



4251

TRACE GAS ANALYSIS OF THE LANDFILL GAS

AT

Withyhedge Landfill Site

Rudbaxton
Haverfordwest
SA62 4DB

Commissioned by: Bryan Cameron

Of

Potter Group

Potter House
Henfaes Lane
Welshpool
Powys
SY21 7BE

Date of Survey:

25th August 2020

Compiled By:

Yu Shen
Senior Project Manager



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

Signed:



Dated: 16th September 2020

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Notes to Report.

- a). EnviroDat Ltd, Report Template V10.
- b). This report should not be reproduced except in full, without written approval of Envirodat Ltd.
- c). Opinions and Interpretations herein are outside the scope of UKAS/MCerts Accreditation.

1. INTRODUCTION

- 1.1 EnviroDat Limited was commissioned by David Williams, on behalf of Potter Group, to measure the trace gas and siloxane components from landfill gas located at Withyhedge Landfill Site. Sampling was performed on the 25th August 2020.
- 1.2 The sampling was conducted in response to permit requirements (Permit No. GP3630HT/V003). 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 the engine 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 Marchwood Scientific Services (MSS) 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 MSS Ltd.
- 3.4 Arsenic was sampled onto an activated charcoal sorbent tube prior to analysis by inductively coupled plasma/mass spectrometry (ICP/MS), in accordance with EA recommendations and SPTGN04. The results are presented in Appendix B. The analytical component of the work was conducted at MSS Ltd.
- 3.5 Hydrogen sulphide and bulk gas analysis was conducted using a certified bulk gas analyser. The results are presented in Appendix A.
- 3.6 Siloxanes sampling was affected 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 MSS Ltd and is UKAS accredited for sampling and analysis.

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 and shown graphically in Appendix C.
- 4.3 Measured concentrations of the siloxane components for the landfill gas are given in Appendix D.

APPENDIX A

Site Information & Preliminary Gas Measurements

TABLE A: Site Information & Preliminary Gas Measurements

Sample Position Details			
Date	25/08/2020	Site	Potter Group - Withyhedge
Ambient Temperature	24°C	Atmospheric Pressure	985mbar
Monitoring Organisation (s)	EnviroDat Ltd	Analytical Laboratory	MSS 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	Teflon Nipple	Temperature of gas	24.8°C, at sample flow meter
Vacuum on Sampling	None, Positive pressure (+256mbar)	Type of waste	Domestic, Industrial, Commercial & Hazardous
		Age of Waste	-
Status of Gas System	Fully Operational, Steady State	Other	-
Parameter	Concentration	Units	Comments
Methane*	45.5	%	-
Carbon Dioxide*	33.0	%	-
Oxygen*	0.3	%	-
Nitrogen	21.2	%	Assumed to be balance of gas
Hydrogen Sulphide*	764	ppm	-

Notes: *Raw results obtained from Envirodat Certified Gas Analyser.

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)
Arsenic	60	200	0.9471	11.37	24	98.5	10.16
Aldehydes	20	200	0.9471	3.79	24	98.5	3.39
VOC	5	50	0.966	0.24	24	98.5	0.22

Compound	Mass of TG (ng)	LoD of TG (ng)	Concentration	Units	Analysis Notes (See below)	Analysis UKAS Accredited (Y/N)
Arsenic (as As)		500	< 49	µg/m3	-	N
Acetaldehyde (Ethanal)	900	100	266	µg/m3	-	Y
Formaldehyde (Methanal)	100	100	30	µg/m3	-	Y
Vinyl chloride	75	10	348	µg/m3	-	N
1,3-butadiene		10	< 46	µg/m3	-	N
Methanethiol	220	50	1019	µg/m3	-	N
Chloroethane	49	10	227	µg/m3	-	N
1-pentene	280	20	1298	µg/m3	-	N
1,4-epoxy-1,3-butadiene (Furan)	530	10	2456	µg/m3	c	N
Ethanethiol	130	50	602	µg/m3	-	N
1,1-dichloroethene		5	< 23	µg/m3	-	N
Dimethyl sulphide	4300	10	19926	µg/m3	c	N
Dichloromethane	21	10	97	µg/m3	-	N
Carbon disulphide	22000	10	101948	µg/m3	b	N
1,2-dichloroethene (trans + cis)	60	10	278	µg/m3	-	N
1,1-dichloroethane	6	5	28	µg/m3	-	N
Propanethiol	70	40	324	µg/m3	-	N
1,2-dichloroethane	26	5	120	µg/m3	-	N
Carbon tetrachloride		5	< 23	µg/m3	-	N
Benzene	1300	1	6024	µg/m3	c	N
Trichloroethylene	67	5	310	µg/m3	-	N
Butanethiol		40	< 185	µg/m3	-	N
Dimethyl disulphide	1200	10	5561	µg/m3	c	N
Toluene	4600	5	21316	µg/m3	b	N
Butyric acid		10	< 46	µg/m3	-	N
Ethyl butyrate		10	< 46	µg/m3	-	N
2-Butoxyethanol		10	< 46	µg/m3	-	N
Styrene	870	5	4032	µg/m3	c	N

Compound	Concentration in ppm	LOD of TG (ppm)	Concentration	Units	Analysis Notes (See below)	Analysis UKAS Accredited (Y/N)
Hydrogen sulphide*	764	10	1159643	µg/m3	-	N

*H2S value is equivalent to 764 ppm, values in highlighted 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.

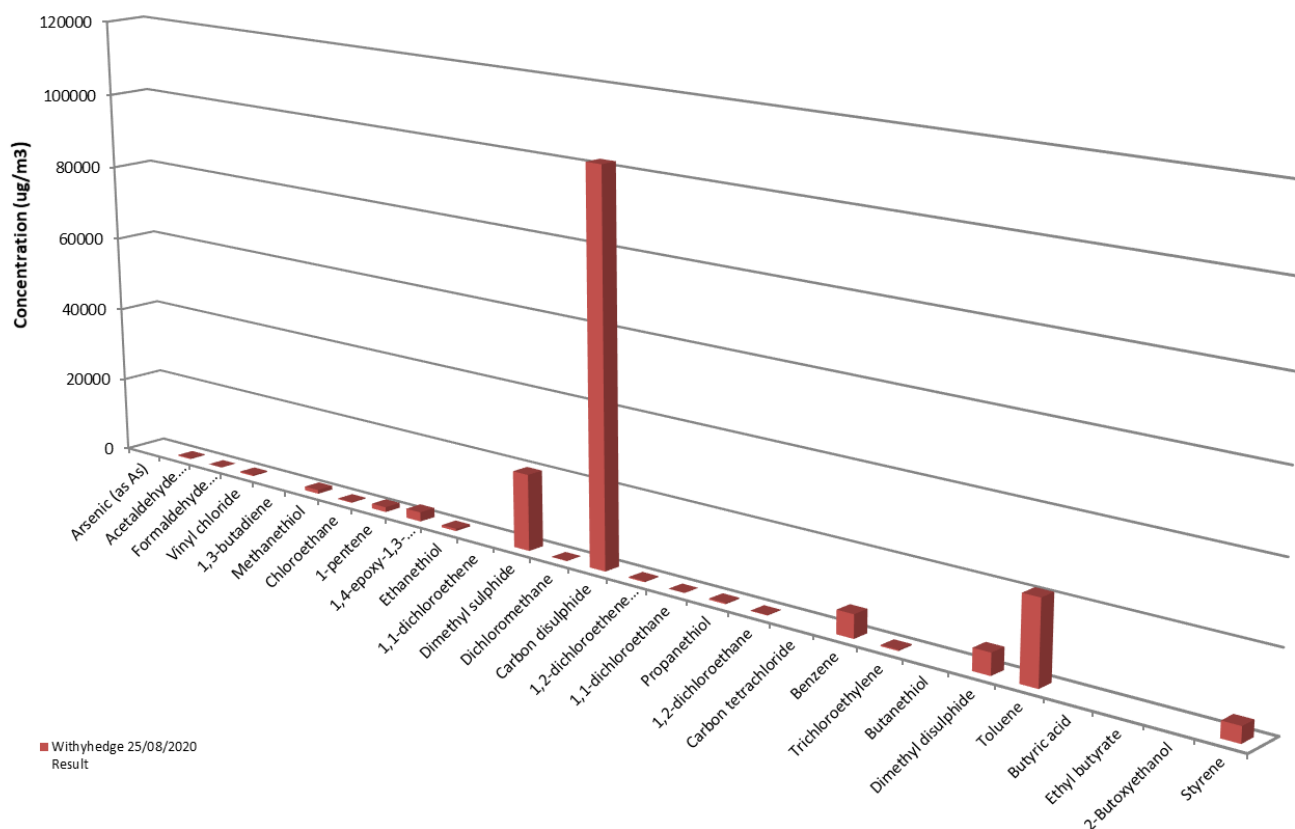
APPENDIX C

Trace Gas Chart

TABLE C: Trace Gas Chart

Priority Trace Components - Withyhedge - 2020

NON DETECTED DATA PRESENTED AS BLANKS - HYDROGEN SULPHIDE RESULTS NOT SHOWN DUE TO RELATIVELY HIGH VALUES



APPENDIX D

Siloxane Results

TABLE D(i): Siloxane Results

Test No	✓	Siloxanes
Date	✓	25/08/2020
Site	✓	Potter Group - Withyhedge
Stack	✓	Fuel Line
Reference Conditions - Oxygen (%)	✓	n/a
- Temperature (°C)		0
- Pressure (kPa)		101.3
Job Number	✓	R20408
Site Team	✓	YS
Test Conducted By	✓	YS
Data Entered By	✓	YS

Test Start Time	✓	13:13
Test End Time	✓	13:33
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)	✓	98.6
Ambient Temperature (°C)	✓	24
Flowmeter Calibration Factor (f)	✓	0.9471
Stack Oxygen Level (%)	✓	n/a
Volume Sampled @ Reference Conditions		3.39

Primary Tube Reference Identification Number	✓	8491 041 112
Security Tube Reference Identification Number	✓	8491 041 113
Blank Tube Reference Identification Numbers	✓	8491 041 115 & 8491 041 116
Mass of Siloxane on Primary Tube (ug)	✓	121.6
Mass of Siloxane on Security Tube (ug)	< ✓	4
Breakthrough (Reject if > 5%)	✓	Accepted
Total Mass of Siloxane in Sample (ug)		125.6

Siloxane Concentration (mg/m ³ @ STP and Ref O ₂)		37.07
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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	5.46	2.07
Decamethyltetrasiloxane	< 0.30	< 0.11
Hexamethylcyclotrisiloxane	1.62	0.62
Hexamethyldisiloxane	7.53	2.60
Octamethylcyclotetrasiloxane	20.80	7.88
Octamethyltrisiloxane	0.77	0.27
Dodecamethylcyclohexasiloxane	< 0.30	< 0.11
Dodecamethylpentasiloxane	< 0.30	< 0.11
Total Siloxane Concentration:	37.07	
Total Silicon Concentration:		13.77