T J BOOTH ASSOCIATES

CONSULTING CIVIL & GEOTECHNICAL ENGINEERS

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Rochdale
Lancashire
OL16 1DH

Mrs L Brooks,
174 Bury Old Road,
Heywood,
Rochdale
OL10 3LN.

Friday, 29 June 2018
Ref: rep-tjba-brooks-174 bury old rd-phs II letter rep-270618.docx

Subject: **174 Bury Old Road, Heywood. Planning Ref: *15/01251/OUT.***

Environmental Phase II Letter Report,

Results of soil chemical testing & gas monitoring.

Dear Sirs,

Please find attached information relating to environmental constraints at the above Site, to address the concerns of the local planning authority specifically with regard to landfill gas & potential ground contamination. Recommendations & a remediation statement are identified at the end of the report.

The Site currently has outline planning permission obtained in June 2016, ref No. *15/01251/OUT*: for *"the erection of 7 dwellings including demolition of existing buildings"*. Condition No.4 required environmental assessment of the Site, and stated:

> 4 No development shall take place until an investigation and risk assessment (in addition to any assessment provided with the planning application) has been submitted to and approved in writing by the Local Planning Authority. The assessment shall investigate the nature and extent of any contamination on the site (whether or not it originates on the site). The assessment shall be undertaken by competent persons and a written report of the findings submitted to and approved in writing by the Local Planning Authority before any development takes place.
>
> The submitted report shall include:
> i) a survey of the extent, scale and nature of contamination
> ii) an assessment of the potential risks to
> - human health,
> - property (existing or proposed) including buildings, crops, livestock, pets, woodland, and service lines and pipes,
> - adjoining land,
> - groundwaters and surface waters,
> - ecological systems,
> - archaeological sites and ancient monuments;
>
> iii) where unacceptable risks are identified, an appraisal of remedial options and proposal of the preferred option(s) to form a remediation strategy for the site.
>
> The development shall thereafter be carried out in full accordance with the duly approved remediation strategy and a verification report submitted to and approved in writing by the Local Planning Authority before any of the building(s) hereby approved are first occupied.

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Proprietor.
Timothy John Booth
BSc (Hons) C.Eng.C.Env. MICE
t/a T J Booth Associates

VAT Reg. N^{O} 748 6510 09

A minor material amendment to planning permission *15/01251/OUT ("revision of house type on plot 2; re-orientation of plots 3 to 5; and minor revisions to road turning head")*, was obtained in June 2018. Condition 4 remained in place.

A Phase 1 Environmental Desk Study Report was undertaken by T J Booth Associates in August 2015, ref No. *rep-tjba-brooks-174 bury old rd-phs I env-rev0*.

In summary, the report concluded that past uses of the Site included partial quarrying & infilling as part of the commercial sand drying business, and more recently as storage & repair (not breaking) of vehicles. Due to these uses, the report recommended that there was potential for shallow ground contamination, and it was recommended that further Site investigations were required for geotechnical & geo-environmental purposes.

Soil sampling was advised to better categorise the potential contamination risk in accordance with BS 10175:2011+A1:2013 & R&D Technical Report P5-066/TR; and tested for metals, speciated PAH, inorganics, sulphates, SOM, TPH (CWG) & asbestos screen.

Due to the proximity of the Boohole Landfill Site neighbouring to the N side, it was advised that assessment for ground gas would be necessary.

Site Investigations (May 2018).

Refer to Site Investigation Plan in appendix.

Site investigations were undertaken by T J Booth Associates with a 3.5t back acting excavator, and comprised 7No. trial holes (THs1-7) for geotechnical purposes. Soil samples (S1-6) were also collected across the Site to assess the upper ground profile for potential soil contamination.

In summary the ground stratigraphy across the Site comprised between 300-500mm of MADE GROUND. This was made up of stone setts within the access road in TH7, and generally sandy/gravelly (occasionally clayey) with rubble & planings elsewhere. Only in TH4 to the NE corner of the Site was natural topsoil found at the ground surface. Beneath the MADE GROUND/TOPSOIL was generally medium dense to dense SAND in natural ground to max 2.7m depth. Part of the centre N side of the Site had historically been quarried and backfilled with stiff but likely unconsolidated clay with brick/stone/concrete rubble, metal, and very occasional timber etc. This was noted to a max depth of 3.5m depth.

Soil sampling.

Soil samples were sealed in 1kg white plastic snap top containers, amber jars & vials where appropriate and sent to Scientific Analysis Laboratories Ltd (now Concept Life Sciences Ltd), to be tested for a range of common contaminants.

Samples S1, S2, S3, S4, S5 & S6 were taken from the upper 500mm of soil as encountered in their respective trial holes, and all samples were tested for metals, speciated PAH, inorganics & sulphates, SOM, and asbestos screening. In addition samples S1 & S2 were sent for TPH (CWG) testing, as these were close to the workshop.

Two additional samples were taken as suspected hydrocarbon contaminated clay was noted at 1.4m depth in TH2 (S2b) & 1m depth in TH3 (S3b). These were only tested for TPH (CWG) analysis.

On return the samples were assessed by TJ Booth Associates to common threshold comparison data, firstly to the Defra Category 4 Screening Levels (C4SL) where available, and then to EA/DEFRA SGV (2009) data and LQM/CIEH GAC 2nd edition (2009) & erratum (2011) thereafter. The soil results were compared to residential threshold levels.

Results indicated the upper made ground soil profile across the Site comprised minor contamination with levels of lead, benz[a]anthracene, benzo[a]pyrene, benzo[b]flouranthene, benzo[k]flouranthene, chrysene, dibenz[ah]anthracene, and indeno[123-cd]pyrene above contamination thresholds for residential end uses. TPH analysis was below levels for residential use.

Gas Risk.

Boohole Landfill Site to the immediate N side of the Development Site was previously a sand quarry from c1890 - 1960, and later became a landfill, closing c1990.

After Rochdale Council investigated the site under statutory obligations in 2009, it was deemed the site posed a potential significant risk to human health associated with the migration of hazardous landfill gas to neighbouring residential properties to the S & E. The former Boohole Landfill was thus designated as Contaminated Land under Part IIA of the Environmental Act 1990.

After the designation of the site as Contaminated Land, further phasing of reporting & site investigations were undertaken by Vertase FLI with the aim of remediating the land & mitigating the risk to nearby residences. The chronology of the reports/works were as follows:

Aug 2009 Remediation Options Appraisal

Jan 2010 Remediation proposals

Jun 2010 Virtual Gas Curtain Design Report

Jun 2011 Completion Report

A virtual gas curtain (VGC) was chosen as the design mitigation for the former landfill, and was installed around the E & S perimeter of the landfill. The design of the VGC is to create low pressure zones around the gassing ground of the landfill which draws gas towards the nodes in the VGC. The nodes are connected by a geo-composite collection structure along the length of the VGS, which then passively vents via stacks to the atmosphere.

The VGS can be seen on the VGS Installation Plan in the appendix, with the Development Site Boundary noted to the SE corner.

As part of the installation of the VGS, Vertase FLI monitored the gas in BHs along the landfill boundary before and after the installation for 6 rounds of monitoring.

Prior to the installation of the VGC, typical concentrations of landfill gas (CH4 & CO2) were high. However, post installation monitoring was also undertaken and was included in the Vertase FLI Completion Report for the VGC. These results generally indicated low levels of CH4 & CO2, which were generally reduced to CS1 status for the Site; although some BHs were increased to CS2 status following concentration readings in BHs above the CH4 1%, and CO2 5% thresholds – despite low flow rates.

The closest RMBC/Vertase borehole monitoring wells to the Development that were on the outside of the VGC were BH14, (nominally 20m away from the W Site Boundary), and BH18, which is located approximately 6m N of the Site. Refer to Site Investigation Plan in Appendix. Boreholes outside of the VGC are thought of as critical as the positioning of these wells gives the best indication of off-site gas migration.

BH14 recorded GSVs that were in the CS3 categorisation for both CH4 & CO2 pre VGC installation. However, GSVs fell to between 0 - 0.0004 in the following 6 rounds of post VGS monitoring which is categorised as CS1.

BH18 recorded GSVs that were in the CS3 categorisation for both CH4 & CO2 pre VGC installation. In the first post monitoring round, the GSV values were CS3 for CH4, and CS2 for CO2. However, GSVs fell to between 0 - 0.0031 for CH4 in the last 4 rounds of post VGS monitoring which would be classed as CS1. However, due to the max concentrations of CH4 noted (3.1%), the Characteristic Situation was increased to CS2 in line with Ciria c665 guidance.

GSVs also fell to between 0 - 0.0009 for C02 in the last 4 rounds of testing. Only the second round of post testing was increased to CS2 from CS1 due to higher concentration of CO2 above thresholds despite the low flow rate.

The Vertase Completion Report concluded the CS3 reading in the first round of post monitoring was due to settling in of the new ground gas regime, and generally classify the Site as max CHARACTERISTIC SITUATION 2.

Conclusion & Remediation Statement.

Soil test results have confirmed that the existing upper (MADE GROUND) soil profile comprised metal & PAH contaminants above threshold limits for action for a residential end use setting.

BS10175:2011+A1:2013 & R&D TECHNICAL REPORT P5-066/TR considers the upper 500mm of ground is sufficient to categorise the site soils with respect to:

- human/animal intake arising from ingestion and dermal contact
- potential for wind entrainment leading to inhalation (of contaminated soils and dusts) or deposition onto neighbouring land
- surface water run-off (e.g. due to flash flooding)
- uptake by shallow rooting plants (e.g. crops, ornamental and wild species)
- surface leaching to groundwater

To mitigate the risk to receptors, it is therefore advised that a cover layer of clean inert soil is imported to the Site to be used in garden and soft landscaping areas. Depending on the final finished levels, existing MADE GROUND beneath proposed soft landscaping should either be covered with 500mm of imported soil, or excavated to 500mm depth and replaced with imported soil.

Existing MADE GROUND may remain beneath permanent hard standings, such as drives, patios, and access road etc.

Any soil imported to the Site should be clean/inert, and free from deleterious materials; and should be suitable for use in a residential end use setting. Validation samples will be tested for contamination suites: metals, inorganics, PAH USEPA16 speciated, and asbestos screening. Results will be analysed against Defra Category 4 Screening Levels (C4SL) where available, and to EA/DEFRA SGV (2009) data; and to LQM/CIEH GAC 2nd edition (2009) & erratum (2011) thereafter, for use in a residential end use setting.

With regard to the gas risk, post gas monitoring of the former Boohole Landfill Site indicate that the highest Characteristic Situation is CS2, which has been adopted for the Development Site. The BHs used for post monitoring are on the Development Site side of the Landfill, and thus give a representative view of the current gas migration potential from the former landfill boundaries to the Development.

With the above in mind, Characteristic Situation 2 gas protection measures should be included in the development plots which should comprise the following of EITHER:

- Reinforced concrete cast in situ floor slab (suspended, ground bearing or raft) with 1200g DPM, and under floor venting. All joints and penetrations sealed to manufacturers details & specifications.

OR:

- Beam & block or pre-cast concrete and 2000g DPM/reinforced gas resistant membrane, and under floor venting. All joints and penetrations sealed to manufacturers details & specifications.

Should any suspected unidentified contamination be encountered throughout the groundworks or construction phase of the development, the suspect area/s should be isolated, advice sought from a suitable qualified environmental professional, and the LPA informed.

A final Site Validation Report should be undertaken following completion of remedial measures indicated above, which should include documentary/photographic evidence of installation of gas protection measures; and include any subsoil/topsoil import sample results. The report should be submitted to the LPA to obtain full discharge of the environmental planning condition.

We trust that the above clear, but should you require further advice please contact the undersigned.

Sincerely yours,

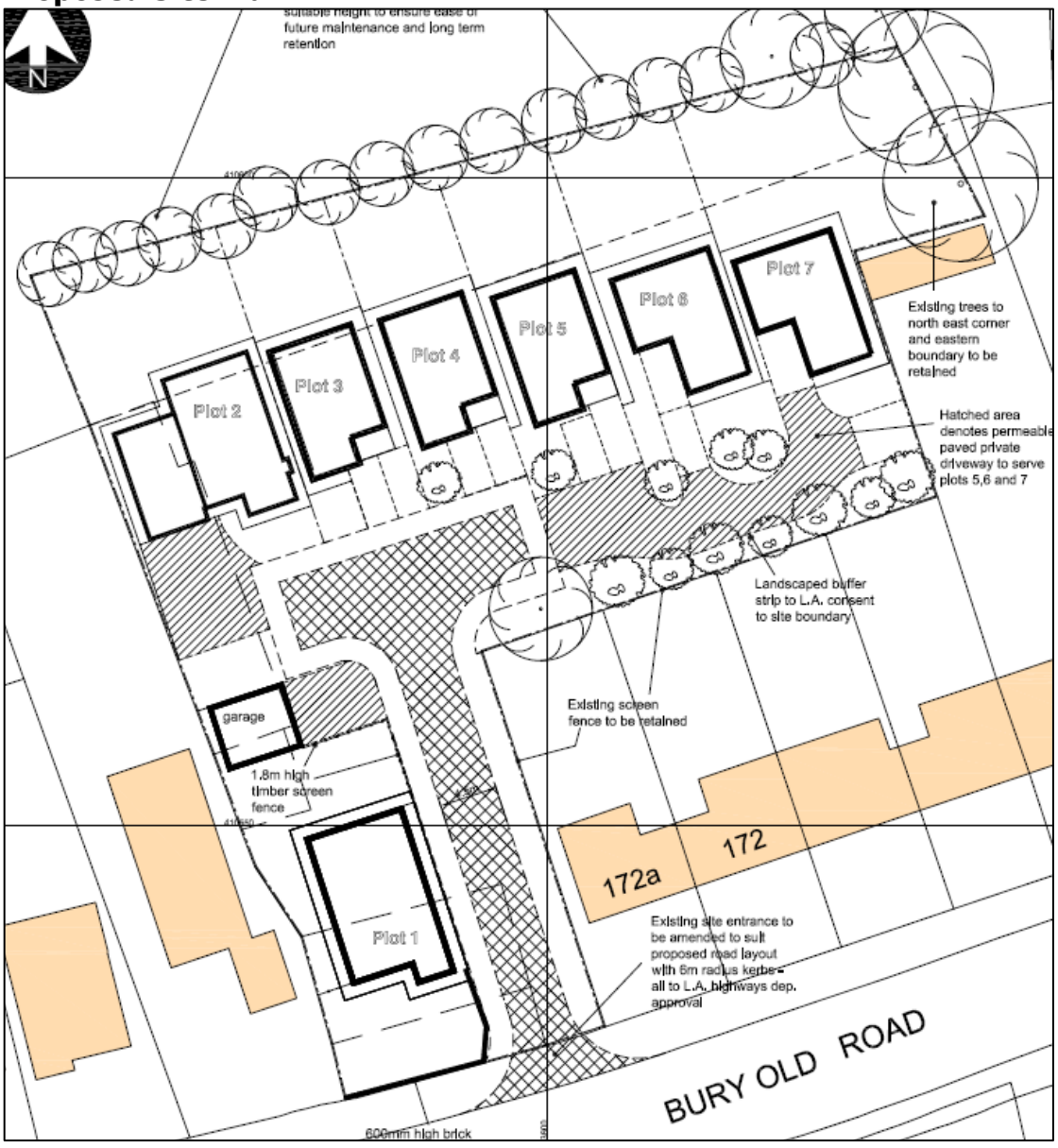
Daniel Slattery, BSc (Hons).

T J Booth Associates.

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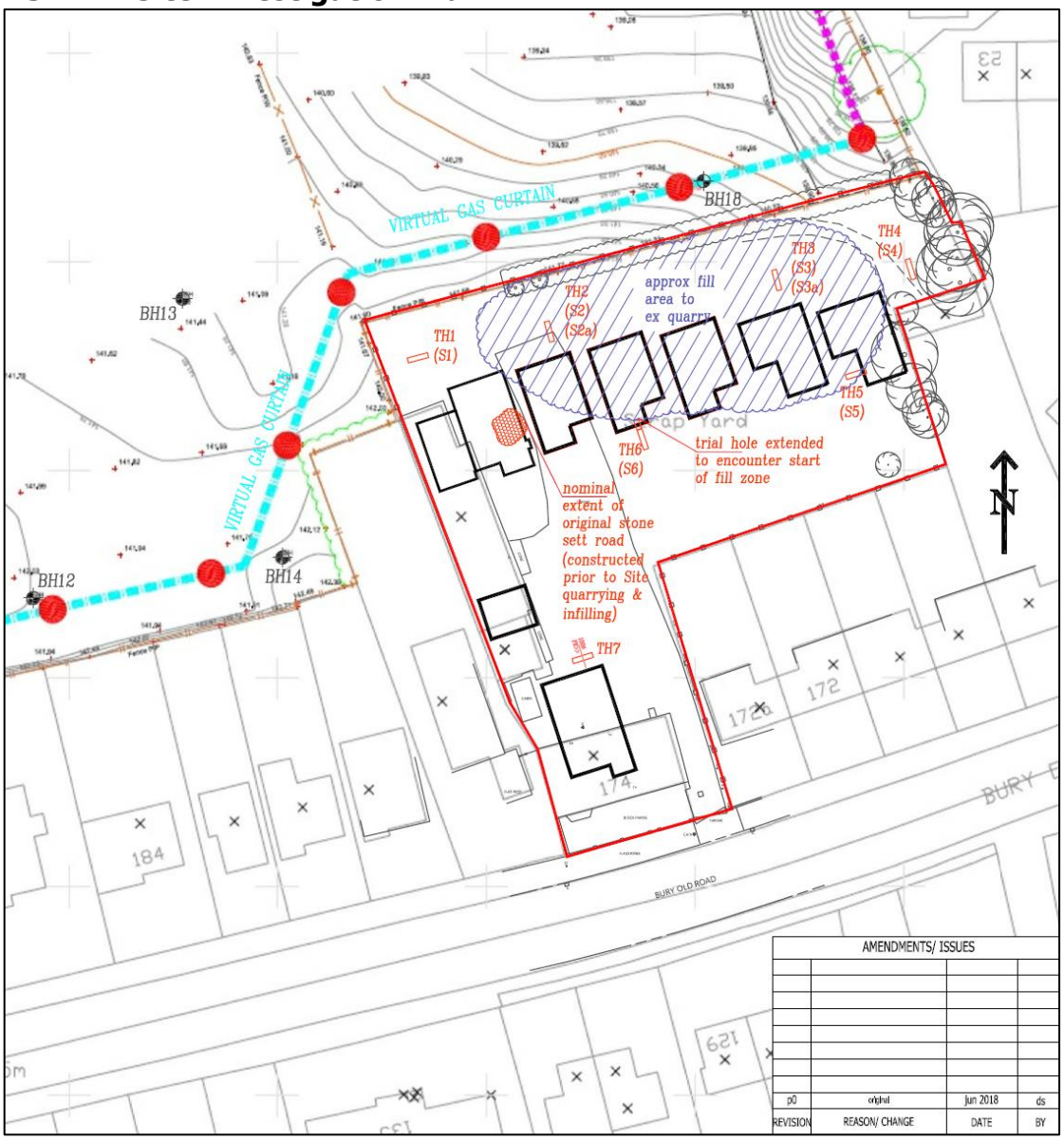
Appendix.

Proposed Site Plan.



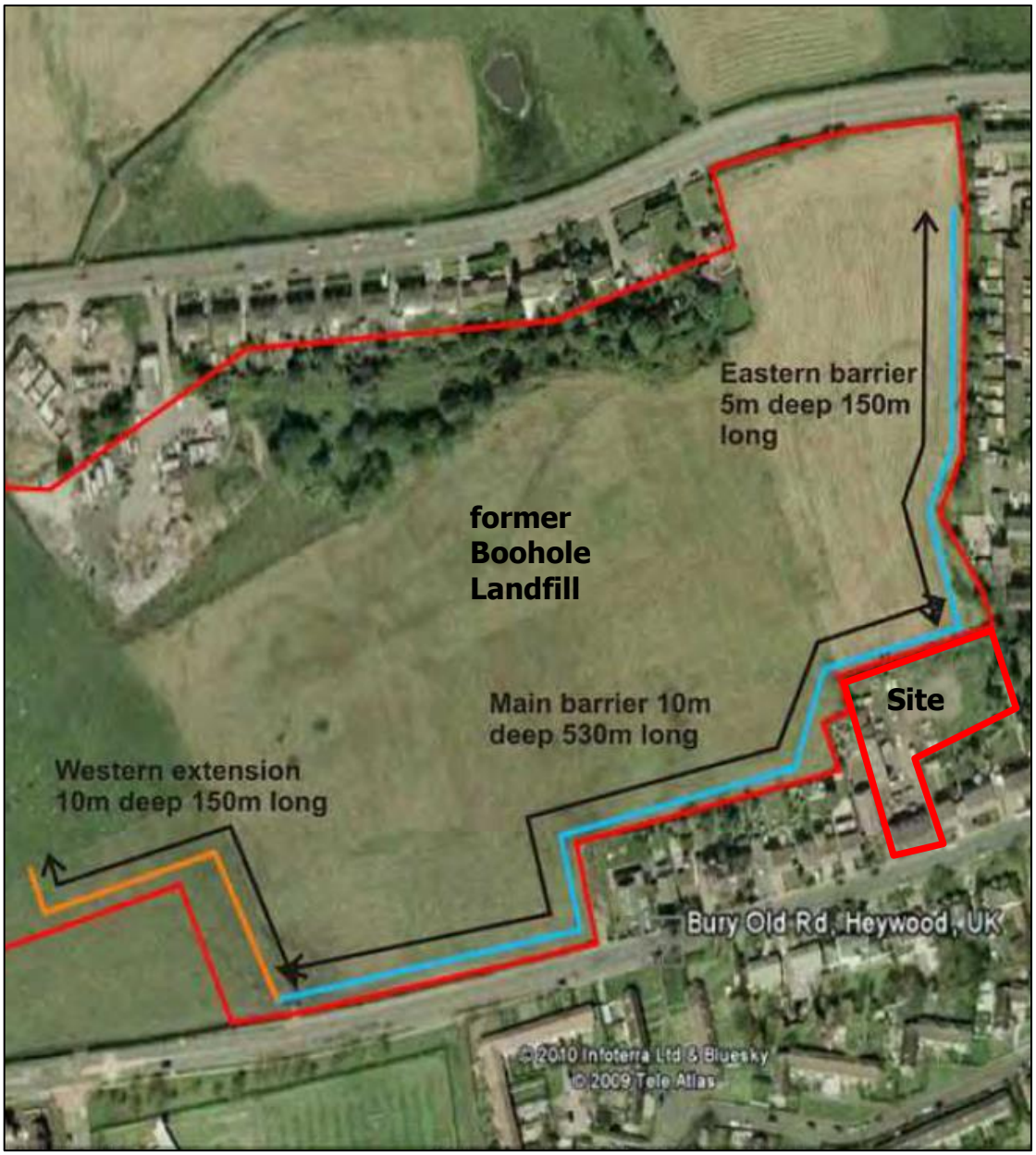
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T J B A - Site Investigation Plan.



Continued…

Vertase FLI BooHole Landfill Virtual Gas Curtain Installation Plan.



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Vertase FLI, BooHole Landfill Gas Monitoring – CH4 GSV Summary.

Table 4.2 Summary of CH_4 Gas Screening Values

Borehole Number	Monitoring Round						
	Pre Works	1	2	3	4	5	6
RBH1	0	0	0.0005	0.0001	0	0	0.0001
RBH2	0	0	0	0	0	0	0.0001
RBH3	0	-	-	-	0	0	0
BH1	7.78	0	0.0042	0.0001	0.0001	0	0
BH3	0	0	-	-	0	0	0
BH4	0.0052	0	0.0001	-	-	-	0
BH5	0.0585	0	0.0001	0.0001	-	-	-
BH8	0.2224	-	0	0.0002	0	0	0.0001
BH10	0.1266	0	0.0184	0	0	0	0
BH11	0.1803	0	0	0	0.0042	0.0002	0.0001
BH14	1.009	0	0	0.0002	0.0001	0	0
BH16	0.0944	0.039	0.1398	0.0205	0.0201	0.0035	0.0153
BH17	0.348	0	0	0	0	0	0.0001
BH18	1.705	0.7548	0	0	0	0.0011	0.0031
BH20	0.0062	0.0008	0	0.0001	0	0	0
BH23	0	-	-	0.0001	0	0	0.0001
		GSV Exceeds CIRIA CS1 GSV					
		Exceeds CIRIA CS1 due to CH_4 concentrations					
		Unable to locate borehole					-
		Borehole located outside VGC					BH

Vertase FLI, BooHole Landfill Gas Monitoring – CO2 GSV Summary.

Table 4.3 Summary of CO_2 Gas Screening Values

Borehole Number	Monitoring Round						
	Pre Works	1	2	3	4	5	6
RBH1	0.0	0.0058	0.0415	0.0092	0.0183	0.0002	0.0102
RBH2	0.0	0.0086	0.0228	0.0	0.0002	0.0003	0.0
RBH3	-	-	-	-	0.0017	0.0006	0.0002
BH1	5.06	0.0	0.0042	0.0008	0.0002	0.0001	0.0
BH3	-	-	-	0.0	0.0	0.0	0.0
BH4	0.0078	0.0001	0.0004	0.0	0.0	0.0001	0.0
BH5	0.0436	-	0.0004	0.0002	-	-	-
BH8	0.1144	-	0.0005	0.0	0,0	0,0	0,0001
BH10	0.0975	0.0	0.0235	0.0	0.0	0.0001	0.0001
BH11	0.1212	0.0	0.0	0.0	0.0192	0.0118	0.006
BH14	0.8947	0.0	0.0	0.0	0.0004	0.0003	0
BH16	0.0494	0.035	0.0972	0.0172	0.0168	0.0034	0,0163
BH17	0.318	0.0002	0.0	0.0	0.0	0.0	0.0
BH18	0.865	0.2328	0.0	0.0	0.0	0.0009	0.0009
BH20	0.0328	0.0008	0.0	0.0002	0,0001	0,0001	0,0
BH23	-	-	-	0.0081	0.0001	0,0001	0,0001
		GSV Exceeds CIRIA Characteristic Situation 1					
		Exceeds CO_2 CIRIA Characteristic Situation 1 concentrations					
		Unable to locate borehole					-
		Borehole located outside VGC					BH

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TJBA - Soil Testing Analysis.

Client / Site	***Brooks - 174 Bury Old Rd, Heywood.***
Sampling Date	***10-May-18***
Comparison of Contamination Test Results with Thresholds (mg/kg)	

Contaminant		No	Max	Mean	t 95	RESIDENTIAL		
							Pass/Fail	Comment
METALS	Arsenic as As, dry weight	6	22	16.5	21.75	37	PASS	
	Boron as B, hot water sol dw	6	1	1	1	291	PASS	
	Cadmium as Cd, dry weight	6	1	1	1	22	PASS	
	chromium as Cr(III) dry weight	6	27.00	17.17	26.25	627	PASS	
	Chromium as Cr(VI), dry weight	6	1	1	1	21	PASS	
	Copper, as Dry Weight	6	110	64.83	101.3	2330	PASS	
	Lead, as Dry Weight	6	500	285	475	200	FAIL	S2,S3,S5
	Mercury as Hg, dry weight	6	1	1	1	1	PASS	
	Nickel as Ni, dry weight	6	47	25.17	42.75	130	PASS	
	Selenium as Se, dry weight	6	3	3	3	350	PASS	
	Zinc as Zn, dry weight	6	330	206.7	325	3750	PASS	
INORGANIC	Cyanide (Total)	6	1	1	1	2.5	PASS	
	Sulphate (Total) as SO4	6	0.12	0.08	0.118	0.24	PASS	
	Sulphide	6	45	21.5	43.5	250	PASS	
	pH	6	8.3	7.65	8.25	6 to 8	FAIL	S2,S3,S5,S6 alkaline
	Sulphur (Elemental)	6	500	500	500	100	comment	
	Asbestos Identification	6	1	0.167	0.75	0	FAIL	S1
ORGANIC	SOM	8	6	6	6			
PAH	acenaphthene	6	4.3	1.078	3.675	1000	PASS	
PAH	acenaphthylene	6	0.75	0.305	0.723	850	PASS	
PAH	anthracene	6	8.6	2.498	7.775	9200	PASS	
PAH	benz[a]anthracene	6	18	5.923	17	5.9	FAIL	S2, S3
PAH	benzo[a]pyrene	6	17	5.692	16	5	FAIL	S2, S3
PAH	benzo[b]flouranthene	6	20	6.783	19	7	FAIL	S2, S3
PAH	benzo[g,h,i]perylene	6	12	4.15	11.45	47	PASS	
PAH	benzo[k]flouranthene	6	16	5.568	15.5	10	FAIL	S2, S3
PAH	chrysene	6	17	5.66	16	9.3	FAIL	S2, S3
PAH	dibenz[ah]anthracene	6	3.3	1.217	3.275	0.9	FAIL	S2, S3
PAH	flouranthene	6	38	12.27	35.75	670	PASS	
PAH	flourene	6	3.4	0.993	3.1	780	PASS	
PAH	indeno[123-cd]pyrene	6	9	3.163	8.725	4.2	FAIL	S2, S3
PAH	napthalene	6	1.1	0.342	0.95	8.7	PASS	
PAH	phenanthrene	6	26	6.773	22.5	380	PASS	
PAH	pyrene	6	30	9.912	28	1600	PASS	
PAH	PAH (Total - SUM EPA16)	6	220	72.35	207.5	1	comment	
FUEL	aliphatic EC 5-6	5	20	18	20	110	PASS	
FUEL	aliphatic EC 6-8	5	20	18	20	370	PASS	
FUEL	aliphatic EC 8-10	5	20	18	20	110	PASS	
FUEL	aliphatic EC 10-12	5	10	6.4	10	540	PASS	
FUEL	aliphatic EC 12-16	5	16	9.6	14.8	3000	PASS	
FUEL	aliphatic EC 16-35	5	122	69.2	115.4	76000	PASS	
FUEL	aromatic EC 5-7,Benzene	5	20	18	20	280	PASS	
FUEL	aromatic EC 7-8,Toluene	5	20	18	20	611	PASS	
FUEL	aromatic EC 8-10	5	63	26.6	54.4	151	PASS	
FUEL	aromatic EC 10-12	5	10	6.6	10	346	PASS	
FUEL	aromatic EC 12-16	5	15	10.8	14.8	593	PASS	
FUEL	aromatic EC 16-21	5	110	71.4	110	770	PASS	
FUEL	aromatic EC 21-35	5	270	176.8	270	1230	PASS	
VOC/BTEX	benzene	5	2	1.8	2	0.87	FAIL	<2 (LOD), c5-7arom pass
VOC/BTEX	toluene	5	2	1.8	2	610	PASS	
VOC/BTEX	ethylbenzene	5	10	3.4	8.4	350	PASS	
VOC/BTEX	m-xylene	5	4	2.2	3.6	240	PASS	
VOC/BTEX	p-xylene	5	4	2.2	3.6	230	PASS	
VOC/BTEX	o-xylene	5	3	2	2.8	250	PASS	
SVOC	phenol	6	1	1	1	420	PASS	

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CLS Ltd - Soil Testing Certificates.

CONCEPT LIFE SCIENCES
DELIVERING SCIENCE

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Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 736332-1

Date of Report: 23-May-2018

Customer: T J Booth Associates
20A Eastgate
Rochdale
OL16 1DH

Customer Contact: Mr Daniel Slattery

Customer Job Reference:
Customer Purchase Order: tjba-100518-CLS
Customer Site Reference: Brooks - 174 Bury Old Road, Heywood
Date Job Received at Concept: 11-May-2018
Date Analysis Started: 14-May-2018
Date Analysis Completed: 23-May-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

Report checked and authorised by :
Sara Abou-Shakra
Customer Service Manager

Issued by :
Sara Abou-Shakra
Customer Service Manager

Continued…

Concept Reference: 736332
Project Site: Brooks - 174 Bury Old Road, Heywood
Customer Reference:

Soil Analysed as Soil
ICRCL (Maxi)

					Concept Reference	736332 001	736332 002	736332 004	736332 006	736332 007
					Customer Sample Reference	S1	S2	S3	S4	S5
					Date Sampled	10-MAY-2018	10-MAY-2018	10-MAY-2018	10-MAY-2018	10-MAY-2018
Determinand	Method	Test Sample	LOD	Units						
Chromium VI	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Arsenic	T6	A40	1	mg/kg	16	14	21	10	16
Boron (water-soluble)	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Cadmium	T6	A40	1	mg/kg	<1	<1	1	<1	<1
Chromium	T6	A40	1	mg/kg	14	27	24	10	14
Copper	T6	A40	1	mg/kg	58	75	110	39	60
Cyanide(Total)	T4	AR	1	mg/kg	<1	<1	<1	<1	1
Cyanide(free)	T4	AR	1	mg/kg	<1	<1	<1	<1	<1
Lead	T6	A40	1	mg/kg	160	350	500	170	400
Mercury	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Nickel	T6	A40	1	mg/kg	19	30	47	13	19
pH	T7	A40			8.0	8.3	8.1	6.7	8.0
Phenols(Mono)	T4	AR	1	mg/kg	<1	<1	<1	<1	<1
Selenium	T6	A40	3	mg/kg	<3	<3	<3	<3	<3
SO4(Total)	T6	A40	0.01	%	0.06	0.11	0.12	0.04	0.08
Sulphide	T4	A40	10	mg/kg	15	45	<10	<10	<10
Sulphur(Free)	T2	AR	500	mg/kg	<500	<500	<500	<500	<500
Thiocyanate	T4	A40	10	mg/kg	<10	<10	<10	<10	<10
Zinc	T6	A40	1	mg/kg	120	220	330	310	160

Concept Reference: 736332
Project Site: Brooks - 174 Bury Old Road, Heywood
Customer Reference:

Soil Analysed as Soil
ICRCL (Maxi)

					Concept Reference	736332 008
					Customer Sample Reference	S6
					Date Sampled	10-MAY-2018
Determinand	Method	Test Sample	LOD	Units		
Chromium VI	T6	A40	1	mg/kg	<1
Arsenic	T6	A40	1	mg/kg	22
Boron (water-soluble)	T6	A40	1	mg/kg	<1
Cadmium	T6	A40	1	mg/kg	<1
Chromium	T6	A40	1	mg/kg	14
Copper	T6	A40	1	mg/kg	47
Cyanide(Total)	T4	AR	1	mg/kg	<1
Cyanide(free)	T4	AR	1	mg/kg	<1
Lead	T6	A40	1	mg/kg	130
Mercury	T6	A40	1	mg/kg	<1
Nickel	T6	A40	1	mg/kg	23
pH	T7	A40			6.8
Phenols(Mono)	T4	AR	1	mg/kg	<1
Selenium	T6	A40	3	mg/kg	<3
SO4(Total)	T6	A40	0.01	%	0.07
Sulphide	T4	A40	10	mg/kg	39
Sulphur(Free)	T2	AR	500	mg/kg	<500
Thiocyanate	T4	A40	10	mg/kg	<10
Zinc	T6	A40	1	mg/kg	100

Continued…

Concept Reference: 736332
Project Site: Brooks - 174 Bury Old Road, Heywood
Customer Reference:

Soil Analysed as Soil
Miscellaneous

					Concept Reference	736332 001	736332 002	736332 004	736332 006	736332 007
					Customer Sample Reference	S1	S2	S3	S4	S5
					Date Sampled	10-MAY-2018	10-MAY-2018	10-MAY-2018	10-MAY-2018	10-MAY-2018
Determinand	Method	Test Sample	LOD	Units						
Asbestos ID	T27	A40			Trace of Chrysotile	N.D.	N.D.	N.D.	N.D.
Soil Organic Matter	T287	A40	0.1	%	8.8	9.9	21	5.0	8.0
Benzo(b)fluoranthene	T149	AR	0.01	mg/kg	2.8	16	20	0.80	0.90
Benzo(k)fluoranthene	T149	AR	0.01	mg/kg	1.7	14	16	0.76	0.76

Concept Reference: 736332
Project Site: Brooks - 174 Bury Old Road, Heywood
Customer Reference:

Soil Analysed as Soil
Miscellaneous

					Concept Reference	736332 008
					Customer Sample Reference	S6
					Date Sampled	10-MAY-2018
Determinand	Method	Test Sample	LOD	Units		
Asbestos ID	T27	A40			N.D.	
Soil Organic Matter	T287	A40	0.1	%	5.6	
Benzo(b)fluoranthene	T149	AR	0.01	mg/kg	0.20	
Benzo(k)fluoranthene	T149	AR	0.01	mg/kg	0.19	

Concept Reference: 736332
Project Site: Brooks - 174 Bury Old Road, Heywood
Customer Reference:

Soil Analysed as Soil
Total and Speciated USEPA16 PAH

				Concept Reference	736332 001	736332 002	736332 004	736332 006	736332 007
				Customer Sample Reference	S1	S2	S3	S4	S5
				Date Sampled	10-MAY-2018	10-MAY-2018	10-MAY-2018	10-MAY-2018	10-MAY-2018
Determinand	Method	Test Sample	LOD	Units					
Naphthalene	T149	AR	0.01	mg/kg	0.15	0.50	1.1	0.14	(9) <0.10
Acenaphthylene	T149	AR	0.01	mg/kg	0.25	0.64	0.75	0.07	(9) <0.10
Acenaphthene	T149	AR	0.01	mg/kg	0.11	1.8	4.3	0.12	(9) <0.10
Fluorene	T149	AR	0.01	mg/kg	0.11	2.2	3.4	0.11	(9) <0.10
Phenanthrene	T149	AR	0.01	mg/kg	0.93	12	26	0.95	0.45
Anthracene	T149	AR	0.01	mg/kg	0.53	5.3	8.6	0.26	0.23
Fluoranthene	T149	AR	0.01	mg/kg	2.9	29	38	1.5	1.8
Pyrene	T149	AR	0.01	mg/kg	3.6	22	30	1.3	2.2
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	1.7	14	18	0.82	0.84
Chrysene	T149	AR	0.01	mg/kg	2.0	13	17	0.77	1.0
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	4.5	30	36	1.6	1.7
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	2.4	13	17	0.77	0.80
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	1.1	7.9	9.0	0.42	0.44
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	0.44	3.2	3.3	0.18	0.14
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	1.8	9.8	12	0.52	0.62
PAH(total)	T149	AR	0.01	mg/kg	22	170	220	9.5	10

Continued…

Concept Reference: 736332
Project Site: Brooks - 174 Bury Old Road, Heywood
Customer Reference:

Soil Analysed as Soil
Total and Speciated USEPA16 PAH

				Concept Reference	**736332 008**
				Customer Sample Reference	**S6**
				Date Sampled	**10-MAY-2018**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
Naphthalene	T149	AR	0.01	mg/kg	**0.06**
Acenaphthylene	T149	AR	0.01	mg/kg	**0.02**
Acenaphthene	T149	AR	0.01	mg/kg	**0.04**
Fluorene	T149	AR	0.01	mg/kg	**0.04**
Phenanthrene	T149	AR	0.01	mg/kg	**0.31**
Anthracene	T149	AR	0.01	mg/kg	**0.07**
Fluoranthene	T149	AR	0.01	mg/kg	**0.42**
Pyrene	T149	AR	0.01	mg/kg	**0.37**
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	**0.18**
Chrysene	T149	AR	0.01	mg/kg	**0.19**
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	**0.39**
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	**0.18**
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	**0.12**
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	**0.04**
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	**0.16**
PAH(total)	T149	AR	0.01	mg/kg	**2.6**

Concept Reference: 736332
Project Site: Brooks - 174 Bury Old Road, Heywood
Customer Reference:

Soil Analysed as Soil
TPH (CWG)

				Concept Reference	**736332 001**	**736332 002**	**736332 003**	**736332 004**	**736332 005**
				Customer Sample Reference	**S1**	**S2**	**S2b**	**S3**	**S3b**
				Date Sampled	**10-MAY-2018**	**10-MAY-2018**	**10-MAY-2018**	**10-MAY-2018**	**10-MAY-2018**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Benzene	T54	AR	1	µg/kg	(110,13) <2	(13) <1	(13,110) <2	(13,110) <2	(13,110) <2
Toluene	T54	AR	1	µg/kg	(13,110) <2	(13) <1	(13,110) <2	(110,13) <2	(110,13) <2
EthylBenzene	T54	AR	1	µg/kg	(110) <2	<1	(110) <2	(110) <2	**10**
M/P Xylene	T54	AR	1	µg/kg	(110) <2	<1	(110) <2	(110) <2	**4**
O Xylene	T54	AR	1	µg/kg	(110) <2	<1	(110) <2	(110) <2	**3**
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	(110) <2	<1	(110) <2	(110) <2	(110) <2
TPH (C5-C6 aliphatic)	T54	AR	10	µg/kg	(110) <20	<10	(110) <20	(110) <20	(110) <20
TPH (C6-C8 aliphatic)	T54	AR	10	µg/kg	(110) <20	<10	(110) <20	(110) <20	(110) <20
TPH (C8-C10 aliphatic)	T54	AR	10	µg/kg	(110) <20	<10	(110) <20	(110) <20	(110) <20
TPH (C10-C12 aliphatic)	T8	AR	1	mg/kg	(9,13) <10	(9,13) <10	(13) <1	(13,9) <10	(13) <1
TPH (C12-C16 aliphatic)	T8	AR	1	mg/kg	(13,9) <10	(9,13) <10	(13) **2**	(13,9) <10	(13) **16**
TPH (C16-C21 aliphatic)	T8	AR	1	mg/kg	(9,13) <10	(9,13) **12**	(13) **5**	(9,13) <10	(13) **17**
TPH (C21-C35 aliphatic)	T8	AR	1	mg/kg	(9,13) **49**	(9,13) **110**	(13) **23**	(13) **79**	(13) **31**
TPH (C6-C7 aromatic)	T54	AR	10	µg/kg	(110) <20	<10	(110) <20	(110) <20	(110) <20
TPH (C7-C8 aromatic)	T54	AR	10	µg/kg	(110) <20	<10	(110) <20	(110) <20	(110) <20
TPH (C8-C10 aromatic)	T54	AR	10	µg/kg	(110) <20	<10	(110) <20	(110) <20	**63**
TPH (C10-C12 aromatic)	T8	AR	1	mg/kg	(9,13) <10	(13,9) <10	(13) <1	(9,13) <10	(13) **2**
TPH (C12-C16 aromatic)	T8	AR	1	mg/kg	(9,13) **14**	(9,13) <10	(13) **8**	(13,9) **15**	(13) **7**
TPH (C16-C21 aromatic)	T8	AR	1	mg/kg	(13,9) **65**	(13,9) **110**	(13) **55**	(13) **110**	(13) **17**
TPH (C21-C35 aromatic)	T8	AR	1	mg/kg	(13,9) **190**	(13,9) **270**	(13) **110**	(13) **270**	(13) **44**

Index to symbols used in 736332-1

Value	Description
A40	Assisted dried < 40C
AR	As Received
N.D.	Not Detected
110	LOD raised due to low internal standard recovery.
9	LOD raised due to dilution of sample

Continued…

13	Results have been blank corrected.
S	Analysis was subcontracted
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Asbestos was subcontracted to REC Asbestos.

Method Index

Value	Description
T287	Calc TOC/0.58
T2	Grav
T6	ICP/OES
T8	GC/FID
T149	GC/MS (SIR)
T27	PLM
T7	Probe
T4	Colorimetry
T54	GC/MS (Headspace)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Benzene	T54	AR	1	µg/kg	U	001-005
Toluene	T54	AR	1	µg/kg	U	001-005
EthylBenzene	T54	AR	1	µg/kg	U	001-005
M/P Xylene	T54	AR	1	µg/kg	U	001-005
O Xylene	T54	AR	1	µg/kg	U	001-005
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	U	001-005
TPH (C5-C6 aliphatic)	T54	AR	10	µg/kg	N	001-005
TPH (C6-C8 aliphatic)	T54	AR	10	µg/kg	N	001-005
TPH (C8-C10 aliphatic)	T54	AR	10	µg/kg	N	001-005
TPH (C10-C12 aliphatic)	T8	AR	1	mg/kg	N	001-005
TPH (C12-C16 aliphatic)	T8	AR	1	mg/kg	N	001-005
TPH (C16-C21 aliphatic)	T8	AR	1	mg/kg	N	001-005
TPH (C21-C35 aliphatic)	T8	AR	1	mg/kg	N	001-005
TPH (C6-C7 aromatic)	T54	AR	10	µg/kg	N	001-005
TPH (C7-C8 aromatic)	T54	AR	10	µg/kg	N	001-005
TPH (C8-C10 aromatic)	T54	AR	10	µg/kg	N	001-005
TPH (C10-C12 aromatic)	T8	AR	1	mg/kg	N	001-005
TPH (C12-C16 aromatic)	T8	AR	1	mg/kg	N	001-005
TPH (C16-C21 aromatic)	T8	AR	1	mg/kg	N	001-005
TPH (C21-C35 aromatic)	T8	AR	1	mg/kg	N	001-005
Chromium VI	T6	A40	1	mg/kg	N	001-002,004,006-008
Arsenic	T6	A40	1	mg/kg	U	001-002,004,006-008
Boron (water-soluble)	T6	A40	1	mg/kg	N	001-002,004,006-008
Cadmium	T6	A40	1	mg/kg	U	001-002,004,006-008
Chromium	T6	A40	1	mg/kg	U	001-002,004,006-008
Copper	T6	A40	1	mg/kg	U	001-002,004,006-008
Cyanide(Total)	T4	AR	1	mg/kg	U	001-002,004,006-008
Cyanide(free)	T4	AR	1	mg/kg	U	001-002,004,006-008
Lead	T6	A40	1	mg/kg	U	001-002,004,006-008
Mercury	T6	A40	1	mg/kg	U	001-002,004,006-008
Nickel	T6	A40	1	mg/kg	U	001-002,004,006-008
pH	T7	A40			U	001-002,004,006-008
Phenols(Mono)	T4	AR	1	mg/kg	U	001-002,004,006-008
Selenium	T6	A40	3	mg/kg	U	001-002,004,006-008
SO4(Total)	T6	A40	0.01	%	N	001-002,004,006-008
Sulphide	T4	A40	10	mg/kg	N	001-002,004,006-008
Sulphur(Free)	T2	AR	500	mg/kg	N	001-002,004,006-008
Thiocyanate	T4	A40	10	mg/kg	N	001-002,004,006-008
Zinc	T6	A40	1	mg/kg	U	001-002,004,006-008
Naphthalene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Acenaphthylene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Acenaphthene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Fluorene	T149	AR	0.01	mg/kg	U	001-002,004,006-008

Continued…

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Phenanthrene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Anthracene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Fluoranthene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Pyrene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Chrysene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
PAH(total)	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Asbestos ID	T27	A40			SU	001-002,004,006-008
Soil Organic Matter	T287	A40	0.1	%	N	001-002,004,006-008
Benzo(b)fluoranthene	T149	AR	0.01	mg/kg	U	001-002,004,006-008
Benzo(k)fluoranthene	T149	AR	0.01	mg/kg	U	001-002,004,006-008

Continued…

CIRIA c665 - CIRIA (Report c665) Wilson and Card Classification.

Modified Wilson and Card classification

	Characteristic situation (CIRIA R149)	Comparable classification in DETR *et al* (1999)	Risk classification	Gas screening value (GSV) (CH_4 or CO_2) (l/hr)[1] Threshold	Additional factors	Typical source of generation
	1	A	Very low risk	<0.07	Typically methane <1 % and/or carbon dioxide <5 %. Otherwise consider increase to Situation 2	Natural soils with low organic content "Typical" made ground
	2	B	Low risk	<0.7	Borehole air flow rate not to exceed 70l/hr. Otherwise consider increase to characteristic Situation 3	Natural soil, high peat/organic content. "Typical" made ground
	3	C	Moderate risk	<3.5		Old landfill, inert waste, mineworking flooded
	4	D	Moderate to high risk	<15	Quantitative risk assessment required to evaluate scope of protective measures.	Mineworking – susceptible to flooding, completed landfill (WMP 26B criteria)
	5	E	High risk	<70		Mineworking unflooded inactive with shallow workings near surface
	6	F	Very high risk	>70		Recent landfill site

Notes on the use of Table 8.5

1 Gas screening value: (Litres of gas/hour) is calculated by multiplying the maximum gas concentration (%) by the maximum measured borehole flow rate (l/hr) – see Glossary.

2 Site characterisation should be based on gas monitoring of concentrations and borehole flow rates for the minimum periods defined in Table 5.5.

3 Source of gas and generation potential/performance should be identified.

4 Soil gas investigation should be in accordance with guidance provided in Chapters 4 to 6.

5 If there is no detectable flow, use the limit of detection of the instrument.

6 The boundaries between the Partners in Technology classifications do not fit exactly with the boundaries for the CIRIA classification.

Continued…

CIRIA (Report c665) Wilson and Card Protective Measures.

Typical scope of gas protective measures

Characteristic situation	Residential building (not those which belong to Situation B)[1]		Office/commercial/industrial development	
(From Table 8.5)	Number of levels of protection	Typical scope of protective measures	Number of levels of protection	Typical scope of protective measures
1	None	No special precautions	None	No special precautions
2	2	a. Reinforced concrete cast *in situ* floor slab (suspended, non-suspended or raft) with at least 1200 g DPM and underfloor venting. b. Beam and block or pre-cast concrete and 2000 g DPM/ reinforced gas membrane and underfloor venting. All joints and penetrations sealed.	1 to 2	a) Reinforced concrete cast *in situ* floor slab (suspended, non-suspended or raft) with at least 1200 g DPM. b) Beam and block or pre cast concrete slab and minimum 2000 g DPM/reinforced gas membrane. c) Possibly underfloor venting or pressurisation in combination with a) and b) depending on use. All joints and penetrations sealed.
3	2	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space.	1 to 2	All types of floor slab as above. All joints and penetrations sealed. Minimum 2000 g/ reinforced gas proof membrane and passively ventilated underfloor sub-space or positively pressurised underfloor sub-space
	3	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated underfloor subspace or positively pressurised underfloor sub-space, oversite capping or blinding and in-ground venting layer.	2 to 3	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility.
	4	Reinforced concrete cast *in situ* floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and ventilated or positively pressurised underfloor sub-space, oversite capping and in-ground venting layer and in-ground venting wells or barriers.	3 to 4	Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility. In ground venting wells or barriers.
	5	Not suitable unless gas regime is reduced first and quantitative risk assessment carried out to assess design of protection measures in conjunction with foundation design.	4 to 5	Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and actively ventilated or positively pressurised underfloor sub-space with monitoring facility, with monitoring. In ground venting wells and reduction of gas regime.

Note:

1 For low rise traditional housing with ventilated clear underfloor void (ie Situation B. See Table 8.7, Box 8.4 and Section 8.3.2).