



4279

ANALYSIS OF THE TRACE LANDFILL GAS

AT

Tir John Landfill Site

Port Tennant
Swnasea
SA1 8LN

Commissioned by: Graham Ball

Of

Enovert

3-5 Greyfriars Business Park
Frank Foley Way, Stafford
ST16 2ST

Date of Survey:

10th August 2023

Compiled By:

Darren Price
Team Leader

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

Signed: 

Dated: 8th September 2023

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Notes to Report.

- a). Element Ltd, Report Template V12.
- b). This report should not be reproduced except in full, without written approval of Element Ltd.
- c). Opinions and Interpretations herein are outside the scope of UKAS/MCerts Accreditation.

1. INTRODUCTION

- 1.1 Element Limited was commissioned by Graham Ball, on behalf of Enovert, to measure the trace gas and siloxane components from landfill gas located at Tir John Landfill Site. Sampling was performed on the 10th August 2023
- 1.2 The sampling was conducted in response to permit requirements (Permit No. BP3738LS). 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 Dual 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 Element protocol, SPTGN04. The results are presented in Appendix B. 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.
- 3.4 Arsenic was sampled onto an activated charcoal sorbent tube prior to analysis by inductively coupled plasma/optical emissions 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 MSS.
- 3.5 Hydrogen sulphide and bulk gases were sampled into a Tedlar bag with analysis by GC/TCD/FID (by MSS) in accordance with SPTGN04. The results are presented in Appendix A and B.
- 3.6 Siloxanes sampling was effected using Element 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 and is UKAS accredited for analysis only.

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	10/08/2023	Site	Tir John Landfill Site
Ambient Temperature	24	Atmospheric Pressure	101.7
Monitoring Organisation (s)	Element Ltd	Analytical Laboratory	MSS Ltd
Location of Sampling Point	Inlet Line to Flare	Area of Influence of collection system sampled	All capped areas of the site
Type of Sampling Point	Tap and Nozzle	Temperature of gas	20°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*	44	%	-
Carbon Dioxide*	20	%	-
Oxygen*	2.5	%	-
Nitrogen	33.5	%	Assumed to be balance of gas
Hydrogen Sulphide*	<10	ppm	-

Notes: *Raw result obtained from tedlar bag sample

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	0.9926	11.91	24	101.7	10.99
Aldehydes	20	200	0.9926	3.97	24	101.7	3.66
VOC	5	50	0.9346	0.23	20	101.7	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)		50	< 5	µg/m ³	-	Y
Acetaldehyde (Ethanal)	200	100	55	µg/m ³	-	Y
Formaldehyde (Methanal)	300	100	82	µg/m ³	-	Y
Vinyl chloride	235	10	1075	µg/m ³	-	N
1,3-butadiene		10	< 46	µg/m ³	-	Y
Methanethiol		50	< 229	µg/m ³	-	N
Chloroethane	20	10	92	µg/m ³	-	Y
1-pentene	65	20	297	µg/m ³	-	Y
1,4-epoxy-1,3-butadiene (Furan)	32	10	146	µg/m ³	-	Y
Ethanethiol		50	< 229	µg/m ³	-	N
1,1-dichloroethene		5	< 23	µg/m ³	-	Y
Dimethyl sulphide		10	< 46	µg/m ³	-	N
Dichloromethane		10	< 46	µg/m ³	-	N
Carbon disulphide	200	10	915	µg/m ³	-	N
1,2-dichloroethene (trans + cis)	22	10	101	µg/m ³	-	Y
1,1-dichloroethane	6	5	27	µg/m ³	-	Y
Propanethiol	120	40	549	µg/m ³	-	Y
1,2-dichloroethane	6	5	27	µg/m ³	-	Y
Carbon tetrachloride		5	< 23	µg/m ³	-	Y
Benzene	710	1	3249	µg/m ³	3	Y
Trichloroethylene	9	5	41	µg/m ³	-	Y
Butanethiol		40	< 183	µg/m ³	-	Y
Dimethyl disulphide		10	< 46	µg/m ³	-	Y
Toluene	840	5	3844	µg/m ³	3	Y
Butyric acid		10	< 46	µg/m ³	-	Y
Ethyl butyrate		10	< 46	µg/m ³	-	Y
2-Butoxyethanol		10	< 46	µg/m ³	-	Y
Styrene	110	5	503	µg/m ³	-	Y

Compound	Concentration of H ₂ S (%)	LoD of H ₂ S (%)	Concentration	Units	Analysis Notes (See below)	Analysis UKAS Accredited (Y/N)
Hydrogen sulphide		0.001	< 15169	µg/m ³	-	N

*H₂S value is equivalent to 10ppm

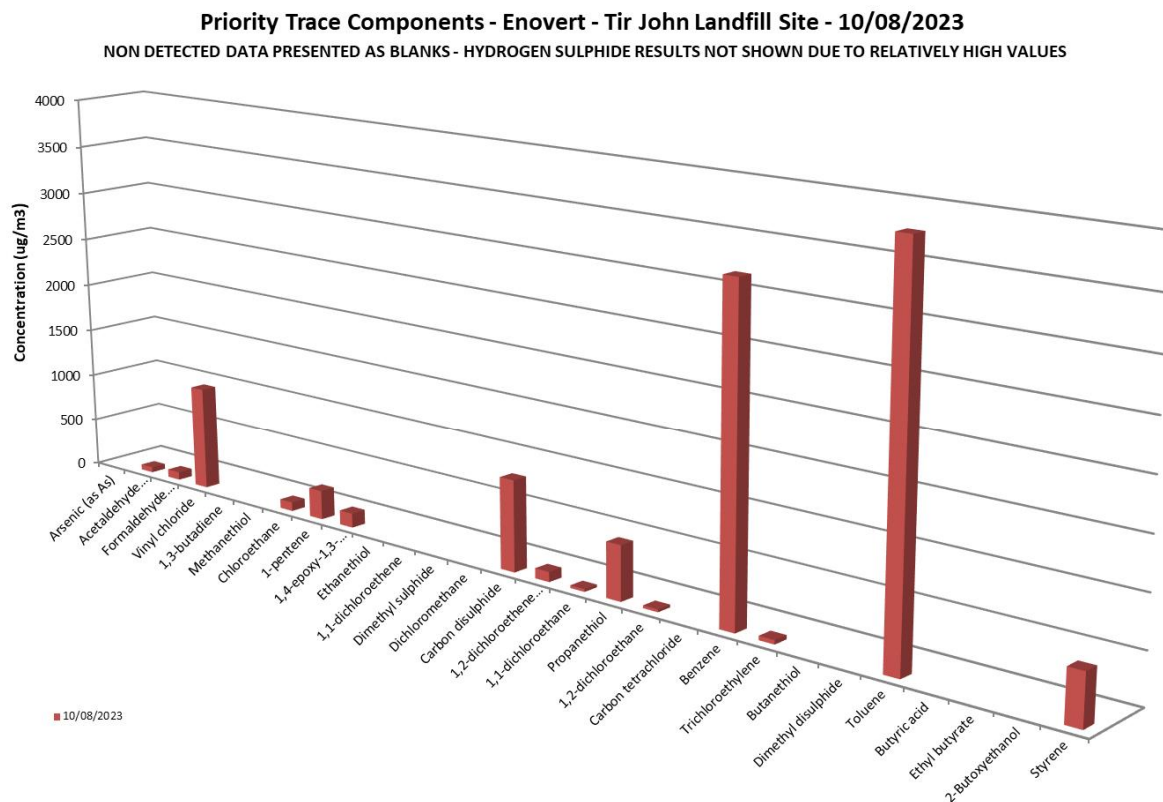
(a) – Results have been blank corrected
(b) – Results should be considered a minimum due to detector saturation
(c) – Results should be viewed with caution due to being outside of the instrument calibration range

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

APPENDIX C

Trace Gas Chart

TABLE C: Trace Gas Chart



APPENDIX D

Siloxane Results

TABLE D(i): Siloxane Results

Test No	T1
Date	10/08/2023
Site	Enovert Tir John
Stack	Raw Gas Sample
Reference Conditions - Oxygen (%)	n/a
- Temperature (°C)	0
- Pressure (kPa)	101.3
Job Number	ERE-23296
Site Team	DP/JC
Test Conducted By	DP/JC
Data Entered By	DP

Test Start Time	10:45
Test End Time	11:05
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)	101.7
Ambient Temperature (°C)	24
Flowmeter Calibration Factor (f)	0.9926
Stack Oxygen Level (%)	2.5
Volume Sampled @ Reference Conditions	3.66

Primary Tube Reference Identification Number	0
Security Tube Reference Identification Number	n/a
Blank Tube Reference Identification Numbers	n/a
Mass of Siloxane on Primary Tube (ug)	76.9
Mass of Siloxane on Security Tube (ug)	n/a
Breakthrough (Reject if > 5%)	n/a
Total Mass of Siloxane in Sample (ug)	76.9

Siloxane Concentration (mg/m ³ @ STP and Ref O ₂)	20.99
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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	10.37	3.93
Decamethyltetrasiloxane	< 0.14	< 0.05
Hexamethylcyclotrisiloxane	< 0.14	< 0.05
Hexamethyldisiloxane	2.13	0.74
Octamethylcyclotetrasiloxane	7.64	2.90
Octamethyltrisiloxane	0.16	0.06
Dodecamethylcyclohexasiloxane	< 0.14	< 0.05
Dodecamethylpentasiloxane	0.27	0.10
Total Siloxane Concentration:	20.99	
		Total Silicon Concentration: 7.88