

Appendix P

Remediation of BH304



INVISTA Textiles (UK) Ltd
73 Queen's Highland
Kepplestone
Aberdeen
AB15 4AR

Remediation of BH304
INVISTA Wilton
INVISTA Textiles (UK) Ltd
P.O. Box 401
Wilton
Redcar
TS10 4XY

September 2010
960100403

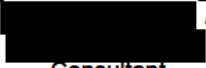
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Report Details

Client	INVISTA Textiles (UK) Ltd
Address	P.O. Box 401 Wilton Redcar TS10 4XY
Report Title	Remediation of BH304
Report Number	960100403
Report Date	September 2010

Quality Assurance

Issue Number /Status	Date	Prepared By	Technical Review	Authorised by
01 First Issue				
		 / Consultant	 Senior Consultant	 Director

If you have any queries regarding this project, please contact 

Executive Summary

ARCADIS (UK) Ltd (ARCADIS) was commissioned by INVISTA Textiles (UK) Ltd (INVISTA) to undertake soil remediation in the immediate vicinity of borehole BH304 for the INVISTA manufacturing site located at Wilton, Redcar, TS10 4XY (the site).

As part of the Environmental Permit surrender ARCADIS was contracted by INVISTA to collect data for comparison against the baseline survey, undertaken in 2002. The groundwater sampling and intrusive investigation works previously undertaken identified an isolated hotspot of ammonium centred on BH304. It was proposed that the most appropriate course of action was to undertake soil remediation.

The ground conditions below the site consists of unconsolidated drift deposits overlying mudstone. The drift deposits comprise of silty clay overlying glacial Boulder Clay. The mudstone is approximately 300m thick and is generally considered to be impermeable. The mudstone formation overlies the Sherwood Sandstone Group.

The intrusive ground investigation undertaken in the area of BH304 by ARCADIS in November 2009 (Environmental Assessment report ref: 960100201, February 2010) encountered Made Ground underlain by a firm to stiff, red brown clay at depths of between 0.2m bgl, and 0.5m bgl. All boreholes were terminated within the clay.

The Environment Agency's Groundwater Vulnerability Map shows the Wilton Site to be an area classified as a "non-aquifer (negligibly permeable)", this has since been reclassified as Secondary (class B) Aquifer (April 2010).

The majority of the groundwater detected at the site during past investigations comprises of localised perched water bodies. Groundwater levels have been found to vary widely over short distances and it has not been possible to infer any shallow groundwater flow direction.

ARCADIS attended site on 16th August 2010 and a limited excavation of the immediate area surrounding BH304 was undertaken, the monitoring well decommissioned and the excavation backfilled with clean imported material. Validation soil samples from the base and side walls of the excavation were submitted for ammonium and pH analysis and asbestos screen.

Ammonium was not detected at concentrations above the laboratory method detection limit (MDL) in any of the samples from the excavation. Following the excavation around BH304, and the decommissioning of the well, it is the opinion of ARCADIS that the area has been successfully remediated and requires no further action.

Table of Contents

1	INTRODUCTION	1
1.1	Background Information	1
1.2	Scope of Works	1
2	GROUND CONDITIONS	2
2.1	Geology	2
2.2	Hydrogeology	2
3	METHODOLOGY	3
3.1	Site Preparation	3
3.2	Excavation Works	3
3.3	Laboratory Analysis	4
4	RESULTS	5
5	CONCLUSION.....	6

Figures

- 1 Site Location and Site Boundary Plan
- 2 BH304 Remedial Excavation Location

Appendices

- A Photographs
- B Excavation Log
- C Laboratory Certificate

List of Abbreviations that may be used in this report

ARCADIS	ARCADIS (UK) Ltd
bgl	below ground level
CAT	Cable Avoidance Tool
INVISTA	INVISTA TEXTILES (UK) Ltd
m	metres
MDL	Method Detection Limit
the site	INVISTA - Wilton

1 INTRODUCTION

ARCADIS (UK) Ltd (ARCADIS) was commissioned by INVISTA Textiles (UK) Ltd (INVISTA) to undertake limited soil remediation in the immediate vicinity of borehole BH304 for the INVISTA manufacturing site located at Wilton, Redcar, TS10 4XY (the site). Figure 1 presents the site location and the site boundary.

1.1 Background Information

ARCADIS was contracted by INVISTA to collect data for comparison against the baseline survey, undertaken in 2002, as part of the Environmental Permit surrender. An initial round of groundwater monitoring was undertaken in July 2009 followed by an intrusive investigation and groundwater monitoring in November 2009. Following this, an additional two rounds of groundwater monitoring, of selected boreholes, was undertaken in June 2010. As part of the work a number of areas of concern were identified, in particular elevated concentrations of ammonium were recorded in BH304. Based on the findings of ARCADIS' previous investigations the impact in BH304 was identified to be an isolated hotspot.

Given the site environmental setting and isolated nature of the impact ARCADIS considered the most appropriate course of action to assist the Environmental Permit surrender was to undertake soil remediation in the immediate vicinity of BH304.

1.2 Scope of Works

The works included the remediation of the area around BH304 via excavation and disposal techniques, decommissioning of the monitoring well and reinstatement of the excavation area to a suitable condition to allow surrender of the Environmental Permit.

2 GROUND CONDITIONS

2.1 Geology

A review of the BGS 1:50,000 Geology Map for the area (Sheet No. 33, Guisborough, solid and drift geology) indicates the site is underlain by unconsolidated drift deposits overlying mudstone. The drift deposits comprise of silty clay overlying glacial Boulder Clay with localised occurrences of a black laminated clay. The mudstone is approximately 300m thick and is generally considered to be impermeable. The mudstone formation overlies the Sherwood Sandstone Group. The characteristics of the drift deposits have been determined through site investigations carried out at the site since 1993.

The following ground conditions were encountered during the intrusive investigation undertaken by ARCADIS in November 2009 when four additional boreholes were drilled around BH304 (Environmental Assessment Report, report ref: 960100201, February 2010).

Made Ground

Reinforced concrete was encountered in three of the four boreholes to depths of between 0.2m (BH304-1) and 0.3m bgl (BH304-2 / 4). Topsoil was encountered to a depth of 0.3m bgl in BH304-3.

Gravels

The made ground was underlain by a grey-brown clayey slightly sandy coarse gravel 0.2m thick in BH304-3. No gravel was encountered in any of the other boreholes.

Clay

A firm to stiff red brown clay was encountered in all of the boreholes at depths of between 0.2m bgl (BH304-1), and 0.5m bgl (BH304-3). All the boreholes were terminated in this clay deposit at depths of between 2.4m bgl (BH304-4) and 6m bgl (BH304-1).

2.2 Hydrogeology

The Environment Agency's Groundwater Vulnerability Map shows the Wilton Site to be an area classified as a "non-aquifer (negligibly permeable)", this has since been reclassified as Secondary (class B) Aquifer (April 2010).

Shallow groundwater monitoring wells have been installed in thirty two of the boreholes drilled across the site. In summary:

- Little or no shallow groundwater inflow has been observed from either the black laminated clay or the Boulder Clay;
- Inflow of shallow groundwater into the boreholes occurs from the sand and silt horizons in the brown silty clay and, in particular, the more granular types of made ground;
- The clay is relatively impermeable and the sand and silt horizons which occur with it are discontinuous; and
- Groundwater levels have been found to vary widely over short distances and it has not been possible to infer any shallow groundwater flow direction.

It has therefore been concluded that the majority of the groundwater detected comprises of localised perched water bodies.

3 METHODOLOGY

Due to the nature of the site geology, which comprises of made ground over clay with pockets of discontinuous sand lenses, and the limited area of impact, monitoring well BH304 was decommissioned and a small excavation of the immediate area (approximately six cubic metres) was undertaken to assist with the surrender of the Environmental Permit.

The excavation material was sampled to enable the appropriate disposal route to be identified.

The excavation was backfilled with clean imported material, the backfill was not placed to any specific engineering specification and no formal reinstatement of the hard standing was undertaken.

There was no baseline for ammonium levels in the soil for borehole BH304. The soil within the BH304 area has been shown to have been historically impacted, prior to the Environmental Permit application, therefore ARCADIS did not define specific remedial targets for this work. Instead, the aim was to improve ground conditions, from those identified during the previous investigation works, so that the land immediately around BH304 was in a suitable condition for the surrender of the Environmental Permit.

3.1 Site Preparation

ARCADIS attended site on 16th August 2010. Initially ARCADIS, accompanied by a representative from INVISTA, carried out a visual inspection of the location of the proposed excavation works. Utility clearance of the area was undertaken by an INVISTA representative. ARCADIS performed further utility clearance using a Cable Avoidance Tool (CAT) prior to commencing the excavation. The excavation area was located on a concrete surface to the south of a roadway. The remediation excavation location is shown on Figure 2.

The excavation area was separated from the site using mesh panel HERAS fencing (Photo 1, Appendix A).

3.2 Excavation Works

Excavation works took place on 17th August 2010 using a Backhoe Excavator. A 2m² area of concrete (centred over BH304) was broken out using a hydraulic hammer (Photo 2, Appendix A). The concrete was visually inspected and deemed suitable for re-use as backfill.

BH304 was decommissioned by removing the well cover and well pipe. The well pipe extended 2m bgl; therefore there was no requirement for the use of bentonite to seal the well at a lower depth than the base of the excavation. During the excavation works there was no visual evidence of BH304 extending deeper than its base.

As the soil was removed the excavation was logged and sampled in accordance with BS 5930:1999. The excavation log is presented in Appendix B. Four soil samples were taken from the excavation; two from the sides and two from the base. Approximately 16 tonnes of material was excavated from an area that was 6m³ and was disposed to landfill by a specialist haulage sub-contractor.

The excavation was backfilled with the concrete removed from the surface and clean imported backfill material.

3.3 Laboratory Analysis

Based on the elevated concentration of the contaminant of concern identified in the previous monitoring and discussions with INVISTA, the soil samples were submitted for ammonium and pH analysis and asbestos screen only. As with all previous investigations at the site, samples were forwarded to ALcontrol Laboratories.

All samples were decanted into dedicated laboratory supplied containers and stored in dedicated cool boxes, at a target temperature of 4°C. All sample IDs and analytical requests were recorded on the laboratory chain of custody form, prior to dispatching for analysis, on the day of sampling, where possible.

All samples were submitted to ALcontrol Laboratories, a certified United Kingdom Accreditation Services (UKAS) accredited laboratory. All samples were sent with a full chain of custody identifying ARCADIS as the client, the ARCADIS project reference, the consultant/project manager, the nature of the sample and the parameters to be tested.

4 RESULTS

The following table presents the results of the laboratory analysis.

	MDL (mg/kg)	ES1 0.60mbgl	ES2 1.35mbgl	ES3 2.00mbgl	ES4 2.00mbgl
Ammonium (as NH ₄)	<15	<15	<15	<15	<15
pH	-	7.8	8.6	8.7	8.7
Asbestos	-	No ACM	No ACM	No ACM	No ACM

Ammonium was not detected in any of the samples from the excavation at concentrations above the laboratory method detection limit. pH was recorded in the range of 7.8 to 8.7. No asbestos containing materials were identified in any of the samples.

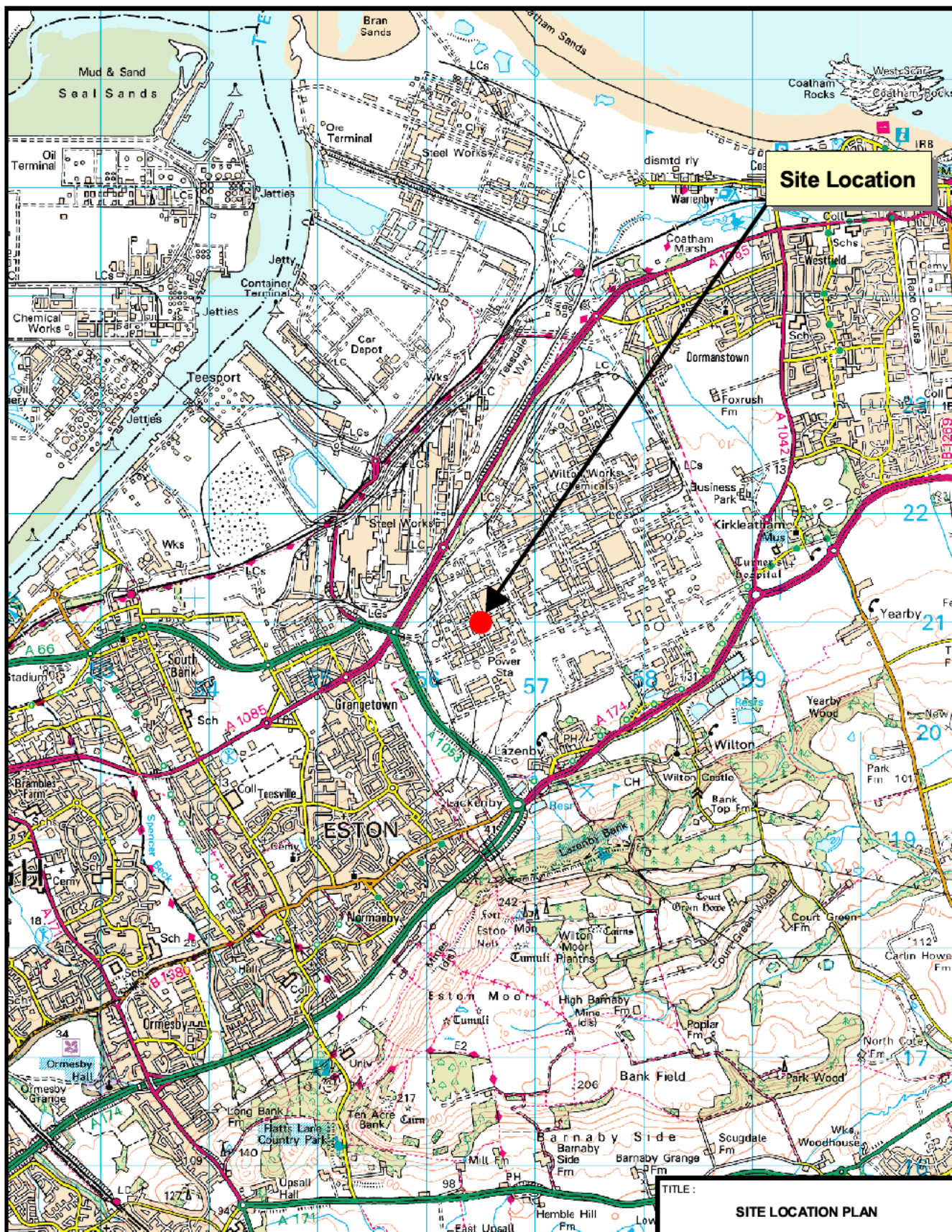
5 CONCLUSION

As part of the work undertaken by ARCADIS for the surrender of INVISTA's Environmental Permit the area around borehole BH304 was identified as an area of concern with elevated concentrations of ammonium. Based on the findings of ARCADIS' previous investigations at the site, the impact in BH304 was identified to be an isolated hotspot. Given the ground conditions and isolated nature ARCADIS considered limited soil remediation the most appropriate course of action.

The aim of the remedial works was to improve the ground conditions so that the land immediately around BH304 was in a suitable condition for the surrender of the Environmental Permit. This was achieved through the excavation of material around BH304 and decommissioning of monitoring well BH304. The excavation was backfilled with clean imported material. None of the samples taken from the sides and base of the excavation recorded ammonium levels higher than the laboratory method detection levels.

Following the removal of the target material around borehole BH304 and the decommissioning of the well it is the opinion of ARCADIS that the area has been successfully remediated and requires no further action to allow the surrender of the Environmental Permit.

FIGURES



REPRODUCED FROM OS 1:50,000 SCALE BY PERMISSION OF ORDNANCE SURVEY® ON BEHALF OF THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE. © CROWN COPYRIGHT. ALL RIGHTS RESERVED. LICENCE NUMBER 100020449. CONTACT ARCADIS UK IN CASE ANY QUERY

LEGEND

● SITE LOCATION

NOTES

TITLE:

SITE LOCATION PLAN

SITE:

INVISTA WILTON

CLIENT:

INVISTA

PROJECT: **9601004**

FIGURE 1

DATE: 03/09/10

DRAWN BY: ASZ

DRG No: 960100405.apr / SLP

SCALE: 1:50,000

PRINT: A4



ARCADIS

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APPENDICES

Appendix A Photographs

CLIENT: Invista	
PHOTOGRAPH #: 1	
COMMENT: Mesh panel HERAS fencing was used to define the excavation area.	

CLIENT: Invista	
PHOTOGRAPH #: 2	
COMMENT: Breaking the concrete using a hydraulic hammer. BH304 was at the centre of the excavation area.	

CLIENT: Invista

PHOTOGRAPH #: 3

COMMENT:

Extent of remedial excavation area.



CLIENT: Invista

PHOTOGRAPH #: 4

COMMENT:

Completed remedial excavation.



CLIENT: Invista

PHOTOGRAPH #: 5

COMMENT:

Loading materials from excavation.



CLIENT: Invista

PHOTOGRAPH #: 6

COMMENT:

Completed remedial works.



Appendix B Excavation Log

Excavation log

BH Log

Project No.: 96010.04

Client: Invista

Site: Wilton

Recorded By:

Date Drilled: 17/8/10

Location by EDM: Base station ID: Distance: Angle:

Drilling Method: JCB digger

Hole Diam (mm):

Final depth (m):

Well Diam (mm):

Well Type:

ARCADIS GERAGHTY & MILLER INTERNATIONAL, LTD.



Borehole ID:

Top (m)	Base (m)	Strata Description/Recovery	Top (m)	Base (m)	Type	PID (ppm)	Well Installation
0.0	0.2	Concrete with rebar.					
0.2	0.5	MADE GROUND, soft, dark brown, slightly sandy, gravelly clay. Gravel is subangular, medium to very coarse. Some cobbles (mudstone). Brick fragments, very coarse, subangular.					
0.5	2.0	Soft to firm, red-brown, with some grey mottling. CLAY Some occasionally gravelly CLAY. Gravel is subangular, fine to medium coarse.	0.6m	tub, 2 jar, 2 rial	ES1		
			1.35m	"	ES2		
			2.0m	"	ES3		
			2.0m	"	ES4		

Remarks:

Groundwater Details:

Strike (m)

Rest (m)

Remarks

Clay/Silts - Consistency/ Discontinuities/ Bedding/ Colour/ Subordinate/ NAME/ other, incl roots etc/ Stratum name.

Rocks - Strength/ Structure/ Colour/ Texture/ Grain Size/ NAME/ Subordinate/ Weathering/ Discontinuities/ Fracture State/ Other.

Sands - Density/ Discontinuity/ Bedding/ Colour/ Subordinate/ Angularity/ Grain Size/ NAME/ other/ Stratum name.

Cross - s x 20, m x 10, l x 5 Disc - s x 25, m x 10, l x 2 Pen - x 50

* = Sample submitted for analysis

Appendix C
Laboratory Certificate



Attention: [REDACTED]

CERTIFICATE OF ANALYSIS

Date: 09 September 2010
Customer: H_ARCADIS_LEE-24
Sample Delivery Group (SDG): 100819-53 **Report No.:** 96243
Your Reference: 96010.03
Location:

We received 4 samples on Thursday August 19, 2010 and 4 of these samples were scheduled for analysis which was completed on Friday August 27, 2010. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Asbestos testing - we are not accredited for screening soil samples for asbestos fibres. We are only accredited to identify asbestos fibres in bulk material (ACM).

Approved By:

[REDACTED]

[REDACTED]

Operations Director - Land UK & Ireland



SDG:	100819-53	Customer:	ARCADIS Geraghty & Miller
Job:	H_ARCADIS_LEE-24	Attention:	
Client Reference:	96010.03	Order No.:	
Location:		Report No:	96243

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
1974691	ES1		0.60	17/08/2010
1974723	ES2		1.35	17/08/2010
1974756	ES3		2.00	17/08/2010
1974799	ES4		2.00	17/08/2010

Only received samples which have had analysis scheduled will be shown on the following pages.

SDG: 100819-53
Job: H_ARCADIS_LEE-24
Client Reference: 96010.03
Location:

Customer: ARCADIS Geraghty & Miller
Attention: XXXXXXXXXX
Order No.:
Report No: 96243

SOLID

Results Legend			Lab Sample No(s)			
X Test N No Determination Possible	Customer Sample Ref.		ES1	ES2	ES3	ES4
	AGS Ref.					
	Depth (m)		0.60	1.35	2.00	2.00
	Container		250g Amber Jar 400g Tin	250g Amber Jar 400g Tin	250g Amber Jar 400g Tin	250g Amber Jar 400g Tin
			80g VOC	80g VOC	80g VOC	80g VOC
Ammonium Soil by Titration	All	NDPs: 0 Tests: 4	X	X	X	X
Sample description	All	NDPs: 0 Tests: 4	X	X	X	X

SDG:	100819-53	Customer:	ARCADIS Geraghty & Miller
Job:	H_ARCADIS_LEE-24	Attention:	
Client Reference:	96010.03	Order No.:	
Location:		Report No:	96243

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm
-----------	----------	------	-----------------	--------	-------------	--------	------------	-------------	-------

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
1974691	ES1	0.60	Dark Brown	Silty Clay	0.063 - 0.1 mm	Stones	N/A
1974723	ES2	1.35	Dark Brown	Silty Clay	0.063 - 0.1 mm	Stones	N/A
1974756	ES3	2.00	Dark Brown	Clay	<0.063 mm	Stones	N/A
1974799	ES4	2.00	Dark Brown	Sandy Clay	0.1 - 2 mm	Stones	N/A

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

SDG: 100819-53

Job: H_ARCADIS_LEE-24

Client Reference: 96010.03

Location:

Customer: ARCADIS Geraghty & Miller

Attention:

Order No.:

Report No: 96243

Test Completion Dates

Lab Sample No(s)	1974691	1974723	1974756	1974799
Customer Sample Ref.	ES1	ES2	ES3	ES4
AGS Ref.				
Depth	0.60	1.35	2.00	2.00
Type	SOLID	SOLID	SOLID	SOLID
Ammonium Soil by Titration	24/08/2010	24/08/2010	24/08/2010	24/08/2010
Asbestos Containing Material Screen	19/08/2010	19/08/2010	19/08/2010	19/08/2010
Boron Water Soluble	23/08/2010	23/08/2010	23/08/2010	23/08/2010
EPH CWG (Aliphatic) GC (S)	24/08/2010	21/08/2010	21/08/2010	21/08/2010
EPH CWG (Aromatic) GC (S)	24/08/2010	21/08/2010	21/08/2010	21/08/2010
GRO by GC-FID (S)	26/08/2010	26/08/2010	26/08/2010	26/08/2010
Metals by iCap-OES (Soil)	23/08/2010	23/08/2010	23/08/2010	23/08/2010
PAH by GCMS	24/08/2010	24/08/2010	24/08/2010	27/08/2010
pH	20/08/2010	23/08/2010	23/08/2010	23/08/2010
Sample description	19/08/2010	19/08/2010	19/08/2010	19/08/2010
TPH CWG GC (S)	26/08/2010	26/08/2010	26/08/2010	26/08/2010

SDG	100819-53	Customer:	ARCADIS Geraghty & Miller
Job:	H_ARCADIS_LEE-24	Attention:	
Client Reference:	96010.03	Order No.:	
Location:		Report No:	96243

ASSOCIATED AQC DATA

Ammonium Soil by Titration

Component	Method Code	QC 14
Exchangeable Ammonium as NH4	TM024	95.60 80.84 : 103.27

Boron Water Soluble

Component	Method Code	QC 19
Water Soluble Boron	TM222	102.95 86.36 : 114.95

EPH CWG (Aliphatic) GC (S)

Component	Method Code	QC 12	QC 18
Total Aliphatics >C12-C35	TM173	82.58 66.13 : 101.56	90.79 58.96 : 117.71

EPH CWG (Aromatic) GC (S)

Component	Method Code	QC 12	QC 18
Total Aromatics >EC12-EC35	TM173	88.59 64.00 : 112.00	90.76 58.79 : 118.66

Metals by iCap-OES (Soil)

Component	Method Code	QC 12	QC 12
Aluminium	TM181	104.41 95.21 : 133.11	103.92 95.21 : 133.11
Antimony	TM181	101.58 63.92 : 138.56	119.10 63.92 : 138.56
Arsenic	TM181	101.21 77.96 : 122.04	109.39 77.96 : 122.04
Barium	TM181	105.82 90.49 : 117.24	102.50 90.49 : 117.24
Beryllium	TM181	100.37 77.50 : 122.50	114.78 77.50 : 122.50
Boron	TM181	95.61 82.46 : 141.11	91.76 82.46 : 141.11
Cadmium	TM181	95.04 77.50 : 122.50	108.78 77.50 : 122.50
Chromium	TM181	101.48 82.90 : 117.10	92.89 82.90 : 117.10
Cobalt	TM181	95.83 78.26 : 121.74	104.44 78.26 : 121.74
Copper	TM181	98.87 86.52 : 113.48	101.41 86.52 : 113.48

SDG 100819-53
Job: H_ARCADIS_LEE-24
Client Reference: 96010.03
Location:

Customer: ARCADIS Geraghty & Miller
Attention: XXXXXXXXXX
Order No.:
Report No: 96243

		QC 12	QC 12
Iron	TM181	100.78 93.59 : 123.28	103.23 93.59 : 123.28
Lead	TM181	99.72 81.22 : 118.78	100.39 81.22 : 118.78
Manganese	TM181	98.55 87.42 : 112.58	97.25 87.42 : 112.58
Mercury	TM181	106.50 72.27 : 127.73	107.91 72.27 : 127.73
Molybdenum	TM181	99.26 71.12 : 128.88	112.71 71.12 : 128.88
Nickel	TM181	97.25 81.27 : 118.73	99.39 81.27 : 118.73
Phosphorus	TM181	106.40 84.04 : 115.96	102.71 84.04 : 115.96
Selenium	TM181	102.02 72.61 : 127.39	106.45 72.61 : 127.39
Strontium	TM181	101.50 80.21 : 119.79	98.79 80.21 : 119.79
Thallium	TM181	84.92 73.04 : 126.96	97.28 73.04 : 126.96
Tin	TM181	95.28 71.55 : 128.45	107.58 71.55 : 128.45
Titanium	TM181	92.63 78.26 : 121.74	91.37 78.26 : 121.74
Vanadium	TM181	99.69 82.03 : 117.97	95.79 82.03 : 117.97
Zinc	TM181	93.53 83.18 : 100.43	91.67 83.18 : 100.43

PAH by GCMS

Component	Method Code	QC 12	QC 29
Acenaphthene	TM218	90.43 68.10 : 128.67	97.30 68.10 : 128.67
Acenaphthylene	TM218	81.41 68.11 : 109.28	87.03 68.11 : 109.28
Anthracene	TM218	83.18 61.75 : 122.01	90.99 61.75 : 122.01
Benz(a)anthracene	TM218	87.61 79.35 : 115.30	93.56 79.35 : 115.30
Benzo(a)pyrene	TM218	97.18 79.80 : 116.48	93.54 79.80 : 116.48
Benzo(b)fluoranthene	TM218	93.41 79.51 : 116.19	95.22 79.51 : 116.19
Benzo(ghi)perylene	TM218	101.62 80.08 : 114.22	96.87 80.08 : 114.22
Benzo(k)fluoranthene	TM218	97.18 65.05 : 129.07	96.12 65.05 : 129.07
Chrysene	TM218	92.51 80.14 : 113.92	97.02 80.14 : 113.92
Dibenzo(ah)anthracene	TM218	101.70 59.79 : 136.56	94.58 59.79 : 136.56
Fluoranthene	TM218	83.73 74.35 : 115.70	94.49 74.35 : 115.70
Fluorene	TM218	87.79 75.68 : 111.55	95.97 75.68 : 111.55

SDG	100819-53	Customer:	ARCADIS Geraghty & Miller
Job:	H_ARCADIS_LEE-24	Attention:	
Client Reference:	96010.03	Order No.:	
Location:		Report No:	96243

		QC 12	QC 29
Indeno(123cd)pyrene	TM218	102.18 74.42 : 114.62	95.43 74.42 : 114.62
Naphthalene	TM218	89.84 73.21 : 108.15	91.15 73.21 : 108.15
Phenanthrene	TM218	85.70 66.61 : 129.12	95.85 66.61 : 129.12
Pyrene	TM218	83.65 74.35 : 111.75	93.87 74.35 : 111.75

pH

Component	Method Code	QC 10	QC 15
pH	TM133	99.00 97.90 : 102.35	99.37 97.42 : 102.50

The above information details the reference name of the analytical quality control sample (AQC) that has been run with the samples contained in this report for the different methods of analysis.

The figure detailed is the percentage recovery result for the AQC.

The subscript numbers below are the percentage recovery lower control limit (LCL) and the upper control limit (UCL). The percentage recovery result for the AQC should be between these limits to be statistically in control.

Table of Results - Appendix

SDG Number : 100819-53

Client : ARCADIS Geraghty & Miller

Client Ref : 96010.03

REPORT KEY

NDP	No Determination Possible	#	ISO 17025 Accredited	*	Subcontracted Test	M	MCERTS Accredited
NFD	No Fibres Detected	PFD	Possible Fibres Detected	»	Result previously reported (Incremental reports only)	EC	Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control

Method No	Reference	Description	Wet/Dry Sample ¹
PM001		Preparation of Samples for Metals Analysis	Dry
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material	Wet
TM001	In - house Method	Determination of asbestos containing material by screening on solids	
TM024	Method 4500A & B, AWWA/APHA, 20th Ed., 1999	Determination of Exchangeable Ammonium and Ammoniacal Nitrogen as N by titration on solids	Wet
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)	
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter	Wet
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID	Dry
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES	Dry
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546	Wet
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer	Dry

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

SDG: 100819-53
Job: H_ARCADIS_LEE-24
Client Ref.: 96010.03
Location:

Customer: ARCADIS Geraghty & Miller
Attention: XXXXXXXXXX
Order No.:
Report No: 96243

Chromatogram

Analysis: EPH CWG (Aliphatic) GC (S)

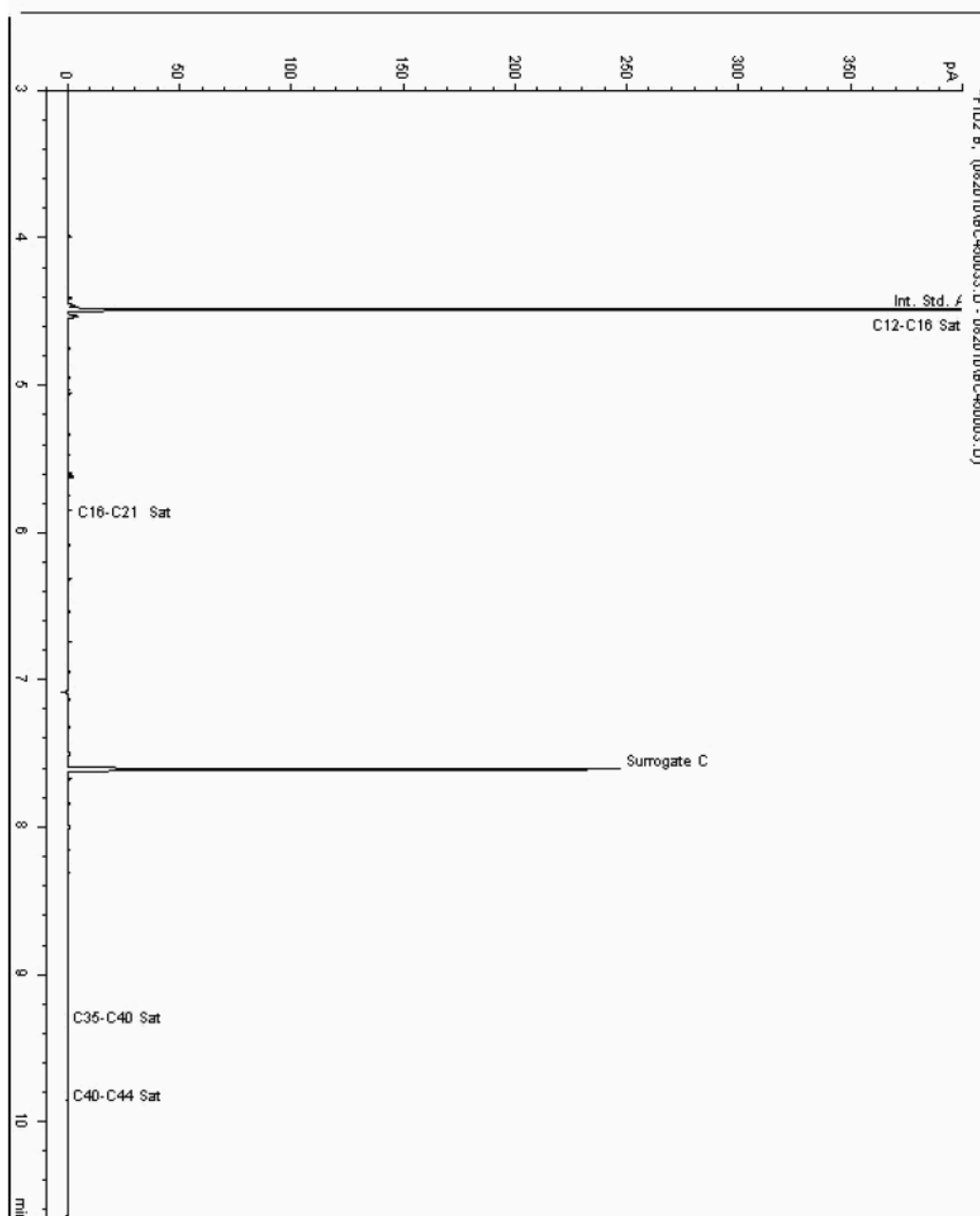
Sample No 1982391

Sample ID ES2

Depth 1.35

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 2080866-1982391
Date Acquired : 21/08/10 06:24:59 PM
Units : ppb
Dilution:



SDG: 100819-53
Job: H_ARCADIS_LEE-24
Client Ref.: 96010.03
Location:

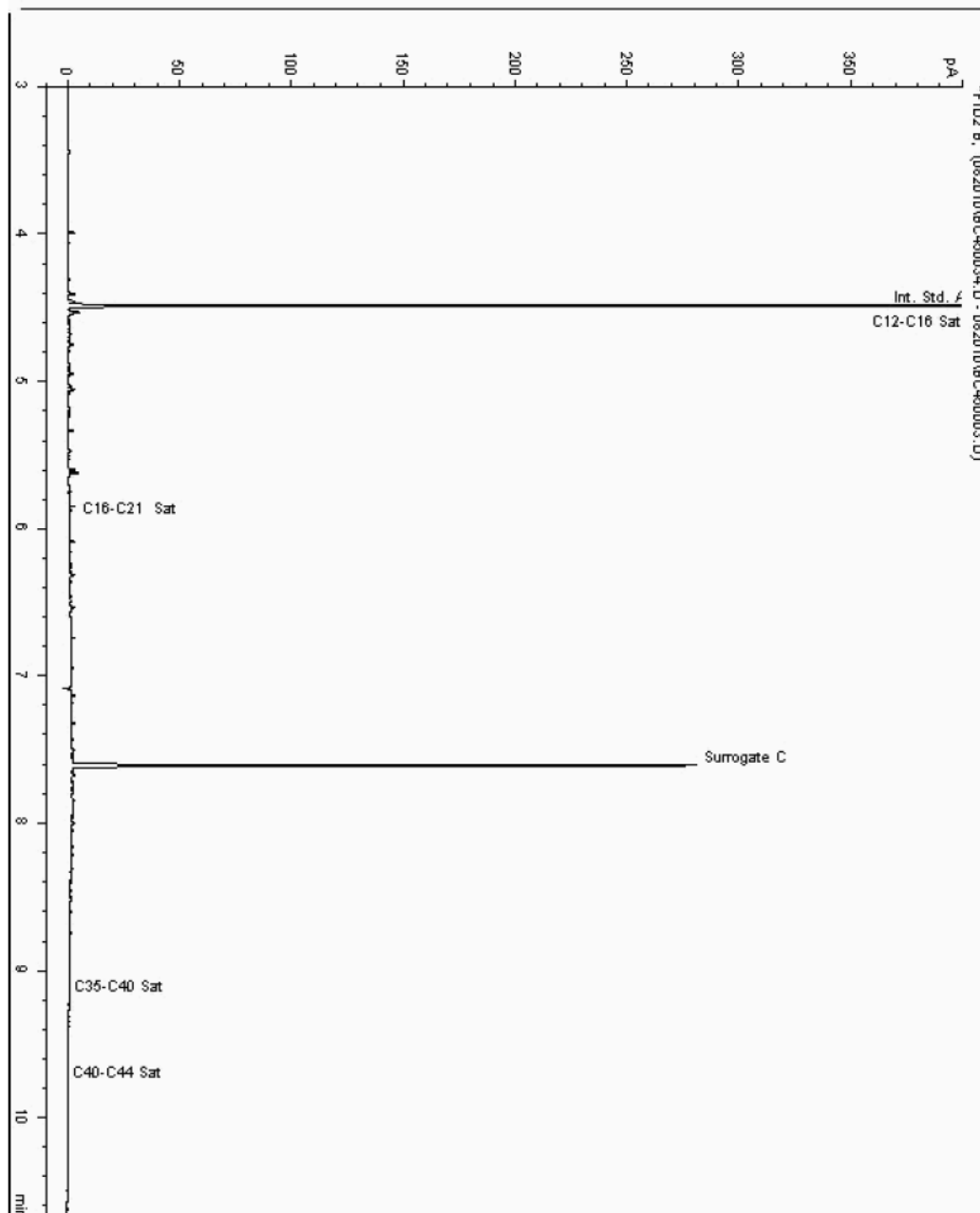
Customer: ARCADIS Geraghty & Miller
Attention: XXXXXXXXXX
Order No.:
Report No: 96243

Analysis: EPH CWG (Aliphatic) GC (S)

Sample No 1982417
Sample ID ES3
Depth 2.00

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 2080880-1982417
Date Acquired : 21/08/10 06:44:42 PM
Units : ppb
Dilution:



SDG: 100819-53
Job: H_ARCADIS_LEE-24
Client Ref.: 96010.03
Location:

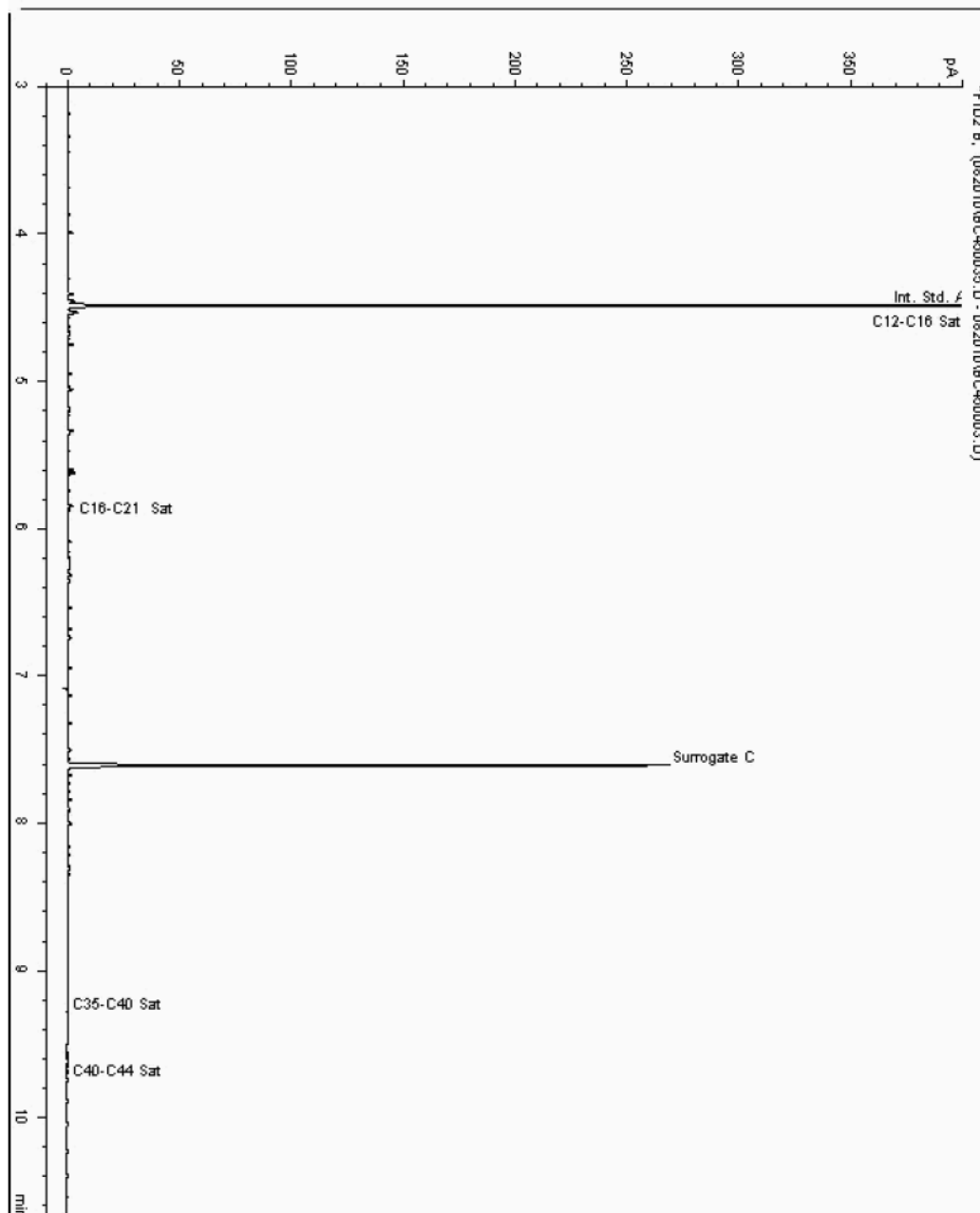
Customer: ARCADIS Geraghty & Miller
Attention: XXXXXXXXXX
Order No.:
Report No: 96243

Analysis: EPH CWG (Aliphatic) GC (S)

Sample No 1982511
Sample ID ES4
Depth 2.00

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 2080894-1982511
Date Acquired : 21/08/10 07:04:04 PM
Units : ppb
Dilution:



SDG: 100819-53
Job: H_ARCADIS_LEE-24
Client Ref.: 96010.03
Location:

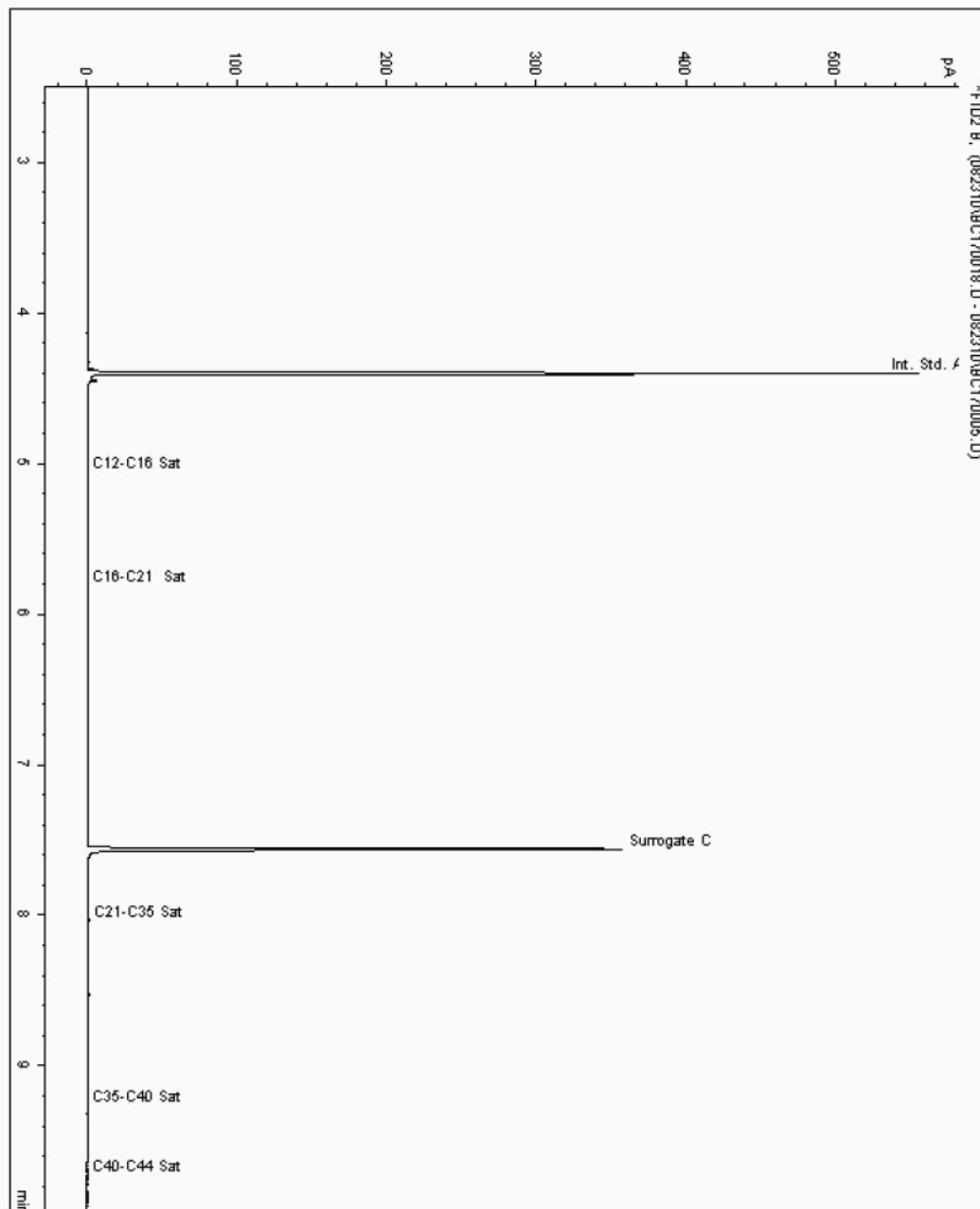
Customer: ARCADIS Geraghty & Miller
Attention: XXXXXXXXXX
Order No.:
Report No: 96243

Analysis: EPH CWG (Aliphatic) GC (S)

Sample No 1984100
Sample ID ES1
Depth 0.60

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 2080852-1984100
Date Acquired : 23/08/10 16:58:22 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.993



SDG: 100819-53
Job: H_ARCADIS_LEE-24
Client Ref.: 96010.03
Location:

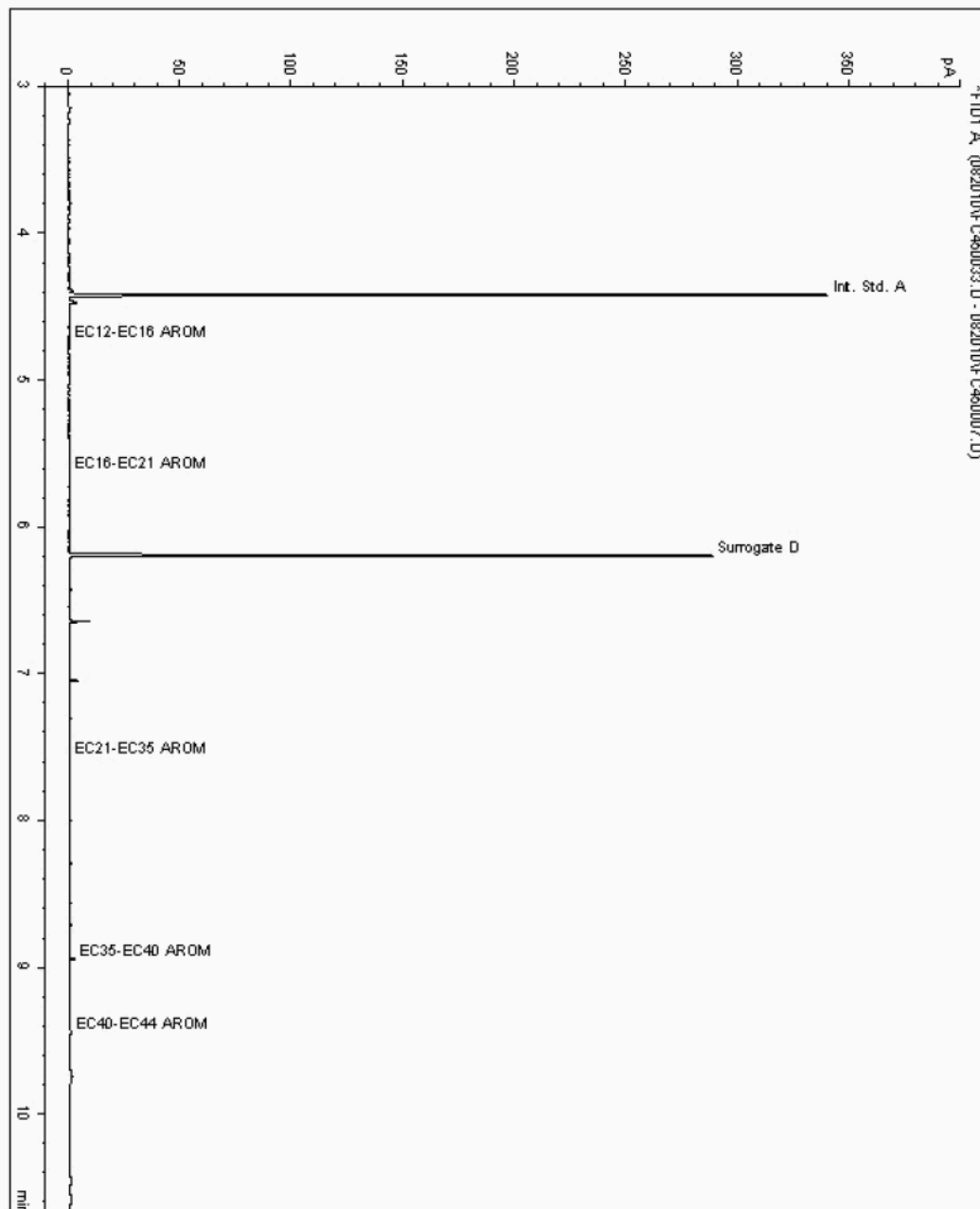
Customer: ARCADIS Geraghty & Miller
Attention: XXXXXXXXXX
Order No.:
Report No: 96243

Analysis: EPH CWG (Aromatic) GC (S)

Sample No 1982391
Sample ID ES2
Depth 1.35

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 2080867-1982391
Date Acquired : 21/08/10 06:25:00 PM
Units : ppb
Dilution:



SDG: 100819-53
Job: H_ARCADIS_LEE-24
Client Ref.: 96010.03
Location:

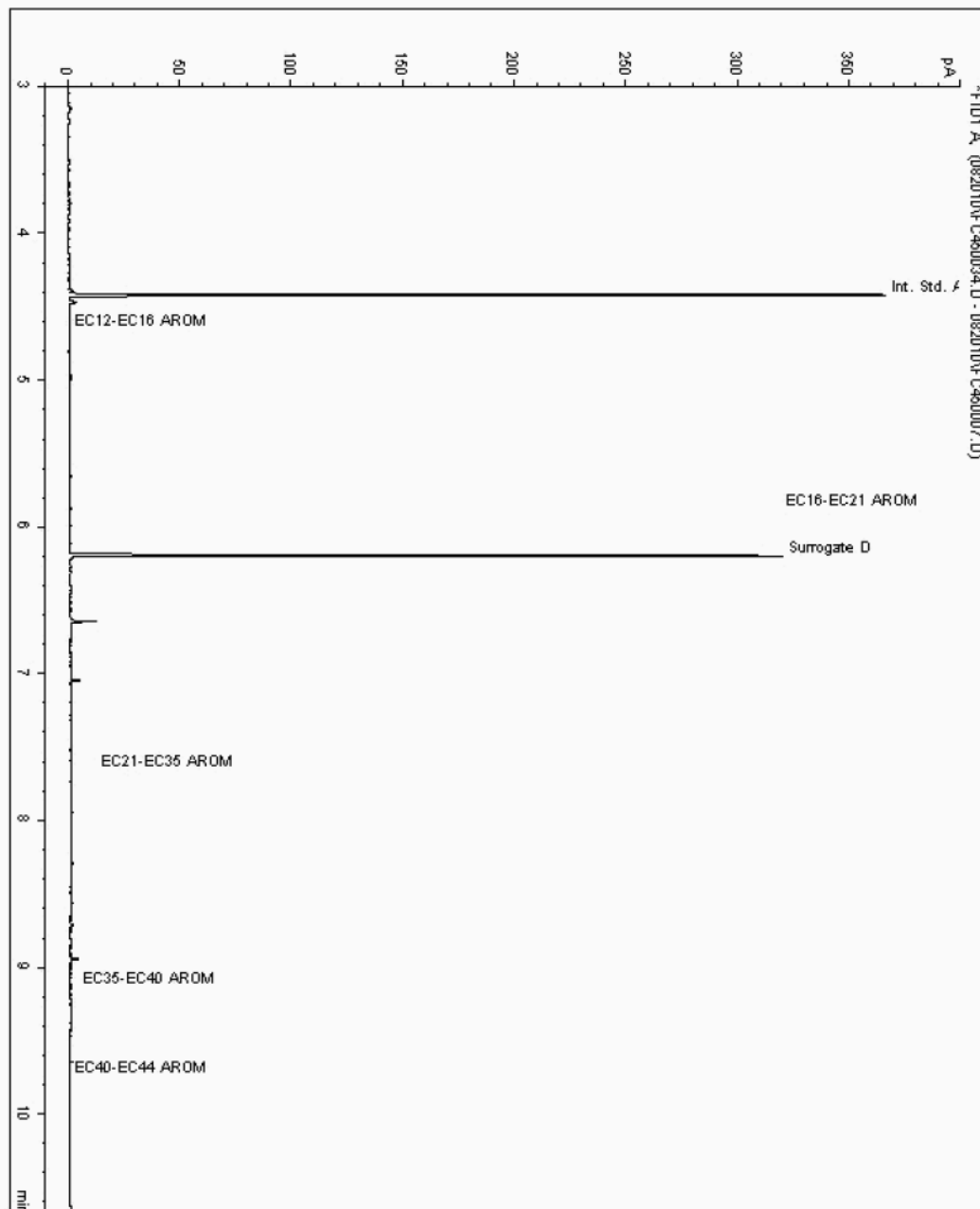
Customer: ARCADIS Geraghty & Miller
Attention: XXXXXXXXXX
Order No.:
Report No: 96243

Analysis: EPH CWG (Aromatic) GC (S)

Sample No 1982417
Sample ID ES3
Depth 2.00

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 2080881-1982417
Date Acquired : 21/08/10 06:44:43 PM
Units : ppb
Dilution:



SDG: 100819-53
Job: H_ARCADIS_LEE-24
Client Ref.: 96010.03
Location:

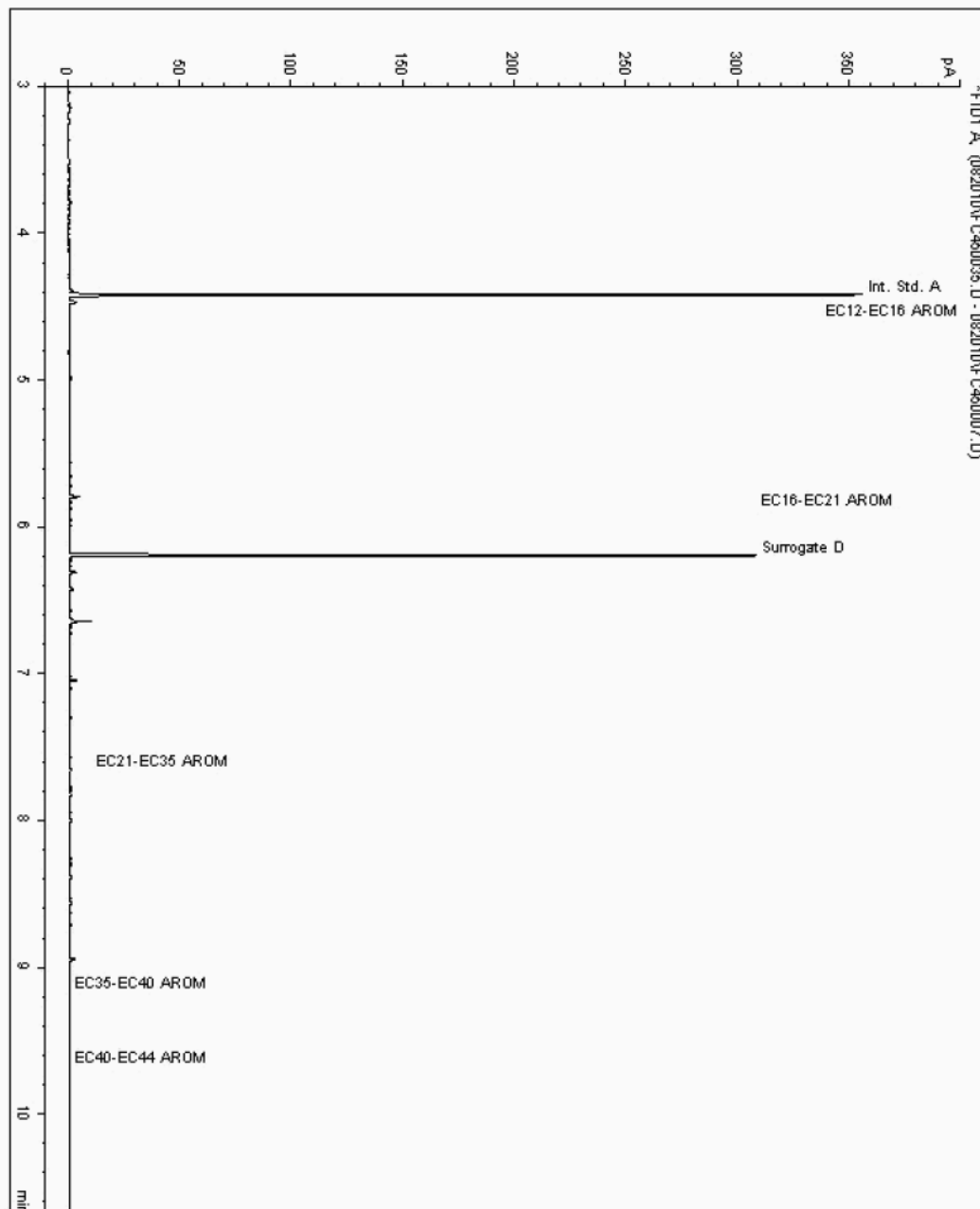
Customer: ARCADIS Geraghty & Miller
Attention: XXXXXXXXXX
Order No.:
Report No: 96243

Analysis: EPH CWG (Aromatic) GC (S)

Sample No 1982511
Sample ID ES4
Depth 2.00

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 2080895-1982511
Date Acquired : 21/08/10 07:04:03 PM
Units : ppb
Dilution:



SDG: 100819-53
Job: H_ARCADIS_LEE-24
Client Ref.: 96010.03
Location:

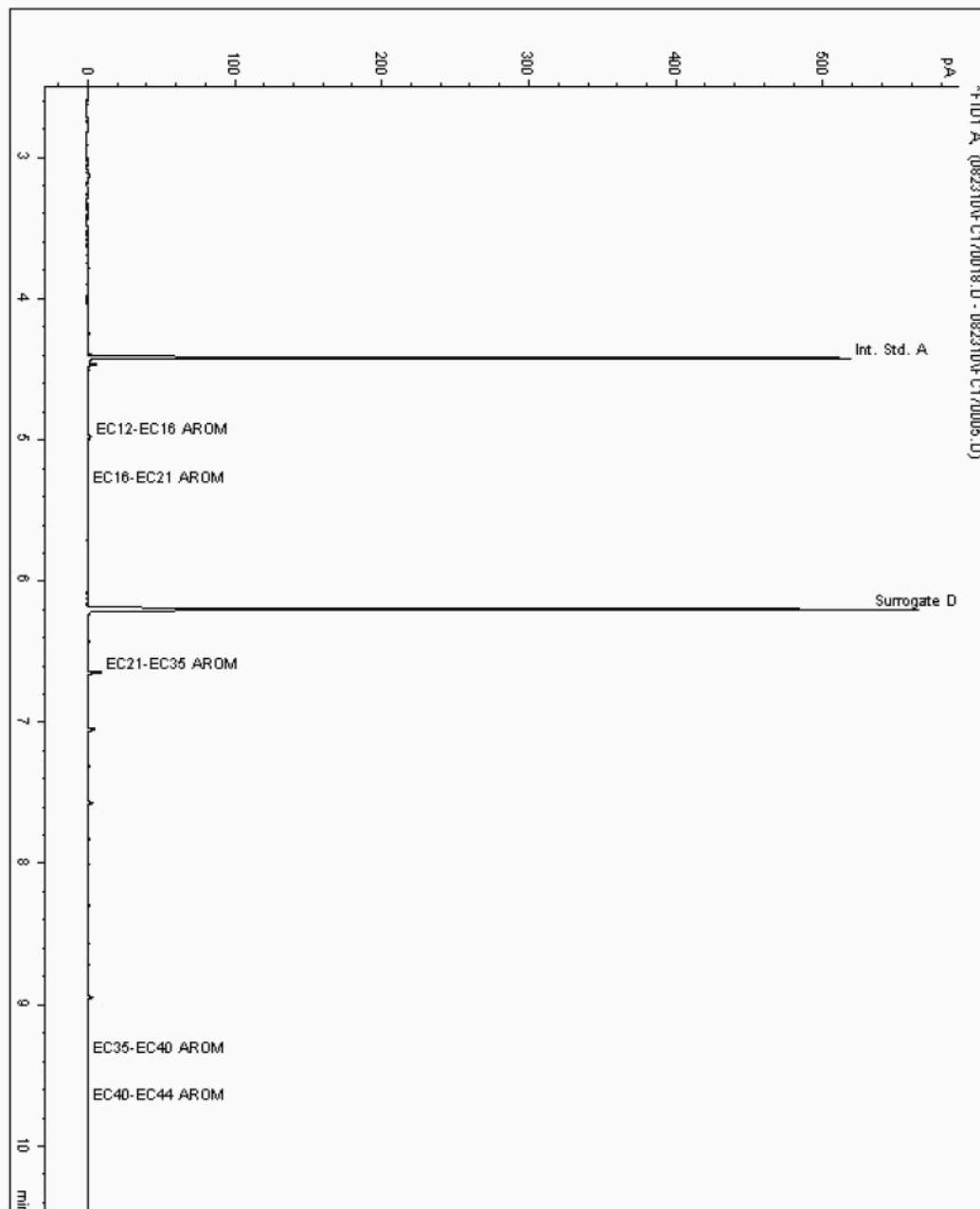
Customer: ARCADIS Geraghty & Miller
Attention: XXXXXXXXXX
Order No.:
Report No: 96243

Analysis: EPH CWG (Aromatic) GC (S)

Sample No 1984100
Sample ID ES1
Depth 0.60

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 2080853-1984100
Date Acquired : 23/08/10 16:58:22 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.993



SDG: 100819-53
Job: H_ARCADIS_LEE-24
Client Ref.: 96010.03
Location:

Customer: ARCADIS Geraghty & Miller
Attention: XXXXXXXXXX
Order No.:
Report No: 96243

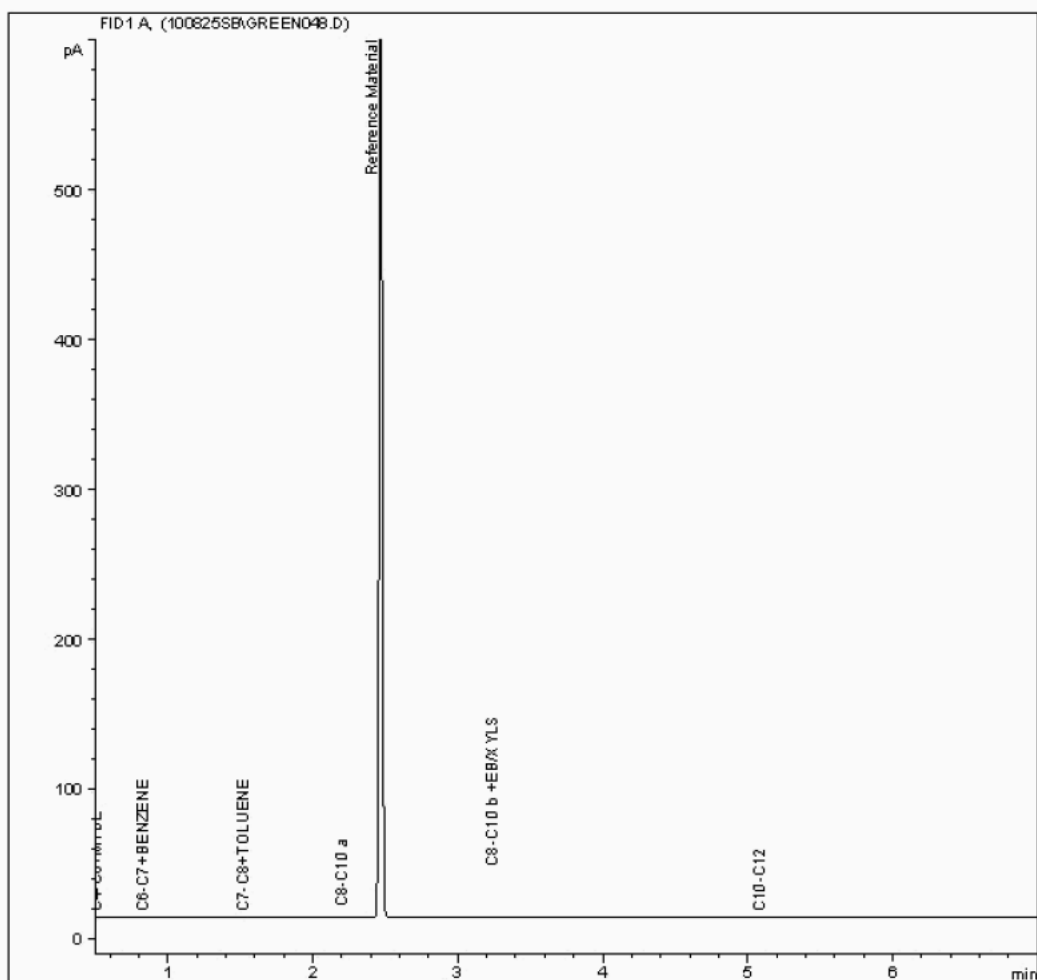
Analysis: GRO by GC-FID (S)

Sample No 1974708
Sample ID ES1
Depth 0.60

ALcontrol Geochem Analytical Services
Gasoline Range Organics

Sample Identity : 2090138-1984543
Date Acquired : 26/08/10 05:29:03
Units : ppb
Dilution : 1

#	Compound Name	Amount
1	C4-C6+MTBE	29
2	C6-C7+BENZENE	11
3	C7-C8+TOLUENE	48
4	C8-C10 a	22
5	Reference Material	8949
6	C8-C10 b +EB/XYLS	301
7	C10-C12	147



SDG: 100819-53
Job: H_ARCADIS_LEE-24
Client Ref.: 96010.03
Location:

Customer: ARCADIS Geraghty & Miller
Attention: XXXXXXXXXX
Order No.:
Report No: 96243

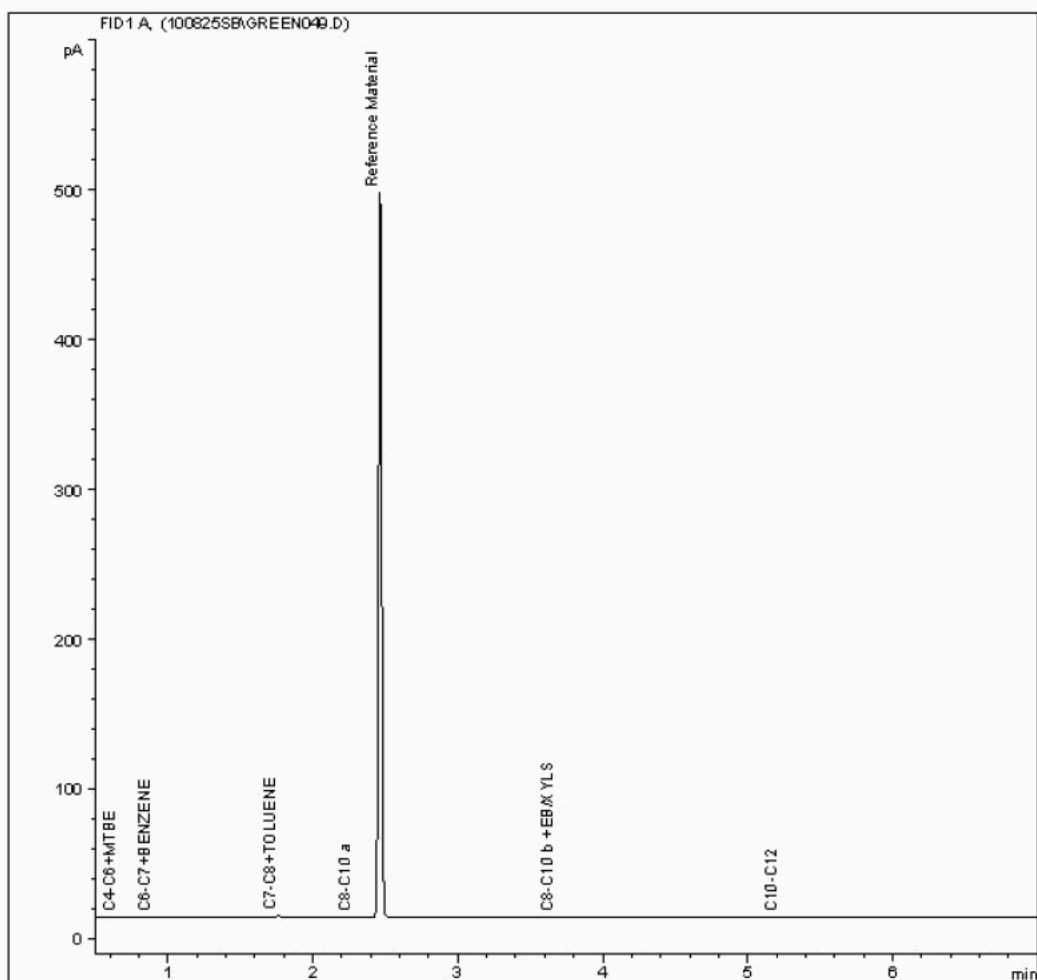
Analysis: GRO by GC-FID (S)

Sample No 1974742
Sample ID ES2
Depth 1.35

ALcontrol Geochem Analytical Services
Gasoline Range Organics

Sample Identity : 2090148-1984551
Date Acquired : 26/08/10 05:43:04
Units : ppb
Dilution : 1

#	Compound Name	Amount
1	C4-C6+MTBE	0
2	C6-C7+BENZENE	0
3	C7-C8+TOLUENE	34
4	C8-C10 a	0
5	Reference Material	6927
6	C8-C10 b +EB/XYLs	0
7	C10-C12	0



SDG: 100819-53
Job: H_ARCADIS_LEE-24
Client Ref.: 96010.03
Location:

Customer: ARCADIS Geraghty & Miller
Attention: XXXXXXXXXX
Order No.:
Report No: 96243

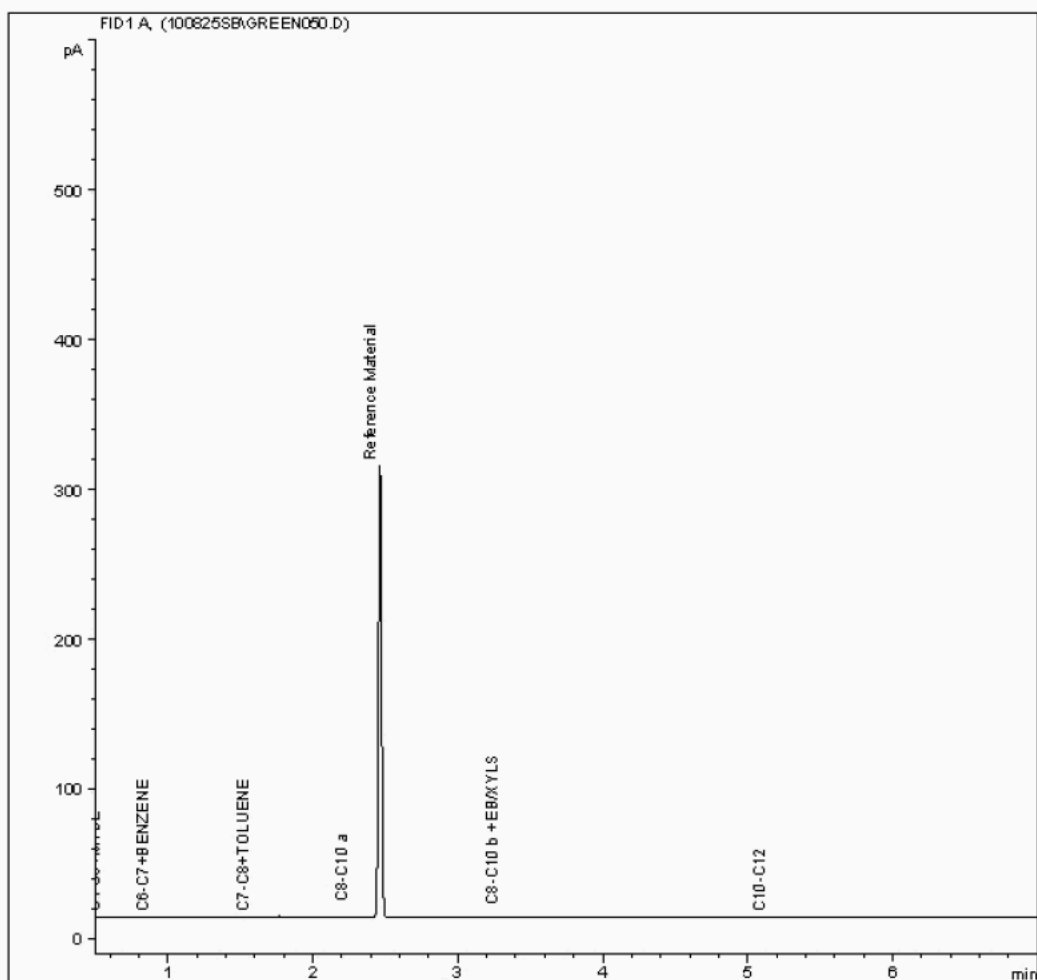
Analysis: GRO by GC-FID (S)

Sample No 1974778
Sample ID ES3
Depth 2.00

ALcontrol Geochem Analytical Services
Gasoline Range Organics

Sample Identity : 2090167-1984565
Date Acquired : 26/08/10 05:57:09
Units : ppb
Dilution : 1

#	Compound Name	Amount
1	C4-C6+MTBE	27
2	C6-C7+BENZENE	17
3	C7-C8+TOLUENE	51
4	C8-C10 a	37
5	Reference Material	4369
6	C8-C10 b +EB/XYLs	113
7	C10-C12	76



SDG: 100819-53
Job: H_ARCADIS_LEE-24
Client Ref.: 96010.03
Location:

Customer: ARCADIS Geraghty & Miller
Attention: XXXXXXXXXX
Order No.:
Report No: 96243

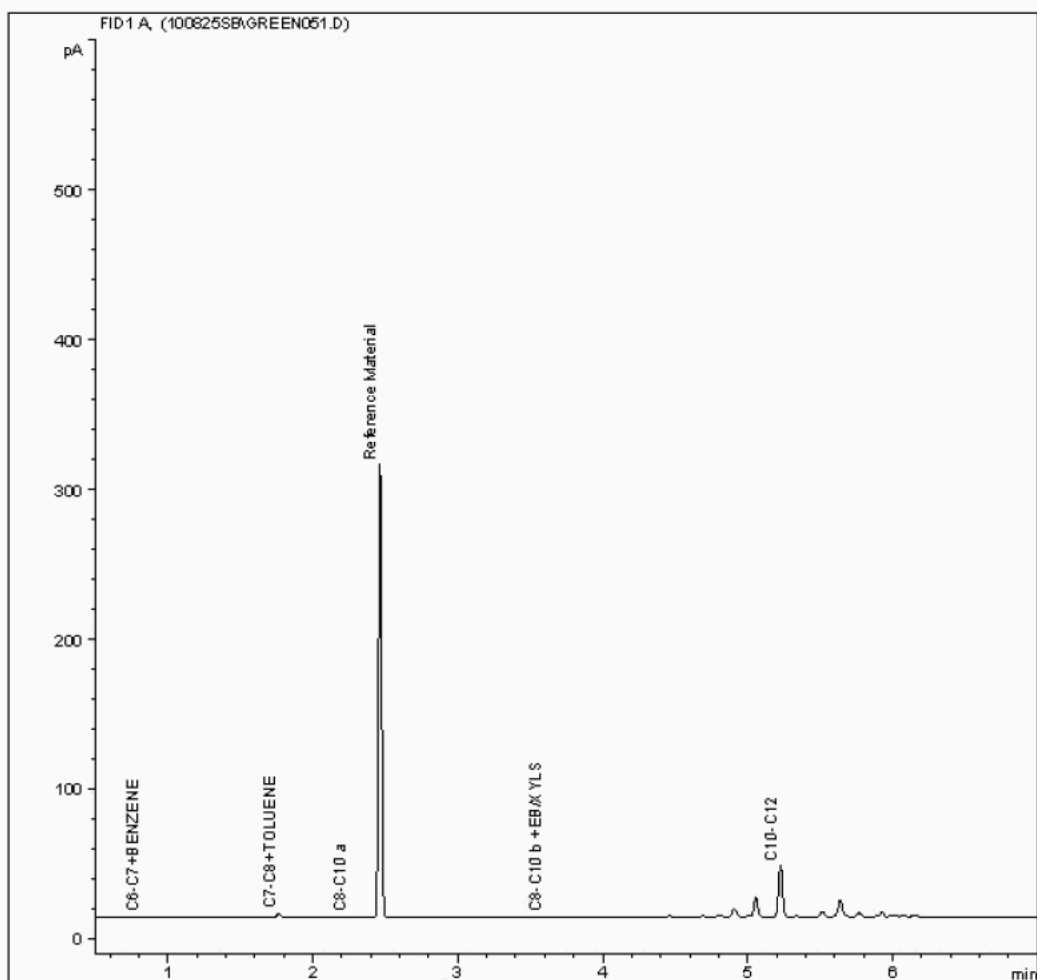
Analysis: GRO by GC-FID (S)

Sample No 1974817
Sample ID ES4
Depth 2.00

ALcontrol Geochem Analytical Services
Gasoline Range Organics

Sample Identity : 2090179-1984588
Date Acquired : 26/08/10 06:11:16
Units : ppb
Dilution : 1

#	Compound Name	Amount
1	C4-C6+MTBE	0
2	C6-C7+BENZENE	0
3	C7-C8+TOLUENE	99
4	C8-C10 a	0
5	Reference Material	4393
6	C8-C10 b +EB/XYLs	0
7	C10-C12	4059



APPENDIX

APPENDIX

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following:
NRA Leach tests, flash point, ammonium as NH_4 by the BRE method, VOC TICS, SVOC TICS, TOF-MS SCAN/SEARCH and TOF-MS TICS.
2. Samples will be run in duplicate upon request, but an additional charge may be incurred.
3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for both soil jars, tubs and volatile jars. All waters and vials will be discarded 10 days after the analysis is completed (e-mailed). All material removed during an asbestos containing material screen and analysed for the presence of asbestos will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.
4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.
5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.
6. When requested, the individual sub sample scheduled will be screened in house for the presence of large asbestos containing material fragments/pieces. If no asbestos containing material is found this will be reported as 'no asbestos containing material detected'. If asbestos containing material is detected it will be removed and analysed by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If asbestos containing material is present no further analysis will be undertaken. At no point is the fibre content of the soil sample determined.
7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace or sediment is present in the volatile sample. This will be flagged up as an invalid VOC on the test schedule or recorded on the log sheet.
8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.
9. NDP – No determination possible due to insufficient/unsuitable sample.
10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.
11. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.
12. Results relate only to the items tested
13. **Surrogate recoveries** – Most of our organic methods include surrogates, the recovery of which is monitored and reported.
For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 – 130 %.
14. **Product analyses** – Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.
15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).
16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 14).
17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.
18. Our MCERTS accreditation for PAHs by GCMS applies to all product types apart from Kerosene, where naphthalene only is not accredited.
19. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.
19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.
20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.
21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.
22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials – whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.
23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C4 – C10 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

LIQUID MATRICES EXTRACTION SUMMARY

ANALYSIS	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
PAH MS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
EPH	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
EPH CWG	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
MINERAL OIL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
PCB 7 CONGENERS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
PCB TOTAL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GS MS
SVOC	DCM	LIQUID/LIQUID SHAKE	GC MS
FREE SULPHUR	DCM	SOLID PHASE EXTRACTION	HPLC
PEST OCP/OPP	DCM	LIQUID/LIQUID SHAKE	GC MS
TRIAZINE HERBS	DCM	LIQUID/LIQUID SHAKE	GC MS
PHENOLS MS	DCM	SOLID PHASE EXTRACTION	GC MS
TPH by INFRA RED (IR)	TCE	LIQUID/LIQUID EXTRACTION	HPLC
MINERAL OIL by IR	TCE	LIQUID/LIQUID EXTRACTION	HPLC
GLYCOLS	NONE	DIRECT INJECTION	GC FID

SOLID MATRICES EXTRACTION SUMMARY

ANALYSIS	D/C OR WET	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
Solvent Extractable Matter	D&C	DCM	SOXTHERM	GRAVIMETRIC
Cyclohexane Ext. Matter	D&C	CYCLOHEXANE	SOXTHERM	GRAVIMETRIC
Thin Layer Chromatography	D&C	DCM	SOXTHERM	IATROSCAN
Elemental Sulphur	D&C	DCM	SOXTHERM	HPLC
Phenols by GCMS	WET	DCM	SOXTHERM	GC-MS
Herbicides	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
Pesticides	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
EPH (DRO)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (Min oil)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (Cleaned up)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH CWG by GC	D&C	HEXANE:ACETONE	END OVER END	GC-FID
PCB tot / PCB con	D&C	HEXANE:ACETONE	END OVER END	GC-MS
Polyaromatic Hydrocarbons (MS)	WET	HEXANE:ACETONE	Microwave TM218.	GC-MS
C8-C40 (C6-C40)EZ Flash	WET	HEXANE:ACETONE	SHAKER	GC-EZ
Polyaromatic Hydrocarbons Rapid GC	WET	HEXANE:ACETONE	SHAKER	GC-EZ
Semi Volatile Organic Compounds	WET	DCM:ACETONE	SONICATE	GC-MS

Identification of Asbestos in Bulk Materials

The results for asbestos identification for soil samples are obtained from possible Asbestos Containing Material, removed during the 'Screening of soils for Asbestos Containing Materials', which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Visual Estimation Of Fibre Content.

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: -

Trace – Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in MDHS 100.

The identification of asbestos containing materials falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

<u>Asbestos Type</u>	<u>Common Name</u>
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-