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GROUND INVESTIGATION &

CONTAMINATION ASSESSMENT REPORT

BRITISH MUSEUM

ENERGY CENTRE PROGRAMME

LONDON WC1

Report Reference No. 118177

On behalf of:-

British Museum
Great Russell Street
London
WC1B 3DG

November 2024

BRITISH MUSEUM

STACE

PROJECT MANAGERS

ALAN BAXTER LIMITED

CONSULTING ENGINEERS

GROUND INVESTIGATION & CONTAMINATION ASSESSMENT

BRITISH MUSEUM

ENERGY CENTRE PROGRAMME

LONDON WC1

Report Reference No. 118177 **November 2024**

INTRODUCTION

The British Museum, the client, intends to construct a new Energy Centre within the south-eastern part of their Bloomsbury Estate, London WC1.

Details of the proposed redevelopment were not available at the time of report preparation.

The client instructed Lucion Ground Engineering Limited to carry out a ground investigation under the direction of Project Managers, Stace, and Consulting Engineers, Alan Baxter Limited, in order to determine the nature and characteristics of the soils beneath the site in relation to the proposed redevelopment and produce a factual report. In addition, geotechnical and chemical laboratory testing, and a contamination assessment was included within the scope of works.

LOCATION, TOPOGRAPHY AND GEOLOGY OF THE SITE

The British Museum's Bloomsbury Estate, London WC1, is bounded to the south-east by Great Russell Street; to the south-west by Bloomsbury Street and Bedford Square; to the north by Russell Square, and to the east by Montague Street. The new Energy Centre site is to be located within the south-eastern part of the Estate, adjacent Monague Street, and is centred at National Grid Reference TQ 30150 81745.

The approximately rectangular 7m wide and 18m long site is between existing Museum storage buildings and the boundary with the adjacent Montague Street footpath. The latter was marked by railings between stone pillars.

At the time of the investigation the site had been recently cleared of two portacabins, and was surfaced with weakly bound asphalt gravel. The western end of the site was traversed, north to south, by a pedestrian tunnel between two of the neighbouring buildings. The roof of the tunnel was about 0.60m above ground level.

The site stands on level ground at about 25mOD, some 1.25km north-west of the eastward flowing River Thames.

The 1936 geological map for this part of London (Sheet V SW) at 6 inches to 1 mile scale (1:10,560) shows the Museum site covered by Taplow Terrace Gravel and underlain by the solid geology of the London Clay. The nearest well record on this map, 290m to the east of the Museum site, indicates 3m of gravel mantling the solid geology London Clay.

The 2006 geological map for the area at 1:50,000 scale, Sheet 256, shows the site to be covered by the renamed Lynch Hill Terrace Gravel, which is shown to be underlain by the solid geology of the London Clay Formation.

SITE WORK

Three hand dug foundation inspection pits (TP 1 to TP 3) were scheduled to be undertaken at positions determined by the Engineer. At the request of the Engineer a fourth trial pit, TP 1A, was added to the scope of works. The exploratory hole positions are depicted on the exploratory hole location plan at the rear of this text.

The site work was undertaken under the supervision of a Geo-environmental Engineer from Lucion Ground Engineering Limited. The works were carried out making due reference to generic and site specific risk assessments, and method statements. The intrusive works were undertaken within working areas delineated by fencing, barriers and warning signs.

The investigation was undertaken following the Engineer's specification and the protocols detailed in British Standards (BS) 'Code of Practice for Site Investigations' (BS5930:1999+A1:2020) and 'Investigation of Potentially Contaminated Sites' (BS10175:2001).

Services information was provided/obtained prior to the start of the investigation and was referenced in relation to the exploratory hole positions prior to boring and a scan was undertaken using a cable avoidance tool (CAT).

Trial Pits

Four foundation inspection pits (TP 1, TP 1A, TP 2 and TP 3) were excavated between 1st and 10th October 2024 using hand tools and long-handled digging equipment by confined space-trained operatives. The surface layer of hardstanding at position TP 3 was removed by stitch-drilling using electrically powered diamond coring equipment. At the request of the client, monitoring of vibrations was undertaken during the site work period within neighbouring store buildings using a Svantec SV258 Pro Vibration & Noise Station.

The exposed strata and foundations were logged, and the soils sampled by the supervising Geo-environmental Engineer. In light of the variation in soils encountered within TP 3 this trial pit record has been sub-divided into TP 3(1) and TP 3(2), with each log detailing the

strata met within the western (TP3(1)) and eastern (TP 3(2)) parts of this excavation, as marked on the exploratory hole location plan.

Small representative disturbed samples of soil were taken at regular intervals throughout the pits and placed in polycarbonate pots (D samples) and glass jars (ES samples). Large bulk disturbed samples (B samples) were also taken in sealed plastic bags.

Following completion of the four excavations and their inspection by a representative of the Engineer, the spoil was returned to the pit and placed in layers, which were recompacted.

The trial pit records give descriptions and depths of the various strata encountered, the details of all samples and the groundwater conditions observed during excavation. Sketch plans, sections and photographs of the exposed foundations are presented on the pages following the hole records for the relevant trial pit excavation.

LABORATORY TESTING

The samples were inspected in the laboratory and assessments of the soil characteristics have been taken into account during preparation of the exploratory hole records. The soil sample descriptions are in accordance with BS5930:2015+A1:2020.

The testing schedule was devised by Lucion Ground Engineering Limited and confirmed as acceptable by the Engineer. The testing was completed within UKAS accredited laboratories. The geotechnical tests were conducted to BS1377:1990 & 2016 and other industry standards.

The results of the geotechnical and chemical tests are respectively presented at the rear of the exploratory hole records and in Appendix 1.

Geotechnical Testing

The moisture content and index properties of selected soil samples were determined as a guide to soil classification and behaviour. The liquid limit was determined by the cone penetrometer method.

The particle size distributions of selected samples were obtained by sieve analysis. Results of these tests are given as particle size distribution curves at the end of this report.

Selected samples of soil were analysed to determine the concentration of soluble sulphates. The pH values were also determined using an electrometric method.

Chemical Testing

Six soil samples recovered from the exploratory holes were tested for total concentrations of arsenic, cadmium, chromium, lead, mercury, selenium, nickel and benzo[a]pyrene, together with speciated polyaromatic hydrocarbons (PAH), boron, copper and zinc, phenols, total and free cyanide, hexavalent chromium, sulphate, sulphide and pH. The soil samples were also tested for organic content.

The samples were also screened for asbestos and tested for total petroleum hydrocarbons (TPH).

Two selected samples of soil were also scheduled for a full Waste Acceptance Criteria (WAC) CEN Leachate Suite at 10l/kg.

GROUND CONDITIONS SUMMARY

The ground conditions encountered within the four trial pits were as expected with a 3.10m to 3.50m thick cover of made ground underlain by superficial Lynch Hill Gravel Member deposits of sand and gravel. The solid geology of the London Clay was not reached by the deepest (4.00m) excavation of this investigation.

Where penetrated, in TP 1A and TP 3, the thickness of made ground corresponded with the depths of the adjacent basement level and tunnel level foundations.

The four excavations were dry throughout excavation and on completion.

COMMENTS ON THE CHEMICAL TEST RESULTS

The results of the laboratory chemical testing on near surface soil samples have primarily been compared to soil screening values (SSVs) produced by Land Quality Management Limited (LQM) and the Chartered Institute for Environmental Health (CIEH) presented in their document 'The LQM/CIEH S4ULs for Human Health Risk Assessment: 2015 (Publication Number S4UL3608)'. The LQM/CIEH S4ULs are intended for use in assessing the potential risks posed to human health by contaminants in soil and are transparently-derived and cautious 'trigger values' above which further assessment of the risks or remedial action may be needed. The S4ULs (Suitable for Use Levels) have been derived, in accordance with UK legislation and Environment Agency policy, using a modified version of the Environment Agency CLEA 1.06 software.

Reference has also been given to AGAC soil screening values produced by Society of Brownfield Risk Assessment (SoBRA) as documented in their July 2020 publication 'Development of Acute Generic Assessment Criteria for Assessing Risks to Human Health from Contaminants in Soil'. With the absence of a S4UL for cyanide, the SoBRA AGAC has been used as the soil screening criteria within this report because the acute dose toxicity thresholds for free cyanide are very close to the chronic dose toxicity thresholds.

In 2014 the Department for Environment Food and Rural Affairs (DEFRA) published, in their document SP1010, Category 4 Screening Levels (C4SL) for several contaminants including lead. The C4SL represent screening levels below which the land could be considered suitable for a specified use and definitely not contaminated land in respect of those determinands. With the absence of S4UL for lead the C4SL has been used as the soil screening criteria within this report.

For each contaminant the adopted soil screening criteria have been calculated for the following land use:

- Commercial and industrial usage

The intended purpose of the SSVs are as "intervention values" in the regulatory framework for assessment of human health risks in relation to land use. These values are not binding standards but are intended to inform judgements about the need for action to ensure that a new use of land does not pose any unacceptable risks to the health of the intended users.

Tables 1 and 2 compare the test results for the made ground with the SSVs in relation to the specified uses. The number of test results, which exceed these values, are also provided.

Table 1: Comparison of Chemical Test Results for Made Ground with SSV

Determinand	Number of Samples	Min Value (mg/kg)	Max Value (mg/kg)	Number of Samples Exceeding SSV for:	Soil Screening Criteria SSV (1% SOM)	
				Commercial/ Industrial	Assessment Method	Commercial/ Industrial mg/kg
Organic Content	6	1.1%	4.7%	-	-	-
Arsenic	6	9.9	17	0	S4UL	640
Cadmium	6	<0.10	0.12	0	S4UL	190
Chromium	6	19	28	0	S4UL	8600
Boron	6	0.46	1.8	0	S4UL	240,000
Lead	6	85	920	0	C4SL	2330
Mercury	6	0.31	9.2	0	S4UL	320
Selenium	6	0.46	0.95	0	S4UL	12,000
Nickel	6	16	26	0	S4UL	980
Phenols	6	<0.10	<0.10	0	S4UL	440
Copper	6	19	120	0	S4UL	68,000
Zinc	6	40	230	0	S4UL	730,000
Free Cyanide	6	<0.50	<0.50	0	AGAC	24

Notes
S4UL and C4SL for metals were derived using 6% SOM. These values are not sensitive to SOM and would also be applicable for 1% SOM and 2.5% SOM
LQM/CIEH S4ULs 'Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3608. All rights reserved'
AGAC soil screening values produced by Society of Brownfield Risk Assessment (SoBRA) as documented in their July 2020 publication 'Development of Acute Generic Assessment Criteria for Assessing Risks to Human Health from Contaminants in Soil'.

Table 2: Comparison of Chemical Test Results for Made Ground with SSV

Determinand	Number of Samples	Min Value (mg/kg)	Max Value (mg/kg)	Number of Samples Exceeding SSV for:	Soil Screening Criteria SSV (1% SOM)	
				Commercial/ Industrial	Assessment Method	Commercial/ Industrial mg/kg
Acenaphthene	6	<0.10	0.50	0	S4UL	84,000
Acenaphthylene	6	<0.10	0.39	0	S4UL	83,000
Anthracene	6	<0.10	0.70	0	S4UL	520,000
Benzo[a] anthracene	6	<0.10	0.84	0	S4UL	170
Benzo[a]pyrene	6	<0.10	0.98	0	S4UL	35
Benzo[b] fluoranthene	6	<0.10	1.5	0	S4UL	44
Benzo[g,h,i] perylene	6	<0.10	1.3	0	S4UL	390
Benzo[k] fluoranthene	6	<0.10	0.53	0	S4UL	1200
Chrysene	6	<0.10	1.4	0	S4UL	350
Dibenz[a,h] anthracene	6	<0.10	<0.10	0	S4UL	3.5
Fluoranthene	6	<0.10	2.3	0	S4UL	23,000
Fluorene	6	<0.10	0.33	0	S4UL	63,000
Indeno[1,2,3-cd]pyrene	6	<0.10	0.49	0	S4UL	500
Naphthalene	6	<0.10	0.78	0	S4UL	190
Phenanthrene	6	<0.10	2.1	0	S4UL	22,000
Pyrene	6	<0.10	2.3	0	S4UL	54,000

Notes
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Discussion of Results

The results of the laboratory analyses (Tables 1 & 2) indicate that the made ground beneath the site did not contain elevated concentrations of the contaminants tested for when compared with the thresholds for commercial/industrial end uses.

Visual and olfactory evidence of hydrocarbon impacted soils was not detected within the soils encountered during the site work. The TPH results recorded within samples

tested from the trial pits were all less than the very low 10mg/kg analysing laboratory detection limit.

No asbestos containing materials were identified within the six samples screened within the analysing laboratory.

Based on the results obtained from the chemical analyses, the soils beneath the site would generally be considered suitable for re-use exposed at the surface in a commercial/industrial setting, representative of the existing and proposed end use.

COMMENTS ON CONTAMINATION IN RELATION TO PROPOSED ENERGY CENTRE DEVELOPMENT

Details of the proposed Energy Centre were not known at the time of report preparation. This investigation may not have revealed the full extent of contamination on the site and appropriate professional advice should be sought if subsequent site works reveal materials that appear to be contaminated.

Contaminated Soil

The exploratory holes found up to 3.50m of made ground beneath the site. No concentrations of contaminants were found that exceeded the SSVs for a commercial/industrial setting, representative of the existing and proposed end use.

There is a low likelihood that the made ground soils would affect groundworkers, and a low likelihood that future end users of the site would be impacted where the made ground is exposed at the surface within landscaped areas in the proposed redevelopment, if envisaged.

Existing Drainage

Redundant foul or surface water drain runs should be removed from beneath the site and precautions should be in place to ensure that any remaining effluent is directly disposed off-site. The integrity of existing drainage should be checked, and where they are to be retained, any damaged sections should be replaced prior to redevelopment. The latter measures should remove any future risk to human health and to the water environment.

Human Health - Construction Workers

The results of the chemical testing indicate that the likelihood of ground contamination affecting groundworkers would be low.

No special precautions would be required during the development of the site by workers who may come into contact with the soil during groundworks, providing that standard precautions are adopted which should generally include the procedures given by the Health and Safety Executive industry guidance.

For the protection of workers during groundworks the following is recommended:

a) Limit repeated or prolonged skin contact with soils by wearing gloves with sleeves rolled down.

b) Washing facilities should be made available to groundworkers, as to minimise the potential for inadvertent ingestion of soil.

c) If any soils are revealed which are different to those encountered by this ground investigation, the advice of a specialist should be sought in view of classifying the material and ascertaining its risk to groundworkers.

d) Dust suppression measures such as 'dampening down', could also be adopted to prevent the spread of soil contaminants.

Human Health - Users of Completed Development

The results of the chemical testing indicate that the likelihood of ground contamination affecting the site users when exposed at the surface would be low. No formal scheme of remediation is therefore required.

Off-Site Disposal of Soil Arisings

The results of chemical analysis are provided in Appendix 1 and can be used for the basic characterisation of the soil destined for landfill. The Environment Agency publication Hazardous Waste, Technical Guidance WM3 outlines the methodology for classifying wastes

and should be referenced for guidance. The test results (total metals, hydrocarbons and cyanide) should be compared to the relevant thresholds to determine whether they fall into the primary categories of non-hazardous waste or hazardous waste and will help indicate the likely European Waste Catalogue (EWC) code, which is determined by the waste type. The results of Waste Acceptance Criteria (WAC) leachate testing should be used to check whether if categorised as non-hazardous waste it could be disposed of at an inert waste landfill; or if categorised as hazardous waste whether it could qualify as stable non-reactive hazardous waste for disposal in non-hazardous landfill.

Excavated material and excess spoil should always be classified prior to removal from site as required by 'Duty of Care' (Environmental Protection Act, 1990) legislation. This means that material must be given a proper description and waste classification prior to removal. Basic characterisation is the responsibility of the waste producer and compliance checking and on-site verification are generally the responsibility of the landfill operator. The landfill operator will need to liaise with the waste producer as the approach relies on the information from basic characterisation.

It is expected that clean arisings from foundation excavations into the natural soils across this site would also fall into the inert category under the European Waste Catalogue description 'Soil and Stones', EWC code 17 05 04 with restrictions excluding topsoil and peat.

LUCION GROUND ENGINEERING LIMITED

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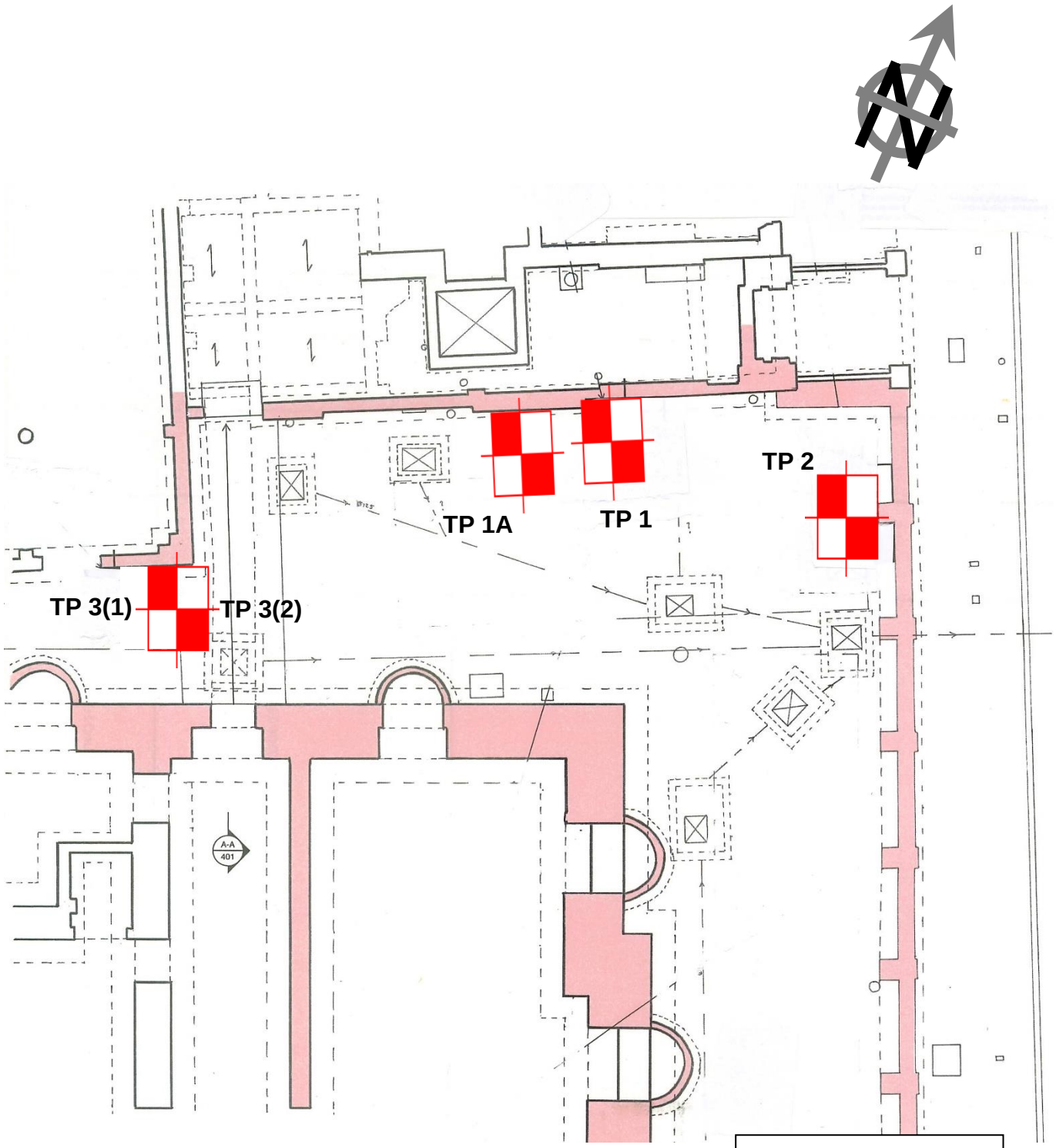
Exploratory Hole Location Plan

Based on a plan provided by the Engineer



Not to Scale

Project : The British Museum, Energy Centre Programme, London WC1

Client : The British Museum

Lucion
Protecting people and planet

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Project No.
118177

APPENDIX 1 – CHEMICAL TEST RESULTS

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Final Report

Report No.:	24-33821-1
Initial Date of Issue:	24-Oct-2024
Re-Issue Details:	
Client	Lucion Ground Engineering Limited
Client Address:	Newark Road Peterborough Cambridgeshire PE1 5UA
Contact(s):	Steve Fleming
Project	118177 British Museum

Quotation No.:	Q24-35007	**Date Received:**	18-Oct-2024
Order No.:	17744	**Date Instructed:**	18-Oct-2024
No. of Samples:	8		
Turnaround (Wkdays):	5	**Results Due:**	24-Oct-2024
Date Approved:	24-Oct-2024		

Approved By:

Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: 118177 British Museum

Client: Lucion Ground Engineering Limited				**Chemtest Job No.:**		24-33821	24-33821	24-33821	24-33821	24-33821	24-33821	24-33821
Quotation No.: Q24-35007				**Chemtest Sample ID.:**		1882681	1882682	1882683	1882684	1882685	1882686	1882687
Order No.: 17744				Client Sample Ref.:		D3/ES3	D4/ES4	D6/ES6	D7/ES7	D2/ES2	D4/ES4	D5/ES5
				Sample Location:		TP1A	TP1A	TP1A	TP1A	TP2	TP3	TP3
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.60	1.10	1.70	2.00	0.40	1.50	2.00
				Date Sampled:		09-Oct-2024	09-Oct-2024	09-Oct-2024	09-Oct-2024	02-Oct-2024	10-Oct-2024	10-Oct-2024
				Asbestos Lab:		DURHAM		DURHAM		DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
pH at 20C		M	2010		4.0	8.7		8.1		8.1	8.5	8.8
Moisture		N	2030	%	0.020	17	17	20	18	22	15	20
Stones and Removed Materials		N	2030	%	0.020	< 0.020		< 0.020		< 0.020	< 0.020	< 0.020
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	0.46		0.80		0.98	0.94	1.8
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	0.016		0.026		< 0.010	0.071	1.1
Cyanide (Free)		M	2300	mg/kg	0.50	< 0.50		< 0.50		[B] < 0.50	< 0.50	< 0.50
Cyanide (Total)		M	2300	mg/kg	0.50	< 0.50		< 0.50		[B] < 0.50	< 0.50	< 0.50
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	4.6		4.8		7.4	3.4	2.6
Arsenic		M	2455	mg/kg	0.5	14		11		17	9.9	11
Cadmium		M	2455	mg/kg	0.10	0.12		< 0.10		0.19	< 0.10	< 0.10
Chromium		M	2455	mg/kg	0.5	22		22		28	19	23
Copper		M	2455	mg/kg	0.50	33		48		120	19	24
Mercury		M	2455	mg/kg	0.05	5.1		0.45		9.2	0.31	0.58
Nickel		M	2455	mg/kg	0.50	20		17		26	18	18
Lead		M	2455	mg/kg	0.50	640		160		920	85	110
Selenium		M	2455	mg/kg	0.25	0.68		0.77		0.95	0.49	0.73
Zinc		M	2455	mg/kg	0.50	73		70		230	40	49
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50		< 0.50		< 0.50	< 0.50	< 0.50
Organic Matter		M	2625	%	0.40	1.6		3.3		4.7	1.1	1.7
Acenaphthene		M	2700	mg/kg	0.10	< 0.10		0.50		< 0.10	< 0.10	< 0.10
Acenaphthylene		M	2700	mg/kg	0.10	< 0.10		0.39		0.38	< 0.10	< 0.10
Anthracene		M	2700	mg/kg	0.10	0.17		0.70		0.15	< 0.10	< 0.10
Benzo[a]anthracene		M	2700	mg/kg	0.10	0.38		0.84		0.50	< 0.10	< 0.10
Benzo[a]pyrene		M	2700	mg/kg	0.10	0.38		0.98		< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		M	2700	mg/kg	0.10	0.76		1.5		< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		M	2700	mg/kg	0.10	< 0.10		1.3		< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		M	2700	mg/kg	0.10	0.17		0.53		< 0.10	< 0.10	< 0.10
Chrysene		M	2700	mg/kg	0.10	0.64		1.4		0.66	< 0.10	< 0.10
Dibenz(a,h)Anthracene		M	2700	mg/kg	0.10	< 0.10		< 0.10		< 0.10	< 0.10	< 0.10
Fluoranthene		M	2700	mg/kg	0.10	0.95		2.3		0.88	< 0.10	< 0.10
Fluorene		M	2700	mg/kg	0.10	< 0.10		0.33		0.13	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		M	2700	mg/kg	0.10	< 0.10		0.49		< 0.10	< 0.10	< 0.10
Naphthalene		M	2700	mg/kg	0.10	< 0.10		0.27		0.27	< 0.10	< 0.10
Phenanthrene		M	2700	mg/kg	0.10	0.55		2.1		0.61	< 0.10	< 0.10
Pyrene		M	2700	mg/kg	0.10	1.2		2.3		0.91	< 0.10	< 0.10
Total Of 16 PAH's		M	2700	mg/kg	2.0	5.2		16		4.5	< 2.0	< 2.0
Total Phenols		M	2920	mg/kg	0.10	< 0.10		< 0.10		< 0.10	< 0.10	< 0.10

Results - Soil

Project: 118177 British Museum

Client: Lucion Ground Engineering Limited				**Chemtest Job No.:**		24-33821	24-33821	24-33821	24-33821	24-33821	24-33821	24-33821
Quotation No.: Q24-35007				**Chemtest Sample ID.:**		1882681	1882682	1882683	1882684	1882685	1882686	1882687
Order No.: 17744				Client Sample Ref.:		D3/ES3	D4/ES4	D6/ES6	D7/ES7	D2/ES2	D4/ES4	D5/ES5
				Sample Location:		TP1A	TP1A	TP1A	TP1A	TP2	TP3	TP3
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.60	1.10	1.70	2.00	0.40	1.50	2.00
				Date Sampled:		09-Oct-2024	09-Oct-2024	09-Oct-2024	09-Oct-2024	02-Oct-2024	10-Oct-2024	10-Oct-2024
				Asbestos Lab:		DURHAM		DURHAM		DURHAM	DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
ACM Type		U	2192		N/A	-		-		-	-	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected		No Asbestos Detected		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Soil Colour		N	2040		N/A	Brown		Brown		Brown	Brown	Brown
Other Material		N	2040		N/A	Stones		Stones		Stones	Stones	Stones
Soil Texture		N	2040		N/A	Sand		Clay		Clay	Sand	Clay
Total TPH >C6-C40	EH_1D_Total	U	2670	mg/kg	10	100		< 10		[B] < 10	< 10	< 10

Results - Soil

Project: 118177 British Museum

Client: Lucion Ground Engineering Limited				**Chemtest Job No.:**		24-33821
Quotation No.: Q24-35007				**Chemtest Sample ID.:**		1882688
Order No.: 17744				Client Sample Ref.:		D2/ES2
				Sample Location:		TP3(1)
				Sample Type:		SOIL
				Top Depth (m):		0.70
				Date Sampled:		10-Oct-2024
				Asbestos Lab:		DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
pH at 20C		M	2010		4.0	8.3
Moisture		N	2030	%	0.020	11
Stones and Removed Materials		N	2030	%	0.020	< 0.020
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	1.2
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	< 0.010
Cyanide (Free)		M	2300	mg/kg	0.50	< 0.50
Cyanide (Total)		M	2300	mg/kg	0.50	< 0.50
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	4.4
Arsenic		M	2455	mg/kg	0.5	13
Cadmium		M	2455	mg/kg	0.10	< 0.10
Chromium		M	2455	mg/kg	0.5	16
Copper		M	2455	mg/kg	0.50	110
Mercury		M	2455	mg/kg	0.05	0.82
Nickel		M	2455	mg/kg	0.50	16
Lead		M	2455	mg/kg	0.50	540
Selenium		M	2455	mg/kg	0.25	0.46
Zinc		M	2455	mg/kg	0.50	49
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50
Organic Matter		M	2625	%	0.40	2.2
Acenaphthene		M	2700	mg/kg	0.10	0.41
Acenaphthylene		M	2700	mg/kg	0.10	0.38
Anthracene		M	2700	mg/kg	0.10	0.44
Benzo[a]anthracene		M	2700	mg/kg	0.10	0.54
Benzo[a]pyrene		M	2700	mg/kg	0.10	0.31
Benzo[b]fluoranthene		M	2700	mg/kg	0.10	0.65
Benzo[g,h,i]perylene		M	2700	mg/kg	0.10	< 0.10
Benzo[k]fluoranthene		M	2700	mg/kg	0.10	0.20
Chrysene		M	2700	mg/kg	0.10	0.75
Dibenz(a,h)Anthracene		M	2700	mg/kg	0.10	< 0.10
Fluoranthene		M	2700	mg/kg	0.10	0.93
Fluorene		M	2700	mg/kg	0.10	0.23
Indeno(1,2,3-c,d)Pyrene		M	2700	mg/kg	0.10	< 0.10
Naphthalene		M	2700	mg/kg	0.10	0.78
Phenanthrene		M	2700	mg/kg	0.10	1.0
Pyrene		M	2700	mg/kg	0.10	0.82
Total Of 16 PAH's		M	2700	mg/kg	2.0	7.4
Total Phenols		M	2920	mg/kg	0.10	< 0.10

Results - Soil

Project: 118177 British Museum

Client: Lucion Ground Engineering Limited				**Chemtest Job No.:**		24-33821
Quotation No.: Q24-35007				**Chemtest Sample ID.:**		1882688
Order No.: 17744				Client Sample Ref.:		D2/ES2
				Sample Location:		TP3(1)
				Sample Type:		SOIL
				Top Depth (m):		0.70
				Date Sampled:		10-Oct-2024
				Asbestos Lab:		DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
ACM Type		U	2192		N/A	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected
Soil Colour		N	2040		N/A	Brown
Other Material		N	2040		N/A	Stones
Soil Texture		N	2040		N/A	Loam
Total TPH >C6-C40	EH_1D_Total	U	2670	mg/kg	10	< 10

Results - Single Stage WAC

Project: 118177 British Museum

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-33821					**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Chemtest Sample ID:	1882682							
Sample Ref:	D4/ES4							
Sample ID:								
Sample Location:	TP1A							
Top Depth(m):	1.10							
Bottom Depth(m):								
Sampling Date:	09-Oct-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**				
Total Organic Carbon	2625		M	%	2.2	3	5	6
Loss On Ignition	2610		M	%	2.8	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800		N	mg/kg	4.3	100	--	--
pH at 20C	2010		M		8.5	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.0060	--	To evaluate	To evaluate
Eluate Analysis				**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455		U	0.0037	0.037	0.5	2	25
Barium	1455		U	0.008	0.075	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	0.0008	0.0084	0.5	10	70
Copper	1455		U	0.011	0.11	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0008	0.0075	0.5	10	30
Nickel	1455		U	0.0008	0.0078	0.4	10	40
Lead	1455		U	0.017	0.17	0.5	10	50
Antimony	1455		U	0.0006	0.0064	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	< 0.003	< 0.025	4	50	200
Chloride	1220		U	4.1	41	800	15000	25000
Fluoride	1220		U	0.12	1.2	10	150	500
Sulphate	1220		U	3.9	39	1000	20000	50000
Total Dissolved Solids	1020		N	85	840	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	3.8	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 118177 British Museum

Chemtest Job No:	24-33821					**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	1882684							
Sample Ref:	D7/ES7							
Sample ID:								
Sample Location:	TP1A							
Top Depth(m):	2.00							
Bottom Depth(m):								
Sampling Date:	09-Oct-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	0.78	3	5	6
Loss On Ignition	2610		M	%	2.8	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800		N	mg/kg	< 2.0	100	--	--
pH at 20C	2010		M		8.2	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.046	--	To evaluate	To evaluate
Eluate Analysis				**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455		U	0.0037	0.037	0.5	2	25
Barium	1455		U	< 0.005	< 0.050	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	0.0006	0.0057	0.5	10	70
Copper	1455		U	0.0032	0.032	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0015	0.015	0.5	10	30
Nickel	1455		U	0.0012	0.012	0.4	10	40
Lead	1455		U	0.0015	0.015	0.5	10	50
Antimony	1455		U	0.0006	0.0055	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	< 0.003	< 0.025	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.34	3.4	10	150	500
Sulphate	1220		U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020		N	130	1300	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	4.8	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	10

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1882685	D2/ES2		TP2	02-Oct-2024	B	Amber Glass 250ml
1882685	D2/ES2		TP2	02-Oct-2024	B	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity at 25°C and Total Dissolved Solids (TDS) in Waters	Conductivity Meter	
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	RE PW PL LE DW FW
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW FW
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation	PL SW FW
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	
2010	pH Value of Soils	pH at 20°C	pH Meter	
2015	Acid Neutralisation Capacity	Acid Reserve	Titration	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID	
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS. Reported PCB 101 results may contain contributions from PCB 90 due to inseparable chromatography.	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	

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"
SOP	Standard operating procedure
LOD	Limit of detection

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.
Any comments or interpretations are outside the scope of UKAS accreditation.
The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.
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 EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.
All Asbestos testing is performed at the indicated 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
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 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.

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable

Report Information

PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com