

Ref J2899/14/E
8th August 2016

**Environmental
Geotechnical
Specialists**



Barclay Firth,
Ground Floor,
Riverside Mills,
Saddleworth Road,
Elland,
HX5 0RY.

For the attention of Neil Hamilton

Dear Neil,

Ref: Land off Hoyle Beck Close, Linthwaite.

It is understood that the above mentioned site has been remediated by the removal of the contaminated ground during the construction process and in accordance with your instructions we have undertaken testing to validate that the site is now uncontaminated. This work is complete and we take pleasure in enclosing the results. The following describes the work undertaken, presents the data obtained and discusses the findings in association with the proposed development.

Fieldworks

Five hand dug trial pits were excavated within selected landscaped areas (Plots 1 to 5) on the 8th August 2016. The trial pit locations are illustrated on the site plan, which is attached to this letter. All trial pits fully penetrated the imported fill to reveal the gravel capillary break. Soil samples were recovered from each trial pit and brought back to Rogers Geotechnical Services Laboratory to be logged in general accordance with BS5930: 2015, and full descriptions are given on the trial pit records, which are attached to this letter. In addition, photographs taken during the fieldworks are also attached, which illustrate the depth of the upper surface of the capillary break below ground level within each trial pit.

Chemical Test Results

A suite of testing was undertaken in samples taken across the site and the following testing regime was undertaken:

- Metals – Cd, Cr^{VI}, Cu, Hg, Ni, Pb, V and Zn.
- Semi and Non-Metals - As, Se, and Free CN⁻.
- Polycyclic aromatic hydrocarbons (PAHs).
- Petroleum hydrocarbons (TPHs).
- Others – pH, organic content and total SO₄²⁻.

A summary of contamination analysis is also attached to this letter.

Discussion of Results

The results of the chemical testing have been compared to the ATRISK soil screening values (SSVs) for residential development with plant uptake, as compiled by WS Atkins plc. These values have been derived in such a way as to adhere to the principles within the revised CLEA model and include the most current release of the SGVs. A list of subscribers is provided within the website¹ and these include many local authorities.

A comparison of the results of the testing, together with the data given above, has been attached to this letter. These results indicate the following:

Table 1: Summary of contaminated areas.

Sample Reference	Depth (m)	Contaminants found to be exceeding SSVs (Residential with plant uptake)
TP1	0.30	PAH [Benzo(a)pyrene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene].
TP2	0.45	PAH [Benzo(a)pyrene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene].
TP3	0.40	Lead, PAH [Pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene].
TP4	0.30	PAH [Chrysene, benzo(a)pyrene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene].
TP5	0.35	PAH [Chrysene, benzo(a)pyrene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene].

Concentrations of chromium^{VI}, free cyanide, phenols and petroleum hydrocarbons (aliphatic C5 to C12 and aromatic C5 to C16) were below the detection limits for the tests. Detectable levels of all other contaminants were recorded, but these fell below the associated ATRISK Soil Screening Values.

It should be appreciated that the soil screening values for the PAHs represents vapour saturation limits. The inhalation of vapour pathway contributes less than 10% of total exposure which is unlikely to significantly affect the combined assessment criterion². In view of this, the ATRISK soil SSVs notes that the users may wish to consider using a combined assessment criterion given by CLEA if free product is not observed, the values for which are also provided on the summary of contamination analysis. In this case, no free product was observed, thus it is considered that the CLEA criteria should be adopted for the PAHs at this site. The results of the contaminants found to exceed these screening values are tabulated below:

Table 2: Summary of areas contaminated by PAHs.

Sample Reference	Depth (m)	Contaminants found to be exceeding SSVs (Residential with plant uptake)
TP1	0.30	PAH [Benzo(a)pyrene].
TP2	0.45	PAH [Benzo(a)pyrene].

¹ <http://www.atrisksoil.co.uk/pages/general/subscribers.asp>

² Ref: ATRISK soil, SSVs derived using CLEA v1.04 for 6% SOM, Residential with plant uptake land use, 14.12.09.

TP3	0.40	PAH [Benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene].
TP4	0.30	PAH [Benzo(a)pyrene, dibenz(a,h)anthracene].
TP5	0.35	PAH [Benzo(a)pyrene, dibenz(a,h)anthracene].

On the basis of the information provided above, it is considered that this material is contaminated by lead and PAH's.

Conclusions

The results of the trial pitting have revealed that between 0.5m and 0.6m of imported fill is present over the granular capillary break. However, the chemical test results indicate the fill to be contaminated. Therefore, it is considered that the fill does not meet the requirements of the remediation objectives and is unsuitable for use at this site given the residential nature of the development.

References

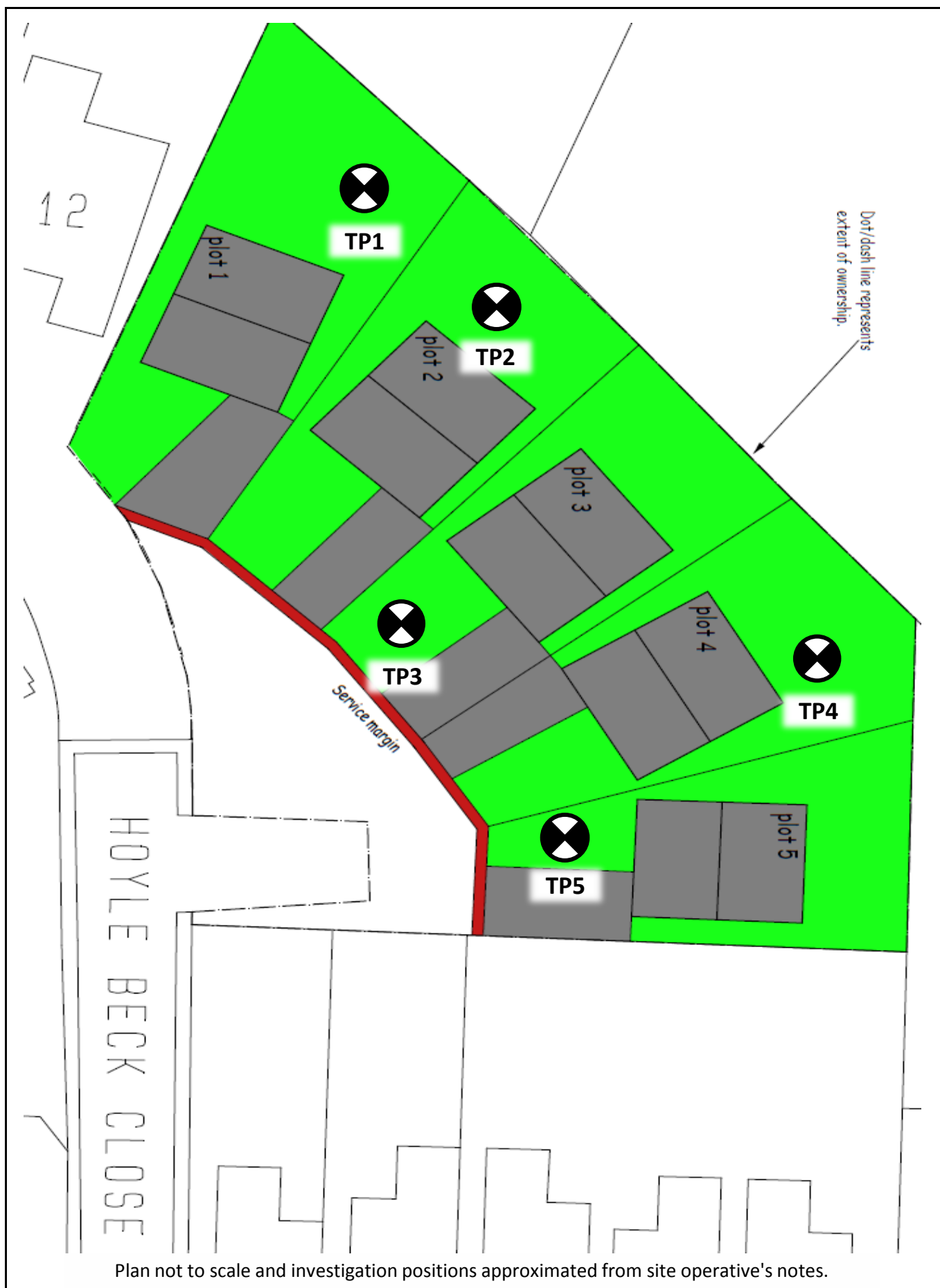
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – Final SC050021/SR2, *Human Health toxicological assessment of contaminants in soil*. Environment Agency, Bristol.
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – SC050021/SR3, *Updated technical background to the CLEA model*. Environment Agency, Bristol.
- WS Atkins plc, 2011, Soil Screening Values, Derived using CLEA v1.04 and January 2009 Guidance: SSVs derived using CLEA v1.04 for 6% SOM, Residential with home grown produce land use.

We trust that this information is of interest and should you have any other requirements do not hesitate to contact us.

For Rogers Geotechnical Services Ltd,
Yours sincerely,

I.Sakoor BEng
Geotechnical Engineer

R. A. Palmer, MSc, FGS.
Graduate Geotechnical Engineer



Title: **Investigation Location Plan**



Rogers Geotechnical Services Ltd

Site Name:
**Hoyle Beck Close
Linthwaite**

Job No:
J2889/14/E



PLOT 1



Rogers
Geotechnical
Services Ltd

Project Name:
Hoyle Beck Close, Linthwaite

Project Number:
J2899/14/E



PLOT 2



Rogers
Geotechnical
Services Ltd

Project Name:
Hoyle Beck Close, Linthwaite

Project Number:
J2899/14/E



PLOT 3



Rogers
Geotechnical
Services Ltd

Project Name:
Hoyle Beck Close, Linthwaite

Project Number:
J2899/14/E



PLOT 4



Rogers
Geotechnical
Services Ltd

Project Name:
Hoyle Beck Close, Linthwaite

Project Number:
J2899/14/E



PLOT 5



Rogers
Geotechnical
Services Ltd

Project Name:
Hoyle Beck Close, Linthwaite

Project Number:
J2899/14/E



2183



Final Report

Report No.: 16-18030-1

Initial Date of Issue: 03-Aug-2016

Client Rogers Geotechnical Services Ltd

Client Address: Offices 1 & 2, Barncliffe Business
Near Bank Shelley
Huddersfield
West Yorkshire
HD8 8LU

Contact(s): Imran Sakoor

Project J2889/14/E - Linthwaite

Quotation No.:

Order No.: 0716-44

No. of Samples: 5

Turnaround (Wkdays): 5

Date Approved: 03-Aug-2016

Date Received: 28-Jul-2016**Date Instructed:** 28-Jul-2016**Results Due:** 03-Aug-2016**Details:** Phil Hellier, Project Director

Results - Soil

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.:				16-18030	16-18030	16-18030	16-18030	16-18030
Quotation No.:	Chemtest Sample ID.:				330076	330077	330078	330079	330080
Order No.: 0716-44	Client Sample Ref.:				Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
	Client Sample ID.:				D	D	D	D	D
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.30	0.45	0.40	0.30	0.35
	Date Sampled:				27-Jul-2016	27-Jul-2016	27-Jul-2016	27-Jul-2016	27-Jul-2016
Determinand	Accred.	SOP	Units	LOD					
Cadmium	M	2450	mg/kg	0.10	0.39	0.43	0.35	0.31	0.55
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Copper	M	2450	mg/kg	0.50	38	46	210	40	57
Mercury	M	2450	mg/kg	0.10	0.27	0.28	0.37	0.17	0.38
Nickel	M	2450	mg/kg	0.50	23	25	32	22	34
Lead	M	2450	mg/kg	0.50	75	80	180	59	160
Zinc	M	2450	mg/kg	0.50	100	120	120	94	120
Vanadium	U	2450	mg/kg	5.0	33	35	34	34	37
Arsenic	M	2450	mg/kg	1.0	21	27	21	22	21
Selenium	M	2450	mg/kg	0.20	0.70	0.89	0.67	0.80	0.69
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Naphthalene	M	2700	mg/kg	0.10	0.50	0.28	6.0	1.1	0.54
Acenaphthylene	M	2700	mg/kg	0.10	0.15	0.10	8.4	0.29	0.24
Acenaphthene	M	2700	mg/kg	0.10	0.33	0.29	2.7	0.71	0.64
Fluorene	M	2700	mg/kg	0.10	0.36	0.39	11	0.81	0.75
Phenanthrene	M	2700	mg/kg	0.10	2.4	2.8	57	6.1	7.0
Anthracene	M	2700	mg/kg	0.10	0.52	0.63	15	1.6	1.8
Fluoranthene	M	2700	mg/kg	0.10	3.2	3.4	44	5.9	9.9
Pyrene	M	2700	mg/kg	0.10	3.5	3.7	41	6.0	9.7
Benzo[a]anthracene	M	2700	mg/kg	0.10	1.7	1.7	18	2.6	4.5
Chrysene	M	2700	mg/kg	0.10	1.9	2.0	18	2.9	5.1
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	2.0	2.0	18	2.9	5.6
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	1.2	1.4	8.0	1.5	3.0
Benzo[a]pyrene	M	2700	mg/kg	0.10	1.5	1.5	15	2.3	4.3
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	0.93	0.92	8.3	1.5	2.9
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	0.88	0.96	3.0	1.1	2.1
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	1.2	1.0	8.0	1.5	3.5
Total Of 16 PAH's	M	2700	mg/kg	2.0	22	23	280	39	62
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	5.6
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	13	36	38	6.8	70
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	M	2680	mg/kg	5.0	13	36	39	6.8	77

Results - Soil

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.:				16-18030	16-18030	16-18030	16-18030	16-18030
Quotation No.:	Chemtest Sample ID.:				330076	330077	330078	330079	330080
Order No.: 0716-44	Client Sample Ref.:				Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
	Client Sample ID.:				D	D	D	D	D
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.30	0.45	0.40	0.30	0.35
	Date Sampled:				27-Jul-2016	27-Jul-2016	27-Jul-2016	27-Jul-2016	27-Jul-2016
Determinand	Accred.	SOP	Units	LOD					
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	3.3
Aromatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	7.2	19	< 1.0	61
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	31	66	180	13	340
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	M	2680	mg/kg	5.0	31	73	200	13	410
Total Petroleum Hydrocarbons	M	2680	mg/kg	10	43	110	240	20	480
pH	M	2010		N/A	7.6	7.7	7.9	7.8	7.9
Sulphate (2:1 Water Soluble) as SO ₄	M	2120	g/l	0.010	0.093	0.078	0.21	0.059	0.27
Moisture	N	2030	%	0.020	21	20	18	19	17
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones	Stones, Roots	Stones	Stones
Soil Texture	N	2040		N/A	Clay	Clay	Sand	Clay	Sand
Sulphate (Total)	M	2430	%	0.010	0.11	0.11	0.20	0.078	0.18
Organic Matter	M	2625	%	0.40	5.3	5.2	9.5	4.7	7.1

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at our Coventry laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk

SUMMARY OF CONTAMINATION ANALYSIS - including Atkins ATRISK SSVs

Job Number: J2889/16/E
Date: 04/08/2016

Tox Data Report No.	Compound	Range of Values Found (mg/kg)		Residential with Homegrown Produce Landuse (mg/kg)		Reference
	<i>Metals</i>	Min	Max			
3	Cadmium	0.31	0.55	10		A
4	Chromium VI	<0.5	<0.5	14.7		A
	Copper	38	210	4020		A
7	Mercury	0.17	0.38	1.00		A
8	Nickel	22	34	130		A
	Lead	59	180	168		A
	Zinc	94	120	17200		A
	Vanadium	33	37	115		A
	<i>Semi and Non Metals</i>					
1	Arsenic	21	27	32		A
10	Selenium	0.67	0.89	350		A
	Free Cyanide	<0.5	<0.5	34		A
9	Phenols (total)	<0.3	<0.3	420		A
	<i>Poly Aromatic Hydrocarbons</i>			ATRISK	CLEA	
20	Napthalene	0.28	6	8.71		A
	Acenaphthene	0.29	2.7	937	2130	A
	Fluorene	0.36	11	746	1930	A
	Anthracene	0.52	15	20.9	18300	A
	Fluoranthene	3.2	44	113	2160	A
	Pyrene	3.5	41	13.2	1550	A
	Benzo(a)anthracene	1.7	18	8.54		A
2	Chrysene	1.9	18	2.64	927	A
2	Benzo(b)fluoranthene	2	18	7.29	9.86	A
2	Benzo(k)fluoranthene	1.2	8	4.12	100	A
2	Benzo(a)pyrene	1.5	15	0.998		A
2	Dibenzo(a,h)anthracene	0.88	3	0.0236	1	A*
2	Indeno(1,2,3-cd)pyrene	0.92	8.3	0.368	9.75	A
2	Benzo(g,h,i)perylene	1.2	8	0.112	103	A
	<i>Petroleum Hydrocarbons</i>					
	Aliphatic C5-C6	<1	<1	26.1		A
	Aliphatic C6-C8	<1	<1	87.8		A
	Aliphatic C8-C10	<1	<1	14.5		A
	Aliphatic C10-C12	<1	<1	87.7		A
	Aliphatic C12-C16	<1	1.2	126		A
	Aliphatic C16-C21	<1	5.6	88200		A
	Aliphatic C21-C35	6.8	70	88200		A
	Aromatic C5-C7 (Benzene)	<1	<1	0.33		A
	Aromatic C7-C8 (Toluene)	<1	<	610		A
	Aromatic C8-C10	<1	<1	23.7		A
	Aromatic C10-C12	<1	<1	132		A
	Aromatic C12-C16	<1	<1	452		A
	Aromatic C16-C21	<1	61	804		A
	Aromatic C21-C35	13	340	1220		A
	<i>Others</i>					
	pH	7.6	7.9	-		-
	Organic Content (%)	4.7	9.5	-		-
	Soluble Sulphate (g/l)	0.059	0.27	-		-
	Total Sulphate (%)	0.078	0.18	-		-

A = WS ATKINS PLC, ATRISK SOIL SCREENING VALUES BASED ON 6% SOIL ORGANIC MATTER

For PAHs ATRISK assumes free product is available whilst CLEA assumes no free product

A* Atrisk's SSV is lower than Chemtest's detectable limit for this compound.