



Appendix E4

Landscaping – WRAP Compost Testing

Document ref: R/14656/008

21 September 2015

Lend Lease
North Wales Prison
Wrexham Industrial Estate
Wrexham
North Wales
LL13 9PS

For the attention of Patricia Dean, Assistant Project Manager

Dear Patricia

Re: WRAP: Use of Recycled Compost in Landscaped Areas at the North Wales Prison Site, Wrexham

1.0 Introduction

Lend Lease propose to use imported, recycled compost as part of the North Wales Prison development. The imported compost is to be combined with natural, site-won Glacial Till to provide a suitable growing medium for use in planned landscaped areas

It was agreed that, prior to import, Hydrock would sample the compost and subject the samples to laboratory testing to ensure that the material was chemically suitable for its proposed use.

This letter report presents the results of the chemical testing and assesses the suitability for use of the compost.

2.0 Sampling Method

The compost materials to be imported to the North Wales Prison site were sampled at source on two occasions. The first of these sampling visits was undertaken at the suppliers' depot located at FCC Environment, Govey Landfill, Ince Lane, Wimbolds Trafford, Chester, CH2 4JP on 15th June 2015, and involved the taking of three samples from each of two windrows containing approximately 400m³ of material each. The three samples from each windrow were combined, coned and quartered to provide two representative samples.

The second sampling visit was undertaken, again at the Govey Landfill depot, on 27th July 2015 and also involved the recovery of three samples from a windrow containing approximately 400m³ of material to produce a combined, representative sample.

3.0 Results

All three representative samples were tested for Hydrock's Default Soil Suite (comprising metals, metalloids, USEPA 16 PAHs, free cyanide, phenols, pH and fraction of organic carbon) and Level 2

aliphatic / aromatic petroleum hydrocarbons (TPH-CWG). Copies of the laboratory testing certificates are included at Annex A.

As the recycled compost is to be used in landscaped areas of the prison, the chemical testing results have been assessed against the Generic Assessment Criteria (GAC) for the CLEA Public Open Space (Residential) land use scenario, as these were felt to be the most appropriate screening criteria for the proposed end use.

The results of the assessment are summarised in Table 3.1. It should be noted that only those determinands which were recorded at detectable concentrations are considered below. The full assessment results are included at Annex A.

Table 3.1 Compost Chemical Assessment Results

Determinand	GAC (mg/kg)	Range of Concentrations (mg/kg)	No. of Exceedances
Arsenic	79	5.5 – 8.0	0
Beryllium	92	0.2 – 0.5	0
Boron	21,000	10 – 13	0
Cadmium	120	0.3 – 0.9	0
Chromium (III)	1,500	8.5 – 16	0
Copper	12,000	52 – 180	0
Lead	630	54 – 85	0
Nickel	290	9.6 – 20	0
Vanadium	440	14 – 45	0
Zinc	81,000	150 – 230	0
Aliphatics >EC16-EC35	250,000	62 - 280	0
Aromatics >EC12-EC16	5,000	<2 – 2.4	0
Aromatics >E16-EC21	3,800	<10 - 21	0
Aromatics >EC21-EC35	3,800	24 - 74	0
Aromatics >EC35-EC44	3,800	<8.4 - 14	0

It can be seen from Table 3.1 that there are no exceedances of the GAC for a Public Open Space (Residential) end use.

4.0 Summary and Conclusions

Three representative samples of the compost to be imported to the North Wales Prison site have been sampled at source prior to importation and chemically tested.

The results of the testing, when assessed against GAC appropriate to a Public Open Space (Residential) end use, did not identify any exceedances of the GAC and it is therefore concluded that the compost is chemically suitable for its intended use.



I trust that the above meets your current requirements.

Yours sincerely
for **Hydrock**

A handwritten signature in blue ink that reads "T.P. Wraxton".

Terry Wraxton
Senior Geo-environmental Consultant

terrywraxton@hydrock.com



Annex A

Laboratory Testing Certificates and Assessment Sheets

Assessment of Chemicals of Potential Concern to Human Health

All values in mg/kg unless otherwise stated							Compost Windrow 329	Compost Windrow 330	Compost Windrow 3								
Location & Depth																	
Chemical of Potential Concern	Lab. RL	No. Samples	Min. Value	Max. Value	No. Samples > or = GAC	GAC											
Arsenic	1	3	5.5	8	0	79	5.5	7.9	8								
Beryllium	0.06	3	0.2	0.5	0	92	0.2	0.3	0.5								
Boron	0.2	3	10	13	0	21000	10	13	13								
Cadmium	0.2	3	0.3	0.9	0	120	0.3	0.5	0.9								
Chromium (III)	1	3	8.5	16	0	1500	8.5	16	16								
Chromium (VI)	1.2	3	1.2	1.2	0	7.7	1.2	1.2	1.2								
Copper	1	3	52	180	0	12000	180	52	64								
Lead	1	3	54	85	0	630	54	69	85								
Mercury, inorganic	0.3	3	0.3	0.3	0	470	0.3	0.3	0.3								
Nickel	1	3	9.6	20	0	290	9.6	14	20								
Selenium	1	3	1	1	0	1400	1	1	1								
Vanadium	1	3	14	45	0	440	14	27	45								
Zinc	1	3	150	230	0	81000	150	180	230								
Cyanide (free)	1	3	1	1	0	1600	1	1	1								
Phenol (total)	1	3	1	1	0	3200	1	1	1								
Acenaphthene	0.1	3	0.1	0.1	0	15000	0.1	0.1	0.1								
Acenaphthylene	0.1	3	0.1	0.1	0	15000	0.1	0.1	0.1								
Anthracene	0.1	3	0.1	0.1	0	74000	0.1	0.1	0.1								
Benz(a)anthracene	0.1	3	0.1	0.1	0	18	0.1	0.1	0.1								
Benzo(a)pyrene	0.1	3	0.1	0.1	0	2.6	0.1	0.1	0.1								
Benzo(b)fluoranthene	0.1	3	0.1	0.1	0	18	0.1	0.1	0.1								
Benzo(ghi)perylene	0.05	3	0.05	0.05	0	120	0.05	0.05	0.05								
Benzo(k)fluoranthene	0.1	3	0.1	0.1	0	26	0.1	0.1	0.1								
Chrysene	0.05	3	0.05	0.05	0	26	0.05	0.05	0.05								
Dibenz(a,h)anthracene	0.1	3	0.1	0.1	0	2.32	0.1	0.1	0.1								
Fluoranthene	0.1	3	0.1	0.1	0	3100	0.1	0.1	0.1								
Fluorene	0.1	3	0.1	0.1	0	9900	0.1	0.1	0.1								
Indeno(1,2,3,cd)pyrene	0.1	3	0.1	0.1	0	11	0.1	0.1	0.1								
Naphthalene	0.05	3	0.05	0.05	0	4200	0.05	0.05	0.05								
Phenanthrene	0.1	3	0.1	0.1	0	3100	0.1	0.1	0.1								
Pyrene	0.1	3	0.1	0.1	0	7400	0.1	0.1	0.1								
Asbestos identified	0																
FOC (dimensionless)	0.133333	(mean)					0.11	0.14	0.15								
SOM (calculated)	22.99%	(mean)					18.96%	24.14%	25.86%								
pH (su)	7.9	(mean)					7.9	8	7.7								

Risk parameter: Human health - POS resi (6%SOM)

Data set: Imported Compost

Client: Lend Lease

Site: North Wales Prison, Wrexham

Job no.: C14656

Legend: Values in blue are at or below the laboratory reporting limit (where a single value is indicated) and are considered as being at the detection limit for the purposes of statistical analysis, as a conservative estimate. Values in red are equal to, or greater than, the generic assessment criterion (GAC).

Assessment of Chemicals of Potential Concern to Human Health

All values in mg/kg unless otherwise stated							Compost	Compost	Compost								
Location & Depth							Windrow 329	Windrow 330	Windrow 3								
Chemical of Potential Concern	Lab. RL	No. Samples	Min. Value	Max. Value	No. Samples > or = GAC	GAC											
Aliphatics EC5-EC6	0.1	3	0.1	0.1	0	600000	0.1	0.1	0.1								
Aliphatics >EC6-EC8	0.1	3	0.1	0.1	0	620000	0.1	0.1	0.1								
Aliphatics >EC8-EC10	0.1	3	0.1	0.1	0	13000	0.1	0.1	0.1								
Aliphatics >EC10-EC12	1	3	1	1	0	13000	1	1	1								
Aliphatics >EC12-EC16	2	3	2	15	0	13000	2	2	15								
Aliphatics >EC16-EC35	10	3	62	280	0	250000	62	99	280								
Aliphatics >EC35-EC44	8.4	3	8.4	8.4	0	250000	8.4	8.4	8.4								
Aromatics EC5-EC7	0.1	3	0.1	0.1	0	56000	0.1	0.1	0.1								
Aromatics >EC7-EC8	0.1	3	0.1	0.1	0	56000	0.1	0.1	0.1								
Aromatics >EC8-EC10	0.1	3	0.1	0.1	0	5000	0.1	0.1	0.1								
Aromatics >EC10-EC12	1	3	1	1	0	5000	1	1	1								
Aromatics >EC12-EC16	2	3	2	2.4	0	5000	2.4	2	2								
Aromatics >EC16-EC21	10	3	10	21	0	3800	10	10	21								
Aromatics >EC21-EC35	10	3	24	74	0	3800	65	74	24								
Aromatics >EC35-EC44	8.4	3	8.4	14	0	3800	14	11	8.4								
ADDITIVITY CHECK							HAZARD QUOTIENTS FOR EACH FRACTION										
							0.000	0.000	0.000								
							0.000	0.000	0.000								
Considered additive							0.000	0.000	0.000								
							0.000	0.000	0.000								
							0.000	0.000	0.001								
							0.000	0.000	0.001								
							0.000	0.000	0.000								
Considered additive							0.000	0.000	0.000								
							0.000	0.000	0.000								
							0.000	0.000	0.000								
							0.000	0.000	0.000								
							0.000	0.000	0.000								
Considered additive							0.003	0.003	0.006								
							0.017	0.019	0.006								
							0.004	0.003	0.002								
							0.000	0.000	0.001								
							0.001	0.001	0.001								
							0.020	0.022	0.012								
Risk parameter: Human health - POS resi (6%SOM)							Legend: Hazard index table - HI or HQ greater than 1 highlighted with yellow shading. Main table values in blue are at or below the laboratory reporting limit (where a single value is indicated) and are considered as being at the detection limit for the purposes of statistical analysis, as a conservative estimate. Main table alues in red are equal to, or greater than, the generic assessment criterion (GAC).										
Data set: Imported Compost																	
Client: Lend Lease																	
Site: North Wales Prison, Wrexham																	
Job no.: C14656																	

**Karen Dale**

Hydrock Consultants Ltd
4 Lakeside
Festival Park
Stoke on Trent
ST1 5RY

t: 01782 261919
f: 01782 262020
e: karendale@hydrock.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 15-73627

Replaces Analytical Report Number : 15-73627, issue no. 1

Project / Site name:	Wrexham Prison	Samples received on:	16/06/2015
Your job number:	C14656	Samples instructed on:	16/06/2015
Your order number:	C14656-S15219	Analysis completed by:	18/06/2015
Report Issue Number:	2	Report issued on:	04/09/2015
Samples Analysed:	2 soil samples		

Signed:

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Emma Winter
Assistant Reporting Manager
For & on behalf of i2 Analytical Ltd.

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 15-73627

Project / Site name: Wrexham Prison

Your Order No: C14656-S15219

Lab Sample Number				455064	455065			
Sample Reference				Windrow 329	Windrow 330			
Sample Number				None Supplied	None Supplied			
Depth (m)				None Supplied	None Supplied			
Date Sampled				15/06/2015	15/06/2015			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1			
Moisture Content	%	N/A	NONE	39	37			
Total mass of sample received	kg	0.001	NONE	0.35	0.32			

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected			
------------------	------	-----	-----------	--------------	--------------	--	--	--

General Inorganics

pH	pH Units	N/A	MCERTS	7.9	8.0			
Free Cyanide	mg/kg	1	NONE	< 1	< 1			
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.17	0.52			
Water Soluble Sulphate (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	174	516			
Fraction Organic Carbon (FOC)	N/A	0.00001	NONE	0.11	0.14			

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0			
----------------------------	-------	---	--------	-------	-------	--	--	--

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Phenanthrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Benzo(a)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Benzo(a)pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	< 1.60	< 1.60			
-----------------------------	-------	-----	--------	--------	--------	--	--	--

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5.5	7.9			
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.2	0.3			
Boron (water soluble)	mg/kg	0.2	MCERTS	10	13			
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.3	0.5			
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2			
Chromium (III)	mg/kg	1	NONE	8.5	16			
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	9.7	16			
Copper (aqua regia extractable)	mg/kg	1	MCERTS	180	52			
Lead (aqua regia extractable)	mg/kg	1	MCERTS	54	69			
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	9.6	14			
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0			
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	14	27			
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	150	180			

Analytical Report Number: 15-73627

Project / Site name: Wrexham Prison

Your Order No: C14656-S15219

Lab Sample Number	455064	455065			
Sample Reference	Windrow 329	Windrow 330			
Sample Number	None Supplied	None Supplied			
Depth (m)	None Supplied	None Supplied			
Date Sampled	15/06/2015	15/06/2015			
Time Taken	None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0			
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0			
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0			
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0			
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0			
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0			

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0			
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0			
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	8.4	12			
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	53	87			
TPH-CWG - Aliphatic >EC16 - EC35	mg/kg	10	NONE	62	99			
TPH-CWG - Aliphatic > EC35 - EC44	mg/kg	8.4	NONE	< 8.4	< 8.4			

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0			
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	2.4	< 2.0			
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10			
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	65	74			
TPH-CWG - Aromatic > EC35 - EC44	mg/kg	8.4	NONE	14	11			

Analytical Report Number : 15-73627

Project / Site name: Wrexham Prison

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and topsoil/loam soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
455064	Windrow 329	None Supplied	None Supplied	Brown loam with vegetation.
455065	Windrow 330	None Supplied	None Supplied	Brown loam with vegetation.

Analytical Report Number : 15-73627

Project / Site name: Wrexham Prison

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073S-PL	W	MCERTS
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Fraction of Organic Carbon in soil	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	NONE
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	NONE
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
TPH Chromatogram	TPH Chromatogram.	In-house method	L064-PL	D	NONE
TPH in (Soil)	Determination of TPH bands by GC-MS/GC-FID	In-house method, TPH with carbon banding.	L064/076PL	D	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS

Analytical Report Number : 15-73627

Project / Site name: Wrexham Prison

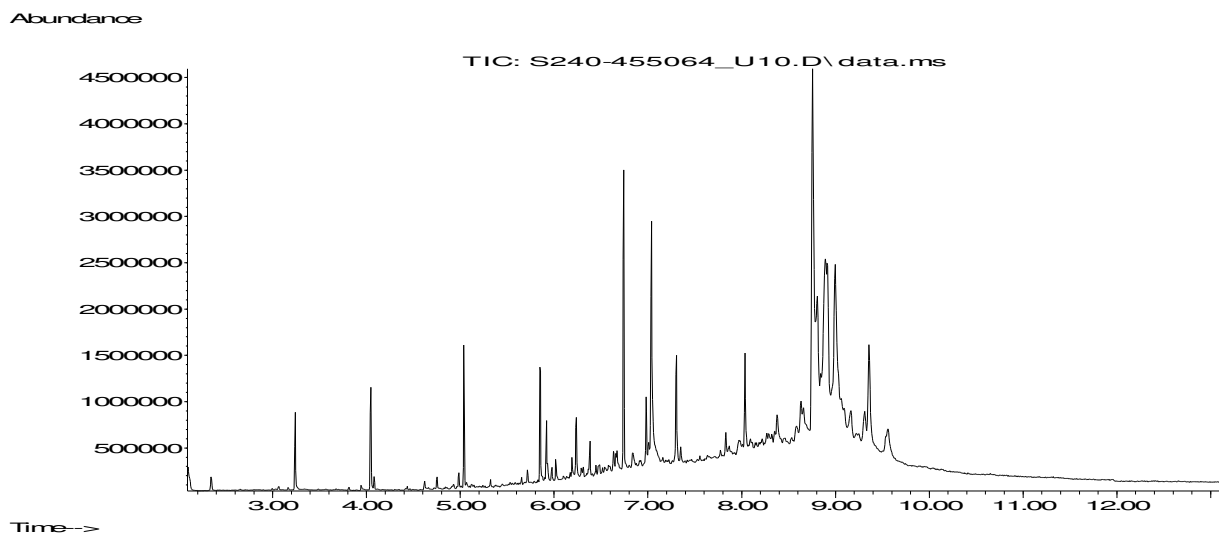
Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

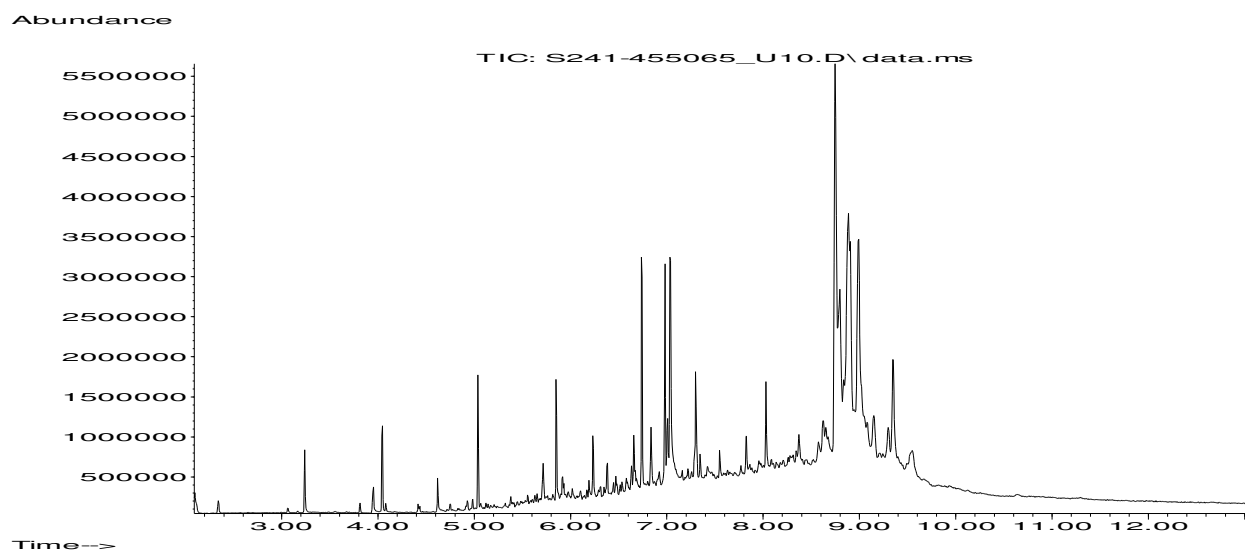
Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
----------------------	-------------------------------	-----------------------------	---------------	--------------------	----------------------

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.





**Karen Dale**

Hydrock Consultants Ltd
2-4 Hawthorne Park
Holdenby Road
Spratton
Northamptonshire
NN6 8LD

t: 01604842888
f: 01604842666
e: karendale@hydrock.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 15-76344

Replaces Analytical Report Number : 15-76344, issue no. 1

Project / Site name:	North Wales Prison	Samples received on:	30/07/2015
Your job number:	C14656	Samples instructed on:	30/07/2015
Your order number:	S7938/C14656	Analysis completed by:	05/08/2015
Report Issue Number:	2	Report issued on:	03/09/2015
Samples Analysed:	1 soil sample		

Signed:

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Emma Winter
Assistant Reporting Manager
For & on behalf of i2 Analytical Ltd.

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 15-76344
Project / Site name: North Wales Prison
Your Order No: S7938/C14656

Lab Sample Number	471330				
Sample Reference	Windrow 3				
Sample Number	None Supplied				
Depth (m)	None Supplied				
Date Sampled	27/07/2015				
Time Taken	None Supplied				

Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	34				
Total mass of sample received	kg	0.001	NONE	0.32				

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected				
------------------	------	-----	-----------	--------------	--	--	--	--

General Inorganics

pH	pH Units	N/A	MCERTS	7.7				
Free Cyanide	mg/kg	1	NONE	< 1				
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.33				
Water Soluble Sulphate (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	334				
Fraction Organic Carbon (FOC)	N/A	0.00001	NONE	0.15				

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0				
----------------------------	-------	---	--------	-------	--	--	--	--

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05				
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10				
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10				
Fluorene	mg/kg	0.1	MCERTS	< 0.10				
Phenanthrene	mg/kg	0.1	MCERTS	< 0.10				
Anthracene	mg/kg	0.1	MCERTS	< 0.10				
Fluoranthene	mg/kg	0.1	MCERTS	< 0.10				
Pyrene	mg/kg	0.1	MCERTS	< 0.10				
Benzo(a)anthracene	mg/kg	0.1	MCERTS	< 0.10				
Chrysene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	< 0.10				
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	< 0.10				
Benzo(a)pyrene	mg/kg	0.1	MCERTS	< 0.10				
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	< 0.10				
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	< 0.10				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05				

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	< 1.60				
-----------------------------	-------	-----	--------	--------	--	--	--	--

Analytical Report Number: 15-76344
Project / Site name: North Wales Prison
Your Order No: S7938/C14656

Lab Sample Number	471330				
Sample Reference	Windrow 3				
Sample Number	None Supplied				
Depth (m)	None Supplied				
Date Sampled	27/07/2015				
Time Taken	None Supplied				

Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
---	--------------	-------------------------------	---------------------------------	--	--	--	--	--

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.0				
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.5				
Boron (water soluble)	mg/kg	0.2	MCERTS	13				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.9				
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2				
Chromium (III)	mg/kg	1	NONE	16				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	16				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	64				
Lead (aqua regia extractable)	mg/kg	1	MCERTS	85				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3				
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	20				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0				
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	45				
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	230				

Monoaromatics

Benzene	µg/kg	1	MCERTS	< 1.0				
Toluene	µg/kg	1	MCERTS	< 1.0				
Ethylbenzene	µg/kg	1	MCERTS	< 1.0				
p & m-xylene	µg/kg	1	MCERTS	< 1.0				
o-xylene	µg/kg	1	MCERTS	< 1.0				
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0				

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1				
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1				
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1				
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0				
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	15				
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	150				
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	130				
TPH-CWG - Aliphatic >EC16 - EC35	mg/kg	10	NONE	280				
TPH-CWG - Aliphatic > EC35 - EC44	mg/kg	8.4	NONE	< 8.4				

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1				
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1				
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1				
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0				
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0				
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	21				
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	24				
TPH-CWG - Aromatic > EC35 - EC44	mg/kg	8.4	NONE	< 8.4				

Analytical Report Number : 15-76344

Project / Site name: North Wales Prison

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and topsoil/loam soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
471330	Windrow 3	None Supplied	None Supplied	Black sandy loam with vegetation.

Analytical Report Number : 15-76344

Project / Site name: North Wales Prison

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073S-PL	W	MCERTS
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Fraction of Organic Carbon in soil	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	NONE
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	NONE
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
TPH Chromatogram	TPH Chromatogram.	In-house method	L064-PL	D	NONE
TPH in (Soil)	Determination of TPH bands by GC-MS/GC-FID	In-house method, TPH with carbon banding.	L064/076PL	D	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS

Analytical Report Number : 15-76344

Project / Site name: North Wales Prison

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
----------------------	-------------------------------	-----------------------------	---------------	--------------------	----------------------

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Document ref: R/14656/012

24 April 2016

Lend Lease
North Wales Prison
Wrexham Industrial Estate
Wrexham
North Wales
LL13 9PS

For the attention of Sam Peck, Project Manager

Dear Patricia

Re: WRAP: Use of Recycled Compost in Landscaped Areas at the North Wales Prison Site, Wrexham

1.0 Introduction

Lend Lease propose to use imported, recycled compost as part of the North Wales Prison development. The imported compost is to be combined with natural, site-won Glacial Till to provide a suitable growing medium for use in planned landscaped areas

It was agreed that, prior to import, Hydrock would sample the compost and subject the samples to laboratory testing to ensure that the material was chemically suitable for its proposed use.

This letter report presents the results of the chemical testing and assesses the suitability for use of the compost.

2.0 Sampling Method

The compost material was sampled at source from the suppliers depot at FCC Environment, Gowey Landfill, Ince Lane, Wimbolds Trafford, Chester, CH2 4JP on 12 April 2016. This involved the taking of three samples from each of two windrows (Windrows 354 and 355) containing approximately 400m³ of material each. The three samples from each windrow were combined, coned and quartered to provide two representative samples.

3.0 Results

The representative samples were tested for Hydrock's Default Soil Suite (comprising metals, metalloids, USEPA 16 PAHs, free cyanide, phenols, pH and fraction of organic carbon) and Level 2 aliphatic / aromatic petroleum hydrocarbons (TPH-CWG). Copies of the laboratory testing certificates are included at Annex A.

As the recycled compost is to be used in landscaped areas of the prison, the chemical testing results have been assessed against the Generic Assessment Criteria (GAC) for the CLEA Public Open Space (Residential) land use scenario, as these were felt to be the most appropriate screening criteria for the proposed end use.

The sample was unsuitable for testing for Chromium (III) and Chromium(VI) due to the high colouration of the soils.

The results of the assessment are summarised in Table 3.1. It should be noted that only those determinands which were recorded at detectable concentrations are considered below. The full assessment results are included at Annex A.

Table 3.1 Compost Chemical Assessment Results

Determinand	GAC (mg/kg)	Range of Concentrations (mg/kg)	No. of Exceedances
Arsenic	79	7.8 – 8.2	0
Beryllium	92	0.4	0
Boron	21,000	13 – 16	0
Cadmium	120	0.6 – 0.7	0
Copper	12,000	53 – 62	0
Lead	630	78 – 87	0
Nickel	290	16	0
Vanadium	440	22 – 33	0
Zinc	81,000	180 – 200	0
Phenol	3,200	3.7 - 10	0
Aliphatics >EC12-EC16	13,000	<2 – 7.5	0
Aliphatics >EC16-EC35	250,000	150 - 200	0
Aliphatics >EC35-EC44	250,000	38	0
Aromatics >EC12-EC16	5,000	<2 – 7	0
Aromatics >E16-EC21	3,800	13 - 29	0
Aromatics >EC21-EC35	3,800	150 – 170	0
Aromatics >EC35-EC44	3,800	110 - 120	0

It can be seen from Table 3.1 that there are no exceedances of the GAC for a Public Open Space (Residential) end use.

Asbestos screening was carried out on all samples by the laboratory. Fibres were identified in both samples and have been identified as Chrysotile loose fibres.

4.0 Summary and Conclusions

Two representative samples of the compost to be imported to the North Wales Prison site have been sampled at source prior to importation and chemically tested.



The results of the testing, when assessed against GAC appropriate to a Public Open Space (Residential) end use, did not identify any chemical exceedances. However, asbestos fibres have been identified within both samples. To date no quantification analysis has been carried out on the samples to determine the weight % of asbestos present within the soils.

The initial conclusion is that the presence of asbestos fibres in the soils indicates they are not acceptable for use as a soil improver at the site. However, if the samples were subject to quantification and shown to be <0.001% w/w it might be that the Environmental Health Officer at WCBC would sanction their use, in that re-use of site soils with an asbestos content of <0.001% w/w is permitted under the remediation strategy.

We trust that the above meets your current requirements.

Yours sincerely
for **Hydrock**

A handwritten signature in blue ink that reads "Eric Cooper".

Eric Cooper
Technical Director

ericcooper@hydrock.com



Annex A

Laboratory Testing Certificates and Assessment Sheets



4041

Karen Dale

Hydrock Consultants Ltd
4 Lakeside
Festival Park
Stoke on Trent
ST1 5RY

t: 01782 261919
f: 01782 262020
e: karen@hydrock.co.uk



Environmental Science

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 16-15287

Project / Site name:	Wrexham Prison	Samples received on:	14/04/2016
Your job number:	C14656	Samples instructed on:	14/04/2016
Your order number:	C14656-S16139	Analysis completed by:	20/04/2016
Report Issue Number:	1	Report issued on:	20/04/2016
Samples Analysed:	2 soil samples		

Signed:

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Emma Winter
Assistant Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.



4041



Environmental Science

Analytical Report Number: 16-15287

Project / Site name: Wrexham Prison

Your Order No: C14656-S16139

Lab Sample Number				560453	560454			
Sample Reference				Windrow 354	Windrow 355			
Sample Number				None Supplied	None Supplied			
Depth (m)				None Supplied	None Supplied			
Date Sampled				12/04/2016	12/04/2016			
Time Taken				1115	1130			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1			
Moisture Content	%	N/A	NONE	57	56			
Total mass of sample received	kg	0.001	NONE	0.40	0.38			

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile- Loose fibres	Chrysotile- Loose fibres			
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Detected			

General Inorganics

pH	pH Units	N/A	MCERTS	8.1	8.2			
Free Cyanide	mg/kg	1	NONE	< 1	< 1			
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.27	0.44			
Water Soluble Sulphate (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	274	440			
Fraction Organic Carbon (FOC)	N/A	0.00001	NONE	0.079	0.082			

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	3.7	10			
----------------------------	-------	---	--------	-----	----	--	--	--

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Phenanthrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Fluoranthene	mg/kg	0.1	MCERTS	0.41	< 0.10			
Pyrene	mg/kg	0.1	MCERTS	0.36	< 0.10			
Benzo(a)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Benzo(a)pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10			
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	< 1.60	< 1.60			
-----------------------------	-------	-----	--------	--------	--------	--	--	--



4041



Environmental Science

Analytical Report Number: 16-15287

Project / Site name: Wrexham Prison

Your Order No: C14656-S16139

Lab Sample Number				560453	560454			
Sample Reference				Windrow 354	Windrow 355			
Sample Number				None Supplied	None Supplied			
Depth (m)				None Supplied	None Supplied			
Date Sampled				12/04/2016	12/04/2016			
Time Taken				1115	1130			
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.2	7.8			
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.4	0.4			
Boron (water soluble)	mg/kg	0.2	MCERTS	13	16			
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.7	0.6			
Chromium (hexavalent)	mg/kg	1.2	MCERTS	U/S**	U/S**			
Chromium (III)	mg/kg	1	NONE	U/S**	U/S**			
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	16	13			
Copper (aqua regia extractable)	mg/kg	1	MCERTS	62	53			
Lead (aqua regia extractable)	mg/kg	1	MCERTS	87	78			
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	16	16			
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0			
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	22	33			
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	200	180			

Monoaromatics

Benzene	ug/kg	1	MCERTS	< 1.0	< 1.0			
Toluene	ug/kg	1	MCERTS	< 1.0	< 1.0			
Ethylbenzene	ug/kg	1	MCERTS	< 1.0	< 1.0			
p & m-xylene	ug/kg	1	MCERTS	< 1.0	< 1.0			
o-xylene	ug/kg	1	MCERTS	< 1.0	< 1.0			
MTBE (Methyl Tertiary Butyl Ether)	ug/kg	1	MCERTS	< 1.0	< 1.0			

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0			
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	7.5	< 2.0			
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	24	23			
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	170	130			
TPH-CWG - Aliphatic >EC16 - EC35	mg/kg	10	NONE	200	150			
TPH-CWG - Aliphatic > EC35 - EC44	mg/kg	8.4	NONE	38	38			

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0			
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	7.0	< 2.0			
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	29	13			
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	170	150			
TPH-CWG - Aromatic > EC35 - EC44	mg/kg	8.4	NONE	110	120			

**U/S - Unsuitable for analysis due to high colour intensity.



Analytical Report Number : 16-15287

Project / Site name: Wrexham Prison

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and topsoil/loam soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
560453	Windrow 354	None Supplied	None Supplied	Black loam with vegetation and peat
560454	Windrow 355	None Supplied	None Supplied	Black loam with vegetation and peat



4041



Environmental Science

Analytical Report Number : 16-15287

Project / Site name: Wrexham Prison

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Fraction of Organic Carbon in soil	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	NONE
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	NONE
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
TPH Chromatogram	TPH Chromatogram.	In-house method	L064-PL	D	NONE
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding.	L076-PL	D	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS

Iss No 16-15287-1 Wrexham Prison C14656

This certificate should not be reproduced, except in full, without the express permission of the laboratory.

The results included within the report are representative of the samples submitted for analysis.

Page 5 of 8



4041



Environmental Science

Analytical Report Number : 16-15287

Project / Site name: Wrexham Prison

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
----------------------	-------------------------------	-----------------------------	---------------	--------------------	----------------------

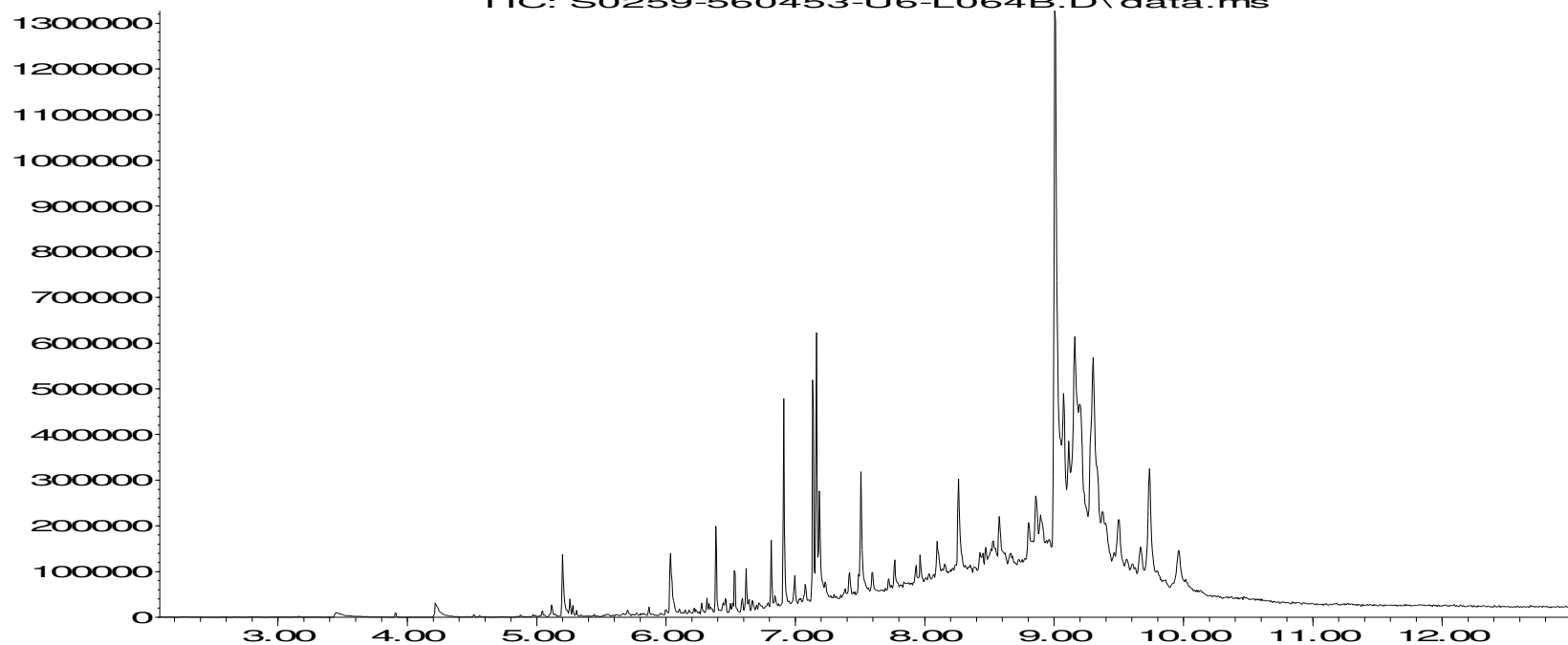
For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Abundance

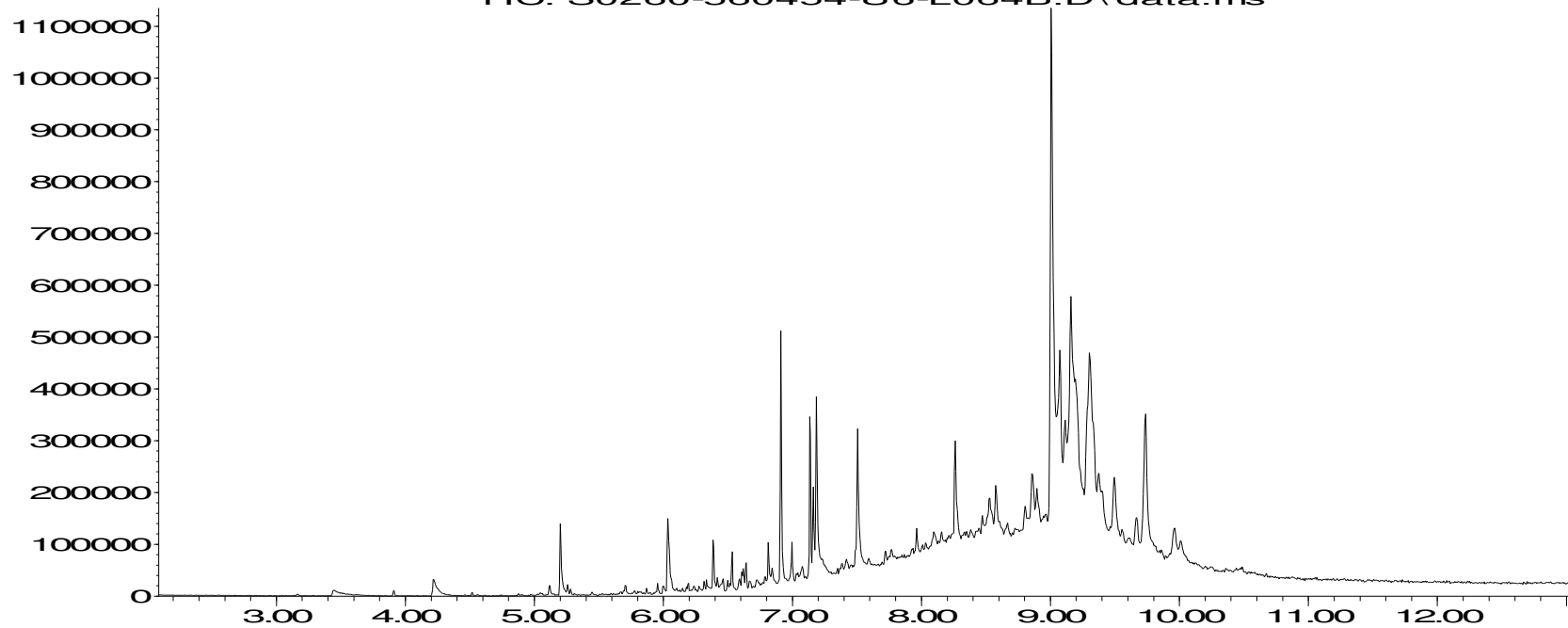
TIC: S0259-560453-U6-L064B.D\data.ms



Time-->

Abundance

TIC: S0260-560454-U6-L064B.D\data.ms



Time-->

Assessment of Chemicals of Potential Concern to Human Health

All values in mg/kg unless otherwise stated							Compost	Compost										
Location & Depth							Windrow 354	Windrow 355										
Chemical of Potential Concern	Lab. RL	No. Samples	Min. Value	Max. Value	No. Samples > or = GAC	GAC												
Arsenic	1	2	7.8	8.2	0	79	8.2	7.8										
Beryllium	0.06	2	0.4	0.4	0	92	0.4	0.4										
Boron	0.2	2	13	16	0	21000	13	16										
Cadmium	0.2	2	0.6	0.7	0	120	0.7	0.6										
Chromium (III)	1	0	0	0	0	1500	U/S	U/S										
Chromium (VI)	1.2	0	0	0	0	7.7	U/S	U/S										
Copper	1	2	53	62	0	12000	62	53										
Lead	1	2	78	87	0	630	87	78										
Mercury, inorganic	0.3	2	0.3	0.3	0	470	0.3	0.3										
Nickel	1	2	16	16	0	290	16	16										
Selenium	1	2	1	1	0	1400	1	1										
Vanadium	1	2	22	33	0	440	22	33										
Zinc	1	2	180	200	0	81000	200	180										
Cyanide (free)	1	2	1	1	0	1600	1	1										
Phenol (total)	1	2	3.7	10	0	3200	3.7	10										
Acenaphthene	0.1	2	0.1	0.1	0	15000	0.1	0.1										
Acenaphthylene	0.1	2	0.1	0.1	0	15000	0.1	0.1										
Anthracene	0.1	2	0.1	0.1	0	74000	0.1	0.1										
Benz(a)anthracene	0.1	2	0.1	0.1	0	18	0.1	0.1										
Benzo(a)pyrene	0.1	2	0.1	0.1	0	2.6	0.1	0.1										
Benzo(b)fluoranthene	0.1	2	0.1	0.1	0	18	0.1	0.1										
Benzo(ghi)perylene	0.05	2	0.05	0.05	0	120	0.05	0.05										
Benzo(k)fluoranthene	0.1	2	0.1	0.1	0	26	0.1	0.1										
Chrysene	0.05	2	0.05	0.05	0	26	0.05	0.05										
Dibenz(a,h)anthracene	0.1	2	0.1	0.1	0	2.32	0.1	0.1										
Fluoranthene	0.1	2	0.1	0.41	0	3100	0.41	0.1										
Fluorene	0.1	2	0.1	0.1	0	9900	0.1	0.1										
Indeno(1,2,3,cd)pyrene	0.1	2	0.1	0.1	0	11	0.1	0.1										
Naphthalene	0.05	2	0.05	0.05	0	4200	0.05	0.05										
Phenanthrene	0.1	2	0.1	0.1	0	3100	0.1	0.1										
Pyrene	0.1	2	0.1	0.36	0	7400	0.36	0.1										
Asbestos identified	0						Detected	Detected										
FOC (dimensionless)	0.0805	(mean)					0.079	0.082										
SOM (calculated)	13.88%	(mean)					13.62%	14.14%										
pH (su)	8.2	(mean)					8.1	8.2										

Risk parameter: Human health - POS resi (6%SOM)

Data set: Imported Compost

Client: Lend Lease

Site: North Wales Prison, Wrexham

Job no.: C14656

Legend: Values in blue are at or below the laboratory reporting limit (where a single value is indicated) and are considered as being at the detection limit for the purposes of statistical analysis, as a conservative estimate. Values in red are equal to, or greater than, the generic assessment criterion (GAC).
**U/S - Unsuitable for analysis due to high colour intensity.

Assessment of Chemicals of Potential Concern to Plant Life

All values in mg/kg unless otherwise stated								Soil Type	Compost	Compost										
Location & Depth									Vindrow 35	Vindrow 35										
Chemical of Potential Concern	Lab. RL	No. Samples	Min. Value	Max. Value	No. Samples > or = GAC	GAC	Result of Significance Test													
Arsenic	1	2	7.8	8.2	0	250	POTENTIALLY SUITABLE FOR USE	8.2	7.8											
Boron	0.2	2	13	16	2	3	FURTHER ASSESSMENT REQUIRED	13	16											
Chromium (III)	1	0	0	0	0	400		U/S	U/S											
Chromium (VI)	1.2	0	0	0	0	25		U/S	U/S											
Copper	1	2	53	62	0	135	POTENTIALLY SUITABLE FOR USE	62	53											
Nickel	1	2	16	16	0	75		16	16											
Zinc	1	2	180	200	0	300	POTENTIALLY SUITABLE FOR USE	200	180											
Mean	8.2																			
pH (su)	8.2							8.1	8.2											

Risk parameter: Plant life pH 7

Data set: Imported Compost

Client: Lend Lease

Site: North Wales Prison, Wrexham

Job no.: C14656

0 0

Legend: Values in blue are at or below the laboratory reporting limit (where a single value is indicated) and are considered as being at the detection limit for the purposes of statistical analysis, as a conservative estimate.

Values in red are equal to, or greater than, the generic assessment criterion (GAC).

Assessment of Chemicals of Potential Concern to Human Health

All values in mg/kg unless otherwise stated							Compost	Compost										
Location & Depth							Windrow 354	Windrow 355										
Chemical of Potential Concern	Lab. RL	No. Samples	Min. Value	Max. Value	No. Samples > or = GAC	GAC												
Aliphatics EC5-EC6	0.1	2	0.1	0.1	0	600000	0.1	0.1										
Aliphatics >EC6-EC8	0.1	2	0.1	0.1	0	620000	0.1	0.1										
Aliphatics >EC8-EC10	0.1	2	0.1	0.1	0	13000	0.1	0.1										
Aliphatics >EC10-EC12	1	2	1	1	0	13000	1	1										
Aliphatics >EC12-EC16	2	2	2	7.5	0	13000	7.5	2										
Aliphatics >EC16-EC35	10	2	150	200	0	250000	200	150										
Aliphatics >EC35-EC44	8.4	2	38	38	0	250000	38	38										
Aromatics EC5-EC7	0.1	2	0.1	0.1	0	56000	0.1	0.1										
Aromatics >EC7-EC8	0.1	2	0.1	0.1	0	56000	0.1	0.1										
Aromatics >EC8-EC10	0.1	2	0.1	0.1	0	5000	0.1	0.1										
Aromatics >EC10-EC12	1	2	1	1	0	5000	1	1										
Aromatics >EC12-EC16	2	2	2	7	0	5000	7	2										
Aromatics >EC16-EC21	10	2	13	29	0	3800	29	13										
Aromatics >EC21-EC35	10	2	150	170	0	3800	170	150										
Aromatics >EC35-EC44	8.4	2	110	120	0	3800	110	120										
ADDITIVITY CHECK							HAZARD QUOTIENTS FOR EACH FRACTION											
							0.000	0.000										
							0.000	0.000										
Considered additive							0.000	0.000										
							0.000	0.000										
							0.001	0.000										
							0.001	0.001										
							0.000	0.000										
Considered additive							0.000	0.000										
							0.000	0.000										
							0.001	0.000										
							0.008	0.003										
							0.045	0.039										
Considered additive							0.029	0.032										
							0.001	0.000										
							0.002	0.001										
							0.052	0.043										
Risk parameter: Human health - POS resi (6%SOM)							Hazard Index table - HI or HQ greater than 1 highlighted with yellow shading.											
Data set: Imported Compost							Legend: Main table values in blue are at or below the laboratory reporting limit (where a single value is indicated) and are considered as being at the detection limit for the purposes of statistical analysis, as a conservative estimate.											
Client: Lend Lease							Main table alues in red are equal to, or greater than, the generic assessment criterion (GAC).											
Site: North Wales Prison, Wrexham																		
Job no.: C14656																		