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Phase 2 Intrusive Site Investigation Report

LOCATION	Proposed Residential Development, Tetlow Street, Liverpool, L4 4LF
ISSUE DATE	31st March 2015
FOR	BYA Architects (Liverpool)
CLIENT REF.	1712
OUR REF.	G15029b

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1. Introduction

Following submission of a Phase 1 Desk Study (ref Report No G15029a issued 8th March 2015) and in accordance with your instruction, Geoinvestigate Ltd subsequently carried out a Phase 2 investigation on a currently vacant plot of land adjacent to Tetlow Street, Liverpool

The purpose of the Phase 2 investigation was to establish the true nature of the ground conditions at the site for foundation design and to assess the risks highlighted in the Phase 1 conceptual ground hazard model (CGHM) with regard to geotechnical hazards and the potential for hazardous gas and contamination to occur at the site.

2. Scope of Phase 2 Investigation

2.1 Scope of Works

The previous Phase 1 report concluded that the following investigation would be appropriate for to assess the potential risks highlighted in that study:

- The sinking of seven (7) boreholes (BH1 to BH7) to depths of between 0.85m and 1.80m within the proposed building footprints and external areas of the development, with associated soil sampling and supervision of the works by a suitably qualified geo-environmental engineer. The boreholes were sunk by windowless sampling drilling techniques using a Dando Terrier drill rig.

- The installation of three (3) gas monitoring wells in boreholes BH1, BH3 and BH7.

- Geotechnical Testing comprising One (1) Atterberg Limits and eighteen (18) moisture determinations to provide information with regard to soil plasticity on the site.

- Six (6) gas monitoring visits over a period of three (3) months, including readings below 1000mb and where possible following a sharp drop in atmospheric pressure.

- Contamination analyses of ten (10) samples of soil recovered at shallow depth (≤0.50m) and deeper underlying soils to confirm that metals, Asbestos, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) are absent or within acceptable limits. (Chemical analyses based on findings of the Phase 1 Desk Study Report). Leachate from three (3) samples was analysed also.

- Provision of a factual and interpretative report including; site plan, borehole logs, contamination results and gas measurements together with advice on suitable foundation types and, if required, remediation and validation The borehole positions are shown on the plan provided in Appendix 1.

The excavations were sampled and logged at site by a geo-environmental engineer and the ground conditions encountered are described on the borehole logs also provided in Appendix 1.

Moisture and Atterberg Limit test results are provided in Appendix 2.

The results of the contamination testing and CLEA v1.06 software are included in Appendices 3 and 4 respectively.

2.2 Sampling Rationale

Boreholes BH1 to BH7 were positioned principally to establish the ground conditions beneath the proposed buildings and their gardens. Their purpose was to recover soil samples for geotechnical and contamination testing.

3. Phase 2 Findings

3.1 Encountered Ground Conditions

It was anticipated from the Phase 1 Desk Study findings that made ground of shallow depth would be encountered possibly arising from previous developments on the site. It was anticipated that the fill would be underlain by sandstone bedrock of the Chester Pebble Beds Formation at shallow depth. No superficial geology was recorded for the site.

3.1.1 Windowless Sampling Boreholes

Generally the boreholes encountered similar ground conditions, comprising generally loose sandy gravel and gravelly sand made ground underlain, in places, by very dense or dense natural sandy gravel and/or hard sandstone bedrock in which refusal was met at relatively shallow depth.

3.1.1.1 BH1 & BH2

Boreholes BH1 and BH2 encountered made ground comprising blackish brown sandy gravel fill to 0.30 and 0.20m respectively, underlain at BH1 by reddish brown gravelly sand fill and at BH2 by grey concrete sandy gravel fill to depths of 0.45m and 0.40m respectively. BH2 then encountered very dense orangish and reddish brown natural sandy gravel to 0.60m. Hard orangish red sandstone was encountered from 0.45m to 0.85m in BH1, and from 0.60m to 1.00m in BH2, at which depths both boreholes met refusal.

In Situ SPT testing (carried out with a solid cone) within the sandstone returned refusal values of N=64 over 150mm in BH1 from 0.85m, and N=76 over 150mm from 1.00m in BH2.

Both boreholes were observed to remain open and dry on completion and no roots were encountered in the excavations.

3.1.1.2 BH3 & BH4

Boreholes BH3 and BH4 encountered similar blackish brown sandy gravel made ground to 0.40 and 0.65m respectively, overlain at BH3 by turf and BH4 by 0.35m of topsoil. Below this at BH4 grey sandy concrete gravel was encountered again to 0.75m underlain by very dense orangish and reddish brown natural sandy gravel, inferred to possibly comprise completely weathered sandstone rock to refusal at 1.45m.

BH3 encountered a the greatest depth of made ground found anywhere on the site with the initial horizon underlain by very loose orangish red sandy gravel fill from 0.40m to 1.65m followed again by

grey sandy concrete gravel (inferred to possibly comprise a former basement floor) to 1.75m where hard orangish red sandstone was encountered from 1.75m to refusal at 1.80m.

In Situ SPT testing (carried out with a solid cone) within the made ground in BH3 returned an N value of N=2 from a depth of 1.00m with a refusal value returned of N=50 over 150mm from1.80m. An N value of N=65 was returned in the natural sandy gravel in BH4 from 1.00m.

Both boreholes were observed to remain open and dry on completion and no roots were encountered in the excavations.

3.1.1.3 BH5, BH6 and BH7

BH6, BH6 and BH7 encountered turf and/or topsoil to depths of between 0.30m and 0.35m underlain by reddish brown gravelly sandy fill similar to that encountered in BH1 to depths of between 0.65m and 0.70m. This was underlain by grey and reddish brown sandy gravel fill at BH6 and BH7 to 0.95m and 0.90m respectively. Very dense and dense natural sandy gravel was again encountered below the made ground horizons in BH5 and BH7 only with all three boreholes then meeting refusal in hard orangish red sandstone at 1.05m in BH6, 1.25m in BH7, and slightly deeper in BH5 at 1.70m (where the natural sandy gravel extended to 1.40m).

In Situ SPT testing (carried out with a solid cone) within the natural sandy gravel in BH5 returned an N value of N=72 from a depth of 1.00m with a refusal values returned of; N=50 over 150mm from1.70m in BH5, N=76 over 125mm from 1.00m in BH6, and N = 73 over 150mm from 1.00m BH7.

All three boreholes were observed to remain open and dry on completion and no roots were encountered in the excavations.

3.1.2 Review of ground conditions encountered

The boreholes encountered generally loose sandy gravel or gravely sand fill, occasionally overlain by thin turf and/or topsoil horizons, to depths of up to 0.95m with deeper made ground encountered at BH3 in a possible former cellar feature. Below the made ground dense and very dense natural sandy gravel and/or hard sandstone bedrock was encountered in which refusal was met.

Generally the depth to bedrock was seen to increase from 0.45m in BH1 in the southwest of the site to perhaps 1.45m in BH4 (where refusal was met) in the northeast, with the exception of BH3 where a possible former cellar was encountered and bedrock found at 1.75m.

3.2. Soil Plasticity and Vegetation Influence.

Soils encountered at the site were generally non-cohesive and classify as non-plastic material according to BS5930. A single (1) Atterberg limits test on a sample recovered from the natural soils in BH5 (at 1.00m) confirmed this.

Therefore it is not considered necessary to incorporate special precautions into foundation depths/design with regard to seasonal shrinkage and swelling attributable to vegetation either currently present at the site or proposed for the new development.

4. Contamination Testing

The Phase 1 desk study had identified that possible made ground within the site associated with the site's previous development may provide the most credible source of contamination.

It was considered that if former land uses within the site had caused contamination the contaminants would most probably occur in the near surface or shallow made ground or topsoil horizons.

Therefore ten (10) samples of soil recovered at shallow depth (≤0.50m) and deeper underlying soils (up to 1.70m) recovered from across the site were tested for a range of substances. These included common contaminants such as Arsenic, Lead and Cadmium which are normally included in a general human health contamination suite together with analysis for Speciated PAHs, PCBs (two samples from BH7 located close to the electricity substation in the neighbouring plot) and Asbestos.

The results of the contamination testing are included in Appendix 3 of this report and have been used in the contamination risk assessment, set out in the following sections.

5. Risk Assessment

5.1 Method

Geoinvestigate Ltd. uses a combination of assessment criterion provided by the environment agency and by the Chartered Institute of Environmental Health; Environment Agency published Soil Guideline Values (SGVs) and Environmental Quality Standards (EQSs), Site Specific Assessment Criteria (SSAC) generated using CLEA software version 1.06 site specific risk assessment modelling, and Land Quality Management / Chartered Institute of Environmental Health (LQM/CIEH) Generic Assessment Criteria (GAC) in order to assess the presence of potentially harmful chemicals within soils and water.

As the site is to be developed as housing it falls within the residential end-use category. It is possible that persons living on the site may cultivate vegetables / fruit for consumption.

In addition to the published SGVs and LQM/CIEH values, site specific assessment criteria (SSAC) have been created using the CLEA model which is presented in Appendix 4. The model was created using CLEA version 1.06 software and has been tailored to the site's intended use as private housing with an allowance for plant up take.

The results of the contamination testing that has been carried out have been compared to the soil quality values from the above sources. Where they fall below these limit values they have been deemed safe for a residential end use.

Where results are above the intervention values, an assessment of the available pathways and receptors has been carried out to determine whether further investigation or remediation is necessary.

An appraisal of the chemical results and relevant limits is set out in the Contamination Risk Assessment that follows.

5.2 Contamination Risk to Identified Receptors

5.2.1 Contamination Risk to Human Health

Topsoil and/or made ground, comprising ostensibly sandy gravel and gravelly sand with sandstone, brick concrete and coal gravel constituents, extended generally to a depth of up to 0.95m (BH6) extending to a maximum depth of 1.75m in BH3. Topsoil and made ground in boreholes BH4, BH6 and BH7 were found to contain occasional ash constituents (in topsoil only at BH6 and BH7), and made ground below 0.65m and 0.70m in BH6 and BH7 respectively was found to contain occasional wood fragments.

No hydrocarbon staining, odours, obvious chemical substances or signs of physical contamination such as glass or metal shards were noted in any of the material uncovered in the boreholes. Neither was there any visible evidence of Asbestos contamination such as roofing board. In light of this it was not anticipated that chemical or physical contamination would pose a significant and immediate hazard for the new development and its users though it was considered necessary to confirm this through analysis given the widespread made ground encountered at the site.

As discussed earlier in the report, levels of determinants have been compared to the SGVs for residential end-use, as published by the Environment Agency in their individual SGV and toxicology reports and accompanying documents, LQM/CIEH GAC values and site specific criteria generated from the CLEA software version 1.06.

The results of the analyses of ten (10) samples of made ground and natural strata recovered from the site from depths up to 1.70m returned concentrations of a range of substances generally falling below respective assessment criteria adopted from the sources named above.

The results of the analyses are shown in Table 1 (below) along with the published SGV values, LQM/CIEH (GAC) values and site specific assessment criteria (SSAC).

The LQM guideline values for PAHs and Hydrocarbons were chosen using the Soil Organic Matter (SOM) option of 2.5%. This is a conservative value, given that analysis of a sample of the underlying soils returned a Total Organic Carbon (TOC) content of 2.03% which is by definition invariably lower than the SOM content (which was estimated from the TOC to be 3.50% in the analysis results). The SSAC generated for the site were calculated using the estimated value of 3.50%.

Table 1: Chemical Determinands

	Range of Returned concentrations (mg/kg)	Residential SGV (mg/kg)	Generic Assessment Criterion – LQM/CIEH (mg/kg)	Site Specific Assessment Criterion (mg/kg)
Boron	<0.5-0.6		291	375
Chromium VI	<1		4.3	
Chromium III	65-109		627	633
Arsenic	3.8-9.5	32		32.4
Cadmium	<0.2-0.5	10	3	5.18
Copper	3.5-13		2330	2330
Mercury (elemental)	<0.5	1		0.66
Table 1 is continued on the following page				

Table 1 (ctd.): Chemical Determinands

	Range of Returned concentrations (mg/kg)	Residential SGV (mg/kg)	Generic Assessment Criterion – LQM/CIEH (mg/kg)	Site Specific Assessment Criterion (mg/kg)
Lead	3.1-96	450*		
Nickel	9.7-18	130		129
Selenium	<0.3-0.6	350		350
Zinc	14-134		3750	3750
Total PAH	<0.16-71.5			
PAH Naphthalene	<0.01-0.29		3.7	5.71
PAH Acenapthylene	<0.01-0.09		400	540
PAH Acenapthene	<0.01-0.56		480	648
PAH Fluorene	<0.01-0.55		380	506
PAH Phenanthrene	<0.01-8.10		200	261
PAH Anthracene	<0.01-1.89		4900	6400
PAH Fluoranthene	<0.01-13.21		460	548
PAH Pyrene	<0.01-12.09		1000	1240
PAH Benzo[a]anthracene	<0.01-**5.99**		4.7	5.52
PAH Chrysene	<0.01-6.14		8.0	8.75
PAH Benzo(b)fluoranthene	<0.01-**6.88**		6.5	6.82
PAH Benzo(k)fluoranthene	<0.01-2.51		9.6	9.85
PAH Benzo(a)pyrene	<0.01-**5.21**		0.94	0.976
PAH Dibenzo(a,h)anthracene	<0.01-**0.97**		0.86	0.889
PAH Indeno(123-cd)pyrene	<0.01-3.61		3.9	4.05
PAH Benzo(ghi)perylene	<0.01-3.64		46	46.6
PCB Congener 28	<0.005			
PCB Congener 118	<0.005			0.0000776
PCB Congener 180	<0.005			
PCB Congener 189				0.0000777
Phenol	<0.5	420	390	364

**Old SGV*

Analysis of soils from the site returned values within SGVs, GAC and SSAC limits for all determinands with the exception of those results presented in bold type in the above table, all of which were returned for the sample recovered from BH7 at a depth of 0.20m (with a single very minor exceedance noted for BH1 at 0.20m).

No Asbestos fibres were detected in any of the three samples analysed and levels of PCBs were below detectable limits in both of the analysed samples.

Slightly elevated sulphur of 2282mgkg^{-1} in BH7 at 1.00m with a water soluble sulphate concentration of 1797mgl^{-1} returned for the same sample.

5.2.2 Contamination Risk to Controlled Waters

Concentrations of potential contaminants returned in ten (10) soil samples generally fell below the chosen assessment criteria. Therefore there is considered to be low risk to underlying groundwater from leaching.

Notwithstanding, leachate was analysed from three (3) samples obtained from 1.00m in BH3, 0.20m in

BH5, and 0.20m in BH7. This screening returned generally negligible concentrations and concentrations below detectable limits and/or safe levels for domestic water supply or the protection of aquatic life levels as published by the Environment Agency which were used as the assessment criteria. The results of the testing and the assessment criteria are shown Table 2 below.

Table 2: Chemical Determinands in Leachate

	Returned Concentrations (µg/l)	UK Standard for Surface Waters intended for Drinking Water Abstraction* (DW) and/or protection of Aquatic Life in surface waters* (Aq) (µg/l)
Inorganic Chemicals		
Arsenic	2.03-5.05	**50** (DW, range: 50-100) (No Aq standard)
Boron	9-12	**1000** (DW & Aq)
Cadmium	<0.07	**5** (DW & Aq)
Chromium	1.5-3.7	**50** (DW) / **5** (Aq, range: 5-250)
Copper	3.0-**5.9**	**50** (DW) / **5** (Aq, range: 5-112)
Lead	2.9-**13**	**50** (DW) / **4** (Aq, range: 4-250
Mercury (elemental Hg)	<0.008-0.032	**1** (DW & Aq)
Nickel	1.2-2.3	**20**** (DW) / **50** (Aq, range: 50-200)
Selenium	0.11-0.29	**10** (DW) (No Aq standard)
Sulphate	<10	**250** (DW & Aq)
Zinc	4-13	**3000** (DW, range: 3000-5000) / **30** (Aq, range: 30-2000)
Organic Chemicals		
Phenols	<10	**50****(DW) / **300** (Aq)
PAHs (total)	<1.6***	**0.2** (DW, range: 0.2-1.0) (No Aq standard)

*sourced from Environment Agency database at http://evidence.environment-agency.gov.uk/ChemicalStandards/home.aspx.
If more than one option is available (dependant on other water properties or environmental setting) the lowest value has been adopted.
**Standard for water supply as no standard available for surface water abstraction for drinking water.
***Sum of USEPA 16, each at Lower Limit of Detection of <0.1

Concentrations of PAH and Phenol are below detectable limits and would not be considered to pose a risk to controlled waters.

In summary the leachate testing returned negligible concentrations of determinands which would generally pass local drinking water and ground water quality standards.

Very minor exceedances (highlighted by bold text) of the lowest assessment criteria options for copper and lead have been noted, these options relate to freshwater with very low calcium carbonate content ($<50mgl^{-1}$) which is unlikely in water of pH8.6-pH8.9 as measured for these leachates (low $CaCO_3$ content would be expected to be more likely in more acidic waters). Though no data has been collected regarding the calcium carbonate content of local waters and underlying groundwater, the minor nature of the exceedances and the slightly alkaline pH of the leachates and soils alike, suggest that these results represent a negligible risk to surface and underground waters. Moreover, all analysed leachates would pass standards for Drinking Water Abstraction.

5.3 Review of Results

The data presented in Tables 1 and 2 show that the majority of the soil samples analysed returned concentrations of potential contaminants in soil and leachate falling below the adopted assessment criteria and as such, surface and sub-soils at the site are considered to be generally uncontaminated and fit for purpose in the context of a residential end use.

However, as discussed previously, levels of four (4) species of PAH were noted in a single sample (recovered from BH7 at a depth of 0.20m) which were in excess of the respective chosen assessment criteria. Consequently topsoil in this location, and at BH6 where very similar ash containing topsoil was encountered, is not considered safe and suitable for use in the proposed residential end use of the site. Ash containing soils recovered from BH4 returned acceptable levels of PAHs and as such these soils are considered fit for purpose in the proposed development.

Additionally a very minor exceedance of assessment criteria for Benzo(a)Pyrene was returned for the sample recovered from a depth of 0.20m in BH1 (1.03mgkg^{-1}); this result is not considered to be representative of unacceptable risk to receptors at the site due to the very minor nature of the exceedance and the publication of a "more pragmatic (whilst still strongly precautionary)*" assessment criterion for this chemical by DEFRA in 2014* of 5mgkg^{-1} which is far in excess of the returned value.

* SP1010 Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination:
- Final Project Report
- Policy Companion Document
- Appendix E B(a)P

All available from:

http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=18341.

A single sample in which elevated levels of sulphur and sulphate were noted in soil was recovered from a natural sandy gravel deposit in BH7. It is possible that the sulphur/sulphate is perhaps sourced from the made ground stratum above though very similar made ground recovered from BH6 (0.80m) was analysed retuning relatively low levels of sulphur/sulphate. Additionally, natural rock recovered from BH5 returned levels below detectable limits. It is therefore assumed that the results for BH7 are likely anomalous, though it may be prudent to assume a slightly higher sulphate concentration at BH6 and BH7 where the similar made ground was encountered when considering concrete design classification.

In addition to the above, sulphate in all analysed leachates was consistently below detectable limits and as such the single, likely anomalous, occurrence of elevated sulphur/sulphate is unlikely to be representative of an unacceptable risk to controlled waters.

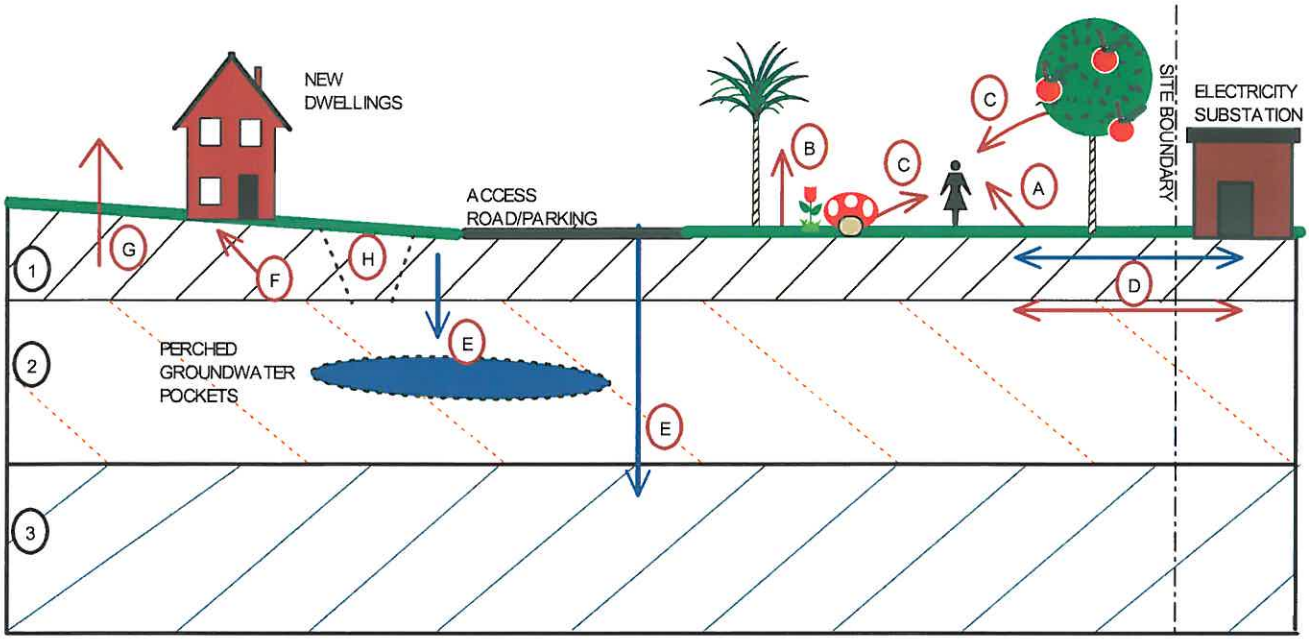
The majority of the SSAC generated using the CLEA v1.06 software are presented in green in the assessment output, indicating there are unlikely to be any unusual circumstances at the site that would present a danger of free phase contamination existing in the soil.

A single elevated pH result for BH6 (0.80m) appears to be anomalous and is unlikely to be representative of unacceptable risk to receptors identified at the site given that is it beyond likely influencing depth of the site surface, not representative of soils generally at the site, and that no groundwater was encountered in the boreholes and no unusual pH levels were returned from the leachate analyses.

The SSAC presented in amber highlight instances where the generated SSAC exceed the estimated soil saturation limit for the associated chemical species. Where this has occurred the analyses have returned soil concentrations either below lower limits of analytical detection, or well below the generated SSAC and generic GAC against which they have been appraised (save for the exceptions discussed above). As such there is considered to be a minimal risk of free phase contamination to exist at the site - a conclusion which is supported by the absence of visual or olfactory evidence of contamination in the soils encountered.

The conceptual model presented on the following page shows pollutant linkages which have been considered at the site between shallow soils and four main receptor groups. These are the site's end users and construction workers, plants and vegetation, neighbouring sites and the underlying aquifer.

Figure 1 – CGHM: Conceptual cross section of site including a Source, Pathway and Receptor Model



1 MADE GROUND HORIZON

2 DRIFT - SANDY GRAVEL DEPOSITS IN PLACES. LIKELY HIGH PERMEABILITY.

3 UNDERLYING GEOLOGY - CHESTER PEBBLE BEDS FORMATION (SANDSTONE) POTENTIALLY HIGH PERMEABILITY

IDENTIFIED HAZARDS Including Potential CONTAMINATION SOURCES

-Elevated levels of four species of PAH in topsoil in southeast of site (plots 8 to 11 in proposed development plan).
-Area of deeper made ground, possible in-filled cellar feature (potential instability).

POLLUTANT LINKAGES: IDENTIFIED RECEPTORS and ASSOCIATED PATHWAY

A - Construction Workers & End Users through Direct Contact / Inhalation / Ingestion. Buildings and hard-standing will encompass some of the site, removing any pathway to end users through direct contact in these areas.
B - Plants and Trees through uptake.
C - End Users through cultivation and consumption of vegetables / fruit. Linkages A to C potentially complete at site until removal of PAH contaminated soils.
D - Neighbouring Sites through lateral migration (in soil and water, including surface water run-off). Migration of PCBs *into* site from substation disproven.
E - Ground water through leaching of sub-soil.
F - Building and services through direct contact. Linkges D to F unlikely to be of concern given localised and shallow nature of identified PAH contamination. See report text for reccomendations regarding concrete design and single slightly elevated water soluble sulphate result.
G - End users and buildings through ground gas migration. Monitoring exercise on going. No significant risk identified to date.
H - Site surface through potential instability arising from possible cellars in historical housing. Identified at BH3, potentially sporadic throughout site. See report text.

6. Hazardous Gas

6.1 Gas Regime

The earlier Phase 1 Desk Study Report (Ref. Report G15029a) suggested that made ground on the site associated with its previous use provide the most plausible sources of hazardous gas.

The initial results of gas monitoring at the site are presented in Table 3 below.

A further set of four measurements are required to properly establish the longer term gassing regime at the site.

Table 3 Summary of Gas Monitoring Data

Borehole	Number of Visits	CH_4 (%)	CO_2 (%)	O_2 (%)	Flow Rate (l/hr)	Atmospheric Pressure (mb)
BH1	2	0.0	0.0	20.7	<0.1	996-1001
BH3		0.0	0.0	20.7	<0.1	
BH7		0.0	0.0-0.1	20.6	<0.1	

The two gas monitoring visits at pressures of 996mb-1001mb returned near normal levels of O_2 between 20.6% and 20.7%, with zero (0.0%) CH_4, and levels of CO_2 ranging from 0.0% to 0.1%. Gas flow rates were <0.1 l/hr and below detectable limits.

6.2 Radon Gas

The desk study findings confirmed that Radon protection is not necessary for new buildings at the site.

7. Conclusions

7.1 Contamination

Analysis of the ground conditions at the site and an assessment of the potential pathways have confirmed that the majority of soils at the site are generally uncontaminated and therefore unlikely to pose a significant risk to human health in the context of the proposed residential end-use of this site.

However, ash containing topsoil encountered at BH7 has returned levels of four species of PAH in excess of the adopted assessment criteria and as such a limited remediation exercise will be required in this section of the site (which will also encompass the location of BH6 where similar near-surface soils were encountered), currently plots 8-11 on the site plan provided in Appendix 1.

The remedial action is likely to be relatively small scale, most likely a site scrape, given that the stratum from which this sample was taken was found to extend to depths of just 0.35 (BH6) and 030m (BH7)m. It may be prudent to carry out an additional sampling and analysis exercise in order to better characterise the spatial extent and depth of the suspect material to streamline/minimise any required remedial work.

The remainder of the site is currently not considered to require any remediation works.

A detailed remediation strategy should be compiled and submitted for approval by the local authority subsequent to the submission of this report and any soils brought into the site for the new development will be required to be proven clean and uncontaminated.

The complete removal of the identified contamination source would render all soils at the site suitable for residential land use.

7.2 Hazardous Gas

On the basis of the initial gas results the gas conditions at the site would be expected to fall within "Characteristic Situation 1" of the Modified Wilson and Card classification or "Green" of the NHBC Traffic Light System for low rise housing with a ventilated under-floor void (min 150mm) (CIRIA C665). Consequently on the basis of these results no gas measures are anticipated to be required in the construction of the new buildings at the site.

However, a further four (4) sets of gas monitoring results need to be obtained before a final decision can be made on the level of gas protection required at the site. These have been scheduled to be carried out over the coming months and the final results will be provided in an addendum to this report which will be available in late May 2015.

7.3 Foundations & Floors

Given that no existing or potential vegetation influence has been identified for soils at the site and that hard shallow bedrock has been encountered in the majority of boreholes the most suitable and cost effective foundation solution is likely to be a traditional strip footing seated on the sandstone rock.

Given that deeper made ground was encountered at BH3 in an inferred former cellar (with rock commencing from 1.75m the strip footings should be extended to this depth accordingly. It is possible that this is a single localised feature associated with the 1970s redevelopment of the site (see Phase 1 desk study report G15029a) and as such this action will likely only be necessary in this single section of the site. However, it is also possible (and perhaps more likely) that this may be a feature of the older 19th century terraced housing which once occupied the site and such features may be present sporadically throughout the study area. If this were found to be the case on commencement of excavation for foundations (i.e. several areas of deeper made ground are encountered) it will be necessary to extend the strip footings to the bedrock at greater depth. If the pockets of made ground are found to be very small/localised it may be feasible to adopt a reinforced strip foundation though this will require an on-site reassessment by a suitable qualified engineer.

In the northeast of the site where natural drift deposits (very dense sandy gravel) were found to extend to slightly greater depths, namely at BH4 and BH5 the competent nature of the soils at these locations will provide adequate support for traditional strip foundations at a depth of 1.00m where SPT N values of N=65 and N=72 were returned.

At the depths detailed above, strip and pad foundations may be designed to a maximum allowable net bearing pressure of 150 kNm^2 and 175 kN/m^2 respectively.

7.4 Concrete Design

The results of chemical analyses of the fill returned Water Soluble Sulphate levels in soil of between <10mgl^{-1}and 1797mgl^{-1} (SO_4) (mean concentration 400mgl^{-1}), and pH levels of between 7.5 and 11.1 (mean 8.84). On this basis concrete in contact with the ground may be designed to ACEC Class DS-1 AC-1s of BRE Special Digest 1 – Concrete in aggressive ground.

However, given the single elevated Water Soluble Sulphate concentration returned for BH7 it might be prudent to adopt ACEC Class DS-2 AC-1s in plots 8-11 of the proposed development.

7.5 Recommendations

It might be advantageous to carry out a brief shallow soil sampling and analysis exercise in the southeast of the site where a requirement for remediation has been identified. This may allow the scope of the required remedial works to be reduced or better delineated, potentially reducing cost and volumes of soil going to landfill.

END OF REPORT

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APPENDIX 1

SITE PLAN

and

BOREHOLE LOGS

GEOINVESTIGATE Ltd.

OUR REF:G15029	YOUR REF:	SITE PLAN (NOT TO SCALE)
DATE:06/03/15	LOCATION: Proposed Development, Tetlow Street, Liverpool L4 4LF	

NORTH

GEOINVESTIGATE Ltd.

Your Ref. **Our Ref.** G15029 **BH No.1** **Sheet No. 1 of 1**
Location: Proposed Development, Tetlow Street, Liverpool L4 4LF **DATE:** 06/03/15

Depth (m)	Description of Strata	Thick -ness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
	TURF / MADE GROUND Loose blackish brown sandy gravel. Gravel is fine to coarse of sandstone with occasional brick, coal and concrete. Cobbles noted	300			O	Cv kN/m^2			0.20
0.30	MADE GROUND Loose dark reddish brown gravelly sand. Gravel is fine to coarse of sandstone and occasional brick and coal Cobbles noted	150			O				0.50
		400					28,36/150mm N=64/150mm		0.75
0.85	Hard orangish red SANDSTONE recovered as angular sandy gravel.				O C		0.85-1.00m		0.85
	Borehole Terminated at 0.85m due to refusal								

Remarks:
No casing used
Dynamic windowless sampling by Terrier Rig to 0.85m
Borehole remained dry on completion
Gas well installed to 0.85m with bung and cover

Key:
Slotted Pipe
Plain Pipe
Bentonite
Gravel Filter

O Disturbed sample
Cv Shear vane
W Water sample
S Standard Penetration Test
C Cone Penetration Test

BH1

GEOINVESTIGATE Ltd.

Your Ref. **Our Ref.** G15029 **BH No.2** **Sheet No. 1 of 1**
Location: Proposed Development, Tetlow Street, Liverpool L4 4LF **DATE**: 06/03/15

Depth (m)	Description of Strata	Thick -ness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
	TURF / MADE GROUND Loose blackish	200				Cv kN/m^2			
0.20	brown sandy gravel. Gravel is fine to coarse				O				0.20
	of sandstone with occasional brick, coal	200							
0.40	and concrete. Cobbles noted								
	MADE GROUND Hard grey cobbles of	200			O				0.50
0.60	concrete. Possible old conc hardstanding								
	Very dense orangish and reddish brown								0.75
	sandy GRAVEL. Gravel is fine to coarse of	400					40,36		
	sandstone. Cobbles noted.						N=76/150mm		
1.00	Hard orangish red SANDSTONE recovered				O C		1.00-1.15m		1.00
	as angular sandy gravel.								
	Borehole Terminated at 1.00m due to refusal								

Remarks:
Casing to 1.00m
Dynamic windowless sampling by Terrier Rig to 1.00m
Borehole remained dry on completion

Key:
Slotted Pipe
Plain Pipe
Bentonite
Gravel Filter

O Disturbed sample
Cv Shear vane
W Water sample
S Standard Penetration Test
C Cone Penetration Test

BH2

GEOINVESTIGATE Ltd.

Your Ref. **Our Ref.** G15029 **BH No.3** **Sheet No. 1 of 1**
Location: Proposed Development, Tetlow Street, Liverpool L4 4LF **DATE**: 06/03/15

Depth (m)	Description of Strata	Thick -ness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
	TURF / MADE GROUND Loose blackish brown sandy gravel. Gravel is fine to coarse of sandstone with occasional brick, coal	400			O	Cv kN/m^2			0.20
0.40	and concrete. Cobbles noted								
	MADE GROUND Very loose orangish red sandy gravel. Gravel is fine to coarse of sandstone, and occasional brick and coal.				O				0.50
									0.75
	Many brick cobbles at 0.95m	1250			O C		2,1,0,0,1,1 N=2 1.00-1.45m		1.00
									1.25
	MADE GROUND Compact grey sandy				O				1.50
1.65	gravel. Gravel is fine to coarse of concrete.						24,26/150mm		
1.75	Possible old basement floor	100					N=50/150mm		
1.80	Hard orangish red SANDSTONE recovered as angular sandy gravel. Some roots	50			O C		1.80-1.95m		1.80
	Borehole Terminated at 1.80m due to refusal								

Remarks:
Casing to 1.00m
Dynamic windowless sampling by Terrier Rig to 1.80m
Borehole remained dry on completion
Gas well installed to 1.80m with bung and cover

Key:
Slotted Pipe
Plain Pipe
Bentonite
Gravel Filter

O Disturbed sample
Cv Shear vane
W Water sample
S Standard Penetration Test
C Cone Penetration Test

BH3

GEOINVESTIGATE Ltd.

Your Ref. **Our Ref.** G15029 **BH No.4** **Sheet No. 1 of 1**
Location: Proposed Development, Tetlow Street, Liverpool L4 4LF **DATE**: 06/03/15

Depth (m)	Description of Strata	Thick -ness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
	TOPSOIL Loose dark brown and reddish brown clayey gravelly sand. |Gravel is fine	350			O	Cv kN/m^2			0.20
0.35	to coarse of sandstone, coal and occ. ash								
	MADE GROUND Loose blackish brown sandy gravel/ gravelly sand. Gravel is fine	300			O				0.50
0.65	to coarse of sandstone, coal and occ. ash								
0.75	MADE GROUND Compact grey sandstone and concrete cobbles	100							0.75
	Very dense orangish and reddish brown sandy GRAVEL. Gravel is fine to coarse of sandstone. Cobbles noted. Probable completely weathered sandstone	700			O C		10,22,15,15,10 25 N=65 1.00-1.45m		1.00
									1.25
1.45					O				1.45
	Borehole Terminated at 1.45m due to refusal								

Remarks:
Casing to 1.00m
Dynamic windowless sampling by Terrier Rig to 1.45m
Borehole remained dry on completion

Key:
Slotted Pipe
Plain Pipe
Bentonite
Gravel Filter

O Disturbed sample
Cv Shear vane
W Water sample
S Standard Penetration Test
C Cone Penetration Test

BH4

GEOINVESTIGATE Ltd.

Your Ref. **Our Ref.** G15029 **BH No.5** **Sheet No. 1 of 1**
Location: Proposed Development, Tetlow Street, Liverpool L4 4LF **DATE**: 06/03/15

Depth (m)	Description of Strata	Thick -ness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.30	TURF / TOPSOIL Loose dark reddish brown sandy gravel / gravelly sand. Gravel is fine to coarse of sandstone	300			O	Cv kN/m^2			0.25
0.70	MADE GROUND Loose dark reddish brown gravelly sand. Gravel is fine to coarse of sandstone and occasional brick and coal Cobbles noted	400			O				0.50
									0.75
1.40	Very dense orangish and reddish brown sandy GRAVEL. Gravel is fine to coarse of sandstone. Cobbles noted. Probable completely weathered sandstone	700			O C		15,20,25,22,23, 20 N = 72 1.00-1.45m		1.00
									1.25
1.70	Hard orangish red SANDSTONE recovered as angular sandy gravel.	300			O		23,28/150mm N=50/150mm		1.50
					O C		1.70-1.85m		1.70
	Borehole Terminated at 1.70m due to refusal								

Remarks:
Casing to 1.00m
Dynamic windowless sampling by Terrier Rig to 1.70m
Borehole remained dry on completion

Key:
Slotted Pipe
Plain Pipe
Bentonite
Gravel Filter

O Disturbed sample
Cv Shear vane
W Water sample
S Standard Penetration Test
C Cone Penetration Test

BH5

GEOINVESTIGATE Ltd.

Your Ref. **Our Ref.** G15029 **BH No.6** **Sheet No. 1 of 1**

Location: Proposed Development, Tetlow Street, Liverpool L4 4LF **DATE**: 06/03/15

Depth (m)	Description of Strata	Thick -ness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.35	TOPSOIL Loose dark brown and reddish brown clayey gravelly sand. |Gravel is fine to coarse of sandstone, coal and occ. ash	350			O	Cv kN/m^2			0.20
0.70	MADE GROUND Loose reddish brown gravelly sand. Gravel is fine to coarse of sandstone and occasional concrete	350			O				0.50
0.95	MADE GROUND Grey and reddish brown sandy gravel and cobbles of fine to coarse	250			O		6,50/75mm N=76/125mm		0.80
1.05	brick and concrete. Some wood fragments	100			O C		1.00-1.25m		1.05
	Hard orangish and reddish brown SANDSTONE								
	Borehole Terminated at 1.05m due to refusal								

Remarks:

Casing to 1.00m

Dynamic windowless sampling by Terrier Rig to 1.00m

Borehole remained dry on completion

Key:

- Slotted Pipe
- Plain Pipe
- Bentonite
- Gravel Filter

O Disturbed sample
Cv Shear vane
W Water sample
S Standard Penetration Test
C Cone Penetration Test

BH6

GEOINVESTIGATE Ltd.

Your Ref. **Our Ref.** G15029 **BH No.7** **Sheet No. 1 of 1**

Location: Proposed Development, Tetlow Street, Liverpool L4 4LF **DATE**: 06/03/15

Depth (m)	Description of Strata	Thick -ness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
	TOPSOIL Loose dark brown and reddish brown clayey gravelly sand. |Gravel is fine	300			O	Cv kN/m^2			0.20
0.30	to coarse of sandstone, coal and occ. ash								
	MADE GROUND Loose reddish brown gravelly sand. Gravel is fine to coarse of	350			O				0.50
0.65	sandstone and occasional concrete								
	MADE GROUND Grey and reddish brown sandy gravel and cobbles of fine to coarse	250							0.75
0.90	brick and concrete. Some wood fragments						12,63/150mm		
	Dense orangish brown sandy GRAVEL.	250			O C		N=73/150mm		1.00
1.15	Gravel is fine to coarse of sandstone						1.00-1.15m		
1.25	Hard orangish and reddish brown SANDSTONE	100			O				1.25
	Borehole Terminated at 1.25m due to refusal								

Remarks:

Casing to 1.00m

Dynamic windowless sampling by Terrier Rig to 1.25m

Borehole closed below 1.00m on completion

Gas well installed to 1.00m with bung and cover

Key:

Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

C Cone Penetration Test

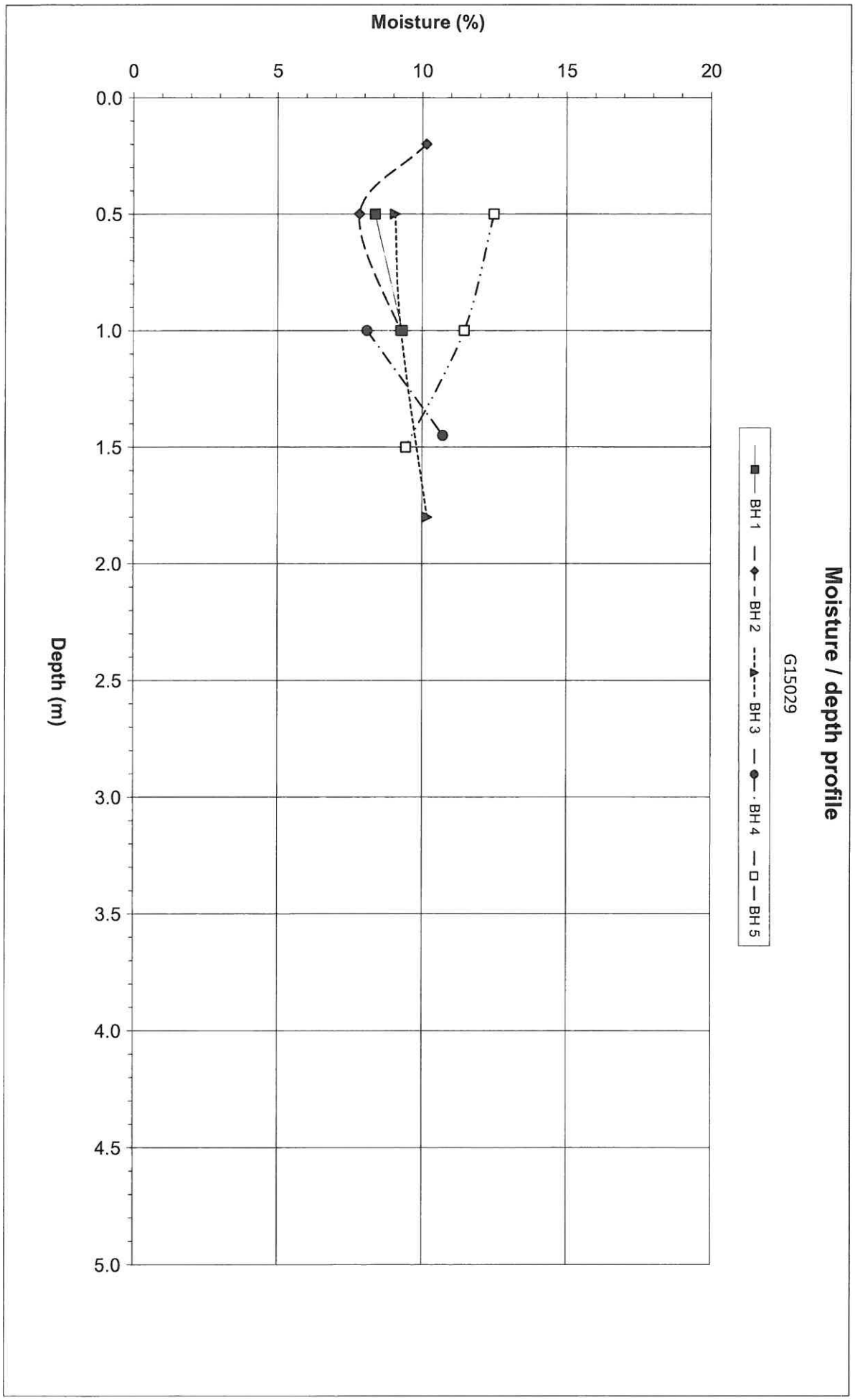
BH7

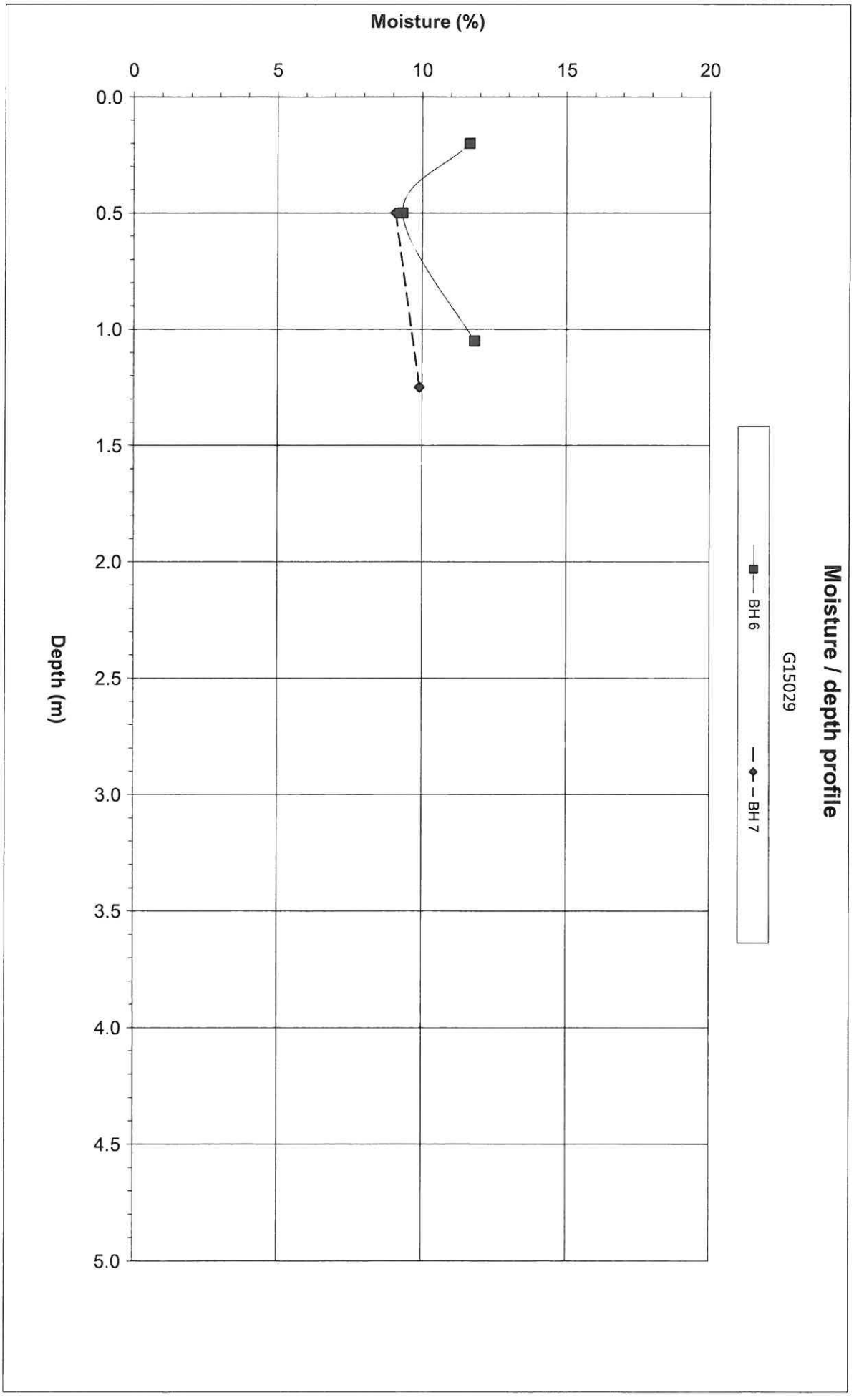
APPENDIX 2

MOISTURE CONTENT PROFILES

and

ATTERBERG LIMIT TEST RESULTS (TABLE 4)


Moisture (%)
0
5
10
15
20
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Depth (m)
BH 1
BH 2
BH 3
BH 4
BH 5
Moisture / depth profile
G15029


Moisture (%)
0
5
10
15
20
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Depth (m)
BH 6
BH 7
Moisture / depth profile
G15029

GEOINVESTIGATE Ltd.

Atterberg Limit Test Results

Our ref. G15029
Your ref.

Table 4
Location: Proposed Development, Tetlow Street, Liverpool L4 4LF

TP / BH No.	Sample Depth (m)	Insitu Moisture Content (%)	% Passing BS 425 Micron Sieve	Corrected Moisture Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)	Soil Classification
1	0.50	8.4						
	1.00	9.3						
2	0.20	10.1						
	0.50	7.8						
	1.00	9.2						
3	0.50	9.1						
	1.00	9.3						
	1.80	10.2						
4	1.00	8.1						
	1.45	10.7						
5	0.50	12.5						
	1.00	11.5	41.4		*	*	*	*
	1.50	9.4						

* Essentially non-plastic material

GEOINVESTIGATE Ltd.

Atterberg Limit Test Results

Our ref. G15029
Your ref.

Table 4
Location: Proposed Development, Tetlow Street, Liverpool L4 4LF

TP / BH No.	Sample Depth (m)	Insitu Moisture Content (%)	% Passing BS 425 Micron Sieve	Corrected Moisture Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)	Soil Classification
6	0.20	11.6						
	0.50	9.3						
	1.05	11.8						
7	0.50	9.1						
	1.25	9.9						

APPENDIX 3
CHEMTECH ANALYTICAL
TEST REPORT

UKAS TESTING 2531

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

CHEMTECH environmental

ANALYTICAL TEST REPORT

Contract no: 54648

Contract name: Proposed Development, Tetlow Street, Liverpool

Client reference: G15029

Clients name: Geo Investigate

Clients address: Units 4 & 5, Terry Dicken Industrial Estate
Ellerbeck Way, Stokesley
North Yorkshire
TS9 7AE

Samples received: 11 March 2015

Analysis started: 11 March 2015

Analysis completed 17 March 2015

Report issued: 18 March 2015

Notes:
Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, withour prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key:
U UKAS accredited test
M MCERTS & UKAS accredited test
$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing
NAD No Asbestos Detected

Approved by:

D. Bowerbank

Karan Campbell, Director
John Campbell, Director
Dave Bowerbank, Customer Services Co-ordinator

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.
Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
54648-1	BH 1	0.20	Sand with Gravel	-	-	9.3
54648-3	BH 3	1.00	Sand with Gravel	-	-	7.9
54648-5	BH 4	0.50	Sand with Gravel	-	-	10.6
54648-6	BH 5	0.20	Sand with Gravel	-	-	7.4
54648-7	BH 5	1.70	Sand with Gravel	-	-	8.1
54648-8	BH 6	0.80	Sand with Gravel	-	-	8.3
54648-9	BH 7	0.20	Sand with Gravel	-	-	7.3
54648-10	BH 7	1.00	Sand with Gravel	-	-	10.1

Chemtech Environmental Limited

SOILS

Lab number			54648-1	54648-2	54648-3	54648-4	54648-5	54648-6
Sample id			BH 1	BH 3	BH 3	BH 4	BH 4	BH 5
Depth (m)			0.20	0.20	1.00	0.20	0.50	0.20
Date sampled			06/03/2015	06/03/2015	06/03/2015	06/03/2015	06/03/2015	06/03/2015
Test	**Method**	**Units**						
Arsenic (total)	CE127 M	mg/kg As	9.5	-	6.0	-	8.6	3.9
Boron (water soluble)	CE063 M	mg/kg B	0.5	-	<0.5	-	<0.5	<0.5
Cadmium (total)	CE127 M	mg/kg Cd	0.5	-	<0.2	-	0.3	<0.2
Chromium (total)	CE127 M	mg/kg Cr	65	-	67	-	86	109
Chromium (III)	-	mg/kg CrIII	65	-	67	-	86	109
Chromium (VI)	CE050	mg/kg CrVI	<1	-	<1	-	<1	<1
Copper (total)	CE127 M	mg/kg Cu	43	-	10	-	23	5.4
Lead (total)	CE127 M	mg/kg Pb	96	-	52	-	44	20
Mercury (total)	CE127 M	mg/kg Hg	<0.5	-	<0.5	-	<0.5	<0.5
Nickel (total)	CE127 M	mg/kg Ni	18	-	14	-	13	11
Selenium (total)	CE127 M	mg/kg Se	0.6	-	0.3	-	0.4	<0.3
Zinc (total)	CE127 M	mg/kg Zn	134	-	42	-	48	19
pH	CE004 M	units	8.7	-	8.6	-	7.5	8.8
Sulphate (2:1 water soluble)	CE061 M	mg/l SO_4	51	-	<10	-	15	<10
Sulphur (total)	CE127	mg/kg S	520	-	426	-	223	114
Sulphide	CE079	mg/kg S^{2-}	<10	-	<10	-	<10	<10
Cyanide (free)	CE077	mg/kg CN	<2	-	<2	-	<2	<2
Cyanide (total)	CE077	mg/kg CN	<2	-	<2	-	<2	<2
Thiocyanate	CE014 M	mg/kg SCN	<1	-	1.1	-	1.4	<1
Phenols (total)	CE078	mg/kg PhOH	<0.5	-	<0.5	-	<0.5	<0.5
Total Organic Carbon (TOC)	CE072 M	% w/w C	-	-	-	-	2.03	-
Estimate of OMC (calculated from TOC)	CE072	% w/w	-	-	-	-	3.50	-
PAH								
Naphthalene	CE087	mg/kg	0.09	-	0.04	-	0.04	0.01
Acenaphthylene	CE087	mg/kg	<0.01	-	<0.01	-	<0.01	<0.01
Acenaphthene	CE087	mg/kg	0.14	-	0.07	-	0.10	0.03
Fluorene	CE087	mg/kg	0.10	-	0.05	-	0.08	0.02
Phenanthrene	CE087	mg/kg	1.19	-	0.68	-	0.62	0.27
Anthracene	CE087	mg/kg	0.26	-	0.17	-	0.10	0.06
Fluoranthene	CE087	mg/kg	2.30	-	1.07	-	0.73	0.46
Pyrene	CE087	mg/kg	2.20	-	1.03	-	0.73	0.42
Benzo(a)anthracene	CE087	mg/kg	1.05	-	0.54	-	0.38	0.21
Chrysene	CE087	mg/kg	1.04	-	0.47	-	0.39	0.19
Benzo(b)fluoranthene	CE087	mg/kg	1.30	-	0.55	-	0.47	0.22
Benzo(k)fluoranthene	CE087	mg/kg	0.51	-	0.24	-	0.19	0.09
Benzo(a)pyrene	CE087	mg/kg	1.03	-	0.47	-	0.35	0.17
Indeno(123cd)pyrene	CE087	mg/kg	0.84	-	0.35	-	0.27	0.13
Dibenz(ah)anthracene	CE087	mg/kg	0.21	-	0.08	-	0.06	0.03
Benzo(ghi)perylene	CE087	mg/kg	0.88	-	0.35	-	0.29	0.13
PAH (total of USEPA 16)	CE087	mg/kg	13.1	-	6.16	-	4.79	2.44

Chemtech Environmental Limited

SOILS

Lab number			54648-1	54648-2	54648-3	54648-4	54648-5	54648-6
Sample id			BH 1	BH 3	BH 3	BH 4	BH 4	BH 5
Depth (m)			0.20	0.20	1.00	0.20	0.50	0.20
Date sampled			06/03/2015	06/03/2015	06/03/2015	06/03/2015	06/03/2015	06/03/2015
Test	**Method**	**Units**						
PCB								
PCB Congener 28	CE137	mg/kg	-	-	-	-	-	-
PCB Congener 52	CE137	mg/kg	-	-	-	-	-	-
PCB Congener 101	CE137	mg/kg	-	-	-	-	-	-
PCB Congener 118	CE137	mg/kg	-	-	-	-	-	-
PCB Congener 138	CE137	mg/kg	-	-	-	-	-	-
PCB Congener 153	CE137	mg/kg	-	-	-	-	-	-
PCB Congener 180	CE137	mg/kg	-	-	-	-	-	-
Subcontracted analysis								
Asbestos	$	-	-	NAD	-	NAD	NAD	-

Chemtech Environmental Limited

SOILS

Lab number			54648-7	54648-8	54648-9	54648-10
Sample id			BH 5	BH 6	BH 7	BH 7
Depth (m)			1.70	0.80	0.20	1.00
Date sampled			06/03/2015	06/03/2015	06/03/2015	06/03/2015
Test	**Method**	**Units**				
Arsenic (total)	CE127 M	mg/kg As	3.8	4.1	5.1	5.1
Boron (water soluble)	CE063 M	mg/kg B	<0.5	<0.5	0.6	0.5
Cadmium (total)	CE127 M	mg/kg Cd	<0.2	<0.2	0.2	<0.2
Chromium (total)	CE127 M	mg/kg Cr	102	77	86	98
Chromium (III)	-	mg/kg CrIII	102	77	86	98
Chromium (VI)	CE050	mg/kg CrVI	<1	<1	<1	<1
Copper (total)	CE127 M	mg/kg Cu	3.5	4.1	13	5.6
Lead (total)	CE127 M	mg/kg Pb	3.1	20	33	6.7
Mercury (total)	CE127 M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 M	mg/kg Ni	11	9.7	11	12
Selenium (total)	CE127 M	mg/kg Se	<0.3	<0.3	0.3	<0.3
Zinc (total)	CE127 M	mg/kg Zn	14	24	40	20
pH	CE004 M	units	8.7	11.1	8.8	8.5
Sulphate (2:1 water soluble)	CE061 M	mg/l SO_4	<10	46	62	1797
Sulphur (total)	CE127	mg/kg S	<100	482	423	2282
Sulphide	CE079	mg/kg S^{2-}	<10	<10	<10	<10
Cyanide (free)	CE077	mg/kg CN	<2	<2	<2	<2
Cyanide (total)	CE077	mg/kg CN	<2	<2	<2	<2
Thiocyanate	CE014 M	mg/kg SCN	<1	<1	<1	<1
Phenols (total)	CE078	mg/kg PhOH	<0.5	<0.5	<0.5	<0.5
Total Organic Carbon (TOC)	CE072 M	% w/w C	-	-	-	-
Estimate of OMC (calculated from TOC)	CE072	% w/w	-	-	-	-
PAH						
Naphthalene	CE087	mg/kg	-	<0.01	0.29	0.01
Acenaphthylene	CE087	mg/kg	-	<0.01	0.09	<0.01
Acenaphthene	CE087	mg/kg	-	<0.01	0.56	<0.01
Fluorene	CE087	mg/kg	-	<0.01	0.55	<0.01
Phenanthrene	CE087	mg/kg	-	0.02	8.10	0.04
Anthracene	CE087	mg/kg	-	<0.01	1.89	<0.01
Fluoranthene	CE087	mg/kg	-	0.06	13.21	0.05
Pyrene	CE087	mg/kg	-	0.06	12.09	0.05
Benzo(a)anthracene	CE087	mg/kg	-	0.03	5.99	0.02
Chrysene	CE087	mg/kg	-	0.02	6.14	<0.01
Benzo(b)fluoranthene	CE087	mg/kg	-	0.04	6.88	0.02
Benzo(k)fluoranthene	CE087	mg/kg	-	0.01	2.51	<0.01
Benzo(a)pyrene	CE087	mg/kg	-	0.02	5.21	0.02
Indeno(123cd)pyrene	CE087	mg/kg	-	0.02	3.61	0.02
Dibenz(ah)anthracene	CE087	mg/kg	-	<0.01	0.97	<0.01
Benzo(ghi)perylene	CE087	mg/kg	-	0.02	3.64	0.01
PAH (total of USEPA 16)	CE087	mg/kg	<0.16	0.31	71.7	0.25

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SOILS

Lab number			54648-7	54648-8	54648-9	54648-10
Sample id			BH 5	BH 6	BH 7	BH 7
Depth (m)			1.70	0.80	0.20	1.00
Date sampled			06/03/2015	06/03/2015	06/03/2015	06/03/2015
Test	**Method**	**Units**				
PCB						
PCB Congener 28	CE137	mg/kg	-	-	<0.005	<0.005
PCB Congener 52	CE137	mg/kg	-	-	<0.005	<0.005
PCB Congener 101	CE137	mg/kg	-	-	<0.005	<0.005
PCB Congener 118	CE137	mg/kg	-	-	<0.005	<0.005
PCB Congener 138	CE137	mg/kg	-	-	<0.005	<0.005
PCB Congener 153	CE137	mg/kg	-	-	<0.005	<0.005
PCB Congener 180	CE137	mg/kg	-	-	<0.005	<0.005
Subcontracted analysis						
Asbestos	$	-	-	-	-	-

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LEACHATES

Lab number			54648-3L	54648-6L	54648-9L
Sample id			BH 3	BH 5	BH 7
Depth (m)			1.00	0.20	0.20
Test	**Method**	**Units**			
Arsenic (dissolved)	CE128 U	µg/l As	3.52	2.03	5.05
Boron (dissolved)	CE128 U	µg/l B	12	9	9
Cadmium (dissolved)	CE128 U	µg/l Cd	<0.07	<0.07	<0.07
Chromium (dissolved)	CE128 U	µg/l Cr	1.5	3.7	2.7
Copper (dissolved)	CE128 U	µg/l Cu	3.0	3.1	5.9
Lead (dissolved)	CE128 U	µg/l Pb	13	2.9	11
Mercury (dissolved)	CE128 U	µg/l Hg	0.032	<0.008	0.027
Nickel (dissolved)	CE128 U	µg/l Ni	1.2	2.3	1.8
Selenium (dissolved)	CE128 U	µg/l Se	0.11	0.16	0.29
Zinc (dissolved)	CE128 U	µg/l Zn	8	4	13
pH	CE004 U	units	8.9	8.6	8.8
Sulphate	CE049 U	mg/l SO_4	<10	<10	<10
Sulphur (dissolved)	CE128 U	mg/l S	0.3	0.4	0.5
Sulphide	CE079	µg/l S^{2-}	<100	<100	<100
Cyanide (free)	CE077	µg/l CN	<20	<20	<20
Cyanide (total)	CE077	µg/l CN	<20	<20	<20
Thiocyanate	CE014	µg/l SCN	<200	<200	<200
Phenols (total)	CE078	µg/l PhOH	<10	<10	<10
PAH					
PAH (total of USEPA 16)	CE087	µg/l	<1.6	<1.6	<1.6

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE063	Boron (water soluble)	Hot water extract, ICP-OES	Dry	M	0.5	mg/kg B
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
-	Chromium (III)	Calculation: Cr (total) - Cr (VI)	Dry		1	mg/kg CrIII
CE050	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	Wet	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO_4
CE127	Sulphur (total)	Acid extraction, ICP-MS	Dry		100	mg/kg S
CE079	Sulphide	Extraction, Continuous Flow Colorimetry	Wet		10	mg/kg S^{2-}
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry	Wet		2	mg/kg CN
CE077	Cyanide (total)	Extraction, Continuous Flow Colorimetry	Wet		2	mg/kg CN
CE014	Thiocyanate	Weak acid extraction, Colorimetry	Dry	M	1	mg/kg SCN
CE078	Phenols (total)	Extraction, Continuous Flow Colorimetry	Wet		0.5	mg/kg PhOH
CE072	Total Organic Carbon (TOC)	Removal of IC by acidification, Carbon Analyser	Dry	M	0.1	% w/w C
CE072	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w
CE087	PAH (speciated)	Solvent extraction, GC-MS	Wet		0.01	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	Wet		1.6	mg/kg
CE137	PCB (ICES 7)	Solvent extraction, GC-MS	Wet		0.005	mg/kg
$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

Chemtech Environmental Limited

METHOD DETAILS

METHOD	LEACHATES	METHOD SUMMARY	STATUS	LOD	UNITS
CE128	Arsenic (dissolved)	ICP-MS	U	0.06	µg/l As
CE128	Boron (dissolved)	ICP-MS	U	6	µg/l B
CE128	Cadmium (dissolved)	ICP-MS	U	0.07	µg/l Cd
CE128	Chromium (dissolved)	ICP-MS	U	0.2	µg/l Cr
CE128	Copper (dissolved)	ICP-MS	U	0.4	µg/l Cu
CE128	Lead (dissolved)	ICP-MS	U	0.2	µg/l Pb
CE128	Mercury (dissolved)	ICP-MS	U	0.008	µg/l Hg
CE128	Nickel (dissolved)	ICP-MS	U	0.5	µg/l Ni
CE128	Selenium (dissolved)	ICP-MS	U	0.07	µg/l Se
CE128	Zinc (dissolved)	ICP-MS	U	1	µg/l Zn
CE004	pH	Based on BS 1377, pH Meter	U	-	units
CE049	Sulphate	Ion Chromatography	U	10	mg/l SO_4
CE128	Sulphur (dissolved)	ICP-MS	U	0.2	mg/l S
CE079	Sulphide	Continuous Flow Colorimetry		100	µg/l S2-
CE077	Cyanide (free)	Distillation, Colorimetry		20	µg/l CN
CE077	Cyanide (total)	Continuous Flow Colorimetry		20	µg/l CN
CE014	Thiocyanate	Colorimetry		200	µg/l SCN
CE078	Phenols (total)	Continuous Flow Colorimetry		10	µg/l PhOH
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS		1.6	µg/l

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
A	Sampling date not provided
B	Sampling time not provided (waters only)
C	Sample exceeded holding time(s)
D	Sample not received in appropriate containers
E	Headspace present in sample container
F	Sample not chemically fixed (where appropriate)
G	Sample not cooled
H	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
54648-1	BH 1	0.20	N	
54648-3	BH 3	1.00	N	
54648-5	BH 4	0.50	N	
54648-6	BH 5	0.20	N	
54648-7	BH 5	1.70	N	
54648-8	BH 6	0.80	N	
54648-9	BH 7	0.20	N	
54648-10	BH 7	1.00	N	

APPENDIX 4

CLEA v1.06 RISK ASSESSMENT: RESULTS, SETTINGS and NOTES

CLEA Software Version 1.06

Report generated	30-Mar-15
Report title	Tetlow Street, Liverpool
Created by	Jack Harper BSc(Hons) MSc at Geoinvestigate Ltd.

Environment Agency

RESULTS

Environment Agency

		Assessment Criterion (mg kg^{-1})			Ratio of ADE to HCV			Saturation Limit (mg kg^{-1})	50% rule?	
		oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal
1	Arsenic	3.24E+01	8.59E+01	NR	1.00	0.38	NR	NR	No	No
2	Boron	3.76E+02	1.23E+05	3.75E+02	1.00	0.00	1.00	NR	Yes	No
3	Cadmium	5.45E+00	3.01E+01	5.18E+00	0.91	0.09	1.00	NR	Yes	Yes
4	Chromium III	1.95E+04	6.44E+02	6.33E+02	0.03	0.97	1.00	NR	No	Yes
5	Copper	2.66E+03	1.05E+04	2.33E+03	0.78	0.22	1.00	NR	Yes	No
6	Mercury, elemental	NR	6.60E-01	NR	NR	1.00	NR	1.50E+01 (vap)	No	No
7	Nickel	5.31E+02	1.29E+02	NR	0.14	1.00	NR	NR	Yes	Yes
8	Selenium	3.50E+02	NR	NR	1.00	NR	NR	NR	Yes	No
9	Zinc	3.75E+03	2.58E+07	3.75E+03	1.00	0.00	1.00	NR	Yes	No
10	Phenol	1.26E+03	5.13E+02	3.64E+02	0.29	0.71	1.00	1.08E+05 (vap)	No	No
11	PAH Naphthalene	8.72E+01	6.11E+00	5.71E+00	0.07	0.93	1.00	2.54E+02 (sol)	No	No
12	PAH Acenaphthylene	5.64E+02	1.29E+04	5.40E+02	0.96	0.04	1.00	2.96E+02 (sol)	No	No
13	PAH Acenaphthene	6.81E+02	1.35E+04	6.48E+02	0.95	0.05	1.00	1.97E+02 (sol)	No	No
14	PAH Fluorene	5.22E+02	1.73E+04	5.06E+02	0.97	0.03	1.00	1.07E+02 (sol)	No	No
15	PAH Phenanthrene	2.64E+02	2.10E+04	2.61E+02	0.99	0.01	1.00	1.25E+02 (sol)	No	No
16	PAH Anthracene	6.50E+03	4.44E+05	6.40E+03	0.99	0.01	1.00	4.07E+00 (vap)	No	No
17	PAH Fluoranthene	5.51E+02	1.05E+05	5.48E+02	0.99	0.01	1.00	6.62E+01 (vap)	No	No
18	PAH Pyrene	1.25E+03	2.44E+05	1.24E+03	0.99	0.01	1.00	7.68E+00 (vap)	No	No
19	PAH Benz[a]anthracene	9.50E+00	1.32E+01	5.52E+00	0.58	0.42	1.00	5.99E+00 (sol)	No	No
20	PAH Chrysene	1.29E+01	2.71E+01	8.75E+00	0.68	0.32	1.00	1.54E+00 (vap)	No	No

Environment Agency

		Assessment Criterion (mg kg^{-1})			Ratio of ADE to HCV			Saturation Limit (mg kg^{-1})	50% rule?	
		oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal
21	PAH Benzo[b]fluoranthene	1.02E+01	2.06E+01	6.82E+00	0.67	0.33	1.00	4.25E+00 (sol)	No	No
22	PAH Benzo[k]fluoranthene	1.49E+01	2.93E+01	9.85E+00	0.66	0.34	1.00	2.40E+00 (sol)	No	No
23	PAH Benzo[a]pyrene	1.47E+00	2.92E+00	9.76E-01	0.67	0.33	1.00	3.19E+00 (vap)	No	No
24	PAH Indeno[123-cd]pyrene	6.03E+00	1.23E+01	4.05E+00	0.67	0.33	1.00	2.15E-01 (vap)	No	No
25	PAH Dibenz[ah]anthracene	1.36E+00	2.57E+00	8.89E-01	0.65	0.35	1.00	1.37E-02 (vap)	No	No
26	PAH Benzo[ghi]perylene	7.11E+01	1.35E+02	4.66E+01	0.66	0.34	1.00	5.39E-02 (vap)	No	No
27	PCB-77	7.72E-05	NR	NR	1.00	NR	NR	2.23E+03 (sol)	Yes	No
28	PCB-118	7.76E-05	NR	NR	1.00	NR	NR	2.44E+03 (vap)	Yes	No
29	PCB-156	7.77E-05	NR	NR	1.00	NR	NR	2.69E+03 (vap)	Yes	No
30	PCB-189	7.77E-05	NR	NR	1.00	NR	NR	2.85E+03 (vap)	Yes	No

Environment Agency

		Soil Distribution				Media Concentrations													
		Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
		%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
1	Arsenic	99.9	0.1	0.0	100.0	3.24E+01	NR	1.62E+01	5.52E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.39E-02	1.30E-02	7.45E-03	1.07E-02	6.48E-03	3.56E-02
2	Boron	97.3	2.7	0.0	100.0	3.75E+02	NR	1.88E+02	6.39E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.50E+02	7.51E+01	7.51E+01	7.51E+01	7.51E+01	1.18E-02
3	Cadmium	99.7	0.3	0.0	100.0	5.18E+00	NR	2.59E+00	8.81E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.69E-01	1.50E-01	1.61E-01	8.28E-02	1.61E-02	7.25E-03
4	Chromium III	100.0	0.0	0.0	100.0	6.33E+02	NR	3.17E+02	1.08E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.90E-02	1.90E-02	1.90E-02	1.90E-02	1.90E-02	1.90E-02
5	Copper	99.7	0.3	0.0	100.0	2.33E+03	NR	1.16E+03	3.97E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.80E+01	4.80E+01	4.80E+01	5.43E+01	4.80E+01	4.80E+01
6	Mercury, elemental	99.9	0.1	0.0	100.0	6.60E-01	2.63E-01	3.30E-01	1.12E-10	0.00E+00	6.16E-05	1.63E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7	Nickel	99.9	0.1	0.0	100.0	1.29E+02	NR	6.44E+01	2.19E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.89E-01	5.54E-01	2.45E-01	3.22E-01	3.22E-01	4.38E-01
8	Selenium	99.5	0.5	0.0	100.0	3.50E+02	NR	1.75E+02	5.96E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.78E+00	1.27E+00	2.91E-01	9.49E-01	1.05E+00	1.05E+00
9	Zinc	99.3	0.7	0.0	100.0	3.75E+03	NR	1.87E+03	6.38E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.02E+02	2.02E+02	2.02E+02	5.36E+02	2.02E+02	2.02E+02
10	Phenol	86.1	13.9	0.0	100.0	3.64E+02	1.55E+00	1.82E+02	6.20E-08	0.00E+00	1.30E-03	7.42E-05	0.00E+00	1.47E+02	2.50E+02	1.59E+02	0.00E+00	0.00E+00	3.00E+02
11	PAH Naphthalene	98.0	2.0	0.0	100.0	5.71E+00	2.83E+00	2.86E+00	9.73E-10	0.00E+00	6.97E-04	1.63E-06	0.00E+00	1.74E+00	2.40E+00	6.17E-01	0.00E+00	0.00E+00	7.85E-01
12	PAH Acenaphthylene	99.3	0.7	0.0	100.0	5.40E+02	8.24E+00	2.70E+02	9.19E-08	0.00E+00	2.70E-03	3.32E-05	0.00E+00	8.34E+01	1.11E+02	2.88E+01	0.00E+00	0.00E+00	1.62E+01
13	PAH Acenaphthene	99.4	0.6	0.0	100.0	6.48E+02	1.03E+01	3.24E+02	1.10E-07	0.00E+00	3.09E-03	3.80E-05	0.00E+00	8.13E+01	1.09E+02	3.10E+01	0.00E+00	0.00E+00	1.32E+01
14	PAH Fluorene	99.5	0.5	0.0	100.0	5.06E+02	3.63E+00	2.53E+02	8.62E-08	0.00E+00	1.25E-03	2.22E-05	0.00E+00	5.43E+01	7.30E+01	2.14E+01	0.00E+00	0.00E+00	7.57E+00
15	PAH Phenanthrene	99.8	0.2	0.0	100.0	2.61E+02	3.34E-01	1.31E+02	4.44E-08	0.00E+00	1.61E-04	6.64E-06	0.00E+00	1.49E+01	2.11E+01	7.54E+00	0.00E+00	0.00E+00	1.19E+00
16	PAH Anthracene	99.8	0.2	0.0	100.0	6.40E+03	1.01E+01	3.20E+03	1.09E-06	0.00E+00	4.51E-03	1.67E-04	0.00E+00	3.57E+02	5.05E+02	1.81E+02	0.00E+00	0.00E+00	2.85E+01
17	PAH Fluoranthene	99.9	0.1	0.0	100.0	5.48E+02	9.32E-02	2.74E+02	9.33E-08	0.00E+00	5.65E-05	6.92E-06	0.00E+00	7.82E+00	1.43E+01	7.58E+00	0.00E+00	0.00E+00	2.41E-01
18	PAH Pyrene	99.9	0.1	0.0	100.0	1.24E+03	2.13E-01	6.22E+02	2.12E-07	0.00E+00	1.33E-04	1.66E-05	0.00E+00	2.05E+01	3.63E+01	1.88E+01	0.00E+00	0.00E+00	6.80E-01
19	PAH Benz[a]anthracene	100.0	0.0	0.0	100.0	5.52E+00	1.11E-04	2.76E+00	9.40E-10	0.00E+00	7.70E-08	3.14E-08	0.00E+00	9.32E-03	3.47E-02	2.40E-02	0.00E+00	0.00E+00	8.83E-05
20	PAH Chrysene	100.0	0.0	0.0	100.0	8.75E+00	2.49E-05	4.37E+00	1.49E-09	0.00E+00	2.12E-08	5.72E-08	0.00E+00	2.55E-02	7.74E-02	5.07E-02	0.00E+00	0.00E+00	3.18E-04

Environment Agency

		Soil Distribution				Media Concentrations													
		Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
		%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
21	PAH Benzo[b]fluoranthene	100.0	0.0	0.0	100.0	6.82E+00	6.58E-06	3.41E+00	1.16E-09	0.00E+00	5.69E-09	NR	0.00E+00	6.88E-03	3.19E-02	2.19E-02	0.00E+00	0.00E+00	5.03E-05
22	PAH Benzo[k]fluoranthene	100.0	0.0	0.0	100.0	9.85E+00	5.71E-06	4.93E+00	1.68E-09	0.00E+00	5.01E-09	NR	0.00E+00	5.46E-03	3.27E-02	2.32E-02	0.00E+00	0.00E+00	3.02E-05
23	PAH Benzo[a]pyrene	100.0	0.0	0.0	100.0	9.76E-01	6.57E-07	4.88E-01	1.66E-10	0.00E+00	5.76E-10	NR	0.00E+00	6.98E-04	3.71E-03	2.63E-03	0.00E+00	0.00E+00	4.36E-06
24	PAH Indeno[123-cd]pyrene	100.0	0.0	0.0	100.0	4.05E+00	4.69E-06	2.02E+00	6.89E-10	0.00E+00	4.05E-09	NR	0.00E+00	5.66E-03	2.27E-02	1.49E-02	0.00E+00	0.00E+00	4.89E-05
25	PAH Dibenz[ah]anthracene	100.0	0.0	0.0	100.0	8.89E-01	1.27E-06	4.45E-01	1.51E-10	0.00E+00	1.05E-09	NR	0.00E+00	3.26E-04	2.34E-03	1.59E-03	0.00E+00	0.00E+00	1.49E-06
26	PAH Benzo[ghi]perylene	100.0	0.0	0.0	100.0	4.66E+01	1.58E-05	2.33E+01	7.93E-09	0.00E+00	1.34E-08	NR	0.00E+00	3.59E-03	5.50E-02	4.04E-02	0.00E+00	0.00E+00	8.18E-06
27	PCB-77	100.0	0.0	0.0	100.0	7.72E-05	1.63E-09	3.86E-05	1.31E-14	0.00E+00	4.18E-13	NR	0.00E+00	1.91E-09	2.29E-08	1.70E-08	0.00E+00	0.00E+00	5.39E-12
28	PCB-118	100.0	0.0	0.0	100.0	7.76E-05	7.40E-10	3.88E-05	1.32E-14	0.00E+00	1.68E-13	NR	0.00E+00	2.10E-10	7.11E-09	5.18E-09	0.00E+00	0.00E+00	2.48E-13
29	PCB-156	100.0	0.0	0.0	100.0	7.77E-05	1.30E-10	3.89E-05	1.32E-14	0.00E+00	3.26E-14	NR	0.00E+00	1.73E-11	2.10E-09	1.48E-09	0.00E+00	0.00E+00	7.62E-15
30	PCB-189	100.0	0.0	0.0	100.0	7.77E-05	2.35E-11	3.89E-05	1.32E-14	0.00E+00	6.78E-15	NR	0.00E+00	1.13E-12	6.36E-10	4.34E-10	0.00E+00	0.00E+00	1.60E-16

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		Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
		Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
1	Arsenic	2.40E-04	2.27E-05	3.70E-05	7.54E-07	0.00E+00	0.00E+00	0.00E+00	79.89	7.54	12.31	0.25	0.00	0.00	0.00	0.00
2	Boron	2.78E-03	7.71E-02	0.00E+00	8.74E-06	0.00E+00	2.08E-01	2.41E-05	1.74	48.25	0.00	0.01	0.00	0.00	49.99	0.01
3	Cadmium	3.84E-05	1.33E-04	1.97E-07	1.21E-07	0.00E+00	7.54E-04	1.21E-06	11.21	38.70	0.06	0.04	0.00	0.00	49.96	0.04
4	Chromium III	4.70E-03	7.45E-05	0.00E+00	1.48E-05	0.00E+00	3.39E-03	1.64E-05	57.37	0.91	0.00	0.18	0.00	0.00	41.36	0.18
5	Copper	1.73E-02	5.27E-02	0.00E+00	5.43E-05	0.00E+00	3.94E-01	4.12E-05	12.34	37.63	0.00	0.04	0.00	0.00	49.97	0.03
6	Mercury, elemental	4.90E-06	5.64E-08	0.00E+00	1.54E-08	5.70E-05	0.00E+00	3.03E-06	0.00	0.00	0.00	0.03	94.91	0.01	0.00	5.05
7	Nickel	9.55E-04	4.71E-04	2.45E-05	3.00E-06	0.00E+00	7.31E-03	3.64E-06	32.78	16.18	0.84	0.10	0.00	0.00	49.90	0.10
8	Selenium	2.60E-03	1.82E-03	0.00E+00	8.16E-06	0.00E+00	1.97E-03	3.64E-06	40.59	28.46	0.00	0.13	0.00	0.00	30.82	0.00
9	Zinc	2.78E-02	2.72E-01	0.00E+00	8.72E-05	0.00E+00	1.52E+00	1.45E-04	4.63	45.36	0.00	0.01	0.00	0.00	49.99	0.01
10	Phenol	2.70E-03	1.95E-01	4.17E-03	8.49E-06	1.20E-03	1.97E-02	2.42E-03	1.20	86.57	1.85	0.00	0.53	0.00	8.76	1.08
11	PAH Naphthalene	4.24E-05	1.21E-03	2.83E-05	1.33E-07	6.45E-04	3.94E-04	1.70E-04	1.70	48.68	1.14	0.01	25.87	0.00	15.80	6.81
12	PAH Acenaphthylene	4.00E-03	5.08E-02	2.67E-03	1.26E-05	2.50E-03	7.88E-06	6.67E-07	6.67	84.67	4.46	0.02	4.17	0.00	0.01	0.00
13	PAH Acenaphthene	4.81E-03	4.91E-02	3.21E-03	1.51E-05	2.86E-03	5.51E-05	1.52E-06	8.01	81.75	5.35	0.03	4.76	0.00	0.09	0.00
14	PAH Fluorene	3.76E-03	3.25E-02	2.51E-03	1.18E-05	1.16E-03	3.32E-05	5.82E-06	9.39	81.33	6.27	0.03	2.89	0.00	0.08	0.01
15	PAH Phenanthrene	1.94E-03	9.03E-03	1.29E-03	6.08E-06	1.49E-04	8.66E-05	3.14E-05	15.45	72.06	10.32	0.05	1.18	0.00	0.69	0.25
16	PAH Anthracene	4.75E-02	2.16E-01	3.17E-02	1.49E-04	4.18E-03	4.50E-06	2.49E-06	15.83	72.16	10.57	0.05	1.39	0.00	0.00	0.00
17	PAH Fluoranthene	4.06E-03	5.64E-03	2.71E-03	1.28E-05	5.26E-05	1.97E-05	5.09E-06	32.49	45.08	21.70	0.10	0.42	0.00	0.16	0.04
18	PAH Pyrene	9.23E-03	1.44E-02	6.16E-03	2.90E-05	1.24E-04	1.97E-05	3.94E-06	30.75	48.12	20.54	0.10	0.41	0.00	0.07	0.01
19	PAH Benz[a]anthracene	4.09E-05	1.19E-05	2.73E-05	1.29E-07	7.25E-08	3.38E-06	6.67E-07	50.91	14.84	34.00	0.16	0.09	0.00	0.00	0.00
20	PAH Chrysene	6.49E-05	2.73E-05	4.33E-05	2.04E-07	2.20E-08	6.19E-06	1.03E-06	47.80	20.11	31.93	0.15	0.01	0.00	0.00	0.00

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		Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
		Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
21	PAH Benzo[b]fluoranthene	5.06E-05	1.06E-05	3.38E-05	1.59E-07	6.59E-09	6.19E-06	7.88E-07	53.15	11.18	35.50	0.17	0.01	0.00	0.00	0.00
22	PAH Benzo[k]fluoranthene	7.31E-05	1.08E-05	4.88E-05	2.29E-07	6.24E-09	5.06E-06	4.24E-07	54.98	8.12	36.72	0.17	0.00	0.00	0.00	0.00
23	PAH Benzo[a]pyrene	7.24E-06	1.23E-06	4.83E-06	2.27E-08	7.04E-10	6.19E-06	3.64E-07	54.30	9.26	36.26	0.17	0.00	0.00	0.00	0.00
24	PAH Indeno[123-cd]pyrene	3.00E-05	7.63E-06	2.00E-05	9.42E-08	4.60E-09	5.63E-06	5.46E-07	51.93	13.21	34.68	0.16	0.01	0.00	0.00	0.00
25	PAH Dibenz[ah]anthracene	6.60E-06	7.65E-07	4.41E-06	2.07E-08	1.10E-09	2.25E-06	2.00E-06	55.95	6.49	37.37	0.18	0.01	0.00	0.00	0.00
26	PAH Benzo[ghi]perylene	3.46E-04	1.94E-05	2.31E-04	1.09E-06	1.69E-08	3.38E-06	6.06E-07	57.90	3.25	38.67	0.18	0.00	0.00	0.00	0.00
27	PCB-77	5.73E-10	1.31E-11	4.12E-10	1.80E-12	3.92E-13	2.76E-09	0.00E+00	28.64	0.66	20.60	0.09	0.02	0.00	50.00	0.00
28	PCB-118	5.76E-10	8.55E-12	4.14E-10	1.81E-12	1.59E-13	2.76E-09	0.00E+00	28.78	0.43	20.70	0.09	0.01	0.00	50.00	0.00
29	PCB-156	5.76E-10	7.19E-12	4.15E-10	1.81E-12	3.19E-14	2.76E-09	0.00E+00	28.82	0.36	20.73	0.09	0.00	0.00	50.00	0.00
30	PCB-189	5.77E-10	6.80E-12	4.15E-10	1.81E-12	7.08E-15	2.76E-09	0.00E+00	28.83	0.34	20.74	0.09	0.00	0.00	50.00	0.00

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		Oral Health Criteria Value ($\mu g\ kg^{-1}\ BW\ day^{-1}$)		Inhalation Health Criteria Value ($\mu g\ kg^{-1}\ BW\ day^{-1}$)		Oral Mean Daily Intake ($\mu g\ day^{-1}$)	Inhalation Mean Daily Intake ($\mu g\ day^{-1}$)	Air-water partition coefficient (K_{aw}) ($cm^3\ cm^{-3}$)	Coefficient of Diffusion in Air ($m^2\ s^{-1}$)	Coefficient of Diffusion in Water ($m^2\ s^{-1}$)	log K_{oc} ($cm^3\ g^{-1}$)	log K_{ow} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor ($g\ g^{-1}$ DW)	Sub-surface soil to indoor air correction factor (dimensionless)	Relative bioavailability via soil ingestion (unitless)	Relative bioavailability via dust inhalation (unitless)
1	Arsenic	ID	0.3	ID	0.002	NR	NR	NR	NR	NR	NR	NR	0.03	0.5	1	1	1
2	Boron	TDI	160	TDI	2.9	3700	0.398	NR	NR	NR	NR	NR	0	0.5	1	1	1
3	Cadmium	TDI	0.36	TDI	0.0014	13.4	0.02	NR	NR	NR	NR	NR	0.001	0.5	1	1	1
4	Chromium III	TDI	150	TDI	0.03	60.2	0.27	NR	NR	NR	NR	NR	0	0.5	1	1	1
5	Copper	TDI	160	TDI	0.286	7000	0.68	NR	NR	NR	NR	NR	0	0.5	1	1	1
6	Mercury, elemental	NR	0	TDI	0.06	0	0.05	1.17E-01	6.34E-06	2.00E-09	4.16	0.62	0	0.5	1	1	1
7	Nickel	TDI	12	TDI	0.006	130	0.06	NR	NR	NR	NR	NR	0.005	0.5	1	1	1
8	Selenium	TDI	6.4	NR	0	35	0.06	NR	NR	NR	NR	NR	0	0.5	1	1	1
9	Zinc	TDI	600	TDI	600	27000	2.4	NR	NR	NR	NR	NR	0	0.5	1	1	1
10	Phenol	TDI	700	TDI	10	350	40	8.35E-06	7.90E-06	6.36E-10	1.92	1.48	0.3	0.5	1	1	1
11	PAH Naphthalene	TDI	20	TDI	0.86	7	2.8	6.62E-03	6.52E-06	5.16E-10	2.81	3.34	0.13	0.5	1	1	1
12	PAH Acenaphthylene	TDI	60	TDI	60	0.14	0.011	5.68E-04	5.97E-06	4.82E-10	3.26	3.91	0.13	0.5	1	1	1
13	PAH Acenaphthene	TDI	60	TDI	60	0.98	0.025	7.59E-04	5.85E-06	4.70E-10	3.37	4.03	0.13	0.5	1	1	1
14	PAH Fluorene	TDI	40	TDI	40	0.59	0.096	4.12E-04	5.58E-06	4.47E-10	3.45	4.13	0.13	0.5	1	1	1
15	PAH Phenanthrene	TDI	12.5	TDI	12.5	1.54	0.518	1.43E-04	5.34E-06	4.32E-10	3.74	4.5	0.13	0.5	1	1	1
16	PAH Anthracene	TDI	300	TDI	300	0.08	0.041	1.81E-04	5.36E-06	4.36E-10	3.75	4.5	0.13	0.5	1	1	1
17	PAH Fluoranthene	TDI	12.5	TDI	12.5	0.35	0.084	6.29E-05	5.01E-06	4.11E-10	4.26	5.13	0.13	0.5	1	1	1
18	PAH Pyrene	TDI	30	TDI	30	0.35	0.065	5.64E-05	5.01E-06	4.15E-10	4.21	5.08	0.13	0.5	1	1	1
19	PAH Benz[a]anthracene	ID	0.138	ID	0.00048	0.06	0.011	3.16E-05	4.60E-06	3.80E-10	4.89	5.91	0.13	0.5	1	1	1
20	PAH Chrysene	ID	0.2	ID	0.0007	0.11	0.017	3.18E-06	4.57E-06	3.77E-10	4.74	5.73	0.13	0.5	1	1	1

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		Oral Health Criteria Value ($\mu g\ kg^{-1}\ BW\ day^{-1}$)		Inhalation Health Criteria Value ($\mu g\ kg^{-1}\ BW\ day^{-1}$)		Oral Mean Daily Intake ($\mu g\ day^{-1}$)	Inhalation Mean Daily Intake ($\mu g\ day^{-1}$)	Air-water partition coefficient (K_{aw}) ($cm^3\ cm^{-3}$)	Coefficient of Diffusion in Air ($m^2\ s^{-1}$)	Coefficient of Diffusion in Water ($m^2\ s^{-1}$)	log K_{oc} ($cm^3\ g^{-1}$)	log K_{ow} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor ($g\ g^{-1}$ DW)	Sub-surface soil to indoor air correction factor (dimensionless)	Relative bioavailability via soil ingestion (unitless)	Relative bioavailability via dust inhalation (unitless)
21	PAH Benzo[b]fluoranthene	ID	0.142	ID	0.0005	0.11	0.013	2.05E-06	4.38E-06	3.62E-10	5.02	6.08	0.13	0.5	1	1	1
22	PAH Benzo[k]fluoranthene	ID	0.2	ID	0.0007	0.09	0.007	1.74E-06	4.36E-06	3.62E-10	5.17	6.26	0.13	0.5	1	1	1
23	PAH Benzo[a]pyrene	ID	0.02	ID	0.00007	0.11	0.006	1.76E-06	4.38E-06	3.67E-10	5.11	6.18	0.13	0.5	1	1	1
24	PAH Indeno[123-cd]pyrene	ID	0.086	ID	0.0003	0.1	0.009	2.05E-06	4.17E-06	3.51E-10	4.94	5.97	0.13	0.5	1	1	1
25	PAH Dibenz[ah]anthracene	ID	0.018	ID	0.000063	0.04	0.033	5.40E-06	4.08E-06	3.40E-10	5.27	6.38	0.13	0.5	1	1	1
26	PAH Benzo[ghi]perylene	ID	0.909	ID	0.0032	0.06	0.01	2.86E-06	4.22E-06	3.56E-10	5.62	6.81	0.13	0.5	1	1	1
27	PCB-77	TDI	0.000002	NR	0	0.000049	0	7.11E-04	4.52E-06	3.63E-10	6.22	6.68	0.14	0.5	1	1	1
28	PCB-118	TDI	0.000002	NR	0	0.000049	0	1.04E-03	4.32E-06	3.47E-10	6.73	7.19	0.14	0.5	1	1	1
29	PCB-156	TDI	0.000002	NR	0	0.000049	0	6.20E-04	4.14E-06	3.33E-10	7.26	7.71	0.14	0.5	1	1	1
30	PCB-189	TDI	0.000002	NR	0	0.000049	0	3.70E-04	3.98E-06	3.21E-10	7.78	8.24	0.14	0.5	1	1	1

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		Soil-to-water partition coefficient ($cm^3\ g^{-1}$)	Vapour pressure (Pa)	Water solubility ($mg\ L^{-1}$)	Soil-to-plant concentration factor for green vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for root vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tuber vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for herbaceous fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for shrub fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tree fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)
1	Arsenic	5.00E+02	NR	1.25E+06	0.00043 fw	0.0004 fw	0.00023 fw	0.00033 fw	0.0002 fw	0.0011 fw
2	Boron	1.00E+01	NR	6.35E+04	0.4 fw	0.2 fw	0.2 fw	0.2 fw	0.2 fw	0.0002 dw
3	Cadmium	1.00E+02	NR	1.62E+06	0.052 fw	0.029 fw	0.031 fw	0.016 fw	0.0031 fw	0.0014 fw
4	Chromium III	4.80E+03	NR	5.85E+05	0.00003 fw	0.00003 fw	0.00003 fw	0.00003 fw	0.00003 fw	0.00003 fw
5	Copper	1.00E+02	NR	1.38E+06	0.0206 fw	0.0206 fw	0.0206 fw	0.0233 fw	0.0206 fw	0.0206 fw
6	Mercury, elemental	2.93E+02	7.03E-02	5.60E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7	Nickel	5.00E+02	NR	2.50E+06	0.0038 fw	0.0043 fw	0.0019 fw	0.0025 fw	0.0025 fw	0.0034 fw
8	Selenium	5.00E+01	NR	2.17E+06	0.0108 fw	0.00364 fw	0.00083 fw	0.00271 fw	0.003 fw	0.003 fw
9	Zinc	3.80E+01	NR	4.32E+06	0.054 fw	0.054 fw	0.054 fw	0.143 fw	0.054 fw	0.054 fw
10	Phenol	1.69E+00	1.15E+01	8.41E+04	model	model	model	0.00E+00	0.00E+00	model
11	PAH Naphthalene	1.31E+01	2.31E+00	1.90E+01	model	model	model	model	model	model
12	PAH Acenaphthylene	3.69E+01	7.08E-02	7.95E+00	model	model	model	model	model	model
13	PAH Acenaphthene	4.76E+01	7.37E-02	4.11E+00	model	model	model	model	model	model
14	PAH Fluorene	5.72E+01	1.56E-02	1.86E+00	model	model	model	model	model	model
15	PAH Phenanthrene	1.12E+02	2.82E-03	1.12E+00	model	model	model	model	model	model
16	PAH Anthracene	1.14E+02	8.49E-05	5.60E-02	model	model	model	model	model	model
17	PAH Fluoranthene	3.69E+02	1.31E-04	2.30E-01	model	model	model	model	model	model
18	PAH Pyrene	3.29E+02	1.53E-05	1.30E-01	model	model	model	model	model	model
19	PAH Benz[a]anthracene	1.58E+03	1.24E-06	3.80E-03	model	model	model	model	model	model
20	PAH Chrysene	1.12E+03	4.52E-08	2.00E-03	model	model	model	model	model	model

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		Soil-to-water partition coefficient ($cm^3\ g^{-1}$)	Vapour pressure (Pa)	Water solubility ($mg\ L^{-1}$)	Soil-to-plant concentration factor for green vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for root vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tuber vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for herbaceous fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for shrub fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tree fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)
21	PAH Benzo[b]fluoranthene	2.13E+03	6.34E-08	2.00E-03	model	model	model	model	model	model
22	PAH Benzo[k]fluoranthene	3.00E+03	1.64E-08	8.00E-04	model	model	model	model	model	model
23	PAH Benzo[a]pyrene	2.62E+03	2.00E-08	3.80E-03	model	model	model	model	model	model
24	PAH Indeno[123-cd]pyrene	1.77E+03	2.12E-09	2.00E-04	model	model	model	model	model	model
25	PAH Dibenz[ah]anthracene	3.78E+03	1.66E-10	6.00E-04	model	model	model	model	model	model
26	PAH Benzo[ghi]perylene	8.46E+03	1.55E-10	2.60E-04	model	model	model	model	model	model
27	PCB-77	3.37E+04	3.86E-04	6.63E-02	model	model	model	0.00E+00	0.00E+00	model
28	PCB-118	1.09E+05	1.68E-04	2.27E-02	model	model	model	0.00E+00	0.00E+00	model
29	PCB-156	3.69E+05	2.94E-05	7.41E-03	model	model	model	0.00E+00	0.00E+00	model
30	PCB-189	1.22E+06	5.14E-06	2.49E-03	model	model	model	0.00E+00	0.00E+00	model

CLEA Software Version 1.06

Report generated	30/03/2015
Report title	Tetlow Street, Liverpool
Created by	Jack Harper BSc(Hons) MSc at Geoinvestigate Ltd.

Environment Agency

BASIC SETTINGS

Land Use	Residential with homegrown produce						
Building	Semi-detached house						
Receptor	Female (res)	Start age class	1	End age class	6	Exposure Duration	6 years
Soil	Sandy loam						

Exposure Pathways

Direct soil and dust ingestion	✓	Dermal contact with indoor dust	✓	Inhalation of indoor dust	✓
Consumption of homegrown produce	✓	Dermal contact with soil	✓	Inhalation of soil dust	✓
Soil attached to homegrown produce	✓			Inhalation of indoor vapour	✓
				Inhalation of outdoor vapour	✓

Environment Agency

Land Use Residential with homegrown produce

Age Class	Exposure Frequencies (days yr^{-1})						Occupation Periods (hr day^{-1})		Soil to skin adherence factors (mg cm^2)		Direct soil ingestion rate (g day^{-1})
	Direct soil ingestion	Consumption of homegrown produce	Dermal contact with indoor dust	Dermal contact with soil	Inhalation of dust and vapour, indoor	Inhalation of dust and vapour, outdoor	Indoors	Outdoors	Indoor	Outdoor	
1	180	180	180	180	365	365	23.0	1.0	0.06	1.00	0.10
2	365	365	365	365	365	365	23.0	1.0	0.06	1.00	0.10
3	365	365	365	365	365	365	23.0	1.0	0.06	1.00	0.10
4	365	365	365	365	365	365	23.0	1.0	0.06	1.00	0.10
5	365	365	365	365	365	365	19.0	1.0	0.06	1.00	0.10
6	365	365	365	365	365	365	19.0	1.0	0.06	1.00	0.10
7	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00
8	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00
9	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00
10	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00
11	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00
12	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00
13	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00
14	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00
15	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00
16	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00
17	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00
18	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00

Environment Agency

Receptor Female (res)

Age Class	Body weight (kg)	Body height (m)	Inhalation rate (m^3 day^{-1})	Max exposed skin factor: Indoor (m^2 m^{-2})	Max exposed skin factor: Outdoor (m^2 m^{-2})	Total skin area (m^2)	Consumption rates (g FW kg^{-1} BW day^{-1}): Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
1	5.60	0.7	8.5	0.32	0.26	3.43E-01	7.12	10.69	16.03	1.83	2.23	3.82
2	9.80	0.8	13.3	0.33	0.26	4.84E-01	6.85	3.30	5.46	3.96	0.54	11.96
3	12.70	0.9	12.7	0.32	0.25	5.82E-01	6.85	3.30	5.46	3.96	0.54	11.96
4	15.10	0.9	12.2	0.35	0.28	6.36E-01	6.85	3.30	5.46	3.96	0.54	11.96
5	16.90	1.0	12.2	0.35	0.28	7.04E-01	3.74	1.77	3.38	1.85	0.16	4.26
6	19.70	1.1	12.2	0.33	0.26	7.94E-01	3.74	1.77	3.38	1.85	0.16	4.26
7	22.10	1.2	12.4	0.22	0.15	8.73E-01	3.74	1.77	3.38	1.85	0.16	4.26
8	25.30	1.2	12.4	0.22	0.15	9.36E-01	3.74	1.77	3.38	1.85	0.16	4.26
9	27.50	1.3	12.4	0.22	0.15	1.01E+00	3.74	1.77	3.38	1.85	0.16	4.26
10	31.40	1.3	12.4	0.22	0.15	1.08E+00	3.74	1.77	3.38	1.85	0.16	4.26
11	35.70	1.4	12.4	0.22	0.14	1.19E+00	3.74	1.77	3.38	1.85	0.16	4.26
12	41.30	1.4	13.4	0.22	0.14	1.29E+00	3.74	1.77	3.38	1.85	0.16	4.26
13	47.20	1.5	13.4	0.22	0.14	1.42E+00	3.74	1.77	3.38	1.85	0.16	4.26
14	51.20	1.6	13.4	0.22	0.14	1.52E+00	3.74	1.77	3.38	1.85	0.16	4.26
15	56.70	1.6	13.4	0.21	0.14	1.60E+00	3.74	1.77	3.38	1.85	0.16	4.26
16	59.00	1.6	13.4	0.21	0.14	1.63E+00	3.74	1.77	3.38	1.85	0.16	4.26
17	70.00	1.6	14.8	0.33	0.27	1.78E+00	2.94	1.40	1.79	1.61	0.22	2.97
18	70.90	1.6	12.0	0.33	0.27	1.80E+00	2.94	1.40	1.79	1.61	0.22	2.97

Environment Agency

Building Semi-detached house

Building footprint (m^2)	4.30E+01
Living space air exchange rate (hr^{-1})	5.00E-01
Living space height (above ground, m)	4.80E+00
Living space height (below ground, m)	0.00E+00
Pressure difference (soil to enclosed space, Pa)	3.10E+00
Foundation thickness (m)	1.50E-01
Floor crack area (cm^2)	5.25E+02
Dust loading factor ($\mu g\ m^{-3}$)	5.00E+01

Soil Sandy loam

Porosity, Total ($cm^3\ cm^{-3}$)	5.30E-01
Porosity, Air-Filled ($cm^3\ cm^{-3}$)	2.00E-01
Porosity, Water-Filled ($cm^3\ cm^{-3}$)	3.30E-01
Residual soil water content ($cm^3\ cm^{-3}$)	1.20E-01
Saturated hydraulic conductivity ($cm\ s^{-1}$)	3.56E-03
van Genuchten shape parameter *m* (dimensionless)	3.20E-01
Bulk density ($g\ cm^{-3}$)	1.21E+00
Threshold value of wind speed at 10m ($m\ s^{-1}$)	7.20E+00
Empirical function (F_x) for dust model (dimensionless)	1.22E+00
Ambient soil temperature (K)	2.83E+02
Soil pH	8.84E+00
Soil Organic Matter content (%)	3.50E+00
Fraction of organic carbon ($g\ g^{-1}$)	2.03E-02
Effective total fluid saturation (unitless)	5.12E-01
Intrinsic soil permeability (cm^2)	4.75E-08
Relative soil air permeability (unitless)	6.42E-01
Effective air permeability (cm^2)	3.05E-08

Environment Agency

Soil - Vapour Model

Depth to top of source (no building) (cm)	0
Depth to top of source (beneath building) (cm)	65
Default soil gas ingress rate?	Yes
Soil gas ingress rate ($cm^3\ s^{-1}$)	2.50E+01
Building ventilation rate ($cm^3\ s^{-1}$)	2.87E+04
Averaging time surface emissions (yr)	6
Finite vapour source model?	Yes
Thickness of contaminated layer (cm)	170

Air Dispersion Model

Mean annual windspeed at 10m ($m\ s^{-1}$)	5.00
Air dispersion factor at height of 0.8m *	2400.00
Air dispersion factor at height of 1.6m *	0.00
Fraction of site cover ($m^2\ m^{-2}$)	0.9

* Air dispersion factor in $g\ m^{-2}\ s^{-1}$ per $kg\ m^{-3}$

Soil - Plant Model

	Dry weight conversion factor	Homegrown fraction Average	Homegrown fraction High	Soil loading factor	Preparation correction factor
	$g\ DW\ g^{-1}\ FW$	dimensionless		$g\ g^{-1}\ DW$	dimensionless
Green vegetables	0.096	0.05	0.33	1.00E-03	2.00E-01
Root vegetables	0.103	0.06	0.40	1.00E-03	1.00E+00
Tuber vegetables	0.210	0.02	0.13	1.00E-03	1.00E+00
Herbaceous fruit	0.058	0.06	0.40	1.00E-03	6.00E-01
Shrub fruit	0.166	0.09	0.60	1.00E-03	6.00E-01
Tree fruit	0.157	0.04	0.27	1.00E-03	6.00E-01

Gardener type Average

CLEA v1.06 RISK ASSESSMENT: NOTES

Justification of Settings Utilised in CLEA v1.06 to generate Site Specific Assessment Criteria

Basic Settings		
Setting	**Elected Option**	**Justification**
Land Use	Residential with home-grown produce -unaltered	Best fit to current intended development
Building Type	Semi-detached house -unaltered	Best fit to current intended development
Receptor Type	Female (residential) -unaltered	Default setting representing most vulnerable receptor
Soil Type	Sandy loam -unaltered	Majority of soils encountered during intrusive works
Soil Organic matter	3.50%	Analytically derived value (estimated from Analytically derived TOC) from soil sampled at site.
pH	8.84	Average analytically derived value from soils sampled at site
Alterations to Advanced settings:		
Finite source model	Switched on	No on-going addition of contamination to soils at site
	1.70m	Maximum encountered depth of made ground encountered at site 1.70m though generally ≤0.95m.
Fraction of hard/vegetative cover at site	0.9	Understood to be greater than 90% covering of site with hard standing or vegetative cover following completion of development.