INFINIS ENERGY SERVICES LIMITED

Periodic monitoring of raw landfill gas

Nant Y Caws Landfill Site

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Issue	1

1015

PERIODIC MONITORING OF RAW LANDFILL GAS

NANT Y CAWS LANDFILL SITE

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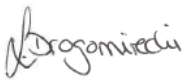
Issue history

Issue	Date	Approved	
LSO210406-TG, 1	26 April 2021	L Drogomirecki	
First issue			

1 Introduction

Infinis Energy Services Limited (Infinis) contracted SOCOTEC UK Limited (SOCOTEC) to undertake monitoring of the landfill gas supply to its combustion operations at the Nant Y Caws Landfill site.

2 Test methodology

Infinis requested that duplicate samples of landfill gas be collected and analysed for the priority trace components (LFGTGN04, Table 1.1) specified in Environment Agency guidance (Guidance for monitoring trace components in landfill gas – LFGTGN04 v3.0, 2010). The test methodology should be in accordance with that specified within LFGTGN04.

Based on LFGTGN04 the priority trace gas components are sampled using a combination of four sampling media as shown in Table 1.

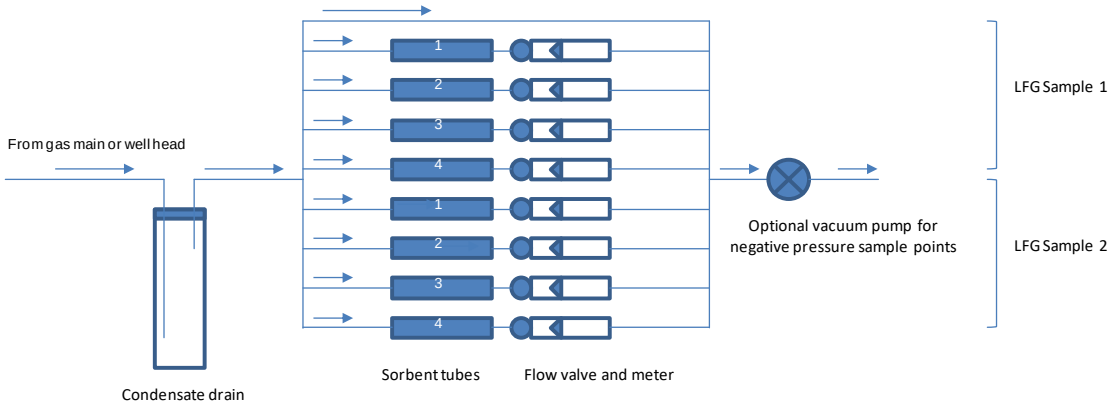
Table 1 Sampling media and analytical methods

Trace component	CAS number	Sampling method	Analytical method
1,1-dichloroethane	75-34-3	Dual solid sorbent	ATD-GC-MS
1,2-dichloroethane	107-06-2	Dual solid sorbent	ATD-GC-MS
1,1-dichloroethene	75-35-4	Dual solid sorbent	ATD-GC-MS
1,2-dichloroethene	540-59-0	Dual solid sorbent	ATD-GC-MS
1,3-butadiene	106-99-0	Dual solid sorbent	ATD-GC-MS
1-butanethiol	109-79-5	Dual solid sorbent	ATD-GC-MS
1-pentene	109-67-1	Dual solid sorbent	ATD-GC-MS
1-propanethiol	107-03-9	Dual solid sorbent	ATD-GC-MS
2-butoxyethanol	111-76-2	Dual solid sorbent	ATD-GC-MS
Arsenic (as As)	7440-38-2	Charcoal	ICP-MS
Benzene	71-43-2	Dual solid sorbent	ATD-GC-MS
Butyric acid	107-92-6	Dual solid sorbent	ATD-GC-MS
Carbon disulphide	75-15-0	Dual solid sorbent	ATD-GC-MS
Chloroethane	75-00-3	Dual solid sorbent	ATD-GC-MS
Chloroethene (vinyl chloride)	75-01-4	Dual solid sorbent	ATD-GC-MS
Dichloromethane	75-09-2	Dual solid sorbent	ATD-GC-MS
Dimethyl disulphide	624-92-0	Dual solid sorbent	ATD-GC-MS
Dimethyl sulphide	75-18-3	Dual solid sorbent	ATD-GC-MS
Ethanal (acetaldehyde)	75-07-0	Silica gel/2,4 DNPH	HPLC-DAD
Ethanethiol	75-08-1	Dual solid sorbent	ATD-GC-MS
Ethyl butyrate	105-54-4	Dual solid sorbent	ATD-GC-MS
Furan (1,4-epoxy-1,3-butadiene)	110-00-9	Dual solid sorbent	ATD-GC-MS
Hydrogen sulphide	7783-06-4	Charcoal	IC
Methanal (formaldehyde)	50-00-0	Silica gel/2,4 DNPH	HPLC-DAD
Methanethiol	74-93-1	Dual solid sorbent	ATD-GC-MS
Styrene	100-42-5	Dual solid sorbent	ATD-GC-MS
Tetrachloromethane	56-23-5	Dual solid sorbent	ATD-GC-MS
Toluene	108-88-3	Dual solid sorbent	ATD-GC-MS
Trichloroethene	79-01-6	Dual solid sorbent	ATD-GC-MS

ATD – automated thermal desorption
GC-MS – gas chromatography and mass spectrometry
ICP-MS – inductively couple plasma/mass spectrometry
HPLC-DAD – high performance liquid chromatography and diode array detection
IC – ion chromatography

Sampling for all components is undertaken simultaneously using a multiple stream sampler as shown in Figure 1.

Figure 1 Landfill gas sampling arrangement



A sample is taken from either the gas main or well head and passed through a condensate drain to remove excess moisture. The sample gas is then split to pass through a series of eight regulated rotameters arranged in two banks of four. There is also a bypass stream for excess sample. This allows the duplicate simultaneous sampling at regulated flow rates onto four sampling media. The flow rates and sampling duration are set in accordance with LFGTGN04 requirements as summarised in Table 2.

Table 2 Sampling media and analytical methods

Media	Target species	Sampling rate (ml/min)	Sampling duration (min)	Sample volume (l)
Dual solid sorbent (Tenax/Sulficarb)	VOCs	20	10	0.2
Silica gel and 2,4 DNPH (SKC 226-119)	Aldehydes	20	50	1.0
Activated carbon 1 (SKC 226-09)	Arsenic	100	50	5.0
Activated carbon 2 (SKC 226-09)	Hydrogen sulphide	100	50	5.0

In the case of negative pressure sources it is necessary to employ a vacuum pump at the sampler's common outlet. This is not normally required with positive pressure systems

This results in two duplicate samples of landfill gas with each sample comprising the four sub-samples above covering all of the priority trace components within Table 1.

The samples are subject to the analytical procedures described in Table 1 to provide a mass on the collected sample which can then be related to the volume of gas sampled to provide a component concentration in the sampled landfill gas.

The sampling followed internal procedure GAS14 and is accredited under test certificate 1015.

3 Site information

Sample point details			
Date	07 April 2021	Site	Nant Y Caws landfill site
Ambient temperature	8 °C	Atmospheric pressure	100.8 kPa
Monitoring organisation	SOCOTEC UKAS 1015	Analytical laboratory	SOCOTEC UKAS 1252
Location of sampling point	Gas main to compound After blower	Area of influence of collection system sampled	All
Type of sample point	¼" Tefen	Temperature of gas	12°C
Pressure at sample point	Not measured	Type of waste	Not recorded
Status of gas system	Active	Age of waste	Not recorded

4 Preliminary checks and field measurements

Parameter		Concentration
Methane	%	37
Carbon dioxide	%	23
Oxygen	%	2.8
Nitrogen	%	37.2
Hydrogen sulphide	ppmv	28.7
Carbon monoxide	ppmv	2.2

*carbon monoxide is measured with a hydrogen sulphide filter in the sampling line.

Preliminary bulk gas measurements were undertaken using a Gasdata GFM 436 electrochemical cell analyser (no Eq No 1905). Reported measurements are spot readings following gas sampling for a period of 5 minutes.

5 Results of landfill gas analysis

The results of the sampling and analysis are summarised in Table 3 below.

Table 3 Priority trace component measurement results

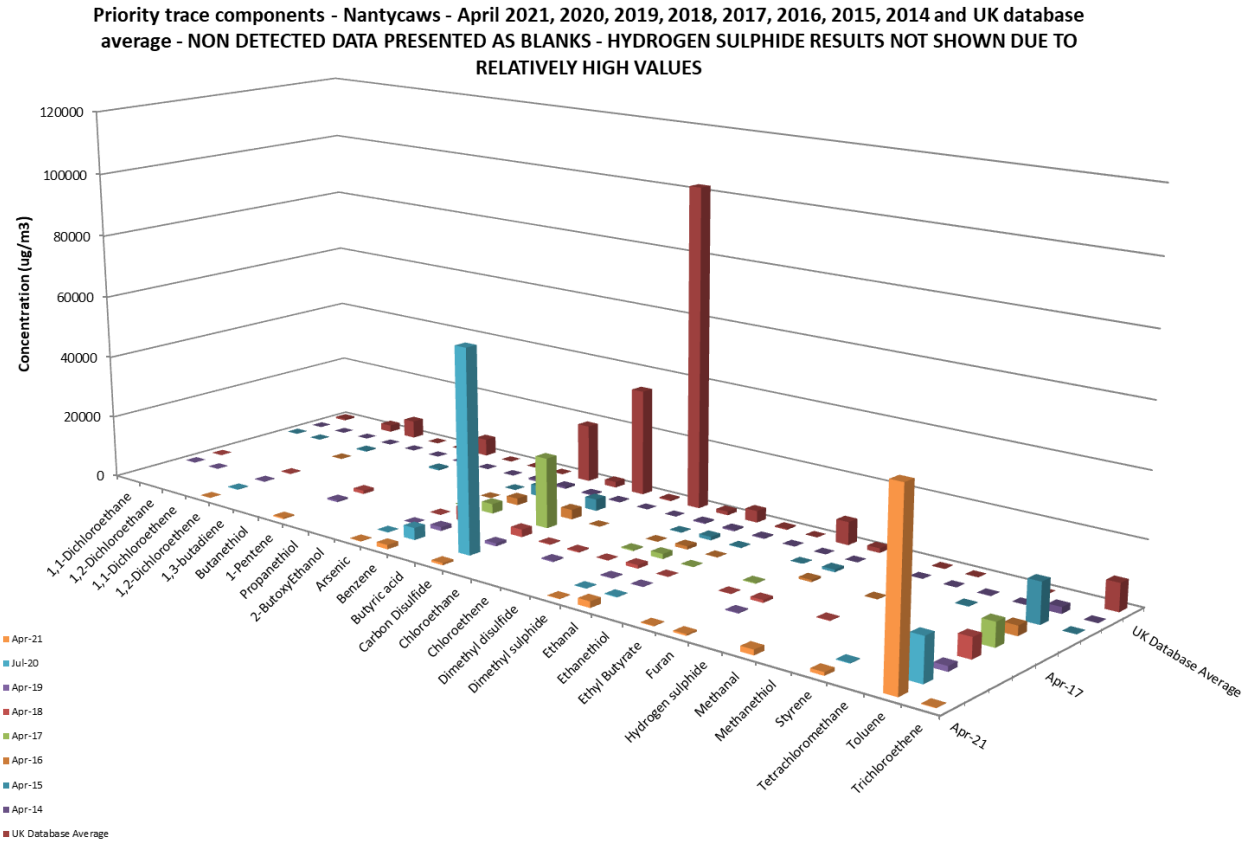
Parameter		Concentration (µg/m^3,STP)
1 Pentene		414
1,1-Dichloroethane		<31
1,1-Dichloroethylene		<47
1,2-Dichloroethane		<52
1,2-Dichloroethylene		41
1,3-Butadiene		<36
1,4 epoxy 1,3 butadiene		486
1-Propanethiol		<103
2-butoxyethanol		<103
Benzene		1345
Butyric acid		<207
Carbon disulphide		672
Carbon tetrachloride		<52
Chloroethane		<52
Dichloromethane		620646
Dimethyl disulphide		<52
Dimethyl sulphide		155
Ethyl butyrate		207
Ethyl mercaptan		<155
Methyl mercaptan		<517
N-Butyl mercaptan		<155
Styrene		1034
Toluene		56893
Trichloroethene		155
Vinyl chloride monomer		<155
Arsenic		143
Hydrogen sulphide		39308
Acetaldehyde	*	1965
Formaldehyde	*	1655

* indicates result is UKAS accredited
< indicates result is below the method limit of detection

The above reported results are the maximum concentrations measured for each parameter in two samples.

The maximum results of the current analyses are compared with historical data and the UK database average in Figure 2.

Figure 2 Historical priority trace component analysis results at Nant Y Caws



6 Notes

Sampling of landfill gas was undertaken in accordance with SOCOTEC procedure GAS14 and is UKAS accredited under certificate 1015.

Analysis of collected samples was undertaken by SOCOTEC's Bretby laboratory. The analytical results which fall within SOCOTEC's scope of accreditation under certificate 1252 are identified in Table 3.

The priority component measurements which can be considered to be within the scope of UKAS accreditation are identified in Table 3.

Any interpretations and opinions expressed are outside of the scope of UKAS accreditation.

END OF REPORT

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