



4251

ANALYSIS OF THE TRACE LANDFILL GAS

AT

Brookhill Landfill Site

Brookhill Way
Pinfold Industrial Estate
Buckley, Flintshire
CH3 7PL

Commissioned by: Mr Phil Mulhall

Of

Flintshire County Council

Alltami Depot
Mold Road - Alltami
Flintshire
CH7 6LG

Date of Survey:

17th March 2015

Compiled By:

Yu Shen
Project Manager

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Mcerts Level II (TE1, 2, 3 & 4)

Signed:



Dated: 7th April 2015

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1. INTRODUCTION

- 1.1 EnviroDat Limited was commissioned by Mr Phil Mulhall, on behalf of Flintshire County Council, to measure the trace gas components from landfill gas located at Brookhill Landfill Site. Sampling was performed on the 17th March 2015.
- 1.2 The sampling was conducted in response to PPC Permit requirements (Permit No. AP3739KS). Monitoring was conducted with reference to the Environment Agency document 'Guidance for Monitoring Trace Components in Landfill Gas' (LFTGN 04).

2. PLANT DESCRIPTION

- 2.1 Landfill gas is currently utilised by CHP plant. Samples of the fuel gas were taken from a feed system for trace gas analysis after the gas booster.

3. SAMPLING PROCEDURES

- 3.1 Trace gas sampling was performed from the fuel gas inlet, with analysis for components identified in Table 1.1 of the EA LFTGN04 guidance note. General site information is presented in Appendix A.
- 3.2 Mixed bed, automated thermal desorption (ATD) tubes were used for sampling of the priority volatile organic species prior to analysis by gas chromatography with mass spectrometry (GC/MS), in accordance with EA recommendations and documented EnviroDat protocol, SPTGN04. The analytical component of the work was conducted at SAL Ltd, Manchester.

- 3.3 The LFTGN04 designated 'priority' carbonyl components (i.e. methanal and ethanal) were sampled onto dinitrophenylhydrazine (DNPH) impregnated, silica gel sorbent tubes prior to analysis by high performance liquid chromatography (HPLC) incorporating an ultraviolet (UV) detection system, in accordance with EA recommendations and SPTGN04. The results are presented in Appendix B. The analytical component of the work was conducted at SAL Ltd, Manchester.
- 3.4 Arsenic was sampled onto an activated charcoal sorbent tube prior to analysis by inductively coupled plasma/optical emission spectrometry (ICP/OES), in accordance with EA recommendations and SPTGN04. The results are presented in Appendix B. The analytical component of the work was conducted at SAL Ltd, Manchester.
- 3.5 Hydrogen sulphide was sampled into a Tedlar bag with analysis by GC/MS (by SAL Ltd) in accordance with SPTGN04. The results are presented in Appendix B.
- 3.6 Siloxanes sampling was effected using EnviroDat Ltd. documented internal protocol SP SILOX. This involves passing a metered volume of the gas through solid sorbent material whereby the siloxane congeners are captured and concentrated to allow analysis by gas chromatography utilising mass spectrometric detection (GC/MS). The analysis was carried out at SAL Ltd, Manchester. The results are presented in Appendix D.

4. RESULTS

- 4.1 Field measurements of the 'bulk gases' are given in Appendix A.
- 4.2 Measured concentrations of the EA 'priority' trace components for the landfill are also given in Appendix B.

5. DISCUSSION AND CONCLUSION

- 5.1 The aim of the survey was to measure trace components from the landfill gas at Brookhill Landfill Site.
- 5.2 The levels of trace components within the landfill gas are of a range and magnitude not dissimilar to what would be expected and can be regarded as comparable with biogenic gas of this nature from other sources. Appendix C shows the variation of trace gas parameters over time.

APPENDIX A

Site Information & Preliminary Gas Measurements

TABLE A: Site Information & Preliminary Gas Measurements

Sample Position Details			
Date	17/03/2015	Site	Brookhill Landfill Site
Ambient Temperature	8.5°C	Atmospheric Pressure	1001mbar
Monitoring Organisation (s)	EnviroDat Ltd	Analytical Laboratory	SAL Ltd
Location of Sampling Point	Inlet Line to Utilisation Plant	Area of Influence of collection system sampled	All capped areas of the site
Type of Sampling Point	Valve	Temperature of gas	10°C, at sample flow meter
Vacuum on Sampling	None, Positive pressure	Type of waste	Domestic, Industrial, Commercial & Hazardous
		Age of Waste	-
Status of Gas System	Fully Operational, Steady State	Other	-
Parameter	Concentration	Units	Comments
Methane*	43.6	%	-
Carbon Dioxide*	36	%	-
Oxygen*	0.7	%	-
Nitrogen*	19.7	%	Assumed to be balance of gas
Hydrogen Sulphide*	-	ppmv	Not required
Carbon Monoxide*	-	ppmv	

Notes: * Raw result obtained from client.

APPENDIX B

Trace Gas Results

TABLE B: Trace Gas Results

Trace Gases - Test 1							
	Test Duration	Flow Rate	Flowmeter	Volume	Ambient T	Barometric P	Volume
	(min)	(ml/min)	CAL Factor	(l as sampled)	(°C)	(kPa)	(l @ STP)
VOC	6	50	1.0134	0.30402	8.5	100.1	0.29
Aldehydes	15	200	1.0148	3	8.5	100.1	2.87
Arsenic	60	200	1.0148	12	8.5	100.1	11.50

Compound	Mass of TG (ng)	LoD of TG (ng)	Concentration	Units	Analysis Notes (See below)	Analysis UKAS Accredited (Y/N)
1, 1 - dichloroethane		10	< 34	µg/m3	-	Y
1, 2 - dichloroethane	13	10	45	µg/m3	-	N
1, 1 - dichloroethene		10	< 34	µg/m3	-	Y
1, 2 - dichloroethene	210	30	721	µg/m3	-	Y
1, 3 - butadiene		10	< 34	µg/m3	-	Y
1 - butanethiol		10	< 34	µg/m3	-	Y
1 - pentene	73	10	251	µg/m3	-	Y
1 - propanethiol		10	< 34	µg/m3	-	Y
2 - butoxyl ethanol		10	< 34	µg/m3	-	N
Arsenic (as As)	3000	1000	261	µg/m3	-	Y
Benzene ^(b)	2900	10	9956	µg/m3	-	Y
Butyric acid		10	< 34	µg/m3	-	N
Carbon disulphide ^(a)	1100	10	3776	µg/m3	-	N
Chloroethane		30	< 103	µg/m3	-	N
Chloroethene (vinyl chloride)		10	< 34	µg/m3	-	Y
Dimethyl disulphide	95	10	326	µg/m3	-	N
Dimethyl sulphide	920	10	3159	µg/m3	-	Y
Ethanal (acetaldehyde)	200	100	70	µg/m3	-	N
Ethanethiol	110	10	378	µg/m3	-	N
Ethyl butyrate		25	< 86	µg/m3	-	N
Furan (1,4-epoxy-1,3 butadiene)		10	< 34	µg/m3	-	N
Hydrogen sulphide (ppm)*	32	10	48571	µg/m3	-	N
Methanal (formaldehyde) ^(a)	100	100	35	µg/m3	-	N
Methanethiol		30	< 103	µg/m3	-	N
Styrene	270	10	927	µg/m3	-	N
Tetrachloromethane		10	< 34	µg/m3	-	Y
Toluene ^(b)	11000	10	37765	µg/m3	-	N
Trichloroethene		10	< 34	µg/m3	-	Y

*H2S value is equivalent to 32 ppm

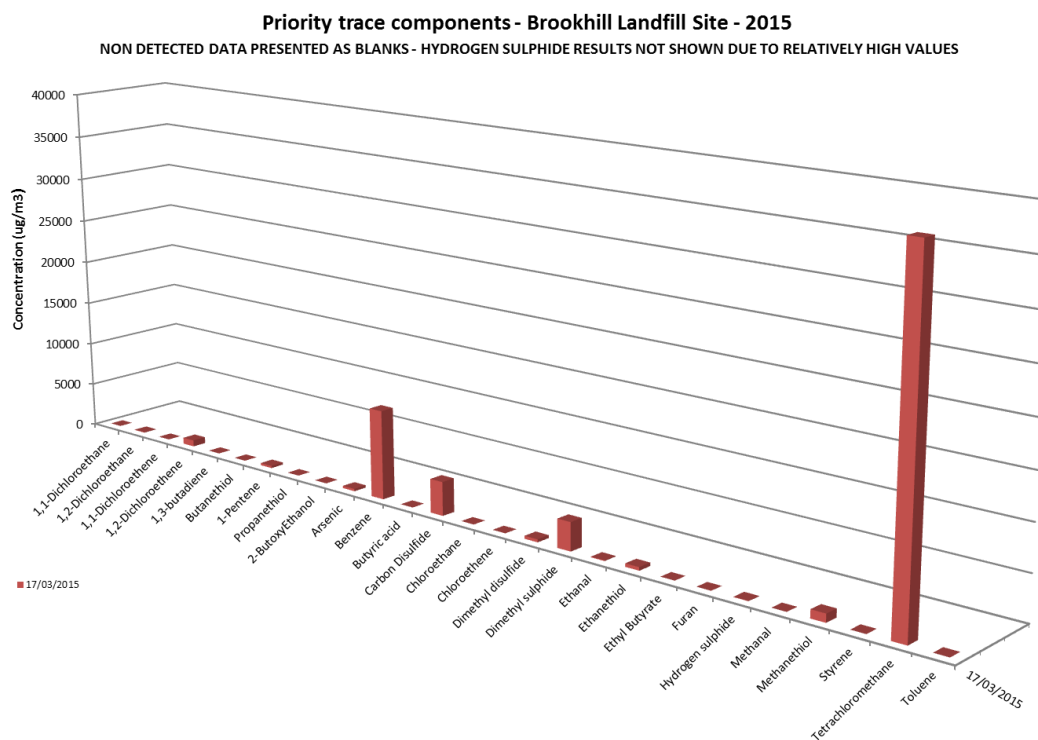
(a) – Results have been blank corrected
(b) – Results should be viewed with caution due to being outside of the instrument calibration range

Reference to UKAS (final column) relates to the accreditation status of the analysis only, sampling is covered under EnviroDat UKAS Accreditation scope.

APPENDIX C

Historical Trace Gas Chart

TABLE C: Historical Trace Gas Chart



APPENDIX D

Siloxane Results

TABLE D(i): Siloxane Results

EnviroDat Limited
Siloxane Test Form

Test No	T1
Date	17/03/2015
Site	Flintshire - Brookhill LFS
Stack	Fuel Line
Reference Conditions - Oxygen (%)	n/a
- Temperature (°C)	0
- Pressure (kPa)	101.3
Job Number	R15100
Site Team	YS + BK + TB
Test Conducted By	Yu Shen
Data Entered By	Yu Shen

Test Start Time	15:45
Test End Time	16:15
Test Duration (min)	30
Flowmeter Rate at Start (ml/min)	200
Flowmeter Rate at End (ml/min)	200
Mean Flowmeter Rate (ml/min)	200
Uncorrected Volume Sampled (l)	6.00

Barometric Pressure (kPa)	100.2
Ambient Temperature (°C)	11.5
Flowmeter Calibration Factor (f)	1.0148
Stack Oxygen Level (%)	n/a
Volume Sampled @ Reference Conditions	5.78

Primary Tube Reference Identification Number	513 1963 239
Security Tube Reference Identification Number	513 1964 030
Blank Tube Reference Identification Numbers	526 2237 493 & 526 2237 495
Mass of Siloxane on Primary Tube (ug)	771
Mass of Siloxane on Security Tube (ug)	6
Breakthrough (Reject if > 5%)	Accepted
Total Mass of Siloxane in Sample (ug)	777

Siloxane Concentration (mg/m ³ @ STP and Ref O ₂)	134.48
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TABLE D(ii): Siloxane/Silicon Congener Breakdown

Siloxane	Siloxane Concentration (mg/m ³ @ STP)	Organic Silicon Concentration (mg/m ³ @ STP)
Decamethylcyclopentasiloxane	81.52	30.89
Decamethyltetrasiloxane	< 0.35	< 0.13
Hexamethylcyclotrisiloxane	1.38	0.52
Hexamethyldisiloxane	3.81	1.32
Octamethylcyclotetrasiloxane	46.90	17.77
Octamethyltrisiloxane	0.52	0.19
Total Siloxane Concentration (excluding TMS):	134.48	
Total Silicon Concentration (including TMS):		50.82