OMEGA ZONE 8, ST HELENS

Omega St Helens Ltd / T J Morris Ltd

Ground Investigation Report
& Remediation Strategy
Appendix F, G, H & I
OPP DOC. 2.23

Appendix F

MONITORING DATA

PRE-REPORT DATA CHECK

All Response Zone depths are complete.

All visit dates match in the Monitoring Results and Monitoring Visit tables.

The following dates exist in the Dips table but do not have a matching entry in the Monitoring Visit table.

The report will be incomplete.

Enter the missing information into the Monitoring Visit table to correct the problem.

Visit Date

29-11-2019

All event names match in the Monitoring Point and Dips tables

Omega Zone 8A, 8B, 8C, 8D, 8E

Key:

Depth to water

- Response zone *fully* flooded during sampling
- Response zone *significantly* flooded during sampling
- Datum or reponse zone information missing. Response zone flooding cannot be calculated

Methane	Carbon Dioxide	Gas Flow
> 1% v/v	> 5% v/v	> 70 l/hr

Visit 1, Event: Round 1, Date: 29/10/2019

Engineer	J. Kinchington
Start/End Time	08:30 - 16:30
Pressure Start/End (mB)	1020 - 1020
Temperature (Deg C)	10.00
Weather Conditions	Clear

Equipment	SerialNo	Calibrated
Gas Analyser	GFM12009	Yes

Comments and Ground Conditions:

Borehole	Response Zone (m)		Gas Flow (l/hr)		Borehole Differential Pressure	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (ppmV)			Depth to Water	Depth to Base	Thickness of product	Sampled ?
	Top	Base	Initial	Steady	Pa	Initial	Steady	Initial	Steady	Initial	Steady	PID	H2S	CO	m	m	mm	Y/N
BH8A01	1.00	6.00	3.00	0.00		0.00	0.00	0.60	0.20	19.50	20.60	1.00	0.00	0.00	0.70	5.67	N/A	No
BH8A02	1.00	5.00	3.60	0.00		0.00	0.00	0.20	0.30	19.80	20.20	1.00	0.00	0.00	1.13	5.07	N/A	No
BH8A03	12.00	20.00	0.00	0.00		0.00	0.00	1.00	0.80	19.30	19.50	1.00	0.00	0.00	17.97	20.50	N/A	No
BH8A05	4.00	6.00	0.00	0.00		0.00	0.00	0.30	0.10	19.40	20.40	1.00	0.00	0.00	5.90	8.61	N/A	No
BH8A06	1.00	8.00	0.00	0.00		0.00	0.00	0.20	0.20	19.80	20.40	1.00	0.00	0.00	1.98	7.81	N/A	No
BH8A08	6.00	12.00	0.00	0.00		0.00	0.00	0.20	0.50	19.80	20.40	1.00	0.00	0.00	3.10	11.97	N/A	No
BH8B01	1.00	5.00	0.00	0.00		0.00	0.00	0.20	0.60	19.90	14.10	1.00	0.00	0.00	3.10	5.95	N/A	No
BH8B03	9.00	19.00	4.50	2.50		0.00	0.00	0.10	1.70	16.30	17.20	1.00	0.00	0.00	17.00	17.79	N/A	No
BH8C01	1.00	4.00	0.00	0.00		0.00	0.00	0.10	0.30	19.80	18.40	1.00	0.00	0.00	0.48	3.00	N/A	No
BH8C02	1.00	4.00	0.00	0.00		0.00	0.00	0.20	0.40	20.10	19.00	1.00	0.00	0.00	6.62	9.13	N/A	No
BH8C03	1.00	4.00	0.00	0.00		0.00	0.20	0.30	0.20	19.70	20.50	1.00	0.00	0.00	0.89	4.00	N/A	No
WS8A01	1.00	5.00	14.00	0.00		0.00	0.00	0.10	1.10	19.10	19.40	1.00	0.00	0.00	0.95	5.98	N/A	No
WS8A03	1.00	5.00	0.00	0.00		0.00	0.00	0.20	0.80	19.90	19.80	1.00	0.00	0.00	0.91	4.99	N/A	No
WS8B02	1.00	5.00	0.00	0.00		0.00	0.00	0.40	0.70	19.90	20.10	1.00	0.00	0.00	0.86	4.97	N/A	No

Omega Zone 8A, 8B, 8C, 8D, 8E

Key:

Depth to water

- Response zone *fully* flooded during sampling
- Response zone *significantly* flooded during sampling
- Datum or reponse zone information missing. Response zone flooding cannot be calculated

Methane	Carbon Dioxide	Gas Flow
> 1% v/v	> 5% v/v	> 70 l/hr

Visit 1, Event: Round 1, Date: 29/10/2019

Engineer	J. Kinchington
Start/End Time	08:30 - 16:30
Pressure Start/End (mB)	1020 - 1020
Temperature (Deg C)	10.00
Weather Conditions	Clear

Equipment	SerialNo	Calibrated
Gas Analyser	GFM12009	Yes

Comments and Ground Conditions:

Borehole	Response Zone (m)		Gas Flow (l/hr)		Borehole Differential Pressure	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (ppmV)			Depth to Water	Depth to Base	Thickness of product	Sampled ?
	Top	Base	Initial	Steady	Pa	Initial	Steady	Initial	Steady	Initial	Steady	PID	H2S	CO	m	m	mm	Y/N
WS8B03	1.00	5.00	0.00	0.10		0.00	0.00	0.20	0.30	0.20	0.30	1.00	0.00	0.00	0.29	4.24	N/A	No
WS8B04	0.50	5.00	0.00	0.00		0.00	0.00	0.10	0.20	19.80	20.10	1.00	0.00	0.00	0.29	3.98	N/A	No
WS8B05	1.00	5.00	0.00	0.00		0.00	0.00	0.50	0.20	19.70	20.30	1.00	0.00	0.00	0.55	4.93	N/A	No
WS8B06	0.50	5.00	0.00	0.00		0.00	0.00	0.20	0.30	19.50	20.30	1.00	0.00	0.00	0.25	4.94	N/A	No
WS8B07	1.00	5.00	0.00	0.00		0.00	0.00	0.20	0.20	19.90	16.10	1.00	0.00	0.00	2.06	5.12	N/A	No
WS8C01	1.00	3.00	0.00	-1.90		0.00	0.00	0.20	0.20	18.80	20.30	1.00	0.00	0.00	3.16	3.28	N/A	No
WS8C02	1.00	5.00	0.00	0.00		0.00	0.00	0.10	0.60	20.20	19.30	1.00	0.00	0.00	0.94	4.84	N/A	No
WS8C03	1.00	4.00	2.00	0.00		0.00	0.00	0.20	0.10	19.40	20.30	1.00	0.00	0.00	0.10	3.60	N/A	No
WS8C06	1.00	5.00	0.00	0.00		0.00	0.00	0.20	2.10	19.50	15.40	1.00	0.00	0.00		4.02	N/A	No
WS8C07	1.00	5.00	0.00	0.00		0.00	0.00	0.20	0.10	20.10	20.30	1.00	0.00	0.00	0.24	4.90	N/A	No
WS8C08	1.00	4.00	1.50	0.00		0.00	0.00	0.10	0.50	20.10	20.10	1.00	0.00	0.00	0.40	4.85	N/A	No

Omega Zone 8A, 8B, 8C, 8D, 8E

Key:

Depth to water

- Response zone *fully* flooded during sampling
- Response zone *significantly* flooded during sampling
- Datum or reponse zone information missing. Response zone flooding cannot be calculated

Methane	Carbon Dioxide	Gas Flow
> 1% v/v	> 5% v/v	> 70 l/hr

Visit 3, Event: Round 2, Date: 15/11/2019

Engineer	E. Lyons
Start/End Time	08:30 - 16:30
Pressure Start/End (mB)	1004 - 1004
Temperature (Deg C)	8.00
Weather Conditions	Clear

Equipment	SerialNo	Calibrated
Gas Analyser	GFM12009	No

Comments and Ground Conditions:

Borehole	Response Zone (m)		Gas Flow (l/hr)		Borehole Differential Pressure	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (ppmV)			Depth to Water	Depth to Base	Thickness of product	Sampled ?
	Top	Base	Initial	Steady	Pa	Initial	Steady	Initial	Steady	Initial	Steady	PID	H2S	CO	m	m	mm	Y/N
BH8A01	1.00	6.00	0.00	0.00		0.00	0.00	0.30	0.10	20.00	20.30	1.00	0.00	0.00	0.70	5.67	N/A	No
BH8A02	1.00	5.00	0.00	0.00		0.00	0.00	0.30	0.30	20.00	20.20	1.00	0.00	0.00	0.94	4.98	N/A	No
BH8A03	12.00	20.00	0.00	0.00		0.00	0.00	0.20	0.10	19.90	20.20	1.00	0.00	0.00	17.96	20.25	N/A	No
BH8A05	4.00	6.00	0.00	0.00		0.00	0.00	0.20	0.20	20.40	20.30	1.00	0.00	0.00	5.52	8.60	N/A	No
BH8A06	1.00	8.00	0.00	0.00		0.00	0.00	0.30	0.30	20.30	20.20	1.00	0.00	0.00	1.85	7.63	N/A	No
BH8A08	6.00	12.00	0.00	0.00		0.00	0.00	0.10	0.30	20.60	20.60	1.00	0.00	0.00	2.78	12.10	N/A	No
BH8B01	1.00	5.00	0.00	0.00		0.00	0.00	0.20	0.60	19.60	16.60	1.00	0.00	0.00	3.03	6.05	N/A	No
BH8B03	9.00	19.00	3.70	3.70		0.00	0.00	0.40	3.10	19.60	12.10	1.00	0.00	0.00	16.98	17.27	N/A	No
WS8A01	1.00	5.00	0.00	0.00		0.00	0.00	0.60	0.70	20.10	19.60	1.00	0.00	0.00	0.87	5.07	N/A	No
WS8A03	1.00	5.00	0.00	0.00		0.00	0.00	0.20	0.40	19.80	19.90	1.00	0.00	0.00	0.91	4.94	N/A	No
WS8B02	1.00	5.00	0.00	0.00		0.00	0.00	0.50	0.50	18.70	20.10	1.00	0.00	0.00	0.80	5.00	N/A	No
WS8B03	1.00	5.00	0.00	0.00		0.00	0.00	0.60	0.30	19.70	20.10	1.00	0.00	0.00	0.28	4.38	N/A	No
WS8B04	0.50	5.00	0.00	0.00		0.00	0.00	2.30	0.30	13.40	20.10	1.00	0.00	0.20	0.15	3.88	N/A	No
WS8B05	1.00	5.00	1.60	0.00		0.00	0.00	0.40	0.20	19.40	20.10	1.00	0.00	0.00	0.53	4.93	N/A	No

Omega Zone 8A, 8B, 8C, 8D, 8E

Key:

Depth to water

- Response zone *fully* flooded during sampling
- Response zone *significantly* flooded during sampling
- Datum or reponse zone information missing. Response zone flooding cannot be calculated

Methane	Carbon Dioxide	Gas Flow
> 1% v/v	> 5% v/v	> 70 l/hr

Visit 3, Event: Round 2, Date: 15/11/2019

Engineer	E. Lyons
Start/End Time	08:30 - 16:30
Pressure Start/End (mB)	1004 - 1004
Temperature (Deg C)	8.00
Weather Conditions	Clear

Equipment	SerialNo	Calibrated
Gas Analyser	GFM12009	No

Comments and Ground Conditions:

Borehole	Response Zone (m)		Gas Flow (l/hr)		Borehole Differential Pressure	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (ppmV)			Depth to Water	Depth to Base	Thickness of product	Sampled ?
	Top	Base	Initial	Steady	Pa	Initial	Steady	Initial	Steady	Initial	Steady	PID	H2S	CO	m	m	mm	Y/N
WS8B06	0.50	5.00	1.60	0.50		0.00	0.00	0.30	0.40	19.20	19.80	1.00	0.00	0.00	0.23	5.02	N/A	No
WS8B07	1.00	5.00	9.30	2.00		0.00	0.00	0.50	1.50	15.00	12.10	1.00	0.00	0.00	1.91	5.17	N/A	No

Omega Zone 8A, 8B, 8C, 8D, 8E

Key:

Depth to water

- Response zone *fully* flooded during sampling
- Response zone *significantly* flooded during sampling
- Datum or reponse zone information missing. Response zone flooding cannot be calculated

Methane	Carbon Dioxide	Gas Flow
> 1% v/v	> 5% v/v	> 70 l/hr

Visit 5, Event: Round 3, Date: 29/10/2019

Engineer	J. Kinchington
Start/End Time	08:30 - 16:30
Pressure Start/End (mB)	1020 - 1020
Temperature (Deg C)	10.00
Weather Conditions	Clear

Equipment	SerialNo	Calibrated
Gas Analyser	GFM12009	Yes

Comments and Ground Conditions:

Borehole	Response Zone (m)		Gas Flow (l/hr)		Borehole Differential Pressure	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (ppmV)			Depth to Water	Depth to Base	Thickness of product	Sampled ?
	Top	Base	Initial	Steady	Pa	Initial	Steady	Initial	Steady	Initial	Steady	PID	H2S	CO	m	m	mm	Y/N
BH8A01	1.00	6.00	1.40	0.00		0.00	0.00	1.50	0.30	17.10	19.80	1.00	0.00	0.00	0.52	5.69	N/A	No
BH8A02	1.00	5.00	0.90	0.00		0.00	0.00	0.30	1.30	19.80	19.40	1.00	0.00	0.00	0.83	4.97	N/A	No
BH8A03	12.00	20.00	42.00	42.00		0.00	0.00	5.40	7.60	4.70	1.20	1.00	0.00	0.00	17.91	18.00	N/A	No
BH8A05	4.00	6.00	0.00	0.00		0.00	0.00	0.60	0.90	19.90	16.80	1.00	0.00	0.00	5.55	8.63	N/A	No
BH8A06	1.00	8.00	8.30	0.30		0.00	0.00	0.80	0.90	18.90	19.50	1.00	0.00	0.00	1.91	7.81	N/A	No
BH8A08	6.00	12.00	0.00	0.00		0.00	0.00	0.20	0.80	19.60	20.00	1.00	0.00	0.00	2.79	12.09	N/A	No
BH8B01	1.00	5.00	0.20	0.00		0.00	0.00	0.60	1.60	18.30	5.90	1.00	0.00	0.00	3.09	6.06	N/A	No
BH8B03	9.00	19.00	57.30	57.10		0.00	0.00	6.70	7.30	1.60	0.20	1.00	0.00	0.00		17.28	N/A	No
WS8A01	1.00	5.00	26.00	0.00		0.00	0.00	7.30	3.10	8.90	16.20	1.00	0.00	0.00	0.81	5.04	N/A	No
WS8A03	1.00	5.00	58.60	0.80		0.00	0.00	0.40	3.00	15.70	15.30	1.00	0.00	0.00	0.83	4.89	N/A	No
WS8B02	1.00	5.00	7.50	0.40		0.00	0.00	0.60	1.60	17.90	18.60	1.00	0.00	0.00	0.78	5.00	N/A	No
WS8B03	1.00	5.00	20.50	0.30		0.00	0.00	2.00	2.00	18.00	16.70	1.00	0.00	0.00	0.19	4.32	N/A	No
WS8B04	0.50	5.00	0.00	0.00		0.00	0.00	7.20	0.20	4.40	19.80	1.00	0.00	0.00	0.08	3.91	N/A	No
WS8B05	1.00	5.00	6.70	0.00		0.00	0.00	1.20	1.60	18.60	16.00	1.00	0.00	0.00	0.51	4.98	N/A	No

Omega Zone 8A, 8B, 8C, 8D, 8E

Key:

Depth to water

- Response zone *fully* flooded during sampling
- Response zone *significantly* flooded during sampling
- Datum or reponse zone information missing. Response zone flooding cannot be calculated

Methane	Carbon Dioxide	Gas Flow
> 1% v/v	> 5% v/v	> 70 l/hr

Visit 5, Event: Round 3, Date: 29/10/2019

Engineer	J. Kinchington
Start/End Time	08:30 - 16:30
Pressure Start/End (mB)	1020 - 1020
Temperature (Deg C)	10.00
Weather Conditions	Clear

Equipment	SerialNo	Calibrated
Gas Analyser	GFM12009	Yes

Comments and Ground Conditions:

Borehole	Response Zone (m)		Gas Flow (l/hr)		Borehole Differential Pressure	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Other Gases (ppmV)			Depth to Water	Depth to Base	Thickness of product	Sampled ?
	Top	Base	Initial	Steady	Pa	Initial	Steady	Initial	Steady	Initial	Steady	PID	H2S	CO	m	m	mm	Y/N
WS8B06	0.50	5.00	3.40	0.00		0.00	0.00	0.60	1.70	17.20	17.10	1.00	0.00	0.00	0.21	5.04	N/A	No

Appendix G

WSP HUMAN HEALTH GAC METHODOLOGY

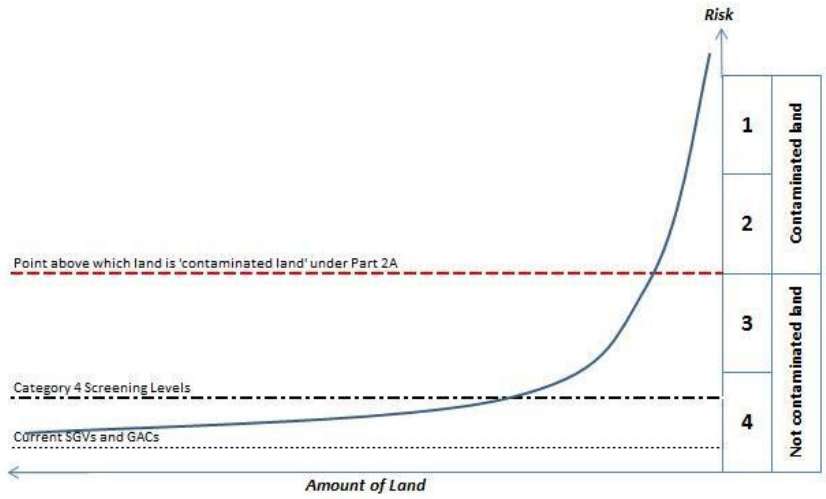
METHODOLOGY FOR THE DERIVATION OF GENERIC QUANTITATIVE ASSESSMENT CRITERIA TO EVALUATE RISKS TO HUMAN HEALTH FROM SOIL & GROUNDWATER CONTAMINATION

UK APPROACH

In the UK, the potential risks to human health from contamination in the ground are usually evaluated through a generic quantitative risk assessment (GQRA) approach. This allows generic and conservative exposure assumptions to be readily applied to risk assessments, and can be a useful tool for rapidly screening data and to identify those contaminants or scenarios that could benefit from further investigation and/or site-specific detailed quantitative risk assessment (DQRA). Current industry good practice is to use the approach presented in the Environment Agency (EA) publications SR2[1] and SR3[2]. This approach allows the derivation of Generic Assessment Criteria (GACs), primarily for chronic exposure.

In April 2012, the Department of Environment, Food and Rural Affairs (Defra) published updated statutory guidance[3] which introduced a four category approach to determining whether land in England and Wales is contaminated or not on the grounds of significant possibility of significant harm (SPOSH). **Figure 1** presents a graphical representation of the categories.

Figure 1: Four Categories for Determining if Land Represent a SPOSH



Cases classified as Category 1 are considered to be SPOSH based on actual evidence or an unacceptably high probability of harm existing. Category 4 cases are those where there is no risk, or a low risk of SPOSH.

[1] Environment Agency '*Human Health Toxicological Assessment of Contaminants in Soil',* Report SC050021/SR2. January 2009.
[2] Environment Agency '*Updated Technical Background to the CLEA Model*,' Report SC050021/SR3. January 2009.
[3] Defra '*Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance'.* April 2012.

GACs represent a minimal risk level, well within Category 4. A 2014 publication by Contaminated Land: Applicatons in Real Environments (CL:AIRE),SP1010[4] and endorsed by Defra[5] provided an approach to determine Category 4 Screening Levels (C4SLs) which are higher than the GACs whilst being "more pragmatic but still strongly precautionary". It also provided C4SLs for six contaminants of concern. Although the C4SLs were designed to support Part 2A assessments to determine 'contaminated land' they are specifically mentioned, along with reference to the Part 2A statutory guidance, by the Department for Communities and Local Government (DCLG) for use in a planning context[6].

An updated version the Contaminated Land Exposure Assessment (CLEA) Workbook (v1.071) was released by the EA in September 2015 to take into account the publication of SP1010. The updates comprised: additional toxicity data for the six chemicals for which C4SLs were derived; two new public open space land use scenarios; updated exposure parameters; options to run the model using C4SL exposure assumptions; and increased functionality. There were no changes to algorithms, so it is still possible to replicate the withdrawn SGVs using the input parameters held within v1.071.

It should be noted that the four category approach has not been adopted in Scotland under Part 2A or the planning regime. The Part 2A statutory guidance applicable in Scotland (Paper SE/2006/44 dated May 2006) does not reflect the changes introduced by Defra in April 2012 which allow for the use of C4SLs within Part 2A risk assessments. Additionally, it is considered that the principal of 'minimal risk' should still apply under planning in Scotland, based on current guidance.

WSP APPROACH

Following the withdrawal of the SGVs, and in the absence of an industry-wide, accepted set of GACs it is down to individual practitioners to derive their own soil assessment criteria. WSP has used the approach provided within SR2, SR3, SP1010, CLEA Workbook v1.071and SR4[7] to produce a set of minimal risk GACs. The chemical-specific data within two key publications were considered during their production: CL:AIRE 2010[8] and LQM 2015[9]. Both documents provide comprehensive sets of GACs for different contaminants of concern.

The LQM Suitable For Use Levels (S4ULs) have selected exposure parameters consistent with the C4SL exposure scenarios. This approach was rejected by WSP as not representing minimal risk. However, the LQM S4UL document was critically reviewed and the approach and chemical input parameters were utilised where considered to be appropriate.

An industry-led C4SL Working Group is in the process of deriving a larger set of C4SLs in the near future, for approximately 20 contaminants. This will include a critical review of the chemical input data for all selected substances, and may therefore lead to further amendments to the chemical input data used in the WSP in-house screening values. It is considered likely that the contaminant list will

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[4] CL:AIRE *'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination'* SP1010, Final Project Report (Revision 2). September 2014.
[5] Defra 'SP1010: *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document'*. December 2014.
[6] DCLG Planning Practice Guidance '*Land Affected by Contamination'*, particularly Paragraphs 001 and 007. Ref IDs: 33-001-20140306 & 33-007-20140612.
[7] Environment Agency '*CLEA Software (Version 1.05) Handbook (and Software)',* Report SC050021/SR4. September 2009.
[8] CL:AIRE 'The EIC/AGS/CL:AIRE *Soil Generic Assessment Criteria for Human Health Risk Assessment'.* ISBN 978-1-05046-20-1. January 2010.
[9] Nathanail et al '*The LQM/CIEH S4ULs for Human Health Risk Assessment'*, Land Quality Press, ISBN 978-0-9931084-0-2. 2015.

crossover with the 2009 EIC/AGS/CL:AIRE GACs. As such, this document was not critically reviewed by WSP.

WSP's current approach to the assessment of risks to human health is to continue to evaluate minimal risk through the use of in-house derived GACs, and to use the published C4SLs as a secondary tier of assessment until such time as additional C4SLs are published and/or in-house values are derived.

EXPOSURE MODELS

LAND USES

WSP has largely adopted the exposure assumptions of the generic land use scenarios included within SR3, with two additional public open space scenarios included from within SP1010:

- Residential with homegrown produce consumption;
- Residential without homegrown produce consumption;
- Allotments;
- Commercial;
- Public open space near residential housing (POS_{resi}); and
- Public park (POS_{park}).

Exceptions are described in the following Sections.

SOIL PROPERTIES

SR3 assumes a sandy loam soil with a pH of 7 and a Soil Organic Matter (SOM) content of 6% for its generic land uses, based on the geographical spread of topsoils in the UK. WSP has adopted these default values. In addition, GACs based on an SOM of 1% and 2.5% have been derived, based on common experience of the nature of Made Ground and lack of topsoil on many brownfield sites.

RECEPTOR CHARACTERISTICS AND BEHAVIOURS

SP1010 provides some updated exposure parameters for long-term inhalation rates[10] and the consumption rates for homegrown produce[11] compared to those provided in SR3. This data was used to derived WSP's GACs.

The changes in inhalation rates do not apply to the allotment generic land use scenario, as these are based on the breathing rates for short-term exposure of light to moderate intensity activity which were derived from a study that was not updated in USEPA 2011, so the SR3 rates were retained.

[10] USEPA, National Centre for Environmental Assessment '*Exposure Factors Handbook: 2011 Edition*' EPA/600/R-09/052F. September 2011.
[11] National Diet and Nutrition Survey 2008/2009 to 2010/2011.

CHEMICAL DATA

PHYSICO-CHEMICAL PARAMETERS

Physico-chemical properties for the contaminants for which GACs have been derived have been obtained following critical review of the following hierarchy of data sources:

1. Environment Agency/Defra SGV reports where available;
2. Environment Agency '*Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values*', Report SC050021/SR7, November 2008; and
3. Published fate and transport reviews within Nathanail et. al 2015 and CL:AIRE 2010.

Where appropriate, and where sufficient data is available, values were adjusted to reflect a UK soil temperature of 10ºC (e.g. K_{aw}).

TOXICOLOGICAL DATA

Toxicological data for the derivation of minimal risk Health Criteria Values (HCV) for each contaminant was selected with due regard to the approach presented in SR2. Where appropriate, the following hierarchy of data sources was used:

1. UK toxicity reviews published by authoritative bodies including:

   EA;

   Public Health England (PHE);

   Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT); and

   Committee on Carcinogenicity of Chemicals in Food, Consumer Products and the Environment (COC).
2. Authoritative European sources such as European Food Standards Agency (EFSA)
3. International organisations including:

   World Health Organisation (WHO); and

   Joint FAO/WHO Expert Committee on Food Additives (JECFA).
4. Authoritative country-specific sources including:

   United States Environmental Protection Agency (USEPA);

   US Agency for Toxic Substances and Disease Registry (ATSDR);

   US Integrated Risk Information System (IRIS); and

   Netherlands National Institute for Public Health and the Environment (RIVM).

Factors such as the applicability of the data to human health (e.g. epidemiological vs. animal studies), the quality of the data, the level of uncertainty in the results and the age of the data were also taken into account in the final selection. Details for specific substances are available on request.

MEAN DAILY INTAKES

Estimations of background exposure for each threshold substance have been updated. In line with the SR2 approach, the exposure from non-threshold substances in the soil does not take into account exposure from other sources, and as such GACs were derived without consideration of the Mean Daily Intake (MDI) for those substances.

The data published by the EA in its series of TOX reports between 2002 and 2009 was evaluated to determine whether the values were considered to remain valid today. Values from these current UK published sources were not amended unless they were considered to be significantly different so that the GACs remained as comparable as possible with the revoked SGVs.

ORAL MEAN DAILY INTAKES

Oral MDI were generally estimated as the sum of exposure via the ingestion of food and drinking water using the default adult physiological parameters presented in Table 3.3 of SR2.

Data on the exposure of substances from food ingestion was generally obtained from UK Total Diet Studies (TDS) published by the Food Standards Agency (FSA) and its predecessor the Ministry of Agriculture, Fisheries and Food (MAFF) and from studies commissioned by COT. Where no UK-specific data was available, MDI were derived from the European Food Safety Authority (EFSA), Health Canada and US sources. This was a rare occurrence, and in these instances, the data was evaluated to determine its applicability to the UK.

Data on the concentrations of substances in tap water was obtained from a variety of sources. UK data was used where available, with preference given to Drinking Water Inspectorate (DWI) 2014 data from water company tap water testing (LOD, 1st and 99th percentile data is available). Where the substance was not included in tap water testing, other UK sources of information were considered including:

DWI data from water company tap water testing from previous years;

COT; and

FSA.

Where UK data was not available, a number of other data sources were considered, largely WHO International Programme on Chemical Safety (IPCS) Concise International Chemical Assessment Documents (CICADs) and background documents for the development of Guidelines for Drinking Water Quality, using professional judgement on the relevance of the data to the UK. The final decision on the MDI from drinking water was made using professional judgement on the balance of relevance and probability, taking into account the detection limit where not detected, Koc and solubility, reduction in use of the substance, banned substances, tight controls (e.g. on explosives) and with due consideration to the SR2 instruction that “if no data or information in background exposure are available, background exposure should be assumed to be negligible and the MDI set to zero….”.

Data from other countries was generally not used because it was considered that the hydrogeology of these countries along with industrial practices were unlikely to be reflective of the UK.

INHALATION MEAN DAILY INTAKES

Inhalation MDIs were based on estimates of average daily exposure by the inhalation pathway and calculated using the default adult physiological parameters presented in Table 3.3 of SR2.

The inhalation MDIs were generally estimated using background exposure data from the UK, derived from Defra's UK-AIR: Air Information Resource[12], which provides ambient air quality data from a number of sites forming a UK-wide monitoring network. The MDIs for heavy metals were based on rolling annual average metal mass concentration data from Defra's UK Heavy Metals Monitoring Network from the period October 2009 to September 2010[13].

Information for some substances was obtained from UK sources including Environment Agency TOX reports and data from the UK Expert Panel on Air Quality Standards (EPAQS). Where recent UK data was not available, data was sourced from the International Programme on Chemical Safety (IPCS), the World Health Organisation (WHO), the Agency for Toxic Substances and Diseases Registry (ATSDR), Health Canada, and various other peer-reviewed sources summarised by LQM/CIEH[14].

For other substances, where no data or information on background exposure was available, background exposure was assumed to be negligible and the MDI set at 0.5*TDI in accordance with guidance in SR2.

PLANT UPTAKE

Soil to plant concentration factors are available in CLEA v1.071 for arsenic, cadmium, hexavalent chromium, lead, mercury, nickel and selenium. For all remaining inorganic chemicals, concentration factors were obtained using the PRISM model. Substance-specific correction factors have been selected in accordance with the guidance established within SR3. This is consistent to the approach utilised in the derivation of the LQM S4UL and the EIC/AGS/CL:AIRE GAC.

Where there is a lack of appropriate data to enable the derivation of specific soil to plant concentrations factors for organic chemicals, plant uptake was modelled within CLEA v1.071 using the generic equations recommended within SR3, as follows:

Green Vegetables – Ryan et al. (1988);

Root Vegetables – Trapp (2002);

Tuber Vegetables – Trapp et al. (2007); and

Tree Fruit – Trapp et al. (2003).

There are no suitable models available for modelling uptake for herbaceous fruit or shrub fruit. Exposure is considered negligible.

[12] Crown 2016 copyright Defra via uk-air.defra.gov.uk, licenced under the Open Government Licence (OGL).
[13] Defra, 2013 Spreadsheet of historic data for multiple years for the Metals network. Available online at: http://uk-air.defra.gov.uk/data/metals-data. [Accessed 13/03/2016].
[14] LQM/CIEH, 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment.

SOIL SATURATION LIMITS

GACs are not limited to their theoretical soil saturation within CLEA, although where either the aqueous or the vapour-based saturation is exceeded, this is highlighted within the Workbook (compared with the lower of the two values). This affects pathways which depend on partitioning calculations so in reality this only affects the vapour pathways and is relevant to organic substances and other substances, such as elemental mercury, that have a significant volatile component. However, the Workbook highlights saturation for direct contact pathways to indicate to the user where further qualitative consideration of free phase contamination at the surface may be required.

Where the lower of the two saturation limits is exceeded and the vapour pathway is the only exposure route being considered, the chronic risks to human health are likely to be negligible. Further evaluation could be undertaken using an alternative model suitable for evaluating non-aqueous phase liquids (NAPLs), such as the Johnson & Ettinger (J&E) approach described in USEPA 2003. However, WSP considers that if NAPLs are suspected, given the known limitations and over-simplifications of J&E, soil vapour monitoring is a more accurate way of assessing potential risks.

Where the lower saturation limit is exceeded for the vapour pathway and a number of exposure routes are being considered, then the contribution from the NAPL via vapour inhalation to the overall exposure can be evaluated using the procedure provided in SR4. WSP would evaluate this as part of a DQRA process or through soil vapour monitoring on-site to determine site-specific soil vapour concentrations.

CHEMICAL SPECIFIC ASSUMPTIONS

CYANIDES

Cyanide has high acute toxicity, and short term exposure is an important consideration when assessing the risks from soils contaminated with cyanide. The primary risk to human receptors from free cyanide in soils is an acute risk.

There is no current UK guidance available for calculating acute risks from free cyanide. Consequently, GAC for acute exposure were derived using the algorithms presented in MADEP 1992[15] and assuming a one-off ingestion of 10g of soil (this conservative value has been taken as an upper bound estimate for a one-off soil ingestion rate amongst children). Receptor body weights have been selected according to the critical receptor for each exposure scenario. The lowest of the chronic and acute GAC for each land use scenario were adopted by WSP. Brinckerhoff.

LEAD

The SGV for lead was withdrawn by the EA in 2009, and in 2011 the EA withdrew their published TOX report in light of new scientific evidence. The C4SL for lead was derived using the latest scientific evidence from a large human dataset. As such, no chemical-specific margin was applied in the derivation of the C4SL for lead. It may be possible for WSP to derive a GAC for lead using the same dataset and applying a chemical-specific margin, but the value is likely to be lower than UK natural background concentrations. Therefore, WSP has adopted the toxicological data used to derive the C4SLs in deriving the GAC for lead until such time as alternative GACs are published by an authoritative body. The relative bioavailability was set at 100% in line with the approach taken for other GACs, whereas the C4SL assumes 60% for soil and 64% for airborne dust. Thus, the WSP GAC are lower than the C4SLs.

[15] MADEP '*Background Documentation for the Development of an "Available Cyanide" Benchmark Concentration*' 1992. http://www.mass.gov/dep/toxics/cn_soil.htm

POLYCYCLIC AROMATIC HYDROCARBONS

WSP's approach to the assessment of polycyclic aromatic hydrocarbons (PAHs) uses the surrogate marker approach. BaP was used as a surrogate marker for all genotoxic PAHs in line with the Health Protection Agency 2010[16] recommendations and SP1010. This assumes that the PAH profile of the data is similar to that of the coal tars used in the Culp *et al* oral carcinogenicity study from which the toxicity data for BaP was produced. In reality, this profile has been shown by HPA to be applicable on the majority of contaminated sites based on assessment of sites across the country.

The alternative is the Toxic Equivalency Factor (TEF) approach which uses a reference compound and assigns TEFs for other compounds based on estimates of potency. Key uncertainties with this approach include the assumption that all compounds have the same toxic mechanism of action within the body and that no compounds with a greater potency than the reference compound are present. It is considered by the HPA that the TEF approach is likely to under predict the true carcinogenicity of PAHs and therefore favours the surrogate marker approach.

For these reasons, WSP considers that the adoption of BaP as a surrogate marker for genotoxic PAHs, as opposed to the TEF approach, is reasonable. In rare cases where the PAH profile may differ from the wide definitions of the Culp *et al* study the user should discuss their project with an experienced risk assessor. In addition, WSP has derived a GAC for naphthalene, which is commonly a risk driver due to its high volatility, relative to other PAH compounds.

TRIMETHYLBENZENES

The GAC for trimethylbenzenes can be used for the assessment of any individual isomer (1,2,3-trimethylbenzene, 1,2,4-trimethylbenzene or 1,3,5-trimethylbenzene), or a mixture of the three isomers.

CHEMICAL GROUPS

For a number of chemical groups, the available toxicity data is for combinations of chemicals. Given that the physico-chemical parameters may differ between the chemicals, the GACs for the chemicals within the groups have been calculated and then the lowest GAC selected to represent the entire group. This was the approach taken by the EA for m-, o- and p-xylenes, and has also been adopted by WSP for:

2-chlorophenol, 2,4-dichlorophenol, 2,4,6-trichlorophenol and 2,3,4,6-tetrachlorophenol;

2-, 3- and 4-methylphenol (total cresols);

aldrin and dieldrin; and

α- and β-endosulphan.

[16] HPA Contaminated Land Information Sheet '*Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)* 2010

EXPOSURE TO VAPOURS

INHALATION OF MEASURED VAPOURS

WSP has derived a set of soil vapour GACs (GAC_{sv}) that allow for the assessment of measured site soil vapour concentrations, using J&E, in order to establish potential risks via indoor inhalation of vapours. This methodology enables a more robust assessment of exposure via the inhalation of soil vapours indoors than using CLEA-derived soil GAC, as it is based upon measured soil vapour concentrations beneath the site. It also allows for the assessment of vapours from all source terms (i.e. groundwater, soil or NAPL). Outdoor inhalation was not included. WSP considers that the indoor inhalation pathway is the significantly dominant risk-driver.

The generic land use scenarios within CLEA (residential and commercial) that were used to derive the soil GAC were used to define the receptor and building characteristics for the soil vapour GAC. Only residential and commercial generic land use scenarios include the indoor inhalation of vapours pathway.

The GAC_{sv} were derived for three different soil types; sand, sandy loam and clay, reflecting the importance of this parameter within the J&E model. A depth to contamination of 0.85 m below the base of the building foundation was assumed (i.e. 1 m below ground level). This differs from the depth assumed for the soil GAC (0.5 m bgl), but was selected by WSP as a reasonable worst case scenario.

It is acknowledged that the J&E commonly over-predicts indoor vapour concentrations. In particular, it will significantly over-predict vapour concentrations for suspended floor slabs, which many new builds are constructed with, it does not take into account lateral migration and assumes an infinite source of contamination at steady state conditions. In addition, it is common for soil gas/vapour wells to be installed with at least 1 m of plain riser at the surface and this equates to a total depth of 0.85 m below the building foundation plus a 0.15 m thick foundation, and so is more representative of the depth that samples will be taken from.

The TDSIs and IDs for each substance were converted from $\mu gkg^{-1}{}_{bw}day^{-1}$ to μgm^{-3} using the standard conversions quoted in Table 3.3 of SR2, thereby replacing the need to model C_{air} in the equation:

$$C_{air} = \alpha . C_{vap} . \mathbf{1{,}000{,}000} cm^3 m^{-3}$$

Where:

C_{air} is the concentration of vapours within the building, mg^{-3}

α is the steady state attenuation coefficient between soil and indoor air, dimensionless

C_{vap} is the soil vapour concentration, $mgcm^{-3}$

The target concentrations within indoor air for each substance (C_{air}) are a function of receptor inhalation rates and occupancy periods, as defined by the site conceptual exposure model (assuming standard CLEA occupancy periods and receptors).

The attenuation factor was calculated using J&E (Equation 10.4 in SR3) and the resulting C_{vap} is equivalent to the GAC_{sv} for the modelled exposure scenario.

Where reported soil vapour concentrations exceed the relevant saturated vapour concentration, free product may occur, and the user should discuss their project with an experienced risk assessor.

INHALATION OF GROUNDWATER-DERIVED VAPOURS

WSP has derived a set of groundwater GACs (GAC_{gw}) to evaluate the potential risks through the indoor inhalation of groundwater-derived vapours by first applying the approach described above for the derivation of the WSP GAC_{sv} to determine the acceptable concentration in soil vapour directly above the water table.

The depth to groundwater was assumed to be 1 m bgl (i.e. 0.85 m below the base of the building foundation). This depth was considered to be more representative of commonly encountered groundwater conditions than the 0.5 m below the base of the building foundation (i.e. 0.65 m bgl) that is used by CLEA for an unsaturated source present in the overlying soil.

The GAC_{gw} was then back-calculated from the GAC_{sv} using the air-water partition coefficient (K_{aw}) for each substance.

The WSP Groundwater Vapour GAC are protective against a dissolved phase contaminant source only. If the presence of NAPL is suspected, the risks from this source will need to be assessed. Where reported groundwater concentrations exceed the relevant solubility limit, free product may occur, and the user should discuss their project with an experienced risk assessor.

Appendix H

GINT SCREENER

PRE-REPORT DATA CHECK

All GEOL_GEO2 codes are complete.

All GEOL_GEO2 codes are recognised and suitable for this report.

All SampleMatrix fields are complete

Commercial, SOM=1%

Site Area(s): Zone 8 A, Zone 8 B
Phase(s): All phases, N/A

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	GAC	PointID	BH8A01	BH8A03	BH8A04	BH8A08	BH8B01	BH8B02	BH8B03	TP8B05	WS8A01	WS8B03	WS8B05
					1.0	0.5	0.3	0.3	1.0	0.3	0.5	0.2	0.2	0.5	0.5
				Depth (m bgl)											
				Sample Date											
				Geology (at top depth of sample)											
alpha - BHC (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Atraton (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Chlordane (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Demeton - O (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Deta-Hexachlorocyclohexane (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Endrin Ketone (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Ethoprophos (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Fensulfothion (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Merphos (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Naled (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Prometon (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Secbumeton (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Stirofos (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Sulprofos (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Tokuthion (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1
Total Aliphatics and Aromatics C5-C35	mg/kg	10.0			<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Commercial, SOM=1%

Site Area(s): Zone 8 A, Zone 8 B
Phase(s): All phases, N/A

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	GAC	PointID	BH8A01	BH8A03	BH8A04	BH8A08	BH8B01	BH8B02	BH8B03	TP8B05	WS8A01	WS8B03	WS8B05
					1.0	0.5	0.3	0.3	1.0	0.3	0.5	0.2	0.2	0.5	0.5
				Depth (m bgl)											
				Sample Date											
				Geology (at top depth of sample)											
Trichloronate (Unrecognised code)	mg/kg	0.10					<0.1						<0.1	<0.1	<0.1

Commercial, SOM=1%

Site Area(s): Zone 8 A, Zone 8 B
Phase(s): All phases, N/A

Aliphatics and Aromatics

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	GAC	PointID	BH8A01	BH8A03	BH8A04	BH8A08	BH8B01	BH8B02	BH8B03	TP8B05	WS8A01	WS8B03	WS8B05
					1.0	0.5	0.3	0.3	1.0	0.3	0.5	0.2	0.2	0.5	0.5
				Depth (m bgl)											
				Sample Date											
				Geology (at top depth of sample)											
Aliphatic C05-C06	mg/kg	0.010	3,190		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aliphatic C06-C08	mg/kg	0.010	7,780		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aliphatic C08-C10	mg/kg	0.010	2,000		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aliphatic C10-C12	mg/kg	1.50	9,690		<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Aliphatic C12-C16	mg/kg	1.20	58,800		<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
Aliphatic C16-C21	mg/kg	1.50			<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Aliphatic C21-C35	mg/kg	3.40			<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4	<3.4
Aromatic C05-C07	mg/kg	0.010	26,200		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aromatic C07-C08	mg/kg	0.010	56,100		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aromatic C08-C10	mg/kg	0.010	3,460		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aromatic C10-C12	mg/kg	0.90	16,200		<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Aromatic C12-C16	mg/kg	0.50	36,200		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aromatic C16-C21	mg/kg	0.60	28,600		<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Aromatic C21-C35	mg/kg	1.40	28,600		<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
Aromatic C5-C35	mg/kg	10.0			<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Aliphatics (C5-C35)	mg/kg	10.0			<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Commercial, SOM=1%

Site Area(s): Zone 8 A, Zone 8 B
Phase(s): All phases, N/A

Asbestos

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	GAC	PointID	BH8A03	BH8A04	BH8B02	BH8B03	TP8B05	WS8A01	WS8B03	WS8B05
					0.5	0.3	0.3	0.5	0.2	0.2	0.5	0.5
				Depth (m bgl)								
				Sample Date								
				Geology (at top depth of sample)								
Asbestos Identification	-											

Asbestos Quantification Comments	-											

Commercial, SOM=1%

Site Area(s): Zone 8 A, Zone 8 B
Phase(s): All phases, N/A

General Chemistry

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	GAC	PointID	WS8B03	WS8B05
					0.5	0.5
				Depth (m bgl)		
				Sample Date		
				Geology (at top depth of sample)		
pH	pH Units				7.2	7.2

Commercial, SOM=1%

Site Area(s): Zone 8 A, Zone 8 B
Phase(s): All phases, N/A

Metals

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	GAC	PointID	BH8A01	BH8A03	BH8A04	BH8A08	BH8B01	BH8B02	BH8B03	TP8B05	WS8A01	WS8B03	WS8B05
					1.0	0.5	0.3	0.3	1.0	0.3	0.5	0.2	0.2	0.5	0.5
				Depth (m bgl)											
				Sample Date											
				Geology (at top depth of sample)											
Arsenic	mg/kg	0.20	635		5.3	13	11	6.3	11	5.7	10	11	9.4	5.7	
Boron	mg/kg	0.20	207,000		<0.2	0.5	0.4	0.2	0.4	0.2	0.3	0.3	0.2	0.2	
Cadmium	mg/kg	0.10	223		<0.1	0.4	0.3	<0.1	0.4	<0.1	0.3	0.3	0.1	0.1	
Chromium	mg/kg	0.15			29	19	21	25	22	23	23	19	28	22	
Copper	mg/kg	0.20	69,800		19	51	39	16	44	11	31	43	19	20	
Hexavalent Chromium	mg/kg	1.00	24.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Lead	mg/kg	0.30	1,390		10	47	38	8.4	40	7.3	35	61	17	41	
Mercury	mg/kg	0.050	1,110		<0.05	0.07	0.06	<0.05	0.07	<0.05	0.06	0.06	<0.05	<0.05	
Nickel	mg/kg	1.00	1,710		26	15	15	21	13	17	16	13	21	16	
Selenium	mg/kg	0.50	12,300		<0.5	0.7	<0.5	<0.5	0.8	0.6	<0.5	<0.5	<0.5	<0.5	
Zinc	mg/kg	1.00	1,050,000		31	58	48	28	59	20	56	60	50	43	

Commercial, SOM=1%

Site Area(s): Zone 8 A, Zone 8 B
Phase(s): All phases, N/A

Other

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	GAC	PointID	BH8A02	BH8B02	WS8A01	WS8A03	WS8B03	WS8B05
					1.0	0.5	0.5	1.0	0.5	0.5
				Depth (m bgl)						
				Sample Date						
				Geology (at top depth of sample)						
Organic matter	%	0.10							0.7	1.7
Total organic carbon (TOC)	%	0.50			0.7	<0.5	2.5	<0.5		

Commercial, SOM=1%

Site Area(s): Zone 8 A, Zone 8 B
Phase(s): All phases, N/A

PAHs

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	GAC	PointID	BH8A01	BH8A03	BH8A04	BH8A08	BH8B01	BH8B02	BH8B03	TP8B05	WS8A01	WS8B03	WS8B05
					1.0	0.5	0.3	0.3	1.0	0.3	0.5	0.2	0.2	0.5	0.5
				Depth (m bgl)											
				Sample Date											
				Geology (at top depth of sample)											
Acenaphthene	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1
Benzo (a) anthracene	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	<0.1
Benzo (a) pyrene	mg/kg	0.10	38.0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1
Benzo (b) fluoranthene	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1
Benzo (ghi) perylene	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo (k) fluoranthene	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1
Chrysene	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1
Dibenzo (ah) anthracene	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1
Fluoranthene	mg/kg	0.10			<0.1	<0.1	<0.1	0.2	<0.1	0.2	<0.1	0.1	0.3	<0.1	<0.1
Fluorene	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1
Indeno (1,2,3-cd) pyrene	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1
Naphthalene	mg/kg	0.10	193		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
PAH (Total)	mg/kg	1.60						<1.6	<1.6	<1.6	<1.6	<1.6			
PAH Total - Other	mg/kg	1.60			<1.6	<1.6	<1.6						3.1	<1.6	<1.6

Commercial, SOM=1%

Site Area(s): Zone 8 A, Zone 8 B
Phase(s): All phases, N/A

PAHs

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	GAC	PointID	BH8A01	BH8A03	BH8A04	BH8A08	BH8B01	BH8B02	BH8B03	TP8B05	WS8A01	WS8B03	WS8B05
					1.0	0.5	0.3	0.3	1.0	0.3	0.5	0.2	0.2	0.5	0.5
				Depth (m bgl)											
				Sample Date											
				Geology (at top depth of sample)											
Phenanthrene	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1
Pyrene	mg/kg	0.10			<0.1	<0.1	<0.1	0.3	<0.1	0.3	0.1	0.3	0.2	<0.1	<0.1

Commercial, SOM=1%

Site Area(s): Zone 8 A, Zone 8 B
Phase(s): All phases, N/A

Pesticides, Herbicides and Insecticides

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	GAC	BH8A04	WS8A01	WS8B03	WS8B05
PointID				BH8A04	WS8A01	WS8B03	WS8B05
				0.3	0.2	0.5	0.5
Depth (m bgl)							
Sample Date							
Geology (at top depth of sample)							
Aldrin	mg/kg	0.10	160	<0.1	<0.1	<0.1	<0.1
Alpha Endosulfan	mg/kg	0.10	3,750	<0.1	<0.1	<0.1	<0.1
Ametryn	mg/kg	0.10		<0.1	<0.1	<0.1	<0.1
Atrazine	mg/kg	0.10	9,320	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl	mg/kg	0.10		<0.1	<0.1	<0.1	<0.1
Beta-BHC	mg/kg	0.10		<0.1	<0.1	<0.1	<0.1
Chlorpyrifos	mg/kg	0.10		<0.1	<0.1	<0.1	<0.1
Coumaphos	mg/kg	0.10		<0.1	<0.1	<0.1	<0.1
Demeton-S	mg/kg	0.10		<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	0.10		<0.1	<0.1	<0.1	<0.1
Dichlorvos	mg/kg	0.10	150	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	0.10	160	<0.1	<0.1	<0.1	<0.1
Disulfoton	mg/kg	0.10		<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	0.10	3,750	<0.1	<0.1	<0.1	<0.1
Endosulfan sulphate	mg/kg	0.10	3,750	<0.1	<0.1	<0.1	<0.1
Endosulfan Total (Summed)	mg/kg	-999	3,750	0.1	0.1	0.1	0.1

Commercial, SOM=1%

Site Area(s): Zone 8 A, Zone 8 B
Phase(s): All phases, N/A

Pesticides, Herbicides and Insecticides

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	GAC	PointID	BH8A04	WS8A01	WS8B03	WS8B05
					0.3	0.2	0.5	0.5
				Depth (m bgl)				
				Sample Date				
				Geology (at top depth of sample)				
Endrin	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Endrin aldehyde	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Fenchlorphos	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Fenthion	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Gamma-BCH	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Methyl parathion	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Mevinphos	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
p,p-DDE	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
p,p-DDT	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Phorate	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Prometryn	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Propazine	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Simazine	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1

Commercial, SOM=1%

Site Area(s): Zone 8 A, Zone 8 B
Phase(s): All phases, N/A

Pesticides, Herbicides and Insecticides

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	GAC	PointID	BH8A04	WS8A01	WS8B03	WS8B05
					0.3	0.2	0.5	0.5
				Depth (m bgl)				
				Sample Date				
				Geology (at top depth of sample)				
Simetryn	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Terbuthylazine	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1
Terbutryn	mg/kg	0.10			<0.1	<0.1	<0.1	<0.1

PRE-REPORT DATA CHECK

All GEOL_GEO2 codes are complete.

All GEOL_GEO2 codes are recognised and suitable for this report.

All SampleMatrix fields are complete

All result and screening units match

The following samples do not have the correct number of TPH fractions
The TPH Hazard Index calculation will be incomplete for these samples.

PointID	Depth	Samp Ref	Samp Type
BH8A01	1		ES
BH8A03	0.5		ES
BH8A04	0.25		ES
BH8A08	0.25		ES
BH8B01	1		ES
BH8B02	0.25		ES
BH8B03	0.5		ES
BH8C01	0.25	2	ES
BH8C02	0.25	2	ES
TP8B05	0.2		ES
TP8C06	0.2		ES
TP8D03	1		ES
TP8D05	0.2		ES
TP8D05	0.5		ES
TP8D09	0.2		ES
TP8D12	0.5		ES
TP8D17	0.5		ES
TP8D18	0.2		ES
TP8D28	1		ES
TP8D31	0.2		ES
TP8D34	0.2		ES
TP8E01	0.2		ES
TP8E03	0.5		ES
WS8A01	0.2		ES
WS8B03	0.5		ES
WS8B05	0.5		ES
WS8C01	0.2		ES
WS8C02	1		ES
WS8C04A	1		ES
WS8C05	0.2		ES
WS8C06	0.5		ES
WS8D01	0.5		ES
WS8D03	0.5		ES
WS8D07	0.2		ES

Commercial, SOM=1%

Site Area(s) Selected: Zone 8 A,Zone 8 B
Phase(s): All phases, N/A

Notes: * For results below LOD, a value of half LOD is used in the calculation of the mean

Unrecognised analytes

ANALYTE	MADEGROUND			NATURAL GROUND			ASSESSMENT CRITERIA (AC)	UNITS	NO. OF LOCATIONS	NO. OF SAMPLES	NO. OF SAMPLES > LOD	NO. OF LOCATIONS >AC	LOCATIONS FAILING SCREENING
	MIN	MEAN*	MAX	MIN	MEAN*	MAX							
alpha - BHC (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Atraton (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Chlordane (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Demeton - O (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Deta-Hexachlorocyclohexane (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Endrin Ketone (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Ethoprophos (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Fensulfothion (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Merphos (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Naled (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Prometon (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Secbumeton (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Stirofos (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Sulprofos (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Tokuthion (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	

Commercial, SOM=1%

Site Area(s) Selected: Zone 8 A,Zone 8 B
Phase(s): All phases, N/A

Notes: * For results below LOD, a value of half LOD is used in the calculation of the mean

Unrecognised analytes

Analyte	Madeground			Natural Ground			Assessment Criteria (AC)	Units	No. of Locations	No. of Samples	No. of Samples > LOD	No. of Locations >AC	Locations Failing Screening
	Min	Mean*	Max	Min	Mean*	Max							
Total Aliphatics and Aromatics C5-C35 (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	11	11	0	0	
Trichloronate (Unrecognised code)	-	-	-	-	-	-	-	mg/kg	4	4	0	0	

Commercial, SOM=1%

Site Area(s) Selected: Zone 8 A,Zone 8 B
Phase(s): All phases, N/A

Notes: * For results below LOD, a value of half LOD is used in the calculation of the mean

Aliphatics and Aromatics

Analyte	Madeground			Natural Ground			Assessment Criteria (AC)	Units	No. of Locations	No. of Samples	No. of Samples > LOD	No. of Locations >AC	Locations Failing Screening
	Min	Mean*	Max	Min	Mean*	Max							
Aliphatic C05-C06	-	-	-	-	-	-	3,190	mg/kg	11	11	0	0	
Aliphatic C06-C08	-	-	-	-	-	-	7,780	mg/kg	11	11	0	0	
Aliphatic C08-C10	-	-	-	-	-	-	2,000	mg/kg	11	11	0	0	
Aliphatic C10-C12	-	-	-	-	-	-	9,690	mg/kg	11	11	0	0	
Aliphatic C12-C16	-	-	-	-	-	-	58,800	mg/kg	11	11	0	0	
Aliphatic C16-C21	-	-	-	-	-	-	-	mg/kg	11	11	0	0	
Aliphatic C21-C35	-	-	-	-	-	-	-	mg/kg	11	11	0	0	
Aromatic C05-C07	-	-	-	-	-	-	26,200	mg/kg	11	11	0	0	
Aromatic C07-C08	-	-	-	-	-	-	56,100	mg/kg	11	11	0	0	
Aromatic C08-C10	-	-	-	-	-	-	3,460	mg/kg	11	11	0	0	
Aromatic C10-C12	-	-	-	-	-	-	16,200	mg/kg	11	11	0	0	
Aromatic C12-C16	-	-	-	-	-	-	36,200	mg/kg	11	11	0	0	
Aromatic C16-C21	-	-	-	-	-	-	28,600	mg/kg	11	11	0	0	
Aromatic C21-C35	-	-	-	-	-	-	28,600	mg/kg	11	11	0	0	
Aromatic C5-C35	-	-	-	-	-	-	-	mg/kg	11	11	0	0	
Total Aliphatics (C5-C35)	-	-	-	-	-	-	-	mg/kg	11	11	0	0	

Commercial, SOM=1%

Site Area(s) Selected: Zone 8 A,Zone 8 B
Phase(s): All phases, N/A

Notes: * For results below LOD, a value of half LOD is used in the calculation of the mean

Aliphatics and Aromatics

Analyte	Madeground			Natural Ground			Assessment Criteria (AC)	Units	No. of Locations	No. of Samples	No. of Samples > LOD	No. of Locations >AC	Locations Failing Screening
	Min	Mean*	Max	Min	Mean*	Max							
TPH Hazard Index	-	-	-	-	-	-	1.00	mg/kg	11	11	N/A	0	

Asbestos

Analyte	Madeground			Natural Ground			Assessment Criteria (AC)	Units	No. of Locations	No. of Samples	No. of Samples > LOD	No. of Locations >AC	Locations Failing Screening
	Min	Mean*	Max	Min	Mean*	Max							
Asbestos Identification	-	-	-	-	-	-	-	-	3	3	0	0	
Asbestos Quantification Comments	-	-	-	-	-	-	-	-	3	3	0	0	
Asbestos Identification	-	-	-	-	-	-	-	---	5	5	0	0	
Asbestos Quantification Comments	-	-	-	-	-	-	-	---	5	5	0	0	

Commercial, SOM=1%

Site Area(s) Selected: Zone 8 A,Zone 8 B
Phase(s): All phases, N/A

Notes: * For results below LOD, a value of half LOD is used in the calculation of the mean

General Chemistry

Analyte	Madeground			Natural Ground			Assessment Criteria (AC)	Units	No. of Locations	No. of Samples	No. of Samples > LOD	No. of Locations >AC	Locations Failing Screening
	Min	Mean*	Max	Min	Mean*	Max							
pH	-	-	-	-	-	-	-	pH Units	2	2	2	0	

Commercial, SOM=1%

Site Area(s) Selected: Zone 8 A,Zone 8 B
Phase(s): All phases, N/A

Notes: * For results below LOD, a value of half LOD is used in the calculation of the mean

Metals

Analyte	Madeground			Natural Ground			Assessment Criteria (AC)	Units	No. of Locations	No. of Samples	No. of Samples > LOD	No. of Locations >AC	Locations Failing Screening
	Min	Mean*	Max	Min	Mean*	Max							
Arsenic	-	-	-	-	-	-	635	mg/kg	10	10	10	0	
Boron	-	-	-	-	-	-	207,000	mg/kg	10	10	9	0	
Cadmium	-	-	-	-	-	-	223	mg/kg	10	10	7	0	
Chromium	-	-	-	-	-	-	-	mg/kg	10	10	10	0	
Copper	-	-	-	-	-	-	69,800	mg/kg	10	10	10	0	
Hexavalent Chromium	-	-	-	-	-	-	24.0	mg/kg	11	11	0	0	
Lead	-	-	-	-	-	-	1,390	mg/kg	10	10	10	0	
Mercury	-	-	-	-	-	-	1,110	mg/kg	10	10	5	0	
Nickel	-	-	-	-	-	-	1,710	mg/kg	10	10	10	0	
Selenium	-	-	-	-	-	-	12,300	mg/kg	10	10	3	0	
Zinc	-	-	-	-	-	-	1,050,000	mg/kg	10	10	10	0	

Commercial, SOM=1%

Site Area(s) Selected: Zone 8 A,Zone 8 B
Phase(s): All phases, N/A

Notes: * For results below LOD, a value of half LOD is used in the calculation of the mean

Other

Analyte	Madeground			Natural Ground			Assessment Criteria (AC)	Units	No. of Locations	No. of Samples	No. of Samples > LOD	No. of Locations >AC	Locations Failing Screening
	Min	Mean*	Max	Min	Mean*	Max							
Organic matter	-	-	-	-	-	-	-	%	2	2	2	0	
Total organic carbon (TOC)	-	-	-	-	-	-	-	%	4	4	2	0	

Commercial, SOM=1%

Site Area(s) Selected: Zone 8 A,Zone 8 B
Phase(s): All phases, N/A

Notes: * For results below LOD, a value of half LOD is used in the calculation of the mean

PAHs

Analyte	Madeground			Natural Ground			Assessment Criteria (AC)	Units	No. of Locations	No. of Samples	No. of Samples > LOD	No. of Locations >AC	Locations Failing Screening
	Min	Mean*	Max	Min	Mean*	Max							
Acenaphthene	-	-	-	-	-	-	-	mg/kg	11	11	0	0	
Acenaphthylene	-	-	-	-	-	-	-	mg/kg	11	11	0	0	
Anthracene	-	-	-	-	-	-	-	mg/kg	11	11	1	0	
Benzo (a) anthracene	-	-	-	-	-	-	-	mg/kg	11	11	1	0	
Benzo (a) pyrene	-	-	-	-	-	-	38.0	mg/kg	11	11	1	0	
Benzo (b) fluoranthene	-	-	-	-	-	-	-	mg/kg	11	11	1	0	
Benzo (ghi) perylene	-	-	-	-	-	-	-	mg/kg	11	11	0	0	
Benzo (k) fluoranthene	-	-	-	-	-	-	-	mg/kg	11	11	1	0	
Chrysene	-	-	-	-	-	-	-	mg/kg	11	11	1	0	
Dibenzo (ah) anthracene	-	-	-	-	-	-	-	mg/kg	11	11	1	0	
Fluoranthene	-	-	-	-	-	-	-	mg/kg	11	11	4	0	
Fluorene	-	-	-	-	-	-	-	mg/kg	11	11	1	0	
Indeno (1,2,3-cd) pyrene	-	-	-	-	-	-	-	mg/kg	11	11	1	0	
Naphthalene	-	-	-	-	-	-	193	mg/kg	11	11	0	0	
PAH (Total)	-	-	-	-	-	-	-	mg/kg	5	5	0	0	
PAH Total - Other	-	-	-	-	-	-	-	mg/kg	6	6	1	0	

Commercial, SOM=1%

Site Area(s) Selected: Zone 8 A,Zone 8 B
Phase(s): All phases, N/A

Notes: * For results below LOD, a value of half LOD is used in the calculation of the mean

PAHs

Analyte	Madeground			Natural Ground			Assessment Criteria (AC)	Units	No. of Locations	No. of Samples	No. of Samples > LOD	No. of Locations >AC	Locations Failing Screening
	Min	Mean*	Max	Min	Mean*	Max							
Phenanthrene	-	-	-	-	-	-	-	mg/kg	11	11	1	0	
Pyrene	-	-	-	-	-	-	-	mg/kg	11	11	5	0	

Commercial, SOM=1%

Site Area(s) Selected: Zone 8 A,Zone 8 B
Phase(s): All phases, N/A

Notes: * For results below LOD, a value of half LOD is used in the calculation of the mean

Pesticides, Herbicides and Insecticides

Analyte	Madeground			Natural Ground			Assessment Criteria (AC)	Units	No. of Locations	No. of Samples	No. of Samples > LOD	No. of Locations >AC	Locations Failing Screening
	Min	Mean*	Max	Min	Mean*	Max							
Aldrin	-	-	-	-	-	-	160	mg/kg	4	4	0	0	
Alpha Endosulfan	-	-	-	-	-	-	3,750	mg/kg	4	4	0	0	
Ametryn	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Atrazine	-	-	-	-	-	-	9,320	mg/kg	4	4	0	0	
Azinphos-methyl	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Beta-BHC	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Chlorpyrifos	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Coumaphos	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Demeton-S	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Diazinon	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Dichlorvos	-	-	-	-	-	-	150	mg/kg	4	4	0	0	
Dieldrin	-	-	-	-	-	-	160	mg/kg	4	4	0	0	
Disulfoton	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Endosulfan II	-	-	-	-	-	-	3,750	mg/kg	4	4	0	0	
Endosulfan sulphate	-	-	-	-	-	-	3,750	mg/kg	4	4	0	0	
Endosulfan Total (Summed)	-	-	-	-	-	-	3,750	mg/kg	4	4	4	0	

Commercial, SOM=1%

Site Area(s) Selected: Zone 8 A,Zone 8 B
Phase(s): All phases, N/A

Notes: * For results below LOD, a value of half LOD is used in the calculation of the mean

Pesticides, Herbicides and Insecticides

ANALYTE	MADEGROUND			NATURAL GROUND			ASSESSMENT CRITERIA (AC)	UNITS	NO. OF LOCATIONS	NO. OF SAMPLES	NO. OF SAMPLES > LOD	NO. OF LOCATIONS >AC	LOCATIONS FAILING SCREENING
	MIN	MEAN*	MAX	MIN	MEAN*	MAX							
Endrin	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Endrin aldehyde	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Fenchlorphos	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Fenthion	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Gamma-BCH	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Heptachlor	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Heptachlor epoxide	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Methoxychlor	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Methyl parathion	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Mevinphos	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
p,p-DDE	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
p,p-DDT	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Phorate	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Prometryn	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Propazine	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Simazine	-	-	-	-	-	-	-	mg/kg	4	4	0	0	

Commercial, SOM=1%

Site Area(s) Selected: Zone 8 A,Zone 8 B
Phase(s): All phases, N/A

Notes: * For results below LOD, a value of half LOD is used in the calculation of the mean

Pesticides, Herbicides and Insecticides

Analyte	Madeground			Natural Ground			Assessment Criteria (AC)	Units	No. of Locations	No. of Samples	No. of Samples > LOD	No. of Locations >AC	Locations Failing Screening
	Min	Mean*	Max	Min	Mean*	Max							
Simetryn	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Terbuthylazine	-	-	-	-	-	-	-	mg/kg	4	4	0	0	
Terbutryn	-	-	-	-	-	-	-	mg/kg	4	4	0	0	

THERE WERE NO EXCEEDANCES OF Commercial, SOM=1%

PRE-REPORT DATA CHECK

All SampleMatrix fields are complete

Region	Wales and England
Water Body	Groundwater
Water Body Type	NA
Surface Water Type	NA

Hardness	NA
Recieving surface water status	NA
Altitude	NA

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

Aliphatics and Aromatics

Aquifer: 0

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
Aliphatic C05-C06	ug/l	10.0	WHO 2008	15,000		<10	<10	<10
Aliphatic C06-C08	ug/l	10.0	WHO 2008	15,000		<10	<10	<10
Aliphatic C08-C10	ug/l	10.0	WHO 2008	300		<10	<10	<10
Aliphatic C10-C12	ug/l	10.0	WHO 2008	300		<10	<10	<10
Aliphatic C12-C16	ug/l	10.0	WHO 2008	300		<10	<10	<10
Aliphatic C16-C21	ug/l	10.0				178	27	34
Aliphatic C16-C35	ug/l	10.0				611	108	191
Aliphatic C21-C35	ug/l	10.0				433	81	157
Aliphatics C12-C35	ug/l	10.0				611	108	191
Aromatic C06-C07	ug/l	10.0				<10	<10	<10
Aromatic C07-C08	ug/l	10.0				<10	<10	<10
Aromatic C08-C10	ug/l	10.0	WHO 2008	300		<10	<10	<10
Aromatic C10-C12	ug/l	10.0	WHO 2008	90.0		<10	<10	<10
Aromatic C12-C16	ug/l	10.0	WHO 2008	90.0		17	<10	<10
Aromatic C12-C35	ug/l	10.0				152	<10	<10
Aromatic C16-C21	ug/l	10.0	WHO 2008	90.0		45	<10	<10
Aromatic C16-C35	ug/l	10.0				135	<10	<10
Aromatic C21-C35	ug/l	10.0	WHO 2008	90.0		90	<10	<10
Total Aliphatics and Aromatics (C5-C35)	ug/l	10.0				763	108	191

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

BTEX and Fuel Additives

Aquifer: 0

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
Benzene	ug/l	1.00	UK DWS	1.00		<1	<1	<1
Ethylbenzene	ug/l	1.00	WHO 2017	300		<1	<1	<1
Methyl t-butylether (MTBE)	ug/l	1.00	WHO 2017	15.0		<1	<1	<1
Tertiary Amyl Methyl Ether (TAME)	ug/l	1.00				<1	<1	<1
Toluene	ug/l	1.00	WHO 2017	700		<1	<1	<1
Xylene	ug/l	2.00	WHO 2017	500		<2	<2	<2
Xylene-m & p	ug/l	1.00				<1	<1	<1
Xylene-o	ug/l	1.00				<1	<1	<1

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

General Chemistry

Aquifer: 0

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
pH	pH Units	1.00	UK DWS	6.50 / 10.0		7.42	8.26	8.21

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

Inorganics — Aquifer: 0

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
Sulphate as SO4	ug/l	2,000 - 10,000	UK DWS	250,000		118000	303000	144000

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

Metals — Aquifer: 0

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
Arsenic	ug/l	0.50	UK DWS	10.0		1.18	2.48	1.96
Cadmium	ug/l	0.080	UK DWS	5.00		0.126	<0.08	<0.08
Chromium	ug/l	1.00	UK DWS	50.0		<1	5.3	4.17
Copper	ug/l	0.30	UK DWS	2,000		5.01	0.957	1.72
Hexavalent Chromium	ug/l	30.0				<30	<30	<30
Lead	ug/l	0.20	UK DWS	10.0		2.27	0.316	<0.2
Mercury	ug/l	0.010	UK DWS	1.00		<0.01	<0.01	<0.01
Nickel	ug/l	0.40	UK DWS	20.0		8.53	4.11	3.21
Selenium	ug/l	1.00	UK DWS	10.0		1.92	7.66	<1
Zinc	ug/l	1.00				32.7	3.53	5.29

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

PAHs

Aquifer: 0

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
Acenaphthene	ug/l	0.005				<0.005	<0.005	<0.005
Acenaphthylene	ug/l	0.005				<0.005	<0.005	<0.005
Anthracene	ug/l	0.005				<0.005	0.0119	<0.005
Benzo (a) anthracene	ug/l	0.005				0.214	0.131	0.012
Benzo (a) pyrene	ug/l	0.002	UK DWS	0.010		0.529	0.196	0.0324
Benzo (b) fluoranthene	ug/l	0.005				0.779	0.25	0.0543
Benzo (ghi) perylene	ug/l	0.005				<0.005	0.126	0.0181
Benzo (k) fluoranthene	ug/l	0.005				0.332	0.114	0.0227
Chrysene	ug/l	0.005				0.314	0.135	0.0236
Dibenzo (ah) anthracene	ug/l	0.005				<0.005	0.0232	<0.005
Fluoranthene	ug/l	0.005				0.598	0.255	0.049
Fluorene	ug/l	0.005				0.0403	0.00669	<0.005
Indeno (1,2,3-cd) pyrene	ug/l	0.005				0.283	0.112	<0.005
Naphthalene	ug/l	0.010				0.0399	<0.01	<0.01
PAH (Total)	ug/l	0.082				3.91	1.66	0.291
Phenanthrene	ug/l	0.005				0.214	0.0565	0.0245
Pyrene	ug/l	0.005				0.571	0.247	0.0541

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

TPH/EPH

Aquifer: 0

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
GRO Surrogate	%					106	99	90
PRO (C5-C12)	ug/l	50.0				<50	<50	<50

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

BTEX and Fuel Additives

Aquifer: N/A

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
Xylene - Total (Summed)	ug/l	-999				1	1	1

PRE-REPORT DATA CHECK

- All analyte codes are matched to the library
- All SampleMatrix fields are complete
- All result and screening units match

Region	Wales and England
Water Body	Groundwater
Water Body Type	NA
Surface Water Type	NA

Hardness	NA
Recieving surface water status	NA
Altitude	NA

Sample Matrix: WATER

Site Area(s) Selected: Zone 8 A, Zone 8 B
Event(s) Selected: All events, Nov-2019

Aliphatics and Aromatics — Aquifer: 0

Analyte	Min	Mean*	Max	Assessment Criteria (AC)	Assessment Criteria Source	Units	No. Locations Sampled	No. Samples > LOD	No. Locations > AC	Location(s) Failing Screening
Aliphatic C05-C06	10.00	5.00	10.00	15,000	WHO 2008	ug/l	3	-	0	
Aliphatic C06-C08	10.00	5.00	10.00	15,000	WHO 2008	ug/l	3	-	0	
Aliphatic C08-C10	10.00	5.00	10.00	300	WHO 2008	ug/l	3	-	0	
Aliphatic C10-C12	10.00	5.00	10.00	300	WHO 2008	ug/l	3	-	0	
Aliphatic C12-C16	10.00	5.00	10.00	300	WHO 2008	ug/l	3	-	0	
Aliphatic C16-C21	27.0	79.7	178.0	-		ug/l	3	3	0	
Aliphatic C16-C35	108	303	611	-		ug/l	3	3	0	
Aliphatic C21-C35	81	224	433	-		ug/l	3	3	0	
Aliphatics C12-C35	108	303	611	-		ug/l	3	3	0	
Aromatic C06-C07	10.00	5.00	10.00	-		ug/l	3	-	0	
Aromatic C07-C08	10.00	5.00	10.00	-		ug/l	3	-	0	
Aromatic C08-C10	10.00	5.00	10.00	300	WHO 2008	ug/l	3	-	0	
Aromatic C10-C12	10.00	5.00	10.00	90.0	WHO 2008	ug/l	3	-	0	
Aromatic C12-C16	10.00	9.00	17.00	90.0	WHO 2008	ug/l	3	1	0	
Aromatic C12-C35	10.0	54.0	152.0	-		ug/l	3	1	0	
Aromatic C16-C21	10.0	18.3	45.0	90.0	WHO 2008	ug/l	3	1	0	
Aromatic C16-C35	10.0	48.3	135.0	-		ug/l	3	1	0	
Aromatic C21-C35	10.0	33.3	90.0	90.0	WHO 2008	ug/l	3	1	0	

Sample Matrix: WATER

Site Area(s) Selected: Zone 8 A, Zone 8 B
Event(s) Selected: All events, Nov-2019

Aliphatics and Aromatics — Aquifer: 0

Analyte	Min	Mean*	Max	Assessment Criteria (AC)	Assessment Criteria Source	Units	No. Locations Sampled	No. Samples > LOD	No. Locations > AC	Location(s) Failing Screening
Total Aliphatics and Aromatics (C5-C35)	108	354	763	-		ug/l	3	3	0	

BTEX and Fuel Additives — Aquifer: 0

Analyte	Min	Mean*	Max	Assessment Criteria (AC)	Assessment Criteria Source	Units	No. Locations Sampled	No. Samples > LOD	No. Locations > AC	Location(s) Failing Screening
Benzene	1.00	0.50	1.00	1.00	UK DWS	ug/l	3	-	0	
Ethylbenzene	1.00	0.50	1.00	300	WHO 2017	ug/l	3	-	0	
Methyl t-butylether (MTBE)	1.00	0.50	1.00	15.0	WHO 2017	ug/l	3	-	0	
Tertiary Amyl Methyl Ether (TAME)	1.00	0.50	1.00	-		ug/l	3	-	0	
Toluene	1.00	0.50	1.00	700	WHO 2017	ug/l	3	-	0	
Xylene	2.00	1.00	2.00	500	WHO 2017	ug/l	3	-	0	
Xylene-m & p	1.00	0.50	1.00	-		ug/l	3	-	0	
Xylene-o	1.00	0.50	1.00	-		ug/l	3	-	0	

Sample Matrix: WATER

Site Area(s) Selected: Zone 8 A, Zone 8 B
Event(s) Selected: All events, Nov-2019

General Chemistry — Aquifer: 0

Analyte	Min	Mean*	Max	Assessment Criteria (AC)	Assessment Criteria Source	Units	No. Locations Sampled	No. Samples > LOD	No. Locations > AC	Location(s) Failing Screening
pH	7.42	7.96	8.26	6.50/10.0	UK DWS	pH Units	3	3	0	

Inorganics — Aquifer: 0

Analyte	Min	Mean*	Max	Assessment Criteria (AC)	Assessment Criteria Source	Units	No. Locations Sampled	No. Samples > LOD	No. Locations > AC	Location(s) Failing Screening
Sulphate as SO4	118000	188333	303000	250,000	UK DWS	ug/l	3	3	1	BH8A06

Sample Matrix: WATER

Site Area(s) Selected: Zone 8 A, Zone 8 B
Event(s) Selected: All events, Nov-2019

Metals — Aquifer: 0

Analyte	Min	Mean*	Max	Assessment Criteria (AC)	Assessment Criteria Source	Units	No. Locations Sampled	No. Samples > LOD	No. Locations > AC	Location(s) Failing Screening
Arsenic	1.18	1.87	2.48	10.0	UK DWS	ug/l	3	3	0	
Cadmium	0.080	0.069	0.126	5.00	UK DWS	ug/l	3	1	0	
Chromium	1.00	3.32	5.30	50.0	UK DWS	ug/l	3	2	0	
Copper	0.96	2.56	5.01	2,000	UK DWS	ug/l	3	3	0	
Hexavalent Chromium	30.0	15.0	30.0	-		ug/l	3	-	0	
Lead	0.20	0.90	2.27	10.0	UK DWS	ug/l	3	2	0	
Mercury	0.010	0.005	0.010	1.00	UK DWS	ug/l	3	-	0	
Nickel	3.21	5.28	8.53	20.0	UK DWS	ug/l	3	3	0	
Selenium	1.00	3.36	7.66	10.0	UK DWS	ug/l	3	2	0	
Zinc	3.5	13.8	32.7	-		ug/l	3	3	0	

Sample Matrix: WATER

Site Area(s) Selected: Zone 8 A, Zone 8 B
Event(s) Selected: All events, Nov-2019

PAHs — Aquifer: 0

Analyte	Min	Mean*	Max	Assessment Criteria (AC)	Assessment Criteria Source	Units	No. Locations Sampled	No. Samples > LOD	No. Locations > AC	Location(s) Failing Screening
Acenaphthene	0.005	0.003	0.005	-		ug/l	3	-	0	
Acenaphthylene	0.005	0.003	0.005	-		ug/l	3	-	0	
Anthracene	0.005	0.006	0.012	-		ug/l	3	1	0	
Benzo (a) anthracene	0.01	0.12	0.21	-		ug/l	3	3	0	
Benzo (a) pyrene	0.03	0.25	0.53	0.010	UK DWS	ug/l	3	3	3	BH8A03, BH8A06, BH8B01
Benzo (b) fluoranthene	0.05	0.36	0.78	-		ug/l	3	3	0	
Benzo (ghi) perylene	0.005	0.049	0.126	-		ug/l	3	2	0	
Benzo (k) fluoranthene	0.02	0.16	0.33	-		ug/l	3	3	0	
Chrysene	0.02	0.16	0.31	-		ug/l	3	3	0	
Dibenzo (ah) anthracene	0.005	0.009	0.023	-		ug/l	3	1	0	
Fluoranthene	0.05	0.30	0.60	-		ug/l	3	3	0	
Fluorene	0.005	0.016	0.040	-		ug/l	3	2	0	
Indeno (1,2,3-cd) pyrene	0.01	0.13	0.28	-		ug/l	3	2	0	
Naphthalene	0.010	0.017	0.040	-		ug/l	3	1	0	
PAH (Total)	0.29	1.95	3.91	-		ug/l	3	3	0	
Phenanthrene	0.025	0.098	0.214	-		ug/l	3	3	0	
Pyrene	0.05	0.29	0.57	-		ug/l	3	3	0	

Sample Matrix: WATER

Site Area(s) Selected: Zone 8 A, Zone 8 B
Event(s) Selected: All events, Nov-2019

TPH/EPH — Aquifer: 0

Analyte	Min	Mean*	Max	Assessment Criteria (AC)	Assessment Criteria Source	Units	No. Locations Sampled	No. Samples > LOD	No. Locations > AC	Location(s) Failing Screening
GRO Surrogate	90.0	98.3	106.0	-		%	3	3	0	
PRO (C5-C12)	50.0	25.0	50.0	-		ug/l	3	-	0	

Sample Matrix: WATER

Site Area(s) Selected: Zone 8 A, Zone 8 B
Event(s) Selected: All events, Nov-2019

BTEX and Fuel Additives — Aquifer: N/A

Analyte	Min	Mean*	Max	Assessment Criteria (AC)	Assessment Criteria Source	Units	No. Locations Sampled	No. Samples > LOD	No. Locations > AC	Location(s) Failing Screening
Xylene - Total (Summed)	1.00	1.00	1.00	-		ug/l	3	3	0	

EXCEEDANCES OF THRESHOLDS

Sample matrix: WATER

Inorganics

Analyte	Point ID	Response Zone Depth (m bgl)	Result	Criteria Source	Threshold	Units	Stratum
Sulphate as SO4	BH8A06	1.00 - 8.00	303000	UK DWS	250000	ug/l	

PAHs

Analyte	Point ID	Response Zone Depth (m bgl)	Result	Criteria Source	Threshold	Units	Stratum
Benzo (a) pyrene	BH8A03	12.00 - 20.00	0.53	UK DWS	0.010	ug/l	
	BH8A06	1.00 - 8.00	0.20	UK DWS	0.010	ug/l	
	BH8B01	1.00 - 5.00	0.032	UK DWS	0.010	ug/l	

PRE-REPORT DATA CHECK

All SampleMatrix fields are complete

Region	Wales and England
Water Body	Surface water
Water Body Type	Inland
Surface Water Type	River or Stream

Hardness	0-50 mg/l
Recieving surface water status	Good (or below)
Altitude	< 80m Elevation

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

Aliphatics and Aromatics

Aquifer: 0

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
Aliphatic C05-C06	ug/l	10.0				<10	<10	<10
Aliphatic C06-C08	ug/l	10.0				<10	<10	<10
Aliphatic C08-C10	ug/l	10.0				<10	<10	<10
Aliphatic C10-C12	ug/l	10.0				<10	<10	<10
Aliphatic C12-C16	ug/l	10.0				<10	<10	<10
Aliphatic C16-C21	ug/l	10.0				178	27	34
Aliphatic C16-C35	ug/l	10.0				611	108	191
Aliphatic C21-C35	ug/l	10.0				433	81	157
Aliphatics C12-C35	ug/l	10.0				611	108	191
Aromatic C06-C07	ug/l	10.0	CL:AIRE 2017	10.0		<10	<10	<10
Aromatic C07-C08	ug/l	10.0	CL:AIRE 2017	74.0		<10	<10	<10
Aromatic C08-C10	ug/l	10.0	CL:AIRE 2017	20.0		<10	<10	<10
Aromatic C10-C12	ug/l	10.0	CL:AIRE 2017	2.00		<10	<10	<10
Aromatic C12-C16	ug/l	10.0	CL:AIRE 2017	2.00		17	<10	<10
Aromatic C12-C35	ug/l	10.0				152	<10	<10
Aromatic C16-C21	ug/l	10.0	CL:AIRE 2017	0.10		45	<10	<10
Aromatic C16-C35	ug/l	10.0				135	<10	<10
Aromatic C21-C35	ug/l	10.0	CL:AIRE 2017	0.0002		90	<10	<10
Total Aliphatics and Aromatics (C5-C35)	ug/l	10.0				763	108	191

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

BTEX and Fuel Additives

Aquifer: 0

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
Benzene	ug/l	1.00	EQS 2015	10.0		<1	<1	<1
Ethylbenzene	ug/l	1.00	Proposed EQS	20.0		<1	<1	<1
Methyl t-butylether (MTBE)	ug/l	1.00				<1	<1	<1
Tertiary Amyl Methyl Ether (TAME)	ug/l	1.00				<1	<1	<1
Toluene	ug/l	1.00	EQS 2015	74.0		<1	<1	<1
Xylene	ug/l	2.00	CL:AIRE 2017	30.0		<2	<2	<2
Xylene-m & p	ug/l	1.00				<1	<1	<1
Xylene-o	ug/l	1.00				<1	<1	<1

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

General Chemistry

Aquifer: 0

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
pH	pH Units	1.00	EQS 2015	6.00 / 9.00		7.42	8.26	8.21

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

Metals

Aquifer: 0

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
Arsenic	ug/l	0.50	EQS 2015	50.0		1.18	2.48	1.96
Cadmium	ug/l	0.080	EQS 2015	0.080		0.126	<0.08	<0.08
Chromium	ug/l	1.00	EQS 2015	4.70		<1	5.3	4.17
Copper	ug/l	0.30	EQS 2015 - Bioavailable	1.00		5.01	0.957	1.72
Hexavalent Chromium	ug/l	30.0	EQS 2015	3.40		<30	<30	<30
Lead	ug/l	0.20	EQS 2015 - Bioavailable	1.20		2.27	0.316	<0.2
Mercury	ug/l	0.010	EQS 2015 MAC	0.070		<0.01	<0.01	<0.01
Nickel	ug/l	0.40	EQS 2015 - Bioavailable	4.00		8.53	4.11	3.21
Selenium	ug/l	1.00				1.92	7.66	<1
Zinc	ug/l	1.00	EQS 2015 - Bioavailable	10.9		32.7	3.53	5.29

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

PAHs

Aquifer: 0

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
Acenaphthene	ug/l	0.005				<0.005	<0.005	<0.005
Acenaphthylene	ug/l	0.005				<0.005	<0.005	<0.005
Anthracene	ug/l	0.005	EQS 2015	0.10		<0.005	0.0119	<0.005
Benzo (a) anthracene	ug/l	0.005				0.214	0.131	0.012
Benzo (a) pyrene	ug/l	0.002	EQS 2015	0.0002		0.529	0.196	0.0324
Benzo (b) fluoranthene	ug/l	0.005				0.779	0.25	0.0543
Benzo (ghi) perylene	ug/l	0.005				<0.005	0.126	0.0181
Benzo (k) fluoranthene	ug/l	0.005				0.332	0.114	0.0227
Chrysene	ug/l	0.005				0.314	0.135	0.0236
Dibenzo (ah) anthracene	ug/l	0.005				<0.005	0.0232	<0.005
Fluoranthene	ug/l	0.005	EQS 2015	0.006		0.598	0.255	0.049
Fluorene	ug/l	0.005				0.0403	0.00669	<0.005
Indeno (1,2,3-cd) pyrene	ug/l	0.005				0.283	0.112	<0.005
Naphthalene	ug/l	0.010	EQS 2015	2.00		0.0399	<0.01	<0.01
PAH (Total)	ug/l	0.082				3.91	1.66	0.291
Phenanthrene	ug/l	0.005				0.214	0.0565	0.0245
Pyrene	ug/l	0.005				0.571	0.247	0.0541

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

TPH/EPH

Aquifer: 0

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
GRO Surrogate	%					106	99	90
PRO (C5-C12)	ug/l	50.0				<50	<50	<50

WATER

Site Area(s) selected: Zone 8 A, Zone 8 B
Event selected: All events, Nov-2019

BTEX and Fuel Additives

Aquifer: N/A

Result > Assessment Criteria

Limit of detection > Assessment Criteria

Analyte	Units	LOD	Reference	GAC	PointID	BH8A03	BH8A06	BH8B01
					Response Zone Depth (m bgl)	12 - 20	1 - 8	1 - 5
					Sample Date	07/11/19	05/11/19	05/11/19
Xylene - Total (Summed)	ug/l	-999				1	1	1

Appendix I

LIMITATIONS

REPORT LIMITATIONS - GROUND RISK AND REMEDIATION

GENERAL

1. WSP UK Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed and outlined in the body of the report.

2. Unless explicitly agreed otherwise, in writing, this report has been prepared under WSP UK Limited standard Terms and Conditions as included within our proposal to the Client.

3. Project specific appointment documents may be agreed at our discretion and a charge may be levied for both the time to review and finalise appointments documents and also for associated changes to the appointment terms. WSP UK Limited reserves the right to amend the fee should any changes to the appointment terms create an increase risk to WSP UK Limited.

4. The report needs to be considered in the light of the WSP UK Limited proposal and associated limitations of scope. The report needs to be read in full and isolated sections cannot be used without full reference to other elements of the report and any previous works referenced within the report.

PHASE 1 GEO ENVIRONMENTAL AND PRELIMINARY RISK ASSESSMENTS

Coverage: *This section covers reports with the following titles or combination of titles: phase 1; desk top study; geo environmental assessment; development appraisal; preliminary environmental risk assessment; constraints report; due diligence report; geotechnical development review; environmental statement; environmental chapter; project scope summary report (PSSR), program environmental impact report (PEIR), geotechnical development risk register; and, baseline environmental assessment.*

5. The works undertaken to prepare this report comprised a study of available and easily documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the Site and correspondence with relevant authorities and other interested parties. Due to the short timescales associated with these projects responses may not have been received from all parties. WSP UK Limited cannot be held responsible for any disclosures that are provided post production of our report and will not automatically update our report.

6. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only for the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, WSP UK Limited reserves the right to review such information and, if warranted, to modify the opinions accordingly.

7. It should be noted that any risks identified in this report are perceived risks based on the information reviewed. Actual risks can only be assessed following intrusive investigations of the site.

8. WSP UK Limited does not warrant work / data undertaken / provided by others.

REPORT LIMITATIONS - GROUND RISK AND REMEDIATION

INTRUSIVE INVESTIGATION REPORTS

Coverage: *The following report titles (or combination) may cover this category of work: geo environmental site investigation; geotechnical assessment; GIR (Ground Investigation reports); preliminary environmental and geotechnical risk assessment; and, geotechnical risk register.*

9. The investigation has been undertaken to provide information concerning either:

    i. The type and degree of contamination present at the site in order to allow a generic quantitative risk assessment to be undertaken; or

    ii. Information on the soil properties present at the site to allow for geotechnical development constraints to be considered.

10. The scope of the investigation was selected on the basis of the specific development and land use scenario proposed by the Client and may be inappropriate to another form of development or scheme. If the development layout was not known at the time of the investigation the report findings may need revisiting once the development layout is confirmed.

11. For contamination purposes, the objectives of the investigation are limited to establishing the risks associated with potential contamination sources with the potential to cause harm to human health, building materials, the environment (including adjacent land), or controlled waters.

12. For geotechnical investigations the purpose is to broadly consider potential development constraints associated with the physical property of the soils underlying the site within the context of the proposed future or continued use of the site, as stated within the report.

13. The amount of exploratory work, soil property testing and chemical testing undertaken has necessarily been restricted by various factors which may include accessibility, the presence of services; existing buildings; current site usage or short timescales. The exploratory holes completed assess only a small percentage of the area in relation to the overall size of the Site, and as such can only provide a general indication of conditions.

14. The number of sampling points and the methods of sampling and testing do not preclude the possible existence of contamination where concentrations may be significantly higher than those actually encountered or ground conditions that vary from those identified. In addition, there may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.

15. The inspection, testing and monitoring records relate specifically to the investigation points and the timeframe that the works were undertaken. They will also be limited by the techniques employed. As part of this assessment, WSP UK Limited has used reasonable skill and care to extrapolate conditions between these points based upon assumptions to develop our interpretation and conclusions. The assumption made in forming our conclusions is that the ground and groundwater conditions (both chemically and physically) are the same as have been encountered during the works undertaken at the specific points of investigation. Conditions can change between investigation points and these interpretations should be considered indicative.

16. The risk assessment and opinions provided are based on currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values. Specific assumptions associated

with the WSP UK Limited risk assessment process have been outlined within the body or associated appendix of the report.

17. Additional investigations may be required in order to satisfy relevant planning conditions or to resolve any engineering and environmental issues.

18. Where soil contamination concentrations recorded as part of this investigation are used for commentary on potential waste classification of soils for disposal purposes, these should be classed as indicative only. Due consideration should be given to the variability of contaminant concentrations taken from targeted samples versus bulk excavated soils and the potential variability of contaminant concentrations between sampling locations. Where major waste disposal operations are considered, targeted waste classification investigations should be designed.

19. The results of the asbestos testing are factually reported and interpretation given as to how this relates to the previous use of the site, the types of ground encountered and site conceptualisation. This does not however constitute a formal asbestos assessment. These results should be treated cautiously and should not be relied upon to provide detailed and representative information on the delineation, type and extent of bulk ACMs and / or trace loose asbestos fibres within the soil matrix at the site.

20. If costs have been included in relation to additional site works, and / or site remediation works these must be considered as indicative only and must be confirmed by a qualified quantity surveyor.

EUROCODE 7: GEOTECHNICAL DESIGN

21. On 1st April 2010, BS EN 1997-1:2004 (Eurocode 7: Geotechnical Design – Part 1) became the mandatory baseline standard for geotechnical ground investigations.

22. In terms of geotechnical design for foundations, slopes, retaining walls and earthworks, EC7 sets guidance on design procedures including specific guidance on the numbers and spacings of boreholes for geotechnical design, there are limits to methods of ground investigation and the quality of data obtained and there are also prescriptive methods of assessing soil strengths and methods of design. Unless otherwise explicitly stated, the work has not been undertaken in accordance with EC7. A standard geotechnical interpretative report will not meet the requirements of the Geotechnical Design Report (GDR) under Eurocode 7. The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. The report is likely to represent a Ground Investigation Report (GIR) under the Eurocode 7 guidance.

DETAILED QUANTITATIVE RISK ASSESSMENTS AND REMEDIAL STRATEGY REPORTS

23. These reports build upon previous report versions and associated notes. The scope of the investigation, further testing and monitoring and associated risk assessments were selected on the basis of the specific development and land use scenario proposed by the Client and may not be appropriate to another form of development or scheme layout. The risk assessment and opinions provided are based on currently available approaches in the generation of Site Specific Assessment Criteria relating to contamination concentrations and are not considered to represent a risk in a specific land use scenario to a specific receptor. No liability can be accepted for the retrospective effects of any future changes or amendments to these values, associated models or associated guidance.