Envirolab Job Number: 11/00569

Client Project Name: Salisbury Square, Hatfield

Client Project Ref: 241882

Lab Sample ID	11/00569/17	11/00569/18	11/00569/19	11/00569/20	11/00569/23	11/00569/25			Units	Method ref
Client Sample No										
Client Sample ID	WS4	WS4	TP1	TP1	TP2	TP3				
Depth to Top	0.20	0.50	0.10	0.40	0.50	0.10				
Depth To Bottom	0.30	0.60								
Date Sampled	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	7	7	4AE		4AE	4AE				
Spec PCB-WHO12										
PCB BZ 81_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 105_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 114_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ $118/123_D$	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 126_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 156_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 157_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 167_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 169_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 189_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 77_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s

APPENDIX K
LABORATORY CERTIFICATES FOR GEOTECHNICAL ANALYSIS

UKAS TESTING
No 2652

Ben Coulston
RSK STATS Geoconsult LIMITED
18 Frogmore Road
Hemel Hempstead
Herts
HP3 9RT

STRUCTURAL SOILS LTD

SITE INVESTIGATION

SOIL, ROCK & MATERIAL TESTING

GEOTECHNICAL CONSULTANCY

CONTAMINATED LAND ASSESSMENT

22nd February 2011

TESTING REPORT

YOUR REF: 241882

SITE: Salisbury Square, Hatfield

CERTIFICATE NUMBER: 581511

DATE SAMPLES RECEIVED: 9th February 2011
DATE TESTING COMMENCED: 9th February 2011

DATE OF SAMPLE DISPOSAL: 22nd March 2011

INSTRUCTIONS: Please carry out Moisture Content, Atterberg Limits, Quick Undrained Triaxial and Particle Size Distribution tests on samples provided.

I have pleasure in enclosing the test report for the above project that you submitted to us for testing.

Yours sincerely

[redacted]

Enc.

18 FROGMORE ROAD
HEMEL HEMPSTEAD
HERTS
HP3 9RT
TEL: 01442 416660
FAX: 01442 437550
hemel@soils.co.uk
www.soils.co.uk

HEAD OFFICE:
Bristol

BRANCH OFFICE:
Castleford
West Yorkshire

SUMMARY OF MOISTURE CONTENT TESTING

Exploratory Position ID	Depth (m)	Sample Ref	Sample Type	Moisture Content (%)
BH1	**6.90**		**D**	**22**
BH1	**9.00**		**B**	**17**
BH2	**3.00**		**D**	**22**
BH2	**5.60**		**D**	**22**
BH2	**5.70**		**U**	**19**
BH2	**8.50**		**U**	**15**

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date	Checked By	Date
[redacted]	22/02/11	[redacted]	22.2.11

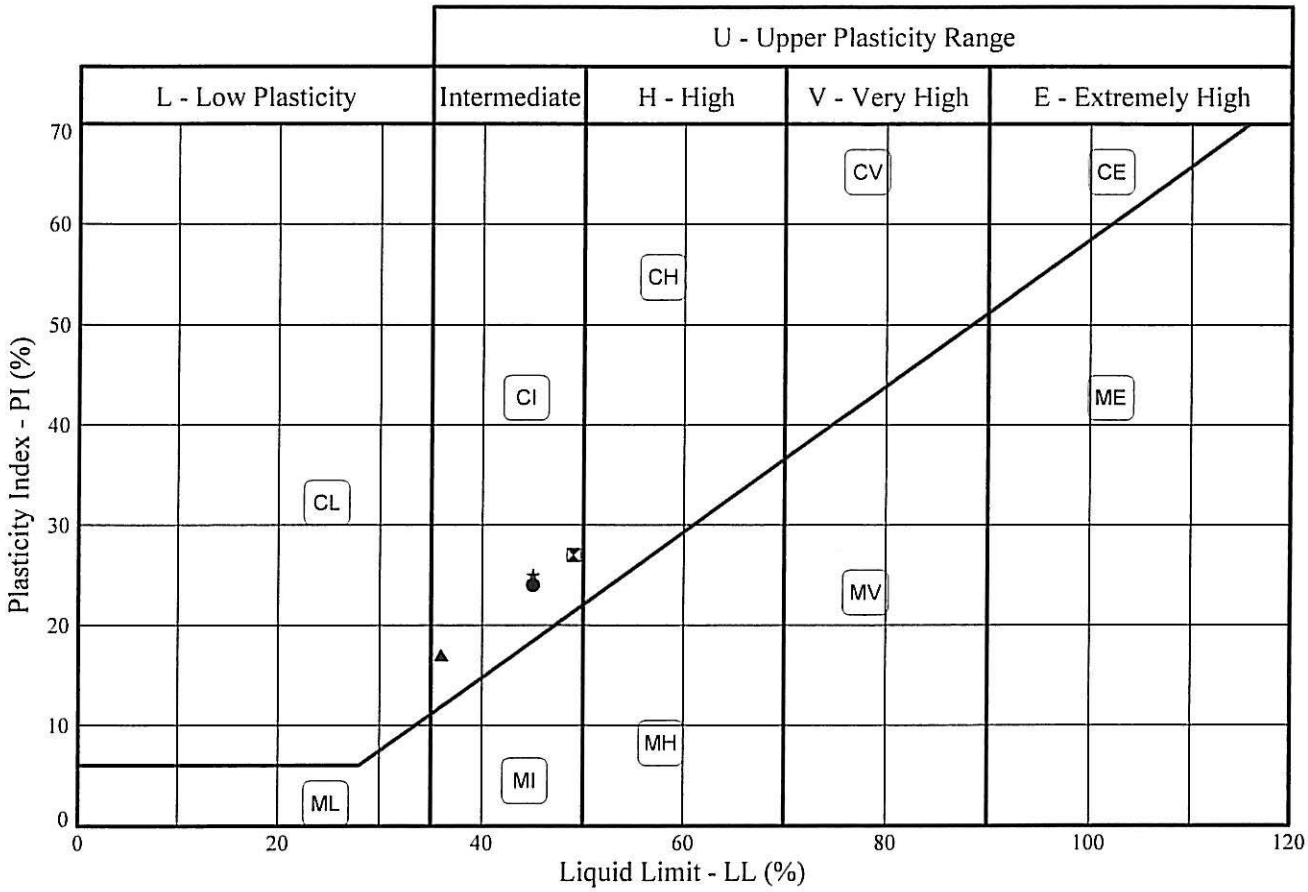
Contract: **Salisbury Square, Hatfield**

Contract Ref: **581511**

AGS

PLASTICITY CHART - PI Vs LL

In accordance with clause 42.3 of BS5930:1981
Testing in accordance with BS1377-2:1990



Sample Identification				BS Test Method #	Preparation Method +	MC %	LL %	PL %	PI %	<425um %
	Exploratory Position ID	Sample	Depth (m)							
●	BH1	D	6.90	3.2/4.4/5.3/5.4	4.2.4	22	45	21	24	90
⊠	BH1	B	9.00	3.2/4.4/5.3/5.4	4.2.4	17	49	22	27	84
▲	BH2	D	3.00	3.2/4.4/5.3/5.4	4.2.4	22	36	19	17	67
★	BH2	D	5.60	3.2/4.4/5.3/5.4	4.2.4	22	45	20	25	89

Tested in accordance with the following clauses of BS1377-2:1990.

3.2 - Moisture Content
4.3 - Cone Penetrometer Method
4.4 - One Point Cone Penetrometer Method
4.6 - One Point Casagrande Method
5.3 - Plastic Limit Method
5.4 - Plasticity Index

+ Tested in accordance with the following clauses of BS1377-2:1990.

4.2.3 - Natural State
4.2.4 - Wet Sieved

Key: * = Non standard test, NP = Non plastic.

Approved Signatories: P. KENT S. CAIRNS

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Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By: [redacted]

Date: 22/02/11

Contract: **Salisbury Square, Hatfield**

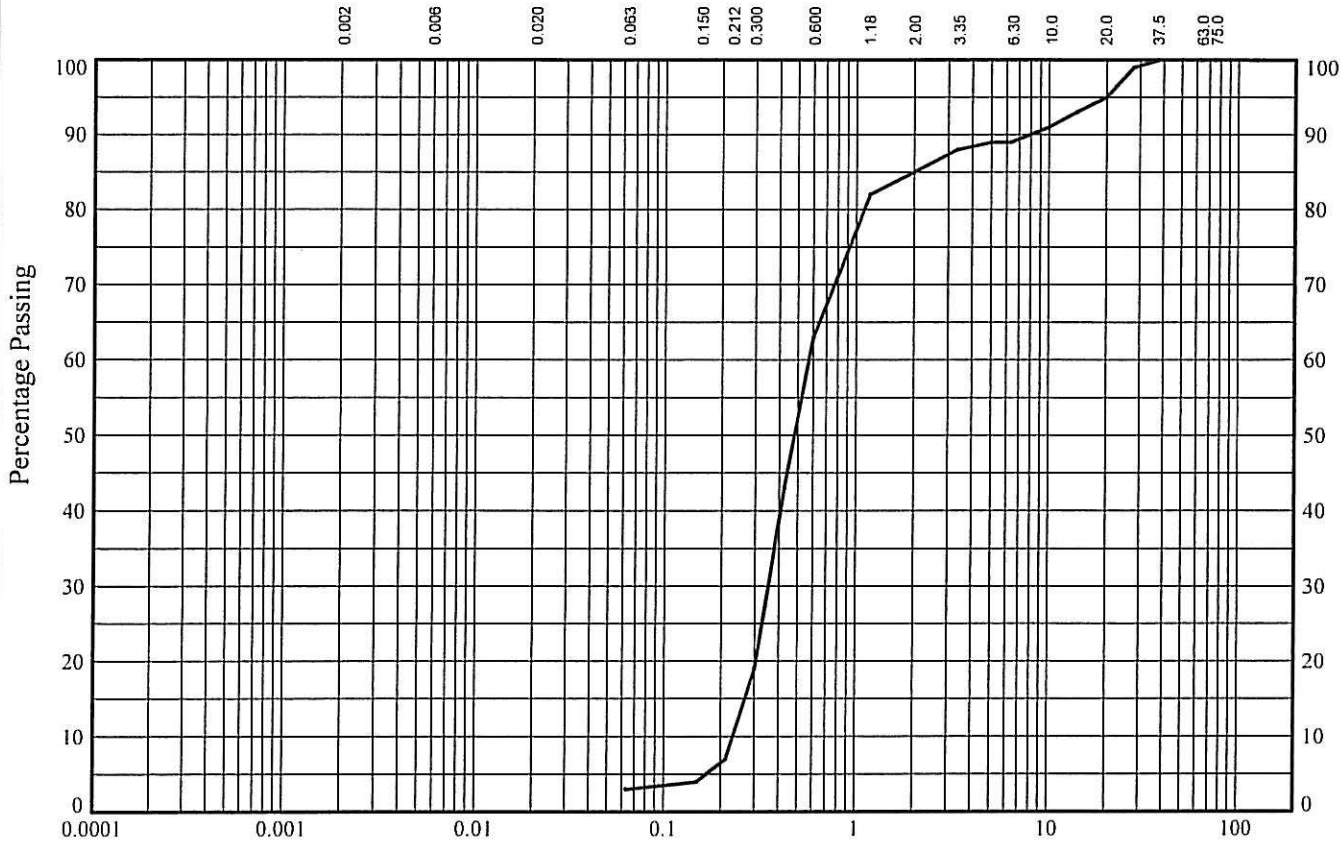
Contract Ref: **581511**

AGS

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2,9.5 of BS1377:Part 2:1990

Borehole : **BH1** Sample Ref: Sample Type: **D** Depth (m): **3.50**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve (mm)	Percentage Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	99
20	95
14	93
10	91
6.3	89
5	89
3.35	88
2	85
1.18	82
0.6	63
0.425	43
0.3	19
0.212	7
0.15	4
0.063	3

Particle Diameter	Percentage Passing

Soil Fraction	Sieve Percentage
GRAVEL	**15**
SAND	**82**
SILT/CLAY	**3**

Soil Description:

Approved Signatories: P. KENT S. CAIRNS

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18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By [redacted] [redacted] Date 22/02/11

Contract **Salisbury Square, Hatfield**

Contract Ref: **581511**

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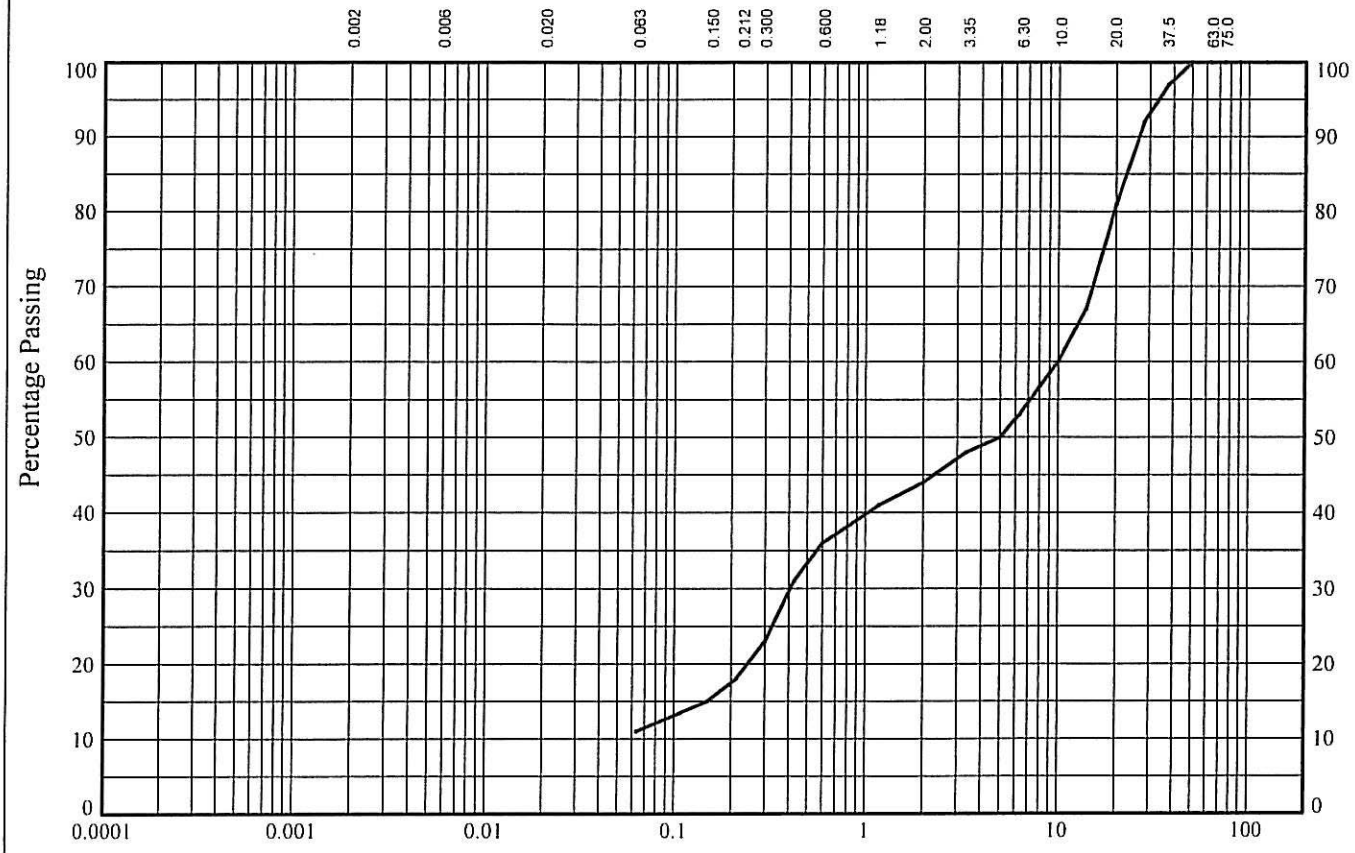
AGS

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2,9.5 of BS1377:Part 2:1990

Borehole : **BH2** Sample Ref: Sample Type: **B** Depth (m): **13.50**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve (mm)	Percentage Passing
125	100
90	100
75	100
63	100
50	100
37.5	97
28	92
20	81
14	67
10	60
6.3	53
5	50
3.35	48
2	44
1.18	41
0.6	36
0.425	31
0.3	23
0.212	18
0.15	15
0.063	11

Particle Diameter	Percentage Passing

Soil Fraction	Sieve Percentage
GRAVEL	**56**
SAND	**33**
SILT/CLAY	**11**

Soil Description:

Approved Signatories: P. KENT S. CAIRNS

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By [redacted] [redacted] Date 22/02/11

Contract **Salisbury Square, Hatfield**

Contract Ref: **581511**

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AGS

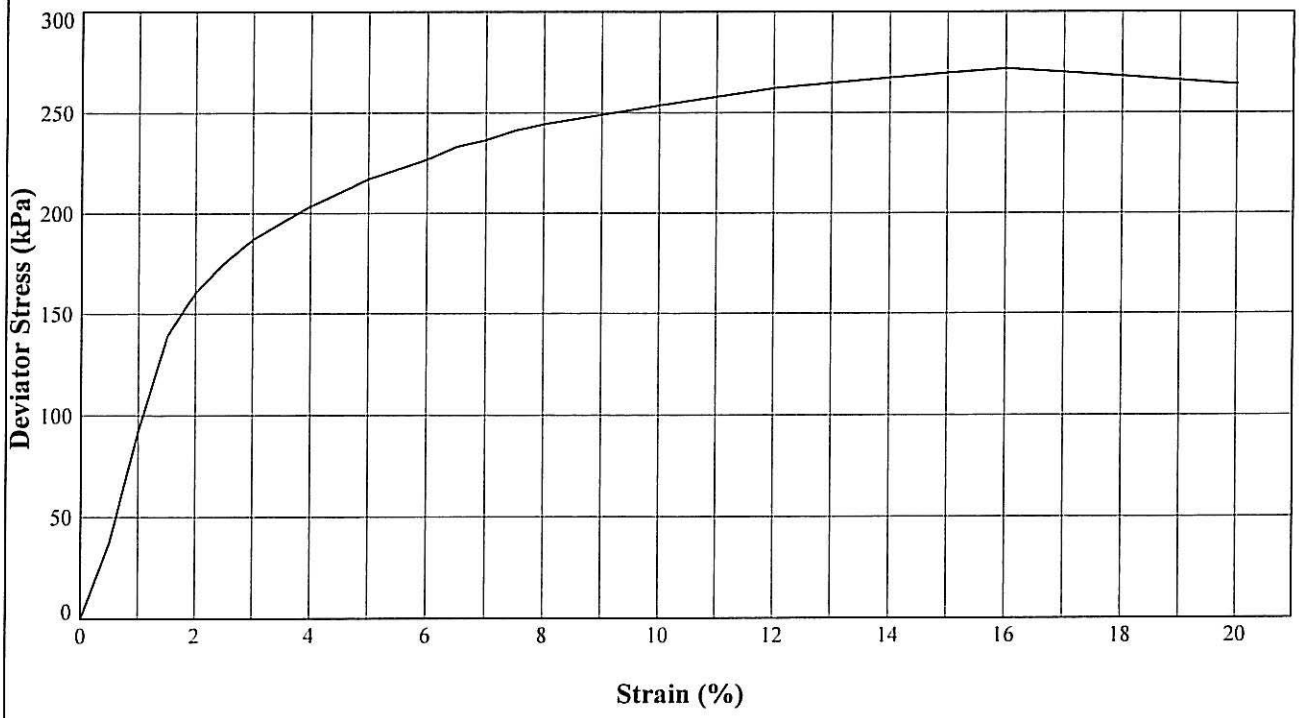
UNCONSOLIDATED QUICK UNDRAINED (SINGLE STAGE) TRIAXIAL COMPRESSION TEST

In accordance with BS1377:Part 7:1990, Clause 8

Borehole : **BH2** Sample Ref: Sample Type: **U** Depth (m): **5.70**

Description : **Very dark grey CLAY with occasional fine to medium chalk fragments**

STAGE NUMBER			1	2	3
SAMPLE DETAILS	Sample Condition		Undisturbed		
	Orientation of sample		Vertical		
	Diameter	(mm)	101.66		
	Height	(mm)	209.80		
	Moisture Content	(%)	19		
	Bulk Density	(Mg/m^3)	2.01		
	Dry Density	(Mg/m^3)	1.69		
TEST DETAILS	Membrane Thickness	(mm)	0.24		
	Rate of Axial Displacement	(%/min)	2.00		
	Cell Pressure	(kPa)	114		
	Membrane Correction	(kPa)	0.76		
	Corrected Deviator Stress	(kPa)	272		
	Undrained Shear Strength	(kPa)	136		
	Strain at Failure	(%)	16.0		
	Mode of Failure		Compound		



Approved Signatories: P. KENT S. CAIRNS

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18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By [redacted] [redacted]

Date 22/02/11

Contract **Salisbury Square, Hatfield**

Contract Ref. **581511**

Page 6 of 7

AGS

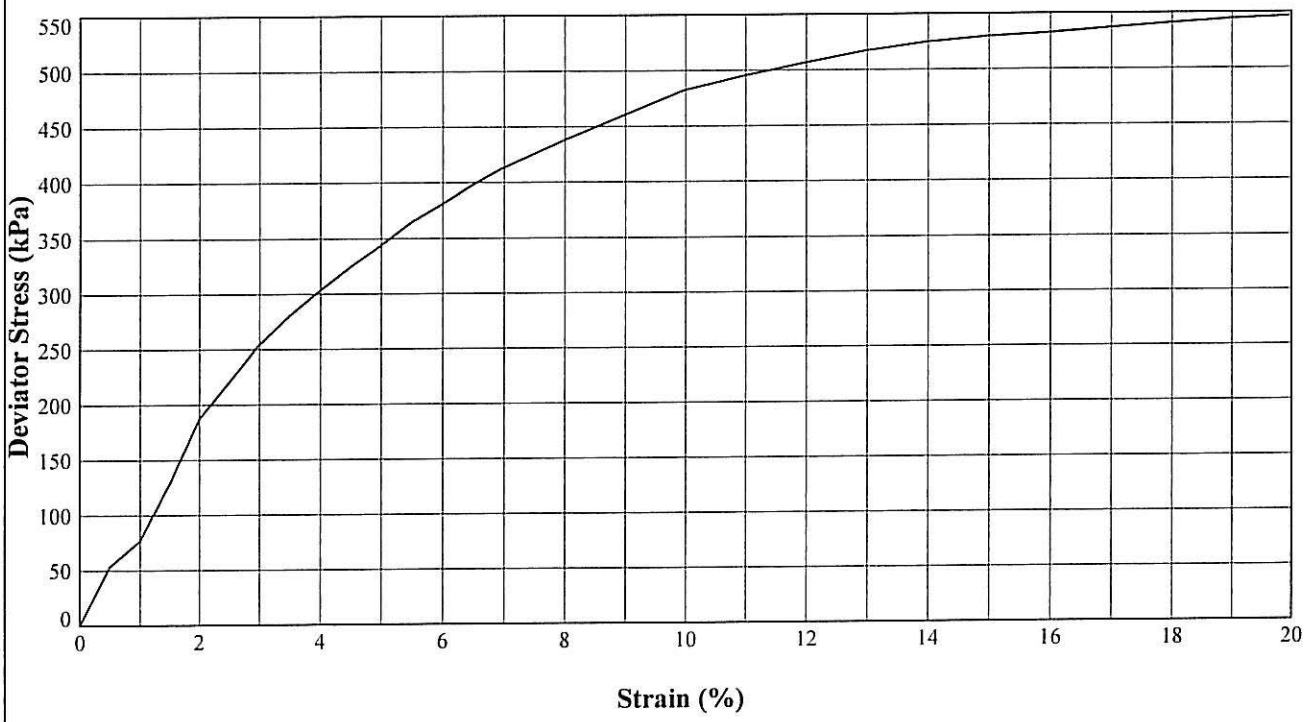
UNCONSOLIDATED QUICK UNDRAINED (SINGLE STAGE) TRIAXIAL COMPRESSION TEST

In accordance with BS1377:Part 7:1990, Clause 8

Borehole : **BH2** Sample Ref: Sample Type: **U** Depth (m): **8.50**

Description : **Very dark grey CLAY with occasional fine to medium chalk fragments**

STAGE NUMBER			1	2	3
SAMPLE DETAILS	Sample Condition		Undisturbed		
	Orientation of sample		Vertical		
	Diameter	(mm)	103.13		
	Height	(mm)	210.55		
	Moisture Content	(%)	16		
	Bulk Density	(Mg/m^3)	2.20		
	Dry Density	(Mg/m^3)	1.91		
TEST DETAILS	Membrane Thickness	(mm)	0.24		
	Rate of Axial Displacement	(%/min)	2.00		
	Cell Pressure	(kPa)	170		
	Membrane Correction	(kPa)	0.89		
	Corrected Deviator Stress	(kPa)	547		
	Undrained Shear Strength	(kPa)	273		
	Strain at Failure	(%)	20.0		
	Mode of Failure		Compound		



Approved Signatories: P. KENT S. CAIRNS

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By [redacted] Date 22/02/11

Contract **Salisbury Square, Hatfield**

Co [redacted] 581511

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AGS

APPENDIX D

Chemical Laboratory Test Records

Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 11/00569
Issue Number: 2 **Date:** 22 March, 2011

Client: RSK STATS Hemel Hempstead
18 Frogmore Road
Hemel Hempstead
Hertfordshire
UK
HP3 9RT

Project Manager: [redacted]
Project Name: Salisbury Square, Hatfield
Project Ref: 241882
Order No: Not specified
Date Samples Received: 10/02/11
Date Instructions Received: 17/03/11
Date Analysis Completed: 22/03/11

Prepared by: [redacted]

Approved by: [redacted]

Notes - Soil analysis
All results are reported as dry weight (<40℃).
Stones >10mm are removed from the sample prior to analysis and results corrected where appropriate.

Notes - General
For soil samples subscript A indicates analysis performed on the sample as received, D indicates analysis performed on dried & crushed sample.
Superscript M indicates method accredited to MCERTS.

Predominant Matrix Codes - 1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER.
Samples with Matrix Code 7 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our MCERTS accreditation.
Secondary Matrix Codes - A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.
IS indicates Insufficient sample for analysis. NDP indicates No Determination Possible. NFI indicates No Fibres Identified.
Superscript # indicates method accredited to ISO 17025.
Accreditation for TPH (C6-C40) applies to the range C6-C36 only.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.

Envirolab Job Number: 11/00569

Client Project Name: Salisbury Square, Hatfield

Client Project Ref: 241882

Lab Sample ID	11/00569/1	11/00569/2	11/00569/3	11/00569/4	11/00569/5	11/00569/6	11/00569/7	11/00569/8	Units	Method ref
Client Sample No										
Client Sample ID	BH1	BH1	BH1	BH1	BH2	BH2	BH2	BH2		
Depth to Top	0.20	0.70	1.50	2.30	0.25	0.50	0.90	1.40		
Depth To Bottom			1.70	2.50						
Date Sampled	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	7	5A	5A	1A	7	5A	7	5A		
ACM Screen$_A$	-	NFI	NFI	-	NFI	NFI	-	-		Visual
pH$_D^{M\#}$	8.1	8.8	9.4	9.0	9.0	8.6	11.6	9.0	pH	A-T-031s
Sulphate (water sol 2:1)$_D^{M\#}$	0.02	0.05	-	0.02	-	0.03	-	-	g/l	A-T-026s
Phenols - Total by HPLC$_A$	<0.2	-	<0.2	-	-	<0.2	-	-	mg/kg	A-T-050s
Total Organic Carbon$_D^{\#}$	-	2.07	-	-	-	-	-	0.83	% w/w	A-T-032s
Arsenic$_D^{M\#}$	26	23	12	7	23	-	23	11	mg/kg	A-T-024
Boron (water soluble)$_D^{M\#}$	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	mg/kg	A-T-027s
Cadmium$_D^{M\#}$	0.6	0.6	<0.5	<0.5	0.5	-	<0.5	<0.5	mg/kg	A-T-024
Copper$_D^{M\#}$	17	50	14	3	17	-	16	33	mg/kg	A-T-024
Chromium$_D^{M\#}$	29	29	29	15	23	-	30	30	mg/kg	A-T-024
Lead$_D^{M\#}$	14	278	21	5	14	-	43	46	mg/kg	A-T-024
Mercury$_D$	<0.17	<0.17	<0.17	<0.17	<0.17	-	<0.17	<0.17	mg/kg	A-T-024
Nickel$_D^{M\#}$	43	32	28	9	35	-	35	21	mg/kg	A-T-024
Selenium$_D^{M\#}$	1	2	<1	<1	<1	-	<1	<1	mg/kg	A-T-024
Zinc$_D^{M\#}$	105	177	46	17	87	-	97	62	mg/kg	A-T-024
TPH total (C6-C40)$_A$	-	-	-	-	-	-	-	168	mg/kg	A-T-007s

Envirolab Job Number: 11/00569

Client Project Name: Salisbury Square, Hatfield

Client Project Ref: 241882

Lab Sample ID	11/00569/1	11/00569/2	11/00569/3	11/00569/4	11/00569/5	11/00569/6	11/00569/7	11/00569/8	Units	Method ref
Client Sample No										
Client Sample ID	BH1	BH1	BH1	BH1	BH2	BH2	BH2	BH2		
Depth to Top	0.20	0.70	1.50	2.30	0.25	0.50	0.90	1.40		
Depth To Bottom			1.70	2.50						
Date Sampled	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	7	5A	5A	1A	7	5A	7	5A		
TPH CWG										
Ali >C5-C6$_A$	<0.01	-	-	-	-	-	-	-	mg/kg	A-T-022s
Ali >C6-C8$_A$	<0.01	-	-	-	-	-	-	-	mg/kg	A-T-022s
Ali >C8-C10$_A$	<0.01	-	-	-	-	-	-	-	mg/kg	A-T-022s
Ali >C10-C12$_A$$^{\#}$	<0.1	-	-	-	-	-	-	-	mg/kg	A-T-023s
Ali >C12-C16$_A$$^{\#}$	<0.1	-	-	-	-	-	-	-	mg/kg	A-T-023s
Ali >C16-C21$_A$$^{\#}$	<0.1	-	-	-	-	-	-	-	mg/kg	A-T-023s
Ali >C21-C35$_A$$^{\#}$	<0.1	-	-	-	-	-	-	-	mg/kg	A-T-023s
Total Aliphatics$_A$$^{\#}$	<0.1	-	-	-	-	-	-	-	mg/kg	A-T-022+23s
Aro >C5-C7$_A$	<0.01	-	-	-	-	-	-	-	mg/kg	A-T-022s
Aro >C7-C8$_A$	<0.01	-	-	-	-	-	-	-	mg/kg	A-T-022s
Aro >C8-C9$_A$	<0.01	-	-	-	-	-	-	-	mg/kg	A-T-022s
Aro >C9-C10$_A$	<0.01	-	-	-	-	-	-	-	mg/kg	A-T-022s
Aro >C10-C12$_A$$^{\#}$	<0.1	-	-	-	-	-	-	-	mg/kg	A-T-023s
Aro >C12-C16$_A$$^{\#}$	<0.1	-	-	-	-	-	-	-	mg/kg	A-T-023s
Aro >C16-C21$_A$$^{\#}$	<0.1	-	-	-	-	-	-	-	mg/kg	A-T-023s
Aro >C21-C35$_A$$^{\#}$	<0.1	-	-	-	-	-	-	-	mg/kg	A-T-023s
Total Aromatics$_A$$^{\#}$	<0.1	-	-	-	-	-	-	-	mg/kg	A-T-022+23s
TPH (Ali & Aro)$_A$$^{\#}$	<0.1	-	-	-	-	-	-	-	mg/kg	A-T-022+23s
MTBE$_A$$^{\#}$	<0.01	-	-	-	-	-	-	-	mg/kg	A-T-022s
BTEX										
BTEX - Benzene$_A$$^{\#}$	<0.01	-	-	-	-	-	-	-	mg/kg	A-T-022s
BTEX - Toluene$_A$$^{\#}$	<0.01	-	-	-	-	-	-	-	mg/kg	A-T-022s
BTEX - Ethyl Benzene$_A$$^{\#}$	<0.01	-	-	-	-	-	-	-	mg/kg	A-T-022s
BTEX - m & p Xylene$_A$$^{\#}$	<0.01	-	-	-	-	-	-	-	mg/kg	A-T-022s
BTEX - o Xylene$_A$$^{\#}$	<0.01	-	-	-	-	-	-	-	mg/kg	A-T-022s

Envirolab Job Number: 11/00569

Client Project Name: Salisbury Square, Hatfield

Client Project Ref: 241882

Lab Sample ID	11/00569/1	11/00569/2	11/00569/3	11/00569/4	11/00569/5	11/00569/6	11/00569/7	11/00569/8	Units	Method ref
Client Sample No										
Client Sample ID	BH1	BH1	BH1	BH1	BH2	BH2	BH2	BH2		
Depth to Top	0.20	0.70	1.50	2.30	0.25	0.50	0.90	1.40		
Depth To Bottom			1.70	2.50						
Date Sampled	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	7	5A	5A	1A	7	5A	7	5A		
PAH 16										
Acenapthene$_A^{M\#}$	<0.01	0.01	0.02	<0.01	<0.01	-	0.04	-	mg/kg	A-T-019s
Acenapthylene$_A^{M\#}$	<0.01	0.05	<0.01	<0.01	<0.01	-	0.14	-	mg/kg	A-T-019s
Anthracene$_A^{M\#}$	<0.01	0.07	<0.01	<0.01	<0.01	-	0.19	-	mg/kg	A-T-019s
Benzo(a)anthracene$_A^{\#}$	<0.01	0.36	0.01	<0.01	<0.01	-	0.67	-	mg/kg	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	0.02	0.47	<0.01	<0.01	<0.01	-	0.94	-	mg/kg	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	0.01	0.33	<0.01	<0.01	0.01	-	0.70	-	mg/kg	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	<0.01	0.71	0.02	<0.01	0.01	-	1.01	-	mg/kg	A-T-019s
Benzo(k)fluoranthene$_A$	0.02	0.48	0.02	<0.01	<0.01	-	0.76	-	mg/kg	A-T-019s
Chrysene$_A^{M\#}$	<0.01	0.70	0.03	<0.01	0.02	-	1.48	-	mg/kg	A-T-019s
Dibenzo(ah)anthracene$_A^{\#}$	<0.01	0.10	<0.01	<0.01	<0.01	-	0.14	-	mg/kg	A-T-019s
Fluoranthene$_A^{M\#}$	0.01	0.78	0.07	<0.01	0.03	-	1.90	-	mg/kg	A-T-019s
Fluorene$_A^{M\#}$	<0.01	<0.01	0.01	<0.01	<0.01	-	0.03	-	mg/kg	A-T-019s
Indeno(123-cd)pyrene$_A^{\#}$	<0.01	0.27	<0.01	<0.01	<0.01	-	0.58	-	mg/kg	A-T-019s
Napthalene$_A^{M\#}$	<0.01	0.03	0.11	0.02	<0.01	-	0.04	-	mg/kg	A-T-019s
Phenanthrene$_A^{M\#}$	0.02	0.17	0.06	<0.01	0.02	-	0.65	-	mg/kg	A-T-019s
Pyrene$_A^{M\#}$	0.01	0.75	0.06	0.02	0.03	-	1.71	-	mg/kg	A-T-019s
Total PAH$_A^{\#}$	0.10	5.28	0.41	0.03	0.13	-	11	-	mg/kg	A-T-019s

Envirolab Job Number: 11/00569

Client Project Name: Salisbury Square, Hatfield

Client Project Ref: 241882

Lab Sample ID	11/00569/9	11/00569/10	11/00569/11	11/00569/12	11/00569/13	11/00569/14	11/00569/15	11/00569/16	Units	Method ref
Client Sample No										
Client Sample ID	BH2	BH2	WS1	WS1	WS2	WS2	WS3	WS3		
Depth to Top	3.00	4.90	0.20	0.50	0.20	0.50	0.20	0.50		
Depth To Bottom			0.30	0.60	0.30	0.60	0.30	0.60		
Date Sampled	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	5A	1A	5AE	5AE	5AE	7	5A			
ACM Screen$_A$	-	-	NFI	-	NFI	NFI	NFI	NFI		Visual
pH$_D$ M#	8.7	8.9	-	8.7	-	7.6	-	-	pH	A-T-031s
Sulphate (water sol 2:1)$_D$ M#	-	0.02	-	<0.01	-	-	-	-	g/l	A-T-026s
Phenols - Total by HPLC$_A$	<0.2	-	<0.2	-	<0.2	-	-	-	mg/kg	A-T-050s
Total Organic Carbon$_D$ #	-	-	-	-	-	0.10	-	-	% w/w	A-T-032s
Arsenic$_D$ M#	11	14	-	12	-	23	-	-	mg/kg	A-T-024
Boron (water soluble)$_D$ M#	<1.0	<1.0	-	<1.0	-	<1.0	-	-	mg/kg	A-T-027s
Cadmium$_D$ M#	<0.5	<0.5	-	<0.5	-	<0.5	-	-	mg/kg	A-T-024
Copper$_D$ M#	18	9	-	26	-	17	-	-	mg/kg	A-T-024
Chromium$_D$ M#	30	18	-	30	-	29	-	-	mg/kg	A-T-024
Lead$_D$ M#	35	16	-	68	-	17	-	-	mg/kg	A-T-024
Mercury$_D$	<0.17	<0.17	-	<0.17	-	<0.17	-	-	mg/kg	A-T-024
Nickel$_D$ M#	21	15	-	21	-	42	-	-	mg/kg	A-T-024
Selenium$_D$ M#	<1	<1	-	<1	-	1	-	-	mg/kg	A-T-024
Zinc$_D$ M#	55	40	-	80	-	95	-	-	mg/kg	A-T-024
TPH total (C6-C40)$_A$	-	-	-	<10	<10	-	<10	-	mg/kg	A-T-007s

Envirolab Job Number: 11/00569

Client Project Name: Salisbury Square, Hatfield

Client Project Ref: 241882

Lab Sample ID	11/00569/9	11/00569/10	11/00569/11	11/00569/12	11/00569/13	11/00569/14	11/00569/15	11/00569/16	Units	Method ref
Client Sample No										
Client Sample ID	BH2	BH2	WS1	WS1	WS2	WS2	WS3	WS3		
Depth to Top	3.00	4.90	0.20	0.50	0.20	0.50	0.20	0.50		
Depth To Bottom			0.30	0.60	0.30	0.60	0.30	0.60		
Date Sampled	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	5A	1A	5AE	5AE	5AE	7	5A			
PAH 16										
Acenapthene$_A^{M\#}$	-	0.02	-	0.02	-	<0.01	-	-	mg/kg	A-T-019s
Acenapthylene$_A^{M\#}$	-	<0.01	-	<0.01	-	<0.01	-	-	mg/kg	A-T-019s
Anthracene$_A^{M\#}$	-	<0.01	-	0.02	-	0.01	-	-	mg/kg	A-T-019s
Benzo(a)anthracene$_A^{\#}$	-	<0.01	-	0.04	-	<0.01	-	-	mg/kg	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	-	<0.01	-	0.04	-	<0.01	-	-	mg/kg	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	-	<0.01	-	0.03	-	<0.01	-	-	mg/kg	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	-	<0.01	-	0.09	-	<0.01	-	-	mg/kg	A-T-019s
Benzo(k)fluoranthene$_A$	-	<0.01	-	0.03	-	<0.01	-	-	mg/kg	A-T-019s
Chrysene$_A^{M\#}$	-	0.02	-	0.13	-	0.01	-	-	mg/kg	A-T-019s
Dibenzo(ah)anthracene$_A^{\#}$	-	<0.01	-	<0.01	-	<0.01	-	-	mg/kg	A-T-019s
Fluoranthene$_A^{M\#}$	-	0.03	-	0.14	-	0.03	-	-	mg/kg	A-T-019s
Fluorene$_A^{M\#}$	-	<0.01	-	<0.01	-	<0.01	-	-	mg/kg	A-T-019s
Indeno(123-cd)pyrene$_A^{\#}$	-	<0.01	-	0.03	-	<0.01	-	-	mg/kg	A-T-019s
Napthalene$_A^{M\#}$	-	0.02	-	0.02	-	<0.01	-	-	mg/kg	A-T-019s
Phenanthrene$_A^{M\#}$	-	0.02	-	0.05	-	0.02	-	-	mg/kg	A-T-019s
Pyrene$_A^{M\#}$	-	0.03	-	0.13	-	0.02	-	-	mg/kg	A-T-019s
Total PAH$_A^{\#}$	-	0.14	-	0.78	-	0.09	-	-	mg/kg	A-T-019s

Envirolab Job Number: 11/00569

Client Project Name: Salisbury Square, Hatfield

Client Project Ref: 241882

Lab Sample ID	11/00569/17	11/00569/18	11/00569/19	11/00569/20	11/00569/23	11/00569/25			Units	Method ref
Client Sample No										
Client Sample ID	WS4	WS4	TP1	TP1	TP2	TP3				
Depth to Top	0.20	0.50	0.10	0.40	0.50	0.10				
Depth To Bottom	0.30	0.60								
Date Sampled	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	7	7	4AE		4AE	4AE				
ACM Screen$_A$	NFI	-	-	NFI	-	-				Visual
pH$_D$ M#	8.4	8.4	8.3	-	8.3	8.2			pH	A-T-031s
Sulphate (water sol 2:1)$_D$ M#	-	0.01	-	-	-	-			g/l	A-T-026s
Total Organic Carbon$_D$ #	0.07	-	-	-	1.08	-			% w/w	A-T-032s
Arsenic$_D$ M#	22	18	10	-	12	22			mg/kg	A-T-024
Boron (water soluble)$_D$ M#	<1.0	<1.0	<1.0	-	<1.0	<1.0			mg/kg	A-T-027s
Cadmium$_D$ M#	<0.5	<0.5	<0.5	-	<0.5	0.9			mg/kg	A-T-024
Copper$_D$ M#	14	11	22	-	37	174			mg/kg	A-T-024
Chromium$_D$ M#	21	20	18	-	20	29			mg/kg	A-T-024
Lead$_D$ M#	39	10	66	-	84	345			mg/kg	A-T-024
Mercury$_D$	<0.17	<0.17	0.17	-	<0.17	1.03			mg/kg	A-T-024
Nickel$_D$ M#	30	33	14	-	18	33			mg/kg	A-T-024
Selenium$_D$ M#	<1	1	<1	-	1	2			mg/kg	A-T-024
Zinc$_D$ M#	73	70	80	-	112	306			mg/kg	A-T-024

Envirolab Job Number: 11/00569

Client Project Name: Salisbury Square, Hatfield

Client Project Ref: 241882

Lab Sample ID	11/00569/17	11/00569/18	11/00569/19	11/00569/20	11/00569/23	11/00569/25			Units	Method ref
Client Sample No										
Client Sample ID	WS4	WS4	TP1	TP1	TP2	TP3				
Depth to Top	0.20	0.50	0.10	0.40	0.50	0.10				
Depth To Bottom	0.30	0.60								
Date Sampled	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	7	7	4AE		4AE	4AE				
TPH CWG										
Ali >C5-C6$_A$	-	<0.01	-	-	-	-			mg/kg	A-T-022s
Ali >C6-C8$_A$	-	<0.01	-	-	-	-			mg/kg	A-T-022s
Ali >C8-C10$_A$	-	<0.01	-	-	-	-			mg/kg	A-T-022s
Ali >C10-C12$_A^{\#}$	-	<0.1	-	-	-	-			mg/kg	A-T-023s
Ali >C12-C16$_A^{\#}$	-	<0.1	-	-	-	-			mg/kg	A-T-023s
Ali >C16-C21$_A^{\#}$	-	<0.1	-	-	-	-			mg/kg	A-T-023s
Ali >C21-C35$_A^{\#}$	-	<0.1	-	-	-	-			mg/kg	A-T-023s
Total Aliphatics$_A^{\#}$	-	<0.1	-	-	-	-			mg/kg	A-T-022+23s
Aro >C5-C7$_A$	-	<0.01	-	-	-	-			mg/kg	A-T-022s
Aro >C7-C8$_A$	-	<0.01	-	-	-	-			mg/kg	A-T-022s
Aro >C8-C9$_A$	-	<0.01	-	-	-	-			mg/kg	A-T-022s
Aro >C9-C10$_A$	-	<0.01	-	-	-	-			mg/kg	A-T-022s
Aro >C10-C12$_A^{\#}$	-	<0.1	-	-	-	-			mg/kg	A-T-023s
Aro >C12-C16$_A^{\#}$	-	<0.1	-	-	-	-			mg/kg	A-T-023s
Aro >C16-C21$_A^{\#}$	-	<0.1	-	-	-	-			mg/kg	A-T-023s
Aro >C21-C35$_A^{\#}$	-	<0.1	-	-	-	-			mg/kg	A-T-023s
Total Aromatics$_A^{\#}$	-	<0.1	-	-	-	-			mg/kg	A-T-022+23s
TPH (Ali & Aro)$_A^{\#}$	-	<0.1	-	-	-	-			mg/kg	A-T-022+23s
MTBE$_A^{\#}$	-	<0.01	-	-	-	-			mg/kg	A-T-022s
BTEX										
BTEX - Benzene$_A^{\#}$	-	<0.01	-	-	-	-			mg/kg	A-T-022s
BTEX - Toluene$_A^{\#}$	-	<0.01	-	-	-	-			mg/kg	A-T-022s
BTEX - Ethyl Benzene$_A^{\#}$	-	<0.01	-	-	-	-			mg/kg	A-T-022s
BTEX - m & p Xylene$_A^{\#}$	-	<0.01	-	-	-	-			mg/kg	A-T-022s
BTEX - o Xylene$_A^{\#}$	-	<0.01	-	-	-	-			mg/kg	A-T-022s

Envirolab Job Number: 11/00569

Client Project Name: Salisbury Square, Hatfield

Client Project Ref: 241882

Lab Sample ID	11/00569/17	11/00569/18	11/00569/19	11/00569/20	11/00569/23	11/00569/25			Units	Method ref
Client Sample No										
Client Sample ID	WS4	WS4	TP1	TP1	TP2	TP3				
Depth to Top	0.20	0.50	0.10	0.40	0.50	0.10				
Depth To Bottom	0.30	0.60								
Date Sampled	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	7	7	4AE		4AE	4AE				
PAH 16										
Acenapthene$_A^{M\#}$	<0.01	<0.01	0.02	-	0.13	-			mg/kg	A-T-019s
Acenapthylene$_A^{M\#}$	<0.01	<0.01	0.05	-	0.01	-			mg/kg	A-T-019s
Anthracene$_A^{M\#}$	<0.01	0.01	0.09	-	1.60	-			mg/kg	A-T-019s
Benzo(a)anthracene$_A^{\#}$	<0.01	<0.01	0.33	-	3.24	-			mg/kg	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	<0.01	<0.01	0.47	-	2.33	-			mg/kg	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	<0.01	<0.01	0.44	-	2.29	-			mg/kg	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	<0.01	0.01	0.68	-	1.90	-			mg/kg	A-T-019s
Benzo(k)fluoranthene$_A$	<0.01	<0.01	0.36	-	2.64	-			mg/kg	A-T-019s
Chrysene$_A^{M\#}$	<0.01	0.02	0.71	-	5.27	-			mg/kg	A-T-019s
Dibenzo(ah)anthracene$_A^{\#}$	<0.01	<0.01	0.05	-	0.42	-			mg/kg	A-T-019s
Fluoranthene$_A^{M\#}$	<0.01	0.03	0.84	-	8.88	-			mg/kg	A-T-019s
Fluorene$_A^{M\#}$	<0.01	<0.01	<0.01	-	0.17	-			mg/kg	A-T-019s
Indeno(123-cd)pyrene$_A^{\#}$	<0.01	<0.01	0.26	-	1.42	-			mg/kg	A-T-019s
Napthalene$_A^{M\#}$	<0.01	0.01	<0.01	-	0.02	-			mg/kg	A-T-019s
Phenanthrene$_A^{M\#}$	<0.01	0.03	0.22	-	3.49	-			mg/kg	A-T-019s
Pyrene$_A^{M\#}$	<0.01	0.02	0.79	-	6.11	-			mg/kg	A-T-019s
Total PAH$_A^{\#}$	<0.01	0.14	5.30	-	39.9	-			mg/kg	A-T-019s

Envirolab Job Number: 11/00569

Client Project Name: Salisbury Square, Hatfield

Client Project Ref: 241882

Lab Sample ID	11/00569/17	11/00569/18	11/00569/19	11/00569/20	11/00569/23	11/00569/25			Units	Method ref
Client Sample No										
Client Sample ID	WS4	WS4	TP1	TP1	TP2	TP3				
Depth to Top	0.20	0.50	0.10	0.40	0.50	0.10				
Depth To Bottom	0.30	0.60								
Date Sampled	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11	03-Feb-11				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	7	7	4AE		4AE	4AE				
Spec PCB-WHO12										
PCB BZ 81_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 105_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 114_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ $118/123_D$	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 126_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 156_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 157_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 167_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 169_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 189_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s
PCB BZ 77_D	-	<0.005	-	-	-	-			mg/kg	A-T-004/5s

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 11/01190
Issue Number: 1 **Date:** 22 March, 2011

Client: RSK STATS Hemel Hempstead
18 Frogmore Road
Hemel Hempstead
Hertfordshire
UK
HP3 9RT

Project Manager: [redacted]
Project Name: Salisbury Square, Hatfield
Project Ref: 241882
Order No: Not specified
Date Samples Received: 18/03/11
Date Instructions Received: 18/03/11
Date Analysis Completed: 22/03/11

Prepared by: [redacted]

Approved by: [redacted]

Notes - Soil analysis
All results are reported as dry weight (<40°C).
Stones >10mm are removed from the sample prior to analysis and results corrected where appropriate.

Notes - General
For soil samples subscript A indicates analysis performed on the sample as received, D indicates analysis performed on dried & crushed sample.
Superscript M indicates method accredited to MCERTS.

Predominant Matrix Codes - 1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER.
Samples with Matrix Code 7 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our MCERTS accreditation.
Secondary Matrix Codes - A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.
IS indicates Insufficient sample for analysis. NDP indicates No Determination Possible. NFI indicates No Fibres Identified.
Superscript # indicates method accredited to ISO 17025.
Accreditation for TPH (C6-C40) applies to the range C6-C36 only.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.

MCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME
UKAS TESTING 1247

Envirolab Job Number: 11/01190

Client Project Name: Salisbury Square, Hatfield

Client Project Ref: 241882

Lab Sample ID	11/01190/1	11/01190/2							Units	Method ref
Client Sample No										
Client Sample ID	BH2	BH1								
Depth to Top	12.20	6.80								
Depth To Bottom										
Date Sampled	03-Feb-11	03-Feb-11								
Sample Type	Soil - D	Soil - D								
Sample Matrix Code	5A	5A								
pH_D M#	8.2	8.0							pH	A-T-031s
Sulphate (water sol 2:1)$_D$ M#	0.15	0.28							g/l	A-T-026s

APPENDIX L
GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH

Generic assessment criteria for human health: residential scenario with home-grown produce

Background

RSK's generic assessment criteria (GAC) were initially prepared following the publication by the Environment Agency (EA) of soil guideline value (SGV) and toxicological (TOX) reports, and associated publications in 2009[1]. RSK GAC were updated following the publication of GAC by LQM/CIEH in 2009[2]. RSK GAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

Updates to the RSK GAC

In 2014, the publication of Category 4 Screening Levels (C4SL)[3,4], as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3)[5] used in the generation of SGVs.

C4SL were initially published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010[3]). Further C4SL were published in 2021 for vinyl chloride, tetrachloroethene (PCE) and trichloroethene (TCE). Where a C4SL has been published, the RSK GAC duplicates the C4SL using all input parameters within the SP1010 final project report[3] and associated chemical specific reports[6], and adopts them as GAC for these substances. Due to the use of decimal places rather than significant figures applied to the Contaminated Land Exposure Assessment (CLEA) tool outputs, the GAC presented may be marginally differently to the C4SL values, however any differences between the values are minimal and would not equate to an unacceptable risk.

For all other substances the C4SL exposure modifications, with the exception of the "top two" produce type approach taken in the C4SL, have been applied to the current RSK GAC. These include alterations to daily inhalation rates for residential and commercial scenarios, reducing soil adherence factors in children (age classes 1 to 12 only) for residential land use, reducing exposure frequency for dermal contact outdoors for residential land use, and updated produce type consumption rates (90th percentile) based on recent data from the National Diet and Nutrition Survey.

The RSK GAC have also been revised with updated toxicology published by LQM/CIEH in 2015[7] or by the USEPA[14], where a C4SL has not been published.

RSK GAC derivation for metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using the CLEA tool v1.071, supporting EA guidance[5,8,9] and revised exposure scenarios published for the C4SL[3]. The SAC are also termed GAC.

Conceptual model

In accordance with SR3[5], the residential with home-grown produce scenario considers risks to a female child between the ages of 0 and 6 years old as the highest risk scenario. In accordance with Box 3.1 of SR3[5], the pathways considered for production of the SAC in the residential with home-grown produce scenario are

- direct soil and dust ingestion
- consumption of home-grown produce
- consumption of soil attached to home-grown produce
- dermal contact with soil and indoor dust
- inhalation of indoor and outdoor dust and vapours.

Figure 1 is a conceptual model illustrating these linkages.

In line with guidance in the EA SGV report for cadmium[1], the RSK GAC for cadmium has been derived based on estimates representative of lifetime exposure. Although young children are generally more likely to have higher exposures to soil contaminants, the renal toxicity of cadmium, and the derivation of the TDI_{oral} and TDI_{inh}, are based on considerations of the kidney burden accumulated over 50 years or so. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period.

With respect to volatilisation, the CLEA model assumes a simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase[9]. The upper boundaries of this partitioning are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model estimates saturated soil concentrations where these limits are reached[9]. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous- or vapour-based soil saturation limits. Model output cells are flagged red where the saturated soil concentration has been exceeded and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10%. In this case, further consideration of the following is required[9]:

- Free phase contamination may be present.
- Exposure from the vapour pathways will be over-predicted by the model, as in reality the vapour phase concentration will not increase at concentrations above saturation limits
- Where the vapour pathway contribution is greater than 90%, it is unlikely the relevant health criteria value (HCV) will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Where the vapour pathway is the predominant pathway (contributes greater than 90% of exposure) or the only exposure route considered and the cell is highlighted red (SAC exceeds saturation limit), the risk based on the assumed conceptual model is likely to be negligible as the vapour risk is assumed to be tolerable at maximum possible soil concentrations. In such circumstances, the vapour pathway exposure should be considered based on the presence of free phase or non-aqueous phase liquid sources and the measured concentrations of volatile organic compounds (VOC) in the vapour phase. Screening could be considered based on setting the SAC as the modelled soil saturation limits. However, as stated within the CLEA handbook[9], this is likely to not be practical in many cases because of the very low saturation limits and, in any case, is highly conservative.

It should also be noted that for mixtures of compounds, free phase may be present where soil (or groundwater) concentrations are well below saturation limits for individual compounds.

Where the vapour pathway is only one of the exposure pathways considered, an additional approach can then be utilised as detailed within Section 4.12 of the CLEA model handbook[9], which explains how to calculate an effective assessment criterion manually.

SR3[5] states that, as a general rule of thumb, it is recognised that estimating vapour phase concentrations from dissolved and sorbed phase contamination by petroleum hydrocarbons are at least a factor of ten higher than those likely to be measured on-site. RSK has therefore applied an empirical subsurface to indoor air correction factor of 10 into the CLEA model chemical database for all petroleum hydrocarbon fractions (including BTEX, trimethylbenzenes and the polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene) to reduce this conservatism.

Input selection

The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7[10], the EA TOX[1] reports, the C4SL SP1010 project report and associated appendices[3,6], the 2015 LQM/CIEH report[7] or the USEPA IRIS database[14]. Where a LLTC[3,6] has been published for a substance, RSK has used these input parameters to derive the RSK GAC. Toxicological and specific chemical parameters for 1,2,4-trimethylbenzene, barium, methyl tertiary-butyl ether (MTBE), 1,1,2-trichlorethane, 1,1-dichloroethene, 1,2-dichloropropane, 2-chloronaphthalene, chloroethane, chloromethane, cis 1,2-dichloroethene, dichloromethane, hexachloroethane and trans 1,2-dichloroethene were obtained from the CL:AIRE Soil Generic Assessment Criteria report[11].

For TPH, aromatic hydrocarbons C_5–C_8 were not modelled, as this range comprises benzene (>EC5-EC7) and toluene (>EC7-EC8), which are modelled separately.

Physical parameters

For the residential with home-grown produce scenario, the CLEA default building is a small, two-storey terrace house with a concrete ground-bearing slab. The house is assumed to have a 100m^2 private garden consisting of lawn and flowerbeds, incorporating a 20m^2 plot for growing fruit and vegetables consumed by the residents. SR3[5] notes this residential building type to be the most conservative in terms of potential for vapour intrusion. The building parameters used in the production of the RSK GACs are the default CLEA v1.06 inputs presented in Table 3.3 of SR3[3], with a dust loading factor detailed in Section 9.3 of SR3[5]. The parameters for a sandy loam soil type were used in line with Table 4.4 of SR3[5]. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for SOM, RSK has produced an additional set of GAC for SOM of 1% and 2.5% for all substances using the CLEA tool.

Summary of modifications to the default CLEA SR3[5] input parameters for residential with home-grown produce land-use scenario

In summary, the RSK GAC were produced using the default input parameters for soil properties, the air dispersion model, building properties and the vapour model detailed in SR3[5]. Modifications to the default SR3[5] exposure scenarios based on the C4SL exposure scenarios[3] are presented in Tables 2 and 3 below.

The final selected GAC are presented by pathway in Table 4 and the combined GAC in Table 5.

Figure 1: Conceptual model for residential scenario with home-grown produce

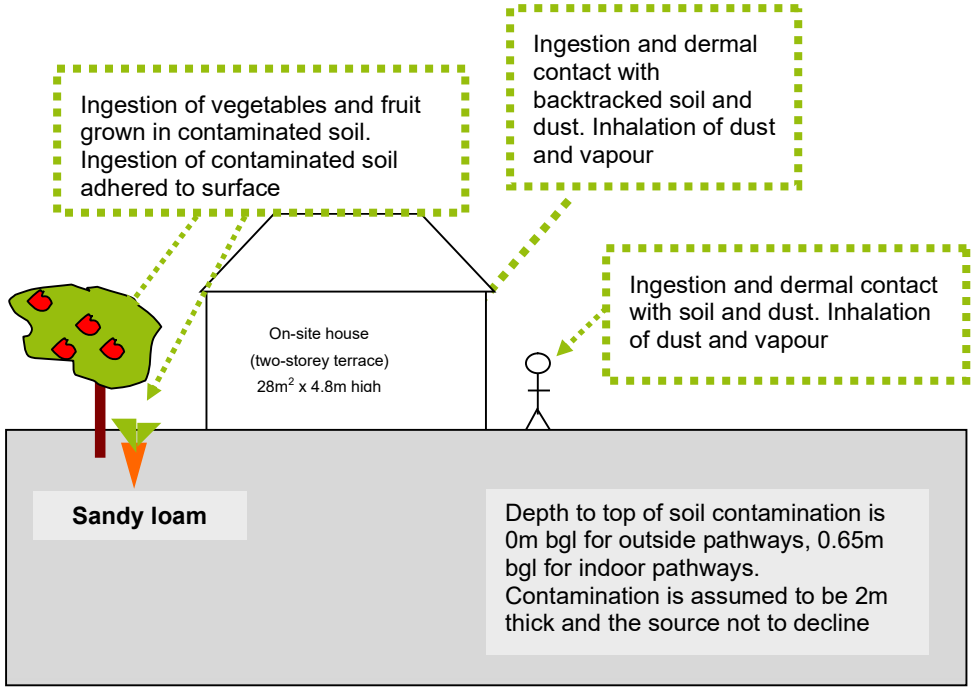

Table 1: Exposure assessment parameters for residential scenario with home-grown produce – inputs for CLEA model

Parameter	Value	Justification
Land use	Residential with homegrown produce	Chosen land use
Receptor	Female child age 1 to 6	Key generic assumption given in Box 3.1, SR3[5]
Building	Small terraced house	Key generic assumption given in Box 3.1, SR3. Small, two-storey terraced house chosen, as it is the most conservative residential building type in terms of protection from vapor intrusion (Section 3.4.6, SR3)[5]
Soil type	Sandy Loam	Most common UK soil type (Section 4.3.1, from Table 3.1, SR3)[5]
Start AC (age class)	1	Range of age classes corresponding to key generic assumption that the critical receptor is a young female child aged 0–6. From Box 3.1, SR3[5]
End AC (age class)	6	
SOM (%)	6	Representative of sandy loamy soil according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents'[13]
	1	To provide SAC for sites where SOM <6% as often observed by RSK
	2.5	
pH	7	Model default

Table 2: Residential with home-grown produce – modified home-grown produce data

Name	Consumption rate 90th percentile (g FW kg^{-1} BW day^{-1}) by age class						Dry weight conversion factor (g DW g^{-1} FW)	Home-grown fraction (average)	Home-grown fraction (high end)	Soil loading factor (g g^{-1} DW)	Preparation correction factor
	1	2	3	4	5	6					
Green vegetables	7.12	5.87	5.87	5.87	4.53	4.53	0.096	0.05	0.33	1.00E-03	2.00E-01
Root vegetables	10.7	2.83	2.83	2.83	2.14	2.14	0.103	0.06	0.4	1.00E-03	1.00E+00
Tuber vegetables	16	6.6	6.6	6.6	4.95	4.95	0.21	0.02	0.13	1.00E-03	1.00E+00
Herbaceous fruit	1.83	3.39	3.39	3.39	2.24	2.24	0.058	0.06	0.4	1.00E-03	6.00E-01
Shrub fruit	2.23	0.46	0.46	0.46	0.19	0.19	0.166	0.09	0.6	1.00E-03	6.00E-01
Tree fruit	3.82	10.3	10.3	10.3	5.16	5.16	0.157	0.04	0.27	1.00E-03	6.00E-01
Justification	Table 3.4, SP1010 [3]						Table 6.3, SR3[5]	Table 4.19, SR3[5]		Table 6.3, SR3[5]	

Table 3: Residential with home-grown produce – modified and use and receptor data

Parameter	Unit	Age class					
		1	2	3	4	5	6
EF (soil and dust ingestion)	day yr^{-1}	180	365	365	365	365	365
EF (consumption of home-grown produce)	day yr^{-1}	180	365	365	365	365	365
EF (skin contact, indoor)	day yr^{-1}	180	365	365	365	365	365
EF (skin contact, outdoor)	day yr^{-1}	170	170	170	170	170	170
EF (inhalation of dust and vapour, indoor)	day yr^{-1}	365	365	365	365	365	365
EF (inhalation of dust and vapour, outdoor)	day yr^{-1}	365	365	365	365	365	365
Justification		Table 3.5, SP1010[3]; Table 3.1, SR3[5]					
Soil to skin adherence factor (outdoor)	mg cm^{-2} day^{-1}	0.1	0.1	0.1	0.1	0.1	0.1
Justification		Table 3.5, SP1010[3]					
Inhalation rate	m^3 day^{-1}	5.4	8.0	8.9/f	10.1	10.1	10.1
Justification		Mean value USEPA, 2011[12]; Table 3.2, SP1010[3]					
Notes: For **cadmium**, the exposure assessment for a residential land use is based on estimates representative of lifetime exposure AC1-18. This is because the TDI_{oral} and TDI_{inh} are based on considerations of the kidney burden accumulated over 50 years. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period. See the Environment Agency Science Report SC05002/ TOX 3[1], Science Report SC050021/Cadmium SGV[1] and the project report SP1010[3] for more information.							

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GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH HOME-GROWN PRODUCE

Table 4

Human Health Generic Assessment Criteria by Pathway for Residential With Home-Grown Produce Scenario

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Metals													
Arsenic	(a,b)	3.71E+01	5.26E+02	NR	NR	3.71E+01	5.26E+02	NR	NR	3.71E+01	5.26E+02	NR	NR
Barium	(b)	1.34E+03	NR	NR	NR	1.34E+03	NR	NR	NR	1.34E+03	NR	NR	NR
Beryllium		1.13E+02	1.72E+00	NR	NR	1.13E+02	1.72E+00	NR	NR	1.13E+02	1.72E+00	NR	NR
Boron		3.00E+02	5.20E+06	NR	NR	3.00E+02	5.20E+06	NR	NR	3.00E+02	5.20E+06	NR	NR
Cadmium	(a)	2.30E+01	4.88E+02	2.21E+01	NR	2.30E+01	4.88E+02	2.21E+01	NR	2.30E+01	4.88E+02	2.21E+01	NR
Chromium (III) - trivalent	(c)	1.84E+04	9.07E+02	NR	NR	1.84E+04	9.07E+02	NR	NR	1.84E+04	9.07E+02	NR	NR
Chromium (VI) - hexavalent	(a,d)	5.85E+01	2.06E+01	NR	NR	5.85E+01	2.06E+01	NR	NR	5.85E+01	2.06E+01	NR	NR
Copper		2.72E+03	1.41E+04	2.47E+03	NR	2.72E+03	1.41E+04	2.47E+03	NR	2.72E+03	1.41E+04	2.47E+03	NR
Lead	(a)	2.01E+02	NR	NR	NR	2.01E+02	NR	NR	NR	2.01E+02	NR	NR	NR
Elemental Mercury (Hg^0)	(d)	NR	2.35E-01	NR	4.31E+00	NR	5.60E-01	NR	1.07E+01	NR	1.22E+00	NR	2.58E+01
Inorganic Mercury (Hg^{2+})		3.95E+01	3.63E+03	3.91E+01	NR	3.95E+01	3.63E+03	3.91E+01	NR	3.95E+01	3.63E+03	3.91E+01	NR
Methyl Mercury (Hg^{4+})		1.26E+01	1.87E+01	7.52E+00	7.33E+01	1.26E+01	3.62E+01	9.34E+00	1.42E+02	1.26E+01	7.68E+01	1.08E+01	3.04E+02
Nickel	(d)	1.27E+02	1.81E+02	NR	NR	1.27E+02	1.81E+02	NR	NR	1.27E+02	1.81E+02	NR	NR
Selenium	(b)	2.58E+02	NR	NR	NR	2.58E+02	NR	NR	NR	2.58E+02	NR	NR	NR
Vanadium		4.13E+02	1.46E+03	NR	NR	4.13E+02	1.46E+03	NR	NR	4.13E+02	1.46E+03	NR	NR
Zinc	(b)	3.86E+03	3.63E+07	NR	NR	3.86E+03	3.63E+07	NR	NR	3.86E+03	3.63E+07	NR	NR
Cyanide (free)		1.37E+00	1.37E+04	1.37E+00	NR	1.37E+00	1.37E+04	1.37E+00	NR	1.37E+00	1.37E+04	1.37E+00	NR
Volatile Organic Compounds													
Benzene	(a)	2.62E-01	9.01E-01	2.03E-01	1.22E+03	5.39E-01	1.68E+00	4.08E-01	2.26E+03	1.16E+00	3.48E+00	8.72E-01	4.71E+03
Toluene		1.53E+02	9.08E+02	1.31E+02	8.69E+02	3.49E+02	2.00E+03	2.97E+02	1.92E+03	7.95E+02	4.55E+03	6.77E+02	4.36E+03
Ethylbenzene		1.10E+02	8.34E+01	4.74E+01	5.18E+02	2.61E+02	1.96E+02	1.12E+02	1.22E+03	6.00E+02	4.58E+02	2.60E+02	2.84E+03
Xylene - m		2.10E+02	8.25E+01	5.92E+01	6.25E+02	5.01E+02	1.95E+02	1.40E+02	1.47E+03	1.15E+03	4.56E+02	3.27E+02	3.46E+03
Xylene - o		1.92E+02	8.87E+01	6.07E+01	4.78E+02	4.56E+02	2.08E+02	1.43E+02	1.12E+03	1.05E+03	4.86E+02	3.32E+02	2.62E+03
Xylene - p		1.98E+02	7.93E+01	5.66E+01	5.76E+02	4.70E+02	1.86E+02	1.33E+02	1.35E+03	1.08E+03	4.36E+02	3.10E+02	3.17E+03
Total xylene		1.92E+02	7.93E+01	5.66E+01	6.25E+02	4.56E+02	1.86E+02	1.33E+02	1.47E+03	1.05E+03	4.36E+02	3.10E+02	3.46E+03
Methyl tertiary-Butyl ether (MTBE)		1.54E+02	1.04E+02	6.22E+01	2.04E+04	2.97E+02	1.69E+02	1.08E+02	3.31E+04	6.03E+02	3.21E+02	2.10E+02	6.27E+04
1,1,1,2 Tetrachloroethane		5.39E+00	1.54E+00	1.20E+00	2.60E+03	1.27E+01	3.56E+00	2.78E+00	6.02E+03	2.92E+01	8.29E+00	6.46E+00	1.40E+04
1,1,2,2-Tetrachloroethane		2.81E+00	3.92E+00	1.64E+00	2.67E+03	6.10E+00	8.04E+00	3.47E+00	5.46E+03	1.36E+01	1.76E+01	7.67E+00	1.20E+04
1,1,1-Trichloroethane		3.33E+02	9.01E+00	8.77E+00	1.43E+03	7.26E+02	1.84E+01	1.80E+01	2.92E+03	1.62E+03	4.04E+01	3.94E+01	6.39E+03
1,1,2 Trichloroethane		1.95E+00	1.25E+00	7.62E-01	4.03E+03	4.21E+00	2.55E+00	1.59E+00	8.21E+03	9.35E+00	5.59E+00	3.50E+00	1.80E+04
1,1-Dichloroethene		1.93E+01	3.29E-01	3.23E-01	2.23E+03	3.85E+01	5.82E-01	5.74E-01	3.94E+03	8.15E+01	1.17E+00	1.16E+00	7.94E+03
1,2-Dichloroethane		3.17E-02	9.20E-03	7.13E-03	3.41E+03	5.73E-02	1.33E-02	1.08E-02	4.91E+03	1.09E-01	2.28E-02	1.88E-02	8.43E+03
1,2,4-Trimethylbenzene		NR	1.76E+00	NR	4.74E+02	NR	4.26E+00	NR	1.16E+03	NR	9.72E+00	NR	2.76E+03
1,3,5-Trimethylbenzene	(e)	NR	NR	NR	2.30E+02	NR	NR	NR	5.52E+02	NR	NR	NR	1.30E+03
1,2-Dichloropropane		4.28E+00	3.40E-02	3.37E-02	1.19E+03	8.44E+00	6.00E-02	5.96E-02	2.11E+03	1.77E+01	1.21E-01	1.20E-01	4.24E+03
Carbon Tetrachloride (tetrachloromethane)		3.10E+00	2.58E-02	2.57E-02	1.52E+03	7.11E+00	5.65E-02	5.62E-02	3.32E+03	1.62E+01	1.28E-01	1.27E-01	7.54E+03
Chloroethane		NR	1.17E+01	NR	2.61E+03	NR	1.59E+01	NR	3.54E+03	NR	2.57E+01	NR	5.71E+03
Chloromethane		NR	1.17E-02	NR	1.91E+03	NR	1.38E-02	NR	2.24E+03	NR	1.85E-02	NR	2.99E+03
Cis 1,2 Dichloroethene		1.56E-01	NR	NR	3.94E+03	2.66E-01	NR	NR	6.61E+03	5.18E-01	NR	NR	1.29E+04
Dichloromethane		7.04E-01	3.05E+00	6.24E-01	7.27E+03	1.27E+00	4.06E+00	1.08E+00	9.68E+03	2.33E+00	6.42E+00	1.92E+00	1.53E+04
Tetrachloroethene (PCE)		1.33E+01	3.19E-01	3.11E-01	4.24E+02	3.11E+01	7.15E-01	6.99E-01	9.51E+02	7.12E+01	1.64E+00	1.60E+00	2.18E+03
Trans 1,2 Dichloroethene		6.45E+00	2.76E-01	NR	3.42E+03	1.29E+01	4.99E-01	NR	6.17E+03	2.74E+01	1.02E+00		1.26E+04
Trichloroethene (TCE)		9.30E-03	3.61E-02	NR	1.54E+03	1.95E-02	7.57E-02	NR	3.22E+03	4.34E-02	1.68E-01	NR	7.14E+03
Vinyl Chloride (chloroethene)		1.13E-02	1.47E-02	6.38E-03	1.36E+03	2.09E-02	1.90E-02	9.97E-03	1.76E+03	3.88E-02	2.91E-02	1.66E-02	2.69E+03
Semi-Volatile Organic Compounds													
2-Chloronaphthalene		2.76E+02	5.39E+00	5.29E+00	1.14E+02	6.59E+02	1.33E+01	1.30E+01	2.80E+02	1.45E+03	3.17E+01	3.10E+01	6.69E+02

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH HOME-GROWN PRODUCE

Table 4

Human Health Generic Assessment Criteria by Pathway for Residential With Home-Grown Produce Scenario

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Acenaphthene		2.27E+02	4.86E+04	2.26E+02	5.70E+01	5.41E+02	1.18E+05	5.38E+02	1.41E+02	1.18E+03	2.68E+05	1.17E+03	3.36E+02
Acenaphthylene		1.85E+02	4.59E+04	1.84E+02	8.61E+01	4.42E+02	1.11E+05	4.40E+02	2.12E+02	9.78E+02	2.53E+05	9.74E+02	5.06E+02
Anthracene		2.43E+03	1.53E+05	2.39E+03	1.17E+00	5.53E+03	3.77E+05	5.45E+03	2.91E+00	1.10E+04	8.76E+05	1.09E+04	6.96E+00
Benzo(a)anthracene		1.01E+01	2.47E+01	7.18E+00	1.71E+00	1.42E+01	4.37E+01	1.07E+01	4.28E+00	1.69E+01	6.26E+01	1.33E+01	1.03E+01
Benzo(a)pyrene	(a)	4.96E+00	3.51E+01	NR	9.11E-01	4.96E+00	3.77E+01	NR	2.28E+00	4.96E+00	3.89E+01	NR	5.46E+00
Benzo(b)fluoranthene		2.96E+00	1.93E+01	2.56E+00	1.22E+00	3.89E+00	2.13E+01	3.29E+00	3.04E+00	4.43E+00	2.22E+01	3.69E+00	7.29E+00
Benzo(g,h,i)perylene		3.77E+02	1.87E+03	3.14E+02	1.54E-02	4.09E+02	1.94E+03	3.38E+02	3.85E-02	4.23E+02	1.97E+03	3.48E+02	9.23E-02
Benzo(k)fluoranthene		8.92E+01	5.41E+02	7.66E+01	6.87E-01	1.10E+02	5.76E+02	9.22E+01	1.72E+00	1.21E+02	5.91E+02	1.00E+02	4.12E+00
Chrysene		1.66E+01	1.19E+02	1.46E+01	4.40E-01	2.54E+01	1.49E+02	2.17E+01	1.10E+00	3.19E+01	1.66E+02	2.67E+01	2.64E+00
Dibenzo(a,h)anthracene		2.90E-01	1.45E+00	2.41E-01	3.93E-03	3.43E-01	1.64E+00	2.84E-01	9.82E-03	3.69E-01	1.74E+00	3.04E-01	2.36E-02
Fluoranthene		2.87E+02	3.83E+04	2.85E+02	1.89E+01	5.63E+02	8.87E+04	5.60E+02	4.73E+01	9.00E+02	1.83E+05	8.96E+02	1.13E+02
Fluorene		1.77E+02	6.20E+03	1.72E+02	3.09E+01	4.19E+02	1.53E+04	4.07E+02	7.65E+01	8.98E+02	3.62E+04	8.77E+02	1.83E+02
Hexachloroethane		2.68E-01	NR	NR	8.17E+00	6.57E-01	NR	NR	2.01E+01	1.55E+00	NR	NR	4.81E+01
Indeno(1,2,3-cd)pyrene		3.09E+01	2.12E+02	2.70E+01	6.13E-02	4.22E+01	2.38E+02	3.59E+01	1.53E-01	4.92E+01	2.50E+02	4.11E+01	3.68E-01
Naphthalene		2.78E+01	2.33E+01	1.27E+01	7.64E+01	6.66E+01	5.58E+01	3.04E+01	1.83E+02	1.53E+02	1.31E+02	7.06E+01	4.32E+02
Phenanthrene		9.85E+01	7.17E+03	9.72E+01	3.60E+01	2.24E+02	1.76E+04	2.22E+02	8.96E+01	4.48E+02	4.07E+04	4.43E+02	2.14E+02
Pyrene		6.25E+02	8.79E+04	6.20E+02	2.20E+00	1.25E+03	2.04E+05	1.24E+03	5.49E+00	2.05E+03	4.23E+05	2.04E+03	1.32E+01
Phenol		1.60E+02	4.58E+02	1.20E+02	2.42E+04	2.96E+02	6.95E+02	2.09E+02	3.81E+04	5.86E+02	1.19E+03	3.93E+02	7.03E+04
Total Petroleum Hydrocarbons													
Aliphatic hydrocarbons EC_5-EC_6		4.99E+03	4.24E+01	4.23E+01	3.04E+02	1.13E+04	7.79E+01	7.78E+01	5.58E+02	2.50E+04	1.61E+02	1.60E+02	1.15E+03
Aliphatic hydrocarbons >EC_6-EC_8		1.49E+04	1.04E+02	1.03E+02	1.44E+02	3.43E+04	2.31E+02	2.31E+02	3.22E+02	7.11E+04	5.29E+02	5.28E+02	7.36E+02
Aliphatic hydrocarbons >EC_8-EC_{10}		1.61E+03	2.68E+01	2.67E+01	7.77E+01	2.91E+03	6.55E+01	6.51E+01	1.90E+02	4.26E+03	1.56E+02	1.54E+02	4.51E+02
Aliphatic hydrocarbons >EC_{10}-EC_{12}		4.57E+03	1.33E+02	1.32E+02	4.75E+01	5.51E+03	3.31E+02	3.26E+02	1.18E+02	5.98E+03	7.93E+02	7.65E+02	2.83E+02
Aliphatic hydrocarbons >EC_{12}-EC_{16}		6.27E+03	1.11E+03	1.06E+03	2.37E+01	6.34E+03	2.78E+03	2.41E+03	5.91E+01	6.36E+03	6.67E+03	4.34E+03	1.42E+02
Aliphatic hydrocarbons >EC_{16}-EC_{35}	(b)	6.46E+04	NR	NR	8.48E+00	9.17E+04	NR	NR	2.12E+01	1.10E+05	NR	NR	5.09E+01
Aliphatic hydrocarbons >EC_{35}-EC_{44}	(b)	6.46E+04	NR	NR	8.48E+00	9.17E+04	NR	NR	2.12E+01	1.10E+05	NR	NR	5.09E+01
Aromatic hydrocarbons >EC8-EC_{10}		5.76E+01	4.74E+01	3.45E+01	6.13E+02	1.38E+02	1.16E+02	8.38E+01	1.50E+03	3.07E+02	2.77E+02	1.94E+02	3.58E+02
Aromatic hydrocarbons >EC_{10}-EC_{12}		8.29E+01	2.58E+02	7.52E+01	3.64E+02	1.96E+02	6.39E+02	1.79E+02	8.99E+02	4.25E+02	1.52E+03	3.91E+02	2.15E+03
Aromatic hydrocarbons >EC_{12}-EC_{16}		1.47E+02	2.85E+03	1.45E+02	1.69E+02	3.36E+02	7.07E+03	3.32E+02	4.19E+02	6.81E+02	1.68E+04	6.74E+02	1.00E+03
Aromatic hydrocarbons >EC_{16}-EC_{21}	(b)	2.63E+02	NR	NR	5.37E+01	5.45E+02	NR	NR	1.34E+02	9.34E+02	NR	NR	3.21E+02
Aromatic hydrocarbons >EC_{21}-EC_{35}	(b)	1.09E+03	NR	NR	4.83E+00	1.47E+03	NR	NR	1.21E+01	1.70E+03	NR	NR	2.90E+01
Aromatic hydrocarbons >EC_{35}-EC_{44}	(b)	1.09E+03	NR	NR	4.83E+00	1.47E+03	NR	NR	1.21E+01	1.70E+03	NR	NR	2.90E+01

Notes:

EC - equivalent carbon. SAC - soil assessment criteria.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

Calculated SAC exceeds soil saturation limit and may significantly affect the interpretation of any exceedances as the contribution of the indoor and outdoor vapour pathway to total exposure is >10%.

Calculated SAC exceeds soil saturation limit but the exceedance will not affect the SAC significantly as the contribution of the indoor and outdoor vapour pathway to total exposure is <10%.

Calculated SAC does not exceed the soil saturation limit.

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway (Section 10.1.1, SR3)

(a) SAC for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead are derived using the C4SL toxicology data.

(b) SAC for boron and selenium should not include the inhalation pathway as no expert group HCV has been derived; aliphatic and aromatic hydrocarbons >EC16 should not include inhalation pathway due to their non-volatile nature and inhalation exposure being minimal (oral, dermal and inhalation exposure is compared to the oral HCV); arsenic should only be based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV report. The Oral SAC should be adopted for zinc and benzo(a)pyrene.

(c) SAC for CrIII should be based on the lower of the oral and inhalation SAC (see LQM/CIEH 2015 Section 6.8)

(d) SAC for elemental mercury, chromium VI and nickel should be based on the inhalation pathway only.

(e) SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used.

Table 5
Human Health Generic Assessment Criteria for Residential with home-grown produce

Compound	SAC for Soil SOM 1% (mg/kg)	SAC for Soil SOM 2.5% (mg/kg)	SAC for Soil SOM 6% (mg/kg)
Metals			
Arsenic	37	37	37
Barium	1,300	1,300	1,300
Beryllium	1.7	1.7	1.7
Boron	300	300	300
Cadmium	22	22	22
Chromium (III) - trivalent	910	910	910
Chromium (VI) - hexavalent	21	21	21
Copper	2,500	2,500	2,500
Lead	200	200	200
Elemental Mercury (Hg^0)	0.2	0.6	1.2
Inorganic Mercury (Hg^{2+})	39	39	39
Methyl Mercury (Hg^{4+})	10	10	10
Nickel	130	130	130
Selenium	258	258	258
Vanadium	410	410	410
Zinc	3,900	3,900	3,900
Cyanide (free)	1.4	1.4	1.4
Volatile Organic Compounds			
Benzene	0.20	0.41	0.87
Toluene	130	300	680
Ethylbenzene	50	110	260
Xylene - m	59	140	327
Xylene - o	61	143	332
Xylene - p	57	133	310
Total xylene	57	133	310
Methyl tertiary-Butyl ether (MTBE)	60	110	210
1,1,1,2 Tetrachloroethane	1.20	2.78	6.46
1,1,2,2-Tetrachloroethane	1.6	3.5	7.7
1,1,1-Trichloroethane	9	18	39
1,1,2 Trichloroethane	0.8	1.6	3.5
1,1-Dichloroethene	0.32	0.57	1.16
1,2-Dichloroethane	0.007	0.011	0.019
1,2,4-Trimethylbenzene	1.8	4.3	9.7
1,3,5-Trimethylbenzene	NR	NR	NR
1,2-Dichloropropane	0.034	0.060	0.120
Carbon Tetrachloride (tetrachloromethane)	0.026	0.056	0.127
Chloroethane	11.7	15.9	25.7
Chloromethane	0.012	0.014	0.019
Cis 1,2 Dichloroethene	0.16	0.27	0.52
Dichloromethane	0.62	1.08	1.92
Tetrachloroethene (PCE)	0.31	0.70	1.60
Trans 1,2 Dichloroethene	0.28	0.50	1.02
Trichloroethene (TCE)	0.009	0.020	0.043
Vinyl Chloride (chloroethene)	0.006	0.010	0.017
Semi-Volatile Organic Compounds			
2-Chloronaphthalene	5	13	31
Acenaphthene	230	540	1,170
Acenaphthylene	180	440	970
Anthracene	2,400	5,500	10,900
Benzo(a)anthracene	7	11	13
Benzo(a)pyrene	5	5	5
Benzo(b)fluoranthene	2.6	3.3	3.7
Benzo(g,h,i)perylene	310	340	350
Benzo(k)fluoranthene	77	92	100
Chrysene	15	22	27
Dibenzo(a,h)anthracene	0.24	0.28	0.30
Fluoranthene	290	560	900
Fluorene	170	410	880
Hexachloroethane	0.27	0.66	1.55
Indeno(1,2,3-cd)pyrene	13	30	71
Naphthalene	13	30	71
Phenanthrene	100	220	440
Pyrene	620	1,240	2,040
Phenol	120	210	390
Total Petroleum Hydrocarbons			
Aliphatic hydrocarbons EC_5-EC_6	42	78	160
Aliphatic hydrocarbons >EC_6-EC_8	100	230	530
Aliphatic hydrocarbons >EC_8-EC_{10}	27	65	154
Aliphatic hydrocarbons >EC_{10}-EC_{12}	130 (48)	330 (118)	760 (283)
Aliphatic hydrocarbons >EC_{12}-EC_{16}	1,100 (24)	2,400 (59)	4,300 (142)
Aliphatic hydrocarbons >EC_{16}-EC_{35}	65,000 (8)	92,000 (21)	110,000
Aliphatic hydrocarbons >EC_{35}-EC_{44}	65,000 (8)	92,000 (21)	110,000
Aromatic hydrocarbons >EC_8-EC_{10}	30	80	190
Aromatic hydrocarbons >EC_{10}-EC_{12}	80	180	390
Aromatic hydrocarbons >EC_{12}-EC_{16}	140	330	670
Aromatic hydrocarbons >EC_{16}-EC_{21}	260	540	930
Aromatic hydrocarbons >EC_{21}-EC_{35}	1,100	1,500	1,700
Aromatic hydrocarbons >EC_{35}-EC_{44}	1,100	1,500	1,700
Minerals			
Asbestos	Stage 1 test – No asbestos detected with ID; Stage 2 test - <0.001% dry weight (exceedance of either equates to an exceedance of the GAC)[1]		

Notes:

'-' Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data.

NR - SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used

EC - equivalent carbon. SAC - soil assessment criteria.

[1] LOD for weight of asbestos per unit weight of soil calculated on a dry weight basis using PLM, handpicking and gravimetry.

The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3.

(VALUE IN BRACKETS)

RSK has adopted an approach for petroleum hydrocarbons in accordance with LQM/CIEH whereby the concentration modelled for each petroleum hydrocarbon fraction has been tabulated as the SAC with the corresponding solubility or vapour saturation limits given in brackets.

Generic assessment criteria for human health: residential scenario without home-grown produce

Background

RSK's generic assessment criteria (GAC) were initially prepared following the publication by the Environment Agency (EA) of soil guideline value (SGV) and toxicological (TOX) reports, and associated publications in 2009[1]. RSK GAC were updated following the publication of GAC by LQM/CIEH in 2009[2]. RSK GAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

Updates to the RSK GAC

In 2014, the publication of Category 4 Screening Levels (C4SL)[3,4], as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3)[5] used in the generation of SGVs.

C4SL were initially published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010[3]). Further C4SL were published in 2021 for vinyl chloride, tetrachloroethene (PCE) and trichloroethene (TCE). Where a C4SL has been published, the RSK GAC duplicates the C4SL using all input parameters within the SP1010 final project report[3] and associated chemical specific reports[6], and adopts them as GAC for these substances. Due to the use of decimal places rather than significant figures applied to the Contaminated Land Exposure Assessment (CLEA) tool outputs, the GAC presented may be marginally differently to the C4SL values, however any differences between the values are minimal and would not equate to an unacceptable risk.

For all other substances the C4SL exposure modifications relevant for residential without home-grown produce end use have been applied to the current RSK GAC. These include alterations to daily inhalation rates for residential and commercial scenarios, reducing soil adherence factors in children (age classes 1 to 12 only) and reducing exposure frequency for dermal contact outdoors.

The RSK GAC have also been revised with updated toxicology published by LQM/CIEH in 2015[7] or by the USEPA[14], where a C4SL has not been published.

RSK GAC derivation for metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using the CLEA tool v1.071, supporting EA guidance[5,8,9] and revised exposure scenarios published for the C4SL[3]. The SAC are also termed GAC.

Conceptual model

In accordance with SR3[5], the residential without home-grown produce scenario considers risks to a female child between the ages of 0 and 6 years old as the highest risk scenario. In

accordance with Box 3.1 of SR3[5], the pathways considered for production of the SAC in the residential without home-grown produce scenario are

- direct soil and dust ingestion in areas of soft landscaping
- dermal contact with soil and indoor dust
- inhalation of indoor and outdoor dust and vapours.

Figure 1 is a conceptual model illustrating these linkages.

In line with guidance in the EA SGV report for cadmium[1], the RSK GAC for cadmium has been derived based on estimates representative of lifetime exposure. Although young children are generally more likely to have higher exposures to soil contaminants, the renal toxicity of cadmium, and the derivation of the TDI_{oral} and TDI_{inh}, are based on considerations of the kidney burden accumulated over 50 years or so. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period.

With respect to volatilisation, the CLEA model assumes a simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase[9]. The upper boundaries of this partitioning are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model estimates saturated soil concentrations where these limits are reached[9]. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous- or vapour-based soil saturation limits. Model output cells are flagged red where the saturated soil concentration has been exceeded and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10%. In this case, further consideration of the following is required[9]:

- Free phase contamination may be present.
- Exposure from the vapour pathways will be over-predicted by the model, as in reality the vapour phase concentration will not increase at concentrations above saturation limits
- Where the vapour pathway contribution is greater than 90%, it is unlikely the relevant health criteria value (HCV) will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Where the vapour pathway is the predominant pathway (contributes greater than 90% of exposure) or the only exposure route considered and the cell is highlighted red (SAC exceeds saturation limit), the risk based on the assumed conceptual model is likely to be negligible as the vapour risk is assumed to be tolerable at maximum possible soil concentrations. In such circumstances, the vapour pathway exposure should be considered based on the presence of free phase or non-aqueous phase liquid sources and the measured concentrations of volatile organic compounds (VOC) in the vapour phase. Screening could be considered based on setting the SAC as the modelled soil saturation limits. However, as stated within the CLEA handbook[9], this is likely to not be practical in many cases because of the very low saturation limits and, in any case, is highly conservative.

It should also be noted that for mixtures of compounds, free phase may be present where soil (or groundwater) concentrations are well below saturation limits for individual compounds.

Where the vapour pathway is only one of the exposure pathways considered, an additional approach can then be utilised as detailed within Section 4.12 of the CLEA model handbook[9], which explains how to calculate an effective assessment criterion manually.

SR3[5] states that, as a general rule of thumb, it is recognised that estimating vapour phase concentrations from dissolved and sorbed phase contamination by petroleum hydrocarbons are at least a factor of ten higher than those likely to be measured on-site. RSK has therefore applied an empirical subsurface to indoor air correction factor of 10 into the CLEA model chemical database for all petroleum hydrocarbon fractions (including BTEX, trimethylbenzenes and the polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene) to reduce this conservatism.

Input selection

The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7[10], the EA TOX[1] reports, the C4SL SP1010 project report and associated chemical specific reports[3,6], the 2015 LQM/CIEH report[7] or the USEPA IRIS database[14]. Where a LLTC[3,6] has been published for a substance, RSK has used these input parameters to derive the RSK GAC. Toxicological and specific chemical parameters for 1,2,4-trimethylbenzene, barium and methyl tertiary-butyl ether (MTBE) were obtained from the CL:AIRE Soil Generic Assessment Criteria report[11].

For TPH, aromatic hydrocarbons C_5–C_8 were not modelled, as this range comprises benzene (>EC5-EC7) and toluene (>EC7-EC8), which are modelled separately.

Physical parameters

For the residential without home-grown produce scenario, the CLEA default building is a small, two-storey terrace house with a concrete ground-bearing slab. SR3[5] notes this residential building type to be the most conservative in terms of potential for vapour intrusion. The building parameters used in the production of the RSK GACs are the default CLEA v1.06 inputs presented in Table 3.3 of SR3[3], with a dust loading factor detailed in Section 9.3 of SR3[5]. The parameters for a sandy loam soil type were used in line with Table 4.4 of SR3[5]. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for this SOM, RSK has produced an additional set of GAC for SOM of 1% and 2.5% for all substances using the CLEA tool.

Summary of modifications to the default CLEA SR3[5] input parameters for residential without home-grown produce

In summary, the RSK GAC were produced using the default input parameters for soil properties, the air dispersion model, building properties and the vapour model detailed in SR3[5]. Modifications to the default SR3[5] exposure scenarios based on the C4SL exposure scenarios[3] are presented in Table 2 below.

The final selected GAC are presented by pathway in Table 3 and the combined GAC in Table 4.

Figure 1: Conceptual model for CLEA residential scenario without home-grown produce

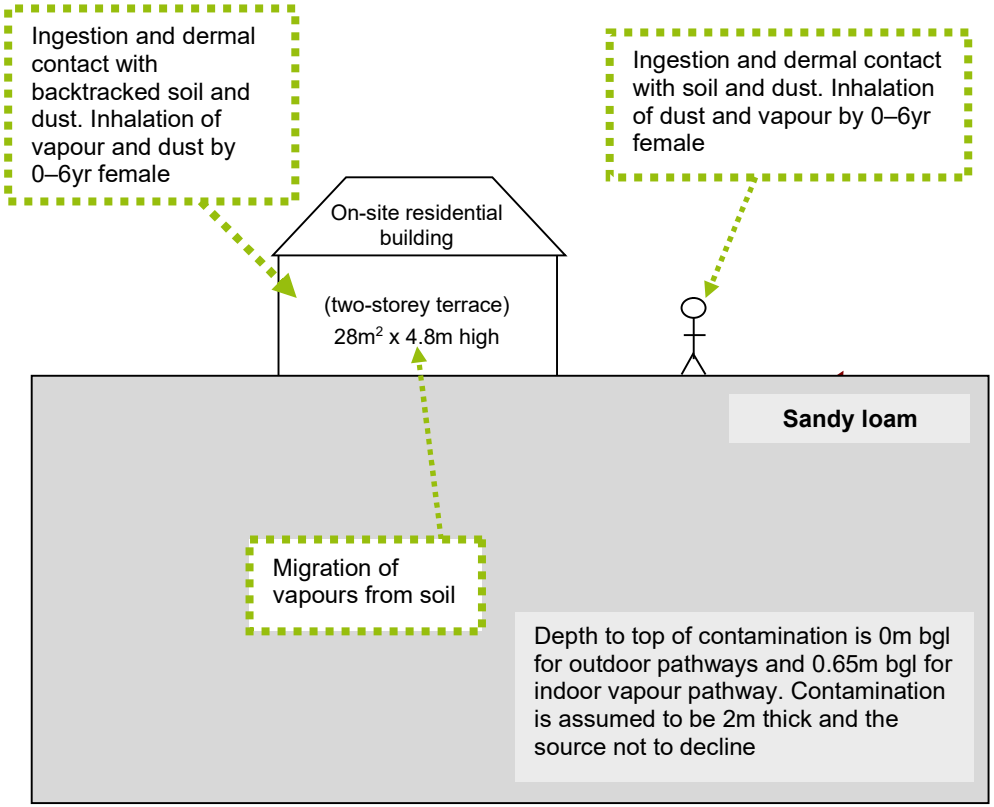

Table 1: Exposure assessment parameters for residential scenario without home-grown produce – inputs for CLEA model

Parameter	Value	Justification
Land use	Residential without home-grown produce	Chosen land use
Receptor	Female child	Key generic assumption given in Box 3.1, SR3[5]
Building	Small terraced house	Key generic assumption given in Box 3.1, SR3[5]. Small, two-storey terraced house chosen, as it is the most conservative residential building type in terms of protection from vapor intrusion (Section 3.4.6, SR3)[5]
Soil type	Sandy loam	Most common UK soil type (Section 4.3.1, from Table 3.1, SR3)[5]
Start age class (AC)	1	Range of age classes corresponding to key generic assumption that the critical receptor is a young female child aged 0–6. From Box 3.1, SR3[5]
End AC	6	
SOM (%)	6	Representative of sandy loamy soil according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents'[13]
	1	To provide SAC for sites where SOM <6% as often observed by RSK
	2.5	
pH	7	Model default

Table 2: Residential without home-grown produce – modified receptor data

Parameter	Unit	Age class					
		1	2	3	4	5	6
Soil to skin adherence factor – (outdoor)	mg soil/cm^2 skin	0.1	0.1	0.1	0.1	0.1	0.1
Justification		Table 3.5, SP1010[3]					
Inhalation rate	m^3 day^{-1}	5.4	8.0	8.9	10.1	10.1	10.1
Justification		Mean value USEPA, 2011[12]; Table 3.2, SP1010[3]					
Notes: For **cadmium**, the exposure assessment for a residential land use is based on estimates representative of lifetime exposure AC1-18. This is because the TDI_{oral} and TDI_{inh} are based on considerations of the kidney burden accumulated over 50 years. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period. See the Environment Agency Science Report SC05002/ TOX 3[1], Science Report SC050021/Cadmium SGV[1] and the project report SP1010[3] for more information.							

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