



4251

ANALYSIS OF THE TRACE LANDFILL GAS

AT

Brookhill Landfill Site

Brookhill Way
Pinfold Industrial Estate
Buckley
Flintshire, CH37 3PL

Commissioned by: Phil Mulhall

Of

Waste Management Service

Flintshire County Council
Alltami Depot
Mold Road - Alltami
Flintshire, CH7 6LG

Date of Survey:

6th May 2016

Compiled By:

David Littlewood
Operations Manager

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

Signed:



Dated:

1st June 2016

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1. INTRODUCTION

- 1.1 EnviroDat Limited was commissioned by Phil Mulhall, on behalf of Flintshire County Council, to measure the trace gas and siloxane components from landfill gas located at Brookhill Landfill Site. Sampling was performed on the 6th May 2016.
- 1.2 The sampling was conducted in response to permit requirements (Permit No. BV7273 Var. YP3835MJ). 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 results are

presented in Appendix B. The analytical component of the work was conducted at Scientific Analysis Laboratories Ltd (SAL Ltd).

- 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.
- 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.
- 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 results are presented in Appendix D. The analysis was carried out at SAL Ltd.

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 gas are given in Appendix B.
- 4.3 Measured concentrations of the siloxane components for the landfill gas are given in Appendix D.

5. DISCUSSION AND CONCLUSION

- 5.1 The aim of the survey was to measure trace components from the landfill gas at Brookhill LFS.
- 5.2 The levels of trace components within the landfill 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 A

Site Information & Preliminary Gas Measurements

TABLE A: Site Information & Preliminary Gas Measurements

Sample Position Details			
Date	06/05/2016	Site	Flintshire County Council Brookhill LFS
Ambient Temperature	19°C	Atmospheric Pressure	996mbar
Monitoring Organisation (s)	EnviroDat Ltd	Analytical Laboratory	SAL
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	Nipple & tap	Temperature of gas	18°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*	46.6	%	-
Carbon Dioxide*	36.1	%	-
Oxygen*	0.0	%	-
Nitrogen*	17.3	%	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	5	50	1.074	0.27	19	99.6	0.25
Aldehydes	20	200	0.997	3.99	19	99.6	3.67
Arsenic	60	200	0.997	11.96	19	99.6	11.00
Compound	Mass of TG (ng)	LoD of TG (ng)	Concentration		Units	Analysis Notes (See below)	Analysis UKAS Accredited (Y/N)
1, 1 - dichloroethane		10	< 41		µg/m3	-	Y
1, 2 - dichloroethane		10	< 41		µg/m3	-	N
1, 1 - dichloroethene		10	< 41		µg/m3	-	Y
1, 2 - dichloroethene		30	< 122		µg/m3	-	Y
1, 3 - butadiene		10	< 41		µg/m3	-	Y
1 - butanethiol		10	< 41		µg/m3	-	Y
1 - pentene		10	< 41		µg/m3	-	Y
1 - propanethiol		10	< 41		µg/m3	-	Y
2 - butoxyl ethanol		10	< 41		µg/m3	-	N
Arsenic (as As)		1000	< 91		µg/m3	-	Y
Benzene		10	< 41		µg/m3	-	Y
Butyric acid		10	< 41		µg/m3	-	N
Carbon disulphide	230	10	932		µg/m3	a	N
Chloroethane		30	< 122		µg/m3	-	N
Chloroethene (vinyl chloride)		10	< 41		µg/m3	-	Y
Dimethyl disulphide		10	< 41		µg/m3	-	N
Dimethyl sulphide		10	< 41		µg/m3	-	Y
Ethanal (acetaldehyde)	500	100	136		µg/m3	-	Y
Ethanethiol		10	< 41		µg/m3	-	N
Ethyl butyrate		25	< 101		µg/m3	-	N
Furan (1,4-epoxy-1,3 butadiene)		10	< 41		µg/m3	-	N
Methanal (formaldehyde)	1800	100	491		µg/m3	a	Y
Methanethiol		30	< 122		µg/m3	-	N
Styrene		10	< 41		µg/m3	-	N
Tetrachloromethane		10	< 41		µg/m3	-	Y
Toluene	960	10	3890		µg/m3	c	N
Trichloroethene		9	< 36		µg/m2	-	Y
Compound	Concentration in ppm	LOD of TG (ppm)	Concentration		Units	Analysis Notes (See below)	Analysis UKAS Accredited (Y/N)
Hydrogen sulphide	530	10	804464		µg/m3	-	N

*H2S value is equivalent to 530 ppm, values in heighlighted box are expressed as ppm and not ng

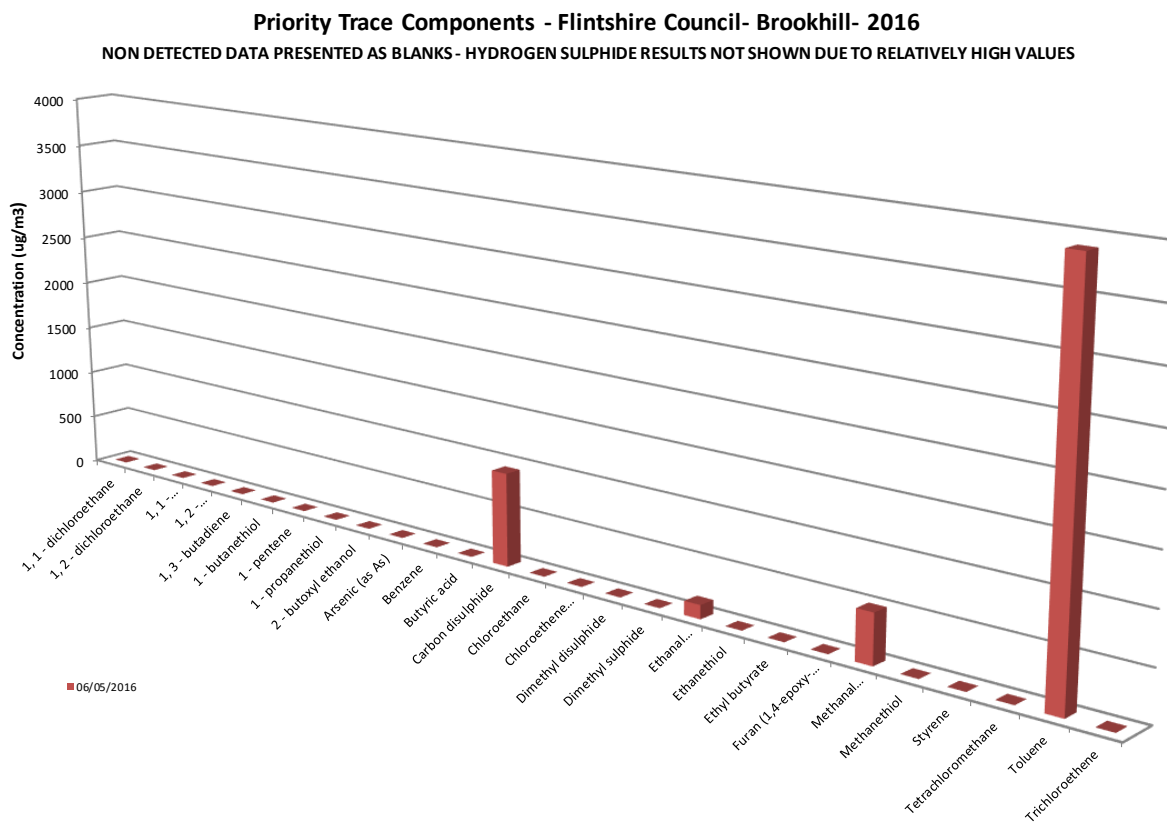
(a) – Results have been blank corrected
(b) – Results should be considered a minimum due to detector saturation
(c) – Results should be viewed with caution due to being outside of the instrument calibration range

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

APPENDIX C

Trace Gas Chart

TABLE C: Trace Gas Chart



APPENDIX D

Siloxane Results

TABLE D(i): Siloxane Results

Test No	1
Date	06/05/2016
Site	Flintshire CC Brookhill
Stack	Fuel Line
Reference Conditions - Oxygen (%)	n/a
- Temperature (°C)	0
- Pressure (kPa)	101.3
Job Number	R16221
Site Team	DL, DK
Test Conducted By	DL, DK
Data Entered By	DL

Test Start Time	09:20
Test End Time	09:40
Test Duration (min)	20
Flowmeter Rate at Start (ml/min)	200
Flowmeter Rate at End (ml/min)	200
Mean Flowmeter Rate (ml/min)	200
Uncorrected Volume Sampled (l)	4.00

Barometric Pressure (kPa)	99.6
Ambient Temperature (°C)	18
Flowmeter Calibration Factor (f)	0.997
Stack Oxygen Level (%)	n/a
Volume Sampled @ Reference Conditions	3.68

Primary Tube Reference Identification Number	5896803433
Security Tube Reference Identification Number	5896803361
Blank Tube Reference Identification Numbers	5896803420/5896803432
Mass of Siloxane on Primary Tube (ug)	106
Mass of Siloxane on Security Tube (ug)	< 6
Breakthrough (Reject if > 5%)	Accepted
Total Mass of Siloxane in Sample (ug)	112

Siloxane Concentration (mg/m ³ @ STP and Ref O ₂)	30.45
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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	9.25	3.50
Decamethyltetrasiloxane	< 0.54	< 0.20
Hexamethylcyclotrisiloxane	0.54	0.21
Hexamethyldisiloxane	2.18	0.75
Octamethylcyclotetrasiloxane	17.40	6.59
Octamethyltrisiloxane	< 0.54	< 0.19
Total Siloxane Concentration:	30.45	
Total Silicon Concentration:		11.45