designations:

Table 1. Aquifer Classification ("Geological Classification").

Classification	Definition
Principal Aquifers (Highly Permeable)	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.
Secondary A Aquifers	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.
Secondary B Aquifers	Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
Secondary Undifferentiated Aquifers	This has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
Unproductive Strata	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Environment Agency Guidance

The Environment Agency's stance on groundwater resources is:

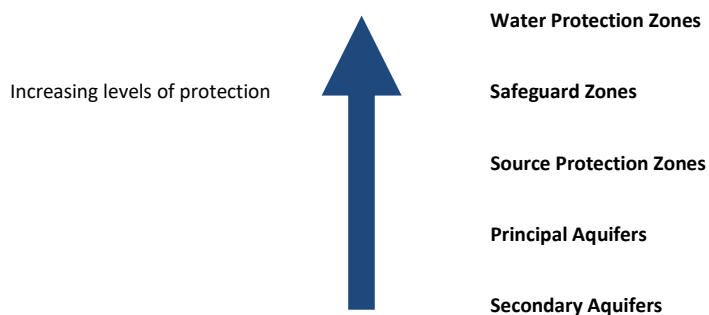
"to protect and manage groundwater resources for present and future generations in ways that are appropriate for the risks we identify"
(Groundwater Protection: Policy and Practice GP3, 2012).

At present, the legislation and guidance pertaining to the protection of controlled waters in the UK is complex; however, the core objectives seek to enforce the position given above.

In 1992, the National Rivers Authority published their Policy and Practice for the Protection of Groundwater (PPPG), this document introduced areas of focus for developments such as Source Protection Zones (SPZs) and Groundwater Vulnerability Maps. The Policy was revised in 1998, since which there have been substantial changes in legislation, driven by key European Directives relating to groundwater include the Groundwater Directive (80/68/EEC) and the Water Framework Directive (2000/60/EC). Aspects of these directives are controlled by primary UK legislation such as the Water Resources Act 1991 as amended by the Water Act 2003. Gaps in the 1998 PPPG that emerged as the result of further legislative changes were addressed in the Environment Agency Policy document Groundwater Protection: Policy and Practice (GP3), Version 1 of November 2012. The three main parts of GP3 were:

- Groundwater principals;
- Position statements and legislation; and
- Technical information.

The Environment Agency has a tiered risk based approach to drinking water protection as summarised below:



Controlled Waters Risk Assessment

A number of tools are available (as detailed in GP3) in order for a developer of a potentially contaminated site to fulfil their obligations under the legislation. A site assessment would be required in order to identify any potential risks to controlled waters and to derive suitable clean up criteria, if required, to ensure the protection of controlled waters.

There are three main stages to any risk assessment of controlled waters:

1. Risk Screening (devise Conceptual Site Model, making reference to groundwater vulnerability maps, site setting, controlled waters context etc)
2. Generic Risk Assessment (EA Remedial Targets Methodology Tier 1 / Comparison of groundwater data with relevant standards)
3. Detailed Quantitative Risk Assessment (Consideration of aquifer properties and site specific parameters, EA Remedial Targets Methodology Tiers 2 & 3)

Risk Screening

Here, the Conceptual Site Model (CSM) is a critical tool to assessing any potentially contaminated site. The information from a robust CSM can be used to establish any pathways or receptors that do not require further assessment at an early stage. For example, it may be possible to confirm the absence of a particular sensitive controlled water receptor (such as a surface water feature) within the vicinity of the Site thereby breaking the associated source-pathway-receptor pollutant linkage. Information from subsequent tiers of risk assessment, such as following intrusive investigations, are used to update the CSM accordingly.

Generic Risk Assessment - England and Wales

When undertaking the Generic Hydrogeological Risk Assessment (EA Remedial Targets Methodology Tier 1), comparison of chemical analytical results is made with those screening criteria.

In accordance with Part 2A of the Environmental Protection Act 1990, Tier Environmental has made regard to all of the Water Quality Standards (WQS) that are relevant to the specific site and a judgment has been made against the most stringent of those relevant standards:

- EQS Directive 2008/105/EC
- Priority Substances Directive 2013/39/EU
- Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015
- UK Drinking Water Standards (UK DWS)
- World Health Organisation (WHO Guidelines) for Drinking Water Quality
- Council Directive 98/83/EC on the quality of water intended for human consumption (Drinking water directive)

In some instances, the laboratory method detection limit is greater than the appropriate EQS/UKDWS value. In these instances, only measured concentrations in excess of the laboratory method detection limit have been considered likely to potentially represent a possible significant risk to controlled waters.

Please note that there is no quantitative criterion for total petroleum hydrocarbons (TPH), or speciated TPH fractions. Historically, standards provided for petroleum hydrocarbons ranges from 10µg/l (Private Water Supply Regulations 1991, removed from the 2009 regulations) to 50µg/l-1000µg/l (Surface Waters (Abstraction for Drinking Water) Regulations 1989) which related to the degree of treatment of water prior to use as drinking water. Over time, the legislative standards have been rescinded and no alternative standard provided, although the Environment Agency planned to release speciated TPH criteria (Fretwell et al., 2009).

In order to assess whether there is a potentially unacceptable risk of pollution of controlled waters, the results of the groundwater chemical analysis for TPH and BTEX were evaluated against Water Quality Standards (WQS) appropriate to the conceptual model for the site:

Table 2. Summary of Selected TPH and BTEX Water Quality Standards Selected for Tier 1 Screening

Determinand	Units	WQS Selected	Source of WQS
Aliphatics >C5-C6	µg/l	15000	Table 5.4 of CL:AIRE 2017#
Aliphatics >C6-C8	µg/l	15000	Table 5.4 of CL:AIRE 2017#
Aliphatics >C8-C10	µg/l	300	Table 5.4 of CL:AIRE 2017#
Aliphatics >C10-C12	µg/l	300	Table 5.4 of CL:AIRE 2017#
Aliphatics >C12-C16	µg/l	300	Table 5.4 of CL:AIRE 2017#
Aliphatics >C16-C21	µg/l	-	Table 5.4 of CL:AIRE 2017#
Aliphatics >C21-C35	µg/l	-	Table 5.4 of CL:AIRE 2017#
Aromatics >C5-EC7	µg/l	10	Table 5.4 of CL:AIRE 2017#
Aromatics >EC7-EC8	µg/l	700	Table 5.4 of CL:AIRE 2017#
Aromatics >EC8-EC10	µg/l	300	Table 5.4 of CL:AIRE 2017#
Aromatics >EC10-EC12	µg/l	100	Table 5.4 of CL:AIRE 2017#

Aromatics >EC12-EC16	µg/l	100	Table 5.4 of CL:AIRE 2017#
Aromatics >EC16-EC21	µg/l	90	Table 5.4 of CL:AIRE 2017#
Aromatics >EC21-EC35	µg/l	90	Table 5.4 of CL:AIRE 2017#
Benzene	µg/l	10	Priority Substance Water Framework Directive 2015 and Table 5.3 of CL:AIRE 2017#
Toluene	µg/l	74	Table 1 Water Framework Directive 2015 and Table 5.3 of CL:AIRE 2017#
Ethylbenzene	µg/l	20	R&D Technical Report P2-115/TR4, 2002
Total xylenes	µg/l	30	DoE (1997c) Hedgecott S. and Lewis S, An update on proposed environmental quality standards for xylenes in water, final report to the Department of the Environment. Report No. DoE 4273/1. Medmenham: WRc; and; Table 5.3 of CL:AIRE 2017#

Notes - # = CL:AIRE document 'Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies' (ISBN 978-1-905046-31-7, dated 2017),

Table 5.3 was referenced in the first instance from the CL:AIRE document 'Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies' (ISBN 978-1-905046-31-7, dated 2017), the to select appropriate Freshwater EQS values for benzene, toluene and total xylenes. The selected value for Ethylbenzene was derived from the proposed EQS value of 20µg/l from the Environment Agency R&D Technical Report P2-115/TR4, 2002. This represents a more conservative value than the 300µg/l value in Table 5.3.

With respect to speciated TPH CWG fractions, Table 5.3 states and refers the reader to 'See Table 5.4'. On this basis, Tier Environmental selected the World Health Organization (WHO) guide values for TPHCWG fractions in drinking water that are presented in Table 5.4 which may be considered appropriately protective of the controlled waters environment based on the conceptual site model.

Generic Risk Assessment is generally undertaken via comparison of reported leachate and/or groundwater concentrations against selected assessment criteria for the potential contaminants of concern identified for the Site from a preliminary desk based assessment.

The selected Generic Assessment Criteria (GAC) derived from a Water Quality Standard (WQS) for any specific substance may not necessarily be a simple number and can often be found to be expressed as:

- Annual mean concentration;
- Maximum allowable concentration;
- 95th percentile concentration for *n* samples;
- Total concentration;
- Dissolved concentration (applicable to filtered samples)

The values may sometimes be expressed for individual substances (e.g. arsenic or for groups of substances e.g. total xylenes or sums of certain PAHs).

Environmental Quality Standards (EQS) have been used where available for Priority Substances and Priority Hazardous Substances set at a European level:

- Priority Substances Directive 2013/39/EU;
- Amending 2008/105 and 2000/118/EC

In addition, EQS values derived for Specific Pollutants have been used as presented in The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

For assessing risks to potable water abstraction supplies, UK Drinking Water Standards presented in the Water Supply (Water Quality) Regulations 2000 (SI/2000/3184) (as amended) have been applied.

In selecting a GAC for a particular Site, Tier Environmental considers the following factors:

- Current use/function of the groundwater (e.g. drinking water, irrigation water, industrial use, base-flow to rivers and streams);
- Plausible, proposed or planned future uses of the water and nearby waters;
- Sensitivity of the critical receptor (e.g. human health, aquatic life); and,
- Requirements to trigger action under the legal context

In accordance with Part 2A:

"in deciding whether pollution of controlled waters is occurring, the assessor will have regard to all of the water quality standards that are relevant to the specific site and make a judgment against the most stringent of those relevant standards"

Should the Level 1 or 2 assessments indicate threshold levels to be exceeded, then there are three alternative ways in which to proceed:

- To devise suitable remedial solutions;
- To carry out more investigation, sampling and analysis;
- To conduct a site-specific Detailed Quantitative Risk Assessment (DQRA) to whether or not the soil materials are suitable for their site-specific intended use or to devise a site-specific clean-up level.

Detailed Quantitative Risk Assessment (DQRA)

The decision to carry out a DQRA will be informed by the initial qualitative and generic assessment. The scope of any such assessment will be accurately defined by the outcomes of the former two stages. The robust CSM will be sufficiently refined by this stage that only certain contaminants of concern, certain pathways and certain receptors will require further assessment.

Additional site specific data is normally required for this stage of assessment, as explained above, more processes that are capable of affecting contaminant concentrations are considered (such as dilution and attenuation).

Remediation criteria derived will therefore be specific to each site and will be based on a detailed assessment of the potential impact at the identified receptor or compliance point. A greater level of confidence can be placed on the predicted impact on the compliance point following a DQRA.

Hazardous and Non Hazardous Substances

The Groundwater (England and Wales) Regulations 2009 control the disposal to the hydrogeological environment of potentially polluting substances which are divided into Hazardous Substances and Non-hazardous Contaminants (this roughly approximates to the former List 1 and List 2 substances).

Hazardous Substances are the most damaging and toxic and must be prevented from directly or indirectly entering the groundwater environment. Hazardous Substances include mineral oils and hydrocarbons, pesticides, biocides, herbicides, solvents and some metals. Discharge of Hazardous Substances to Controlled Waters must be prevented.

Non-hazardous Pollutants are any contaminants other than Hazardous Substances. Non-hazardous Pollutants are potentially toxic but are less harmful than Hazardous Substances, but their direct discharge to groundwater is generally not permitted and any indirect discharge to groundwater must be limited and be controlled by technical precautions in order to prevent pollution. Non-hazardous Pollutants include ammonia and nitrites, many metals and fluorides.

APPENDIX M - ASSESSMENT CRITERIA APPLIED FOR GROUND GAS

Ground Gas Monitoring Methodology

Monitoring for the following is generally performed as part of ground gas assessment:

- Methane (CH₄): an odourless, flammable gas. Mixtures of methane with air containing between 5 and 15% v/v methane are explosive.
- Carbon dioxide (CO₂): an asphyxiant at elevated concentrations. Denser than air, it can accumulate in excavations, and within low points inside buildings
- Oxygen (O₂): important in the assessment of the potential formation of explosive mixtures with methane. Monitoring normally measures both methane and oxygen concentrations in ground gas to derive an indication of the risk of explosive mixture formation, expressed as a percentage of the Lower Explosive Limit (LEL). Low concentrations of oxygen in ground gas can also exacerbate the risk of CO₂ asphyxiation.
- Hydrogen sulphide (H₂S): odorous and toxic, capable of forming flammable mixtures with air.

In addition, depending on the Conceptual Site Model, monitoring may also include for measurements of Volatile Organic Compounds (VOCs); present as chemical contaminants of soil and sometimes also biologically produced in low concentrations.

Assessment of methane (CH₄) and carbon dioxide (CO₂)

Methane and carbon dioxide can arise from natural geological sources, mine workings, rotting organic matter (peat, landfilled materials, etc.) and/or contaminant biodegradation. Assessment of ground gas composition and flows is therefore an essential part of site assessment. The need to adequately address potential risks from ground gas on development sites is therefore required under the planning regime.

In order to appropriately assess the site risks, the Construction Industry Research and Information Association (CIRIA) and others have issued several guidance documents on landfill and ground gas that are intended to provide advice on how to investigate and deal with gas contaminated ground with respect to development. These are:

- Report 149: 'Protecting Development from Methane' (CIRIA, 1995a)
- Report 150: 'Methane Investigation Strategies' (CIRIA, 1995b)
- Report 151: 'Interpreting Measurement of Gas in the Ground' (CIRIA, 1995c)
- Report 152: 'Risk Assessment for Methane and Other Gases from the Ground' (CIRIA, 1995d)

More recent guidance has been published to update the documents detailed above to collaborate and promote industry 'good practice'. These are:

- CIRIA Report 665: 'Assessing risks posed by hazardous ground gases to buildings (CIRIA, 2008)
- NHBC: 'Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present' (NHBC, 2007)
- BS8485:201+A1:2019: Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (BSI Group, 2019)
- BS8576:2013: Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs) (BSI Group, 2013)
- SoBRA Report Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater (Feb 2017)
- CL:AIRE Technical Bulletin TB17 Ground Gas Monitoring and 'Worst Case' Conditions (CL:AIRE Aug 2018)

The earlier CIRIA 149 approach is now considered to be too conservative. A more realistic measure of the risk posed by methane and CO₂ in ground gas can be established by determining an appropriate Gas Screening Value (GSV), using the methods described in the NHBC and CIRIA 659 documents. These values are based upon earlier work undertaken by Wilson and Card (1999).

GSVs are calculated by multiplying the borehole flow rate (l/hr) by the percentage (% v/v) concentration in the gas stream of the specific component, i.e.:

$$\text{GSV} = (\text{Concentration} / 100) \times \text{Flow rate.}$$

A risk-based methodology for deriving GSVs is defined for two situations (designated A and B), which are adequate for the great majority of site cases (as per CIRIA 665 Section 8.3):

- **Situation A:** Any development other than Situation B, e.g. factories, shops, commercial, warehouses, schools, cinemas, sports centres, stadiums, high rise housing, housing with basements, etc
- **Situation B:** Low rise building with minimum ventilated under floor void (min 150 mm)

Under Situation A, classification of the scope of protection required is determined from the site GSV, summarised in Table 1. For Situation B, GSVs derived are used in a 'Traffic Light' classification (summarised in Table 2) which determines the required level and scope of protection measures. Tables 1 and 2 are summaries only: the details provided in the body text, footnotes and appendices of the above-referenced documents should be read in conjunction with the results to determine the appropriate level of protection.

For conservatism, Tier Environmental **initially** uses the maximum concentration and gas flow rate of methane detected in any borehole during all of the monitoring visits in deriving recommendations on appropriate protection measures. This represents the worst-case risk of forming an explosive mixtures. For carbon dioxide, steady state concentrations and flow data are applied, as these determine the development of an asphyxiating mixture. All values are selected whether or not they occurred in the same borehole or during the same monitoring event.

Exceedances of the maximum concentrations used in a Tier 1 Gas Risk Assessment can be tolerated, when the conceptual site model indicates that it is safe to do so. However, appropriately derived GSV values must never be exceeded - where site-specific circumstances permit the derivation of alternative GSVs according to the defined conceptual model, then the appropriate GSV values should be applied.

Table 1. GSV Categories Defined for Situation A (Summarised from CIRIA Report 665).

Risk classification	GSV (CH ₄ or CO ₂ ; l/hr)	Additional factors	Characteristic Situation
Very low	<0.07	Typically methane <=1% and/or CO ₂ <=5%, otherwise consider increase to Low Risk.	1
Low	<0.7	Typically borehole ground gas flow rate <=70 l/hr; otherwise consider increase to Moderate Risk.	2
Moderate	<3.5	---	3
Moderate to high	<15	QRA required to evaluate scope of remediation measures.	4
High	<70	---	5
Very high	>70	---	6

Table 2. GSV Categories Defined for Situation B (Summarised from NHBC, 2007).

Methane		CO ₂		"Traffic light" classification
Typical max. conc. (% v/v)	GSV (l/hr)	Typical max. conc. (% v/v)	GSV (l/hr)	
				Green
1	0.13	5	0.78	Amber 1
5	0.63	10	1.60	
				Amber 2
20	1.60	30	3.10	Red

Assessment of hydrogen sulphide (H₂S)

H₂S is toxic and highly odorous ("rotten eggs") gas. It is often a minor component within mine gases, in ground gas within or overlying strata rich in pyrites or other sulphide-rich ores, and in most natural gas fields.

H₂S can be generated biologically in significant concentrations by the decomposition by sulphate-reducing bacteria of natural or anthropogenic organic matter under oxygen-free conditions. Its potential generation will be greater in environments containing elevated sulphate concentrations (including sea water). H₂S is therefore common within the gas arising from estuarine and marine sediments, pond sediment, stagnant water bodies, bogs and marshlands and landfilled waste, for example.

It must be noted that H₂S normally occurs together with other potentially hazardous ground gases. The measures adopted for protection against these will prove equally protective against H₂S.

There are no standards by which H₂S concentrations in ground gas can be assessed directly. Therefore, the significance of measured H₂S concentrations in ground gas must be evaluated on a case-by-case basis, taking into account the measured concentrations of other components and the specific conceptual site and exposure models. To assist in this process, the following standards and guidance may be applied.

General protection of land users

There are no UK air quality standards for general exposure to H₂S. The World Health Organisation has derived ambient air quality standards (WHO, 2000) for this gas, which may be used to inform risk assessment and decision-making:

The 24 hour average exposure guideline value for ambient air: 0.15 mg/m³ (0.1 ppmv, approx.; this was derived by the application of a 100x safety factor to the LOAEL for long-term exposure).

This is significantly above the odour threshold, which is typically around 0.01 mg/m³. To avoid substantial nuisance odour complaints, WHO (2000) recommends that the 30 minute average H₂S concentration in ambient air should not exceed: 0.007 mg/m³ (0.005 ppmv, approx.).

Occupational exposures

For occupational exposure, the HSE (2005) limits for H₂S are applicable:

- 8 hour time weighted average occupational exposure limit: 5 ppmv (7 mg/m³).
- Short-term exposure limit (15 minute reference period): 10 ppmv (14 mg/m³).

VOC Data Collection, Sampling and Assessment

BS8576 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs).

Volatile organic compounds (VOCs) include, for example, halogenated hydrocarbons such as trichloroethene, non-halogenated hydrocarbons such as benzene, and organosulfur compounds such as thiols (mercaptans). They can occur as a component of ground gas originating from historically contaminated ground, spills and leaks from industry, commercial or residential properties (e.g. from pipelines, storage facilities, and at the point of use or dispensing), land-filled wastes and from naturally occurring sources.

The migration of VOCs in ground gas can be via three primary mechanisms:

- diffusive flow (movement of constituent along a concentration gradient);
- advective flow (movement of constituent due to motion of a transporting fluid);
- dispersion (transport resulting from local variations in fluid flow, e.g. due to friction effects in the matrix).

The choice of sampling and monitoring techniques should be based upon the conceptual model and be designed to achieve the objectives of the investigation, bearing in mind the requirements of any subsequent analytical procedures and the need to provide relevant data of sufficient quantity and quality. Consideration should also be given to the nature of ground under investigation, as well as the nature and distribution of contamination, the geology and the hydrogeology. Every effort should be made to avoid cross-contamination and at no point should underlying aquifers be put at risk.

Where the response zone extends below the water table, gas present in the groundwater will tend to produce an equilibrium concentration in the well headspace. This applies to both permanent gases and VOCs but can be particularly misleading in the latter case. Testing for dissolved gases in groundwater is useful to help interpret monitoring results in such a situation. Similarly, any VOCs in a floating non-aqueous hydrocarbon layer will produce an equilibrium concentration in the well headspace.

The monitoring period and frequency of monitoring for VOCs in ground gases should be developed on a site-specific basis from the conceptual site model and investigation data quality objectives.

Ground gas samples can be collected from the unsaturated zone adjacent to, or above, the known or suspected source of VOCs in ground gas through installation of a ground gas monitoring point in the unsaturated zone (see 10.2), and from a near-surface location beneath hardstanding or a floor or foundation slab through installation of a near- or sub-slab monitoring point (see 10.3). For monitoring of VOCs in ground gas the monitoring well should be installed into unsaturated ground to allow sampling for VOCs to take place. The borehole should not be progressed below the groundwater table or the surface of any floating non-aqueous layer. The borehole should be progressed to the target sampling depth within the unsaturated zone. Full details can be found in BS8576 Section 10.2 onwards.

Assessment of VOC concentrations have been made for limited number of VOCs by SoBRA with the Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater in Feb 2017.

The assessment of VOC concentrations is not covered by above-referenced reports. These data can be used to inform the human health risk assessment for site occupants but should not be relied upon to assess human health risk due to uncertainties in the ground gas flow regime, variability in the (generally low) contaminant concentrations measured and inaccuracies in the concentrations measured by PID instruments.

Data on the VOC concentration in ground gas can also help inform potential occupational exposure risks to construction and similar workers. For this purpose, the measured values can be compared to the relevant occupational exposure limit (OEL) for the contaminant(s) of concern, as given in HSE (2005). In cases of doubt as to the identity of the organic contaminants within the ground gas or when these are present as a complex mixture, then the 8 hour time-weighted average (TWA) exposure limit for benzene (1 ppmv) will be applied for screening purposes. This is a reasonably conservative approach since the OEL for benzene is lower than that for the great majority of organic contaminants commonly encountered in soil and groundwater at contaminated sites

APPENDIX N - CHEMICAL AND GEOTECHNICAL TEST SAMPLING

Samples were selected by a representative of Tier Environmental during the site investigation works in accordance with the sampling approach described elsewhere in this report.

Samples for geotechnical and related testing

Bulk samples were placed within robust heavy duty plastic bags and sealed, together with small disturbed samples, within airtight 1 litre plastic containers.

100 mm diameter ‘undisturbed’ samples (“U100 samples”) were obtained where possible from cable percussive and large diameter window sample boreholes within cohesive materials.

Samples for chemical analysis

All samples for chemical analysis were placed into clean new containers as summarised in Table 1. Unless explicitly stated elsewhere in this report, no preservatives were used to eliminate the risk that preservatives cause contaminant dissolution or analytical interference. Containers for VOC analysis were fully filled to exclude headspace.

Soil samples were dispensed as soon as possible after collection using reusable stainless steel spatulas, trowels or similar implements.

Ground water samples were collected from boreholes using single-use Teflon bailers or dedicated Waterra tubing with foot valves, except as otherwise noted within this report. Caution was taken to avoid excessive agitation during collection

New disposable gloves were used by the engineer for the collection of each sample.

Reusable equipment was washed down with distilled or deionised water between samples, except where tarry or similarly sticky materials were present. In such cases specific cleaning procedures were adopted as specifically described elsewhere in this report.

All sub-samples taken for chemical analysis were placed into refrigerators or cool boxes containing frozen ice packs immediately after aliquoting. All samples were transferred in cool boxes containing frozen ice packs to the relevant UKAS/MCERTS accredited laboratory as soon as possible. Recommended maximum holding times before analysis are summarised in Table 1.

Table 1. Sample containers and holding times.

Analysis	Container/special requirements	Max. holding time at 4°C before analysis
Soil and sediment samples		
VOCs	30-60 g brown or green glass jar with VOC-resistant cap and inert cap liner. Must be fully filled.	14 days
TPHCWG	30-60 g brown or green glass jar with VOC-resistant cap and inert cap liner PLUS 250-500 g brown or green glass jar with unwaxed cap liner. ¹ The former must be fully filled.	14 days
All other organics	250-500 g brown or green glass jar with unwaxed cap liner.	7 days
Inorganics	Air-tight 0.5-2.0 kg plastic container (250-500 g brown or green glass jar may also be used).	14 days ²
Water samples		
VOCs	40-50 ml glass vial with VOC resistant screw cap and inert liner. Must be fully filled.	14 days
TPHCWG	40-50 ml glass vial with VOC resistant screw cap and inert liner PLUS 500-1000 ml brown or green glass bottle with screw cap and unwaxed liner. ¹ The former must be fully filled, the latter should be filled if possible.	14 days
All other organics	500-1000 ml brown or green glass bottle with screw cap. Fill if possible.	7 days
Inorganics	500-1000 ml translucent or opaque screw cap plastic <i>or</i> brown or green glass bottles. Fill if possible.	14 days ³

¹ The smaller vessel is used for analysis of the volatile components within the TPH mixture and the larger one is for the non-volatile components.

² 14 days is set as a reasonable limit for all routine analyses of soil for those inorganic components vulnerable to chemical and/or biological breakdown. Samples for sulphate analysis are vulnerable to biological sulphate-reduction but can be held for up to 28 days. For total metals, a holding period of up to 6 months is acceptable.

³ 14 days applies for all routine analyses of most inorganic components that may be vulnerable to chemical and/or biological reactions. In the specific cases of sulphide, nitrite, nitrate and phosphate analyses, storage time must not exceed 48 hours. For total metals, a holding time of up to 6 months is acceptable.

Tier Environmental standard analytical suites

The analyses included with Tier Environmental's standard analytical suites for soil, soil leachate and water samples are presented in Table 2. Other individual analyses were specified as described within this report.

Table 2. Tier Environmental Standard Analytical Suites.

Parameter	Sample type					
	Soil		Leachate ¹		Water	
		LoD ² (mg/kg or as stated)		LoD (µg/l or as stated)		LoD (µg/l or as stated)
Metals and metalloids						
Arsenic	✓	1	✓	10	✓	10
Cadmium	✓	1	✓	5	✓	5
Chromium	✓	1	✓	5	✓	5
Mercury	✓	1	✓	1	✓	1
Lead	✓	1	✓	4	✓	4
Selenium	✓	2	✓	10	✓	10
Copper	✓	1	✓	1	✓	1
Nickel	✓	1	✓	50	✓	50
Zinc	✓	1	✓	8	✓	8
Other inorganics						
Ammonia (as NH ₄ -N)					✓	15
Total sulphate	✓	100			✓	50 mg/l
Water-soluble sulphate	✓	0.1 g/l				
Hardness (as CaCO ₃)					✓	1 mg/l
Organics						
Monohydric phenol	✓	1	✓	0.5	✓	0.5
Speciated PAHs (USEPA 16)	✓	0.1	✓	0.01	✓	0.01
Total Organic Carbon	✓	0.1 wt%				
Others						
Electrical conductivity					✓	NA
pH	✓	NA	✓	NA	✓	NA

NA - Not applicable

¹ Leachate preparation according to NRA (1994), 10:1 liquid to solid ratio.

² The table presents the desired limit of detection for the analysis. Higher LoDs may be reported on analytical data sheets due to interference between analytes within specific samples or if the laboratory needed to dilute samples to achieve results within the calibrated range for that instrument.

Analytical QA procedures

Introduction

Quality Assurance (QA) is a system of review and audit that assesses the effectiveness of that product and assures the producer and user that defined standards of quality have been met. If we consider site investigation and chemical analysis, QA is the management system that ensures these measures are in place and working as intended.

QA within the laboratory form part of relevant certification programmes (such as UKAS and MCERTS) and, indeed, will be undertaken in some form by any reputable analyst, whether for a certified technique or not. Laboratory QA/QC is beyond the control of Tier Environmental and will not be considered further in this document, although the relevant laboratory documentation can be obtained upon request. QA must also form part of the design and execution of a site investigation.

Two parameters often used to assess measurement quality objectives are bias and precision. Bias is a systematic deviation in the data. For example, a positive bias (concentrations higher than in reality) would be introduced if sampling bottles were a source of the analyte and this fact was unknown. Precision is the variation in the measurements around a central 'expected' value. This could be due both to real variability in the environmental medium being measured and random errors in the analytical process. Both precision and bias can be assessed by the use of appropriate blanks and replicates within the site investigation programme.

The objectives of the QA activities undertaken in this present site investigation were to recognise and quantify systematic bias within the analytical dataset and to obtain an indication of precision. In environmental samples, much of the observed variability is likely to result from heterogeneity in the sampled medium, particularly for soil and sediment samples.

Such QA practice within the sampling programme is required by current guidance (e.g., Environment Agency report P5-065/TR (2000); Environment Agency LFTGN02 (2002); BS 10175:2001).

Alternative QA procedures to the generic approach presented in this appendix may be specified for a project, provided case-specific justification is given.

QA checking procedure (data validation)

The responsible Engineer and Project Reviewer are required to undertake data validation and provide comment on data quality within the main body of the report(s) issued, when noteworthy matters arise. This QA checking should involve:

Confirming that data reported by the laboratory have achieved the standards specified by the certification scheme (MCERTS or UKAS). This will be indicated on the analytical certificates issued by the laboratory.

Checking that the limit of detection (LoD) and limit of quantification (LoQ) achieved by the laboratory for an individual analyte is appropriate for the purposes of the report. LoD and LoQ will vary dependent upon analyte concentrations, sample matrix properties and interference from co-contaminants.

A check that the reported range of concentrations are reasonable for the analyte. For example, the dissolved concentration of an analyte in a water sample should not exceed saturation. If it does, then this merits further consideration (e.g., was colloidal organic matter or other solid-phase material present or could there have been unobserved free-phase organic liquid?) and explicit comment. At its simplest, there may be a unit error.

Where analysis involves reporting of Tentatively Identified Compounds (TICs; normally by mass spectrometry), the reviewers should check that these might reasonably be expected at the site under consideration. The uncertainties in identification by MS mean that it is not uncommon that TICs are incorrectly assigned. In cases of doubt, the analytical laboratory can re-check the raw data and confirm.

A review of the analytical precision by comparing data obtained for duplicate samples. There is no absolute threshold - variability is entirely dependent upon the sample matrix and manner in which the contaminant has entered the sample. Variability that cannot reasonably be assigned to such factors (for example a very high apparent variability in data for sediment-free water samples) should be reviewed with the laboratory. Variability that is attributable to the sample matrix can nevertheless provide important pointers to improve understanding of contaminant transport pathways and the risks posed by pollutant linkages (e.g., soil heterogeneity, the association of contamination with particular soil fractions, the presence of residual NAPL within soil pores or the role of suspended sediments in contaminant transport).

Confirmation that no errors have been introduced by data transcription, unit conversion or corrections between preliminary and certificates issued by the laboratory. The reviewer should audit a proportion (typically 5-10%) of all data from the original (final) certificates of analysis through to the equivalent values in the report for those specific samples.

It is important to consult the analytical laboratory if apparent QA issues arise. Many apparent concerns can be adequately resolved on the basis of revisiting the raw analytical data or by obtaining a better understanding of the inherent limitations of the analysis for a particular matrix or sample type.

APPENDIX O - COMPLYING WITH CONTROL OF ASBESTOS REGULATIONS 2012

Complying with Control of Asbestos Regulations (CAR): Risk Assessments, Licensing and Training

This appendix outlines CAR risk assessments and where they should be applied in relation to assessing and remediating brownfield sites. The information below details the different classifications of work with asbestos under CAR, summarises the legal requirements for asbestos awareness training for all involved in the investigation and management of asbestos containing soil (ACS), and details the potential requirements for suitable proficiency training relating specifically to ACS.

CAR RISK ASSESSMENTS

A CAR Risk Assessment is required for any work which may expose employees to asbestos. It is recommended that a precautionary approach is adopted if there is any doubt about risks associated with asbestos.

There are three main activities for potential asbestos exposure during work on brownfield sites:

- Site reconnaissance visits;
- Site investigation works; and
- Site remediation.

CAR risk assessments are needed at each stage but may be incorporated during the site investigation stage into the overarching health and safety risk assessments.

The CAR risk assessment must:

- Identify the type of asbestos to which employees are liable to be exposed, where possible, or assume it is present in different forms;
- Determine the type and extent of exposures to asbestos that may occur during the work
- Identify the steps to be taken to prevent exposure or reduce it to the lowest level reasonably practicable; and,
- Consider the effects of control measures that have been or will be taken.

The CAR risk assessment should include any information used to inform the risk assessment such as asbestos reports or desk study information. In the event that this information is not available, the assessor should be assumed that all forms of asbestos may be present on Site.

For all investigation and remediation of ACSs, a detailed written work plan should be produced and followed as detailed on the HSE website and in the CAR.

The CAR risk assessments for specific investigations or remediation projects, will determine whether or not work is 'licensable work' (LW), notifiable non-licensable work' (NNLW) or 'non-licensed work' (NLW). In addition, training requirements are also defined by the CAR risk assessment.

Some examples of control measures that apply during site reconnaissance, site investigation works, and site remediation are given below and should be applied depending on the asbestos risks identified for the Site at each stage of investigation:

- Avoiding stirring up dust;
- Cleaning footwear after site works;
- Removing and bagging any overalls for disposal/laundry;
- Respirators and hygiene facilities for high risk sites;
- Segregated welfare units;
- Wetting ground
- Minimising soil disturbances;
- Implementation or retention of capping/break layers;
- Implementation of awareness training;
- Air monitoring;
- Managing stockpiles;
- Area segregation;
- Wheel washing
- Road washing/cleaning

It is important to note that during Site reconnaissance visits, Site investigation works and Site remediation that asbestos should not be considered in isolation and control measures are likely to form part of a wider health and safety precautions.

Respiratory protective equipment (RPE)

RPE is the last line of defence and its requirement would be defined by the CAR risk assessment. HSE (2013b) advises that RPE should have an assigned protection factor of 20 or more for all work with asbestos. In certain instances, full face-piece, positive pressure respirators with a protection factor of 40 are necessary (to EN 12942:1998, TM3).

Suitable types of RPE for most **short** duration non-licensed asbestos work:

- Disposable respirator to standards EN149 (type FFP3) or EN1827 (type FMP3)
- Half mask respirator (to standard EN140) with P3 filter
- Semi-disposable respirator (to EN405) with P3 filter

These filters are not suitable for people with beards/stubble or for long or continuous use.

LICENSING

CAR defined certain types of activities involving asbestos as 'licensable work' (LW) or as 'notifiable non-licensable work' (NNLW). All other work would be 'non-licensable work' (NLW).

LW is defined as:

- work where exposure is not 'sporadic and low intensity'
- work where the risk assessment cannot demonstrate that the control limits (four hour and 10 minute limits) will not be exceeded
- work on asbestos coating
- work on AIB or insulation where risk assessment is either of first two points above or not of short duration (where short duration is defined for any work liable to disturb asbestos as taking less than two hours per week (including ancillary work) and no one person carries out that work for more than one hour').

NNLW includes work with:

- AIB or asbestos insulation of short duration that is not licensable
- fire-damaged asbestos cement or asbestos cement damaged so as to create significant dust and debris
- asbestos ropes, yarns, woven cloths in poor condition or handling cutting or breaking up the materials
- asbestos papers, felts and cardboard in poor condition, unencapsulated or not bound into another material.

Work with weathered asbestos cement, air monitoring and collecting samples of ACM in buildings would not normally be notifiable.

It is impossible to specify definitively what activities will and will not be licensable. This decision should be made as part of the CAR risk assessment. CAR is not primarily aimed at work with ACSs and there is little published information on airborne asbestos concentrations during work with ACSs. Nevertheless, CAR will require some remediation projects, and occasionally site investigations, to be LW. Investigations on other sites may involve NNLW. The decision as to whether work is LW or NNLW should be made during the CAR risk assessment by those in charge of the brownfield site investigations and remediation projects.

TRAINING REQUIREMENTS

Asbestos health and safety courses are offered by a number of providers in the UK. Training courses that include the problem of identifying ACMs in soil should be undertaken at regular intervals by those involved in the investigation, assessment and management of sites where ACs are known or suspected. It is the role of the employer to identify the level of training required for an employee based on their role, experience and duties. Reference to Regulation 10 of CAR should be referred to for more information on training requirements.

Recognising asbestos within soils is challenging due to the heterogeneity of such soils and the discolouration of asbestos by smeared soil. Specific training for ground workers should include understanding fibre release potential, potential control measures in the field, how to take representative ACSs safely, sample labelling and what analytical tests are available and when they should be implemented.

Health and safety training required under CAR includes asbestos awareness, non-licensable work (including notifiable non-licensable work) and licensable work with asbestos.

In addition to health and safety training, some staff involved in the technical identification on site of ACMs, sampling and analysis may require technical proficiency training (competency training).

Training vs. Competence

HSE (2005) identifies that 'training alone does not make people competent. Training must be consolidated by practical experience so that the person becomes confident, skilful and knowledgeable in practice on the job'. It is critical that ACS surveyors demonstrate competency with details of relevant field experience alongside training and examples of previous works/references.