2024 ANNUAL REVIEW OF MONITORING

Withyhedge Landfill site
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Commissioned by
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1 INTRODUCTION

1.1 Background

Resources Management UK Limited (RML) operates Withyhedge Landfill Site at Bowling Farm, Rudbaxton, approximately 5.5 km north of Haverfordwest in Pembrokeshire. The site is a non-hazardous landfill that covers approximately 53 ha. The site comprises two phases known as Phases 1 and 2. Phase 1 is classified as a non–hazardous landfill but has historically accepted a restricted number of hazardous wastes including asbestos. Phase 2 is a non- hazardous landfill. Both sites were operated by RML and were permitted as separate facilities until a variation was issued to consolidate the two sites into one.

At the start of 2022, the Dauson Environmental Group acquired RML.

On 15 May 2024, RML temporarily ceased accepting waste. Waste deposition recommenced on 6 January 2025. During the intervening time, capping (combining temporary and permanent capping) was extended across the waste mass ensuring that all waste was covered and gas management infrastructure expanded.

In June 2024, a Permit Variation was submitted by RML that suggested modifications to various aspects of the Permit including the monitoring programme. The application is currently being considered by NRW.

1.2 Scope

This report has been prepared independently by Geotechnology to assist RML satisfy the Permit which requires an annual review of monitoring.

The report brings together monitoring results and data gathered by RML and third parties and compares the data to current Permit thresholds, where relevant. A plan of the environment monitoring is provided in Drawing 1.

2 SURFACE WATER

Surface water run-off from restored phases at the site is channelled into a sequence of lagoons. The lagoon system ultimately discharges into Rudbaxton Water, which is the closest watercourse to the site. This flows east to west along the northern perimeter of Phase 1 and then Phase 2 before draining to the southwest where it enters the Western Cleddau River, approximately 2km southwest of the site.

As the site is located in a rural agricultural catchment underlain by pyritiferous shale and where there are potentially several diffuse sources of pollution in close proximity, there is a challenge to discern the cause of fluctuations in water quality. Environmental monitoring is currently focussed on key indicators of potential landfill leachate such as ammonia, chloride, BOD and COD alongside trace metals and organics such as nickel, cadmium, phenols and naphthalene.

However, several of these parameters may also be influenced by other processes and activities occurring within the catchment, some of which have developed and been permitted since the landfill was granted planning permission and an Environmental Permit. These include:

- Dairy farming and the application of slurry to the fields on the northern banks of Rudbuxton Water that drain into the same catchment. It is understood that farm practice involves feeding and cutting silage several times a year. There are several farms in the catchment.
- Discharge from sewerage treatment plant at Spittal, upstream of the site. According to Welsh Water there were 323 storm water overflow releases in 2021 with a combined duration of over 2700 hours. Other events have also occurred more recently with overflows sometimes occurring below the maximum flow rate required to be reached to permit an overflow.
- Natural passage of groundwater through the weathered horizon of the shale where pyrite is being oxidised along fractures releasing trace metals, sulphate, and resulting in groundwater with very acidic pH (<5). Such acidic groundwater can increase trace metal mobility and all parties have recognised that background groundwater is, in parts, naturally mineralised due to these processes.

Some of these processes may contribute the same pollutants to the catchment as the approved Phase I dilute and disperse landfill.

2.1 Quality

Surface water quality monitoring is undertaken at lagoon discharge point D1, north of Phase 1. Rudbaxton Water is also monitored monthly at points SP1, SP3, SP5, SP6 and SP7. These latter monitoring points do not have specified compliance limits.

Table 2-1 provides a comparison of the maximum results observed at D1 in recent years with the Permit emission limits. This reveals no exceedances.

Table 2-1 Comparison of water quality (maximum concentrations) at D1 with Permit Emission Limits

Parameter	Limit (incl unit)				
		Q1	Q2	Q3	Q4
2022					
pH	6 to 9 (pH units)		7.2 - 7.6	7.4	6.8 - 6.9
Total Suspended solids	30 (mg/l)	<1.5	27.2	8	22.8
Ammoniacal Nitrogen	0.5 (mg/l)	0.05	0.22	0.06	0.32
Biological Oxygen Demand	17 (mg/l)	6	2.7	0	1.6
Chemical Oxygen Demand	150(mg/l)	21	4	9	15
Chloride	250 (mg/l)	29.2	32.8	40	29.9
2023					
pH	6 to 9 (pH units)	7.5	7.6	7.3	7.3
Total Suspended solids	30 (mg/l)	7.2	1.6	<1.5	<1.5
Ammoniacal Nitrogen	0.5 (mg/l)	0.08	0.1	0.09	0.09
Biological Oxygen Demand	17 (mg/l)	2.6	1.7	5.3	5.3
Chemical Oxygen Demand	150(mg/l)	8	5	17	17
Chloride	250 (mg/l)	35.9	27.1	30	30
2024					
pH	6 to 9 (pH units)	7.8	7.8	6.6	7.1
Total Suspended solids	30 (mg/l)	25.2	4.4	2.4	9.5
Ammoniacal Nitrogen	0.5 (mg/l)	0.43	0.21	0.47	0.09
Biological Oxygen Demand	17 (mg/l)	6.3	2.8	2	6.1
Chemical Oxygen Demand	150(mg/l)	30	73	24	29
Chloride	250 (mg/l)	35.5	43.2	46.8	30.2

2.2 Flow

Surface water flow measured at D1 is shown in Plate 2-1.

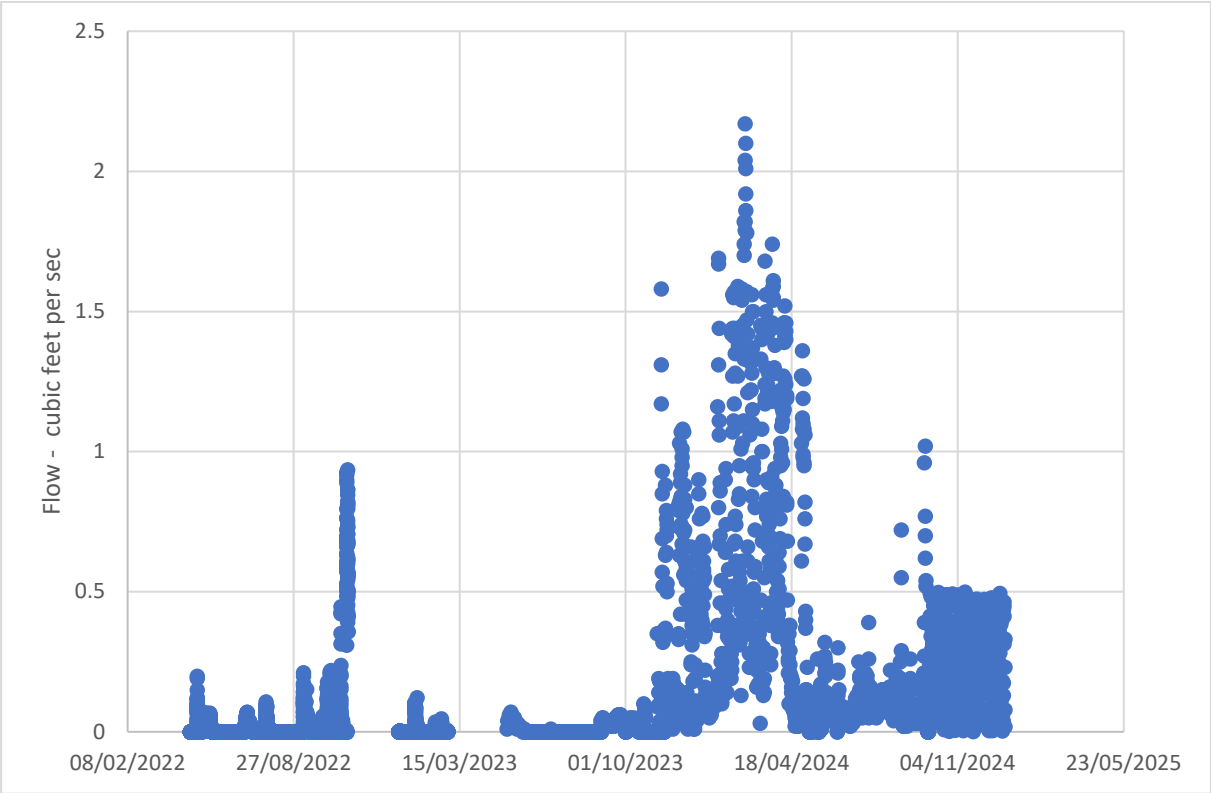


Plate 2-1 Flow gauging at D1

3 LEACHATE

3.1 Leachate Extraction

Leachate is pumped from leachate extraction wells via a series of pipelines that ultimately allow the leachate to be impounded in tanks before off-site disposal. The total tonnage of leachate extracted from the whole site in recent years is summarised in Table 3-1. Also presented is the volume of leachate extracted from unlined Phase 1.

Table S4.1 of the permit requires the Operator to extract a minimum leachate volume of 1,278m^3 per annum (241m^3 per well) from wells LE1 to LE6 in Phase 1. These wells are continuously pumped using float switches throughout the year in order to maintain < 1m leachate head and the wells are often found dry. As such, it is not always practicable to comply with the minimum extraction requirements, as indicated in Table 3-1. The historical technical basis for this extraction volume is unclear, and because maintaining the leachate low levels as low as practicable offers environmental protection, this aspect is reviewed in the Permit Variation.

Table 3-1 Leachate extracted

	Whole site	**Phase 1**
	Leachate removed/tonnes	Leachate pumped/m^3
2022		
Q1	7707.2	33
Q2	2417.62	112
Q3	248.02	94
Q4	4147.36	77
TOTAL		**316**
2023		
Q1	6242.2	76
Q2	3427.12	72
Q3	1703.14	45
Q4	10,750.58	45
TOTAL		**238**
2024		
Q1	20,041.18	40
Q2	10,733.3	30
Q3	5,029.72	27
Q4	8295.35	24
TOTAL		**121**

3.2 Leachate Levels

All quarterly reported leachate levels were below 1m apart from periods in the first half of the year. Keeping leachate levels low is critical as it minimises risk to the environment. The raw data was reported in each of the quarterly reports.

3.3 Leachate Quality

Leachate quality is varied across the different phases of landfill due to different ages of waste and waste chemistry changing through time. Selected key parameters are summarised in Table 3-2. The monitoring continues to indicate that Ammonia and Chloride are the key contaminants of concern with other substances at significantly lower concentration.

Table 3-2 Selected maximum leachate chemistry

		Q1	Q2	Q3	Q4
2022					
Ammoniacal nitrogen	mg/l	3740	3030	3110	2900
Cadmium	mg/l	0.0339	0.0032	0.0031	0.0058
Chloride	mg/l	4110	3180	4470	2900
Mecoprop	mg/l	0.0418	0.041	0.0415	<0.0001
Nickel	mg/l	0.302	0.393	0.238	0.274
2023					
Ammoniacal nitrogen	mg/l	2600	1600	9173	2269
Cadmium	mg/l	0.019	0.0014	0.0015	0.0005
Chloride	mg/l	2600	2800	3419	3568
Mecoprop	mg/l	0.0034	0.0903	0.0062	0.03
Nickel	mg/l	0.442	0.3946	0.353	0.412
2024					
Ammoniacal nitrogen	mg/l	2200	2200	2082	1418
Cadmium	mg/l	0.0029	0.0046	0.0002	0.00011
Chloride	mg/l	3300	2125	2817	2286
Mecoprop	mg/l	0.02	0.0077	0.0071	0.0001
Nickel	mg/l	0.7	0.192	0.098	0.192

4 GROUNDWATER

As shown in Drawing 1, there is an extensive groundwater monitoring network with many boreholes spaced less than 50m apart around the landfill. Some of the downgradient monitoring positions are within ~10m of the landfill edge.

Some boreholes are considered to intersect fractures whilst others intersect the rock matrix through which little groundwater would be expected to quickly pass. Previous studies have shown, to the agreement of all parties, that background groundwater is naturally mineralised with sometimes acidic pH due to the passage of poorly buffered groundwater passing along fractures containing pyrite. As the pyrite naturally oxidises and weathers it release protons causing lower pH, sulphate, iron and trace metals.

4.1 Groundwater Quality

Comparison of the groundwater quality against the Permit emission limits is provided in the tables below. Breaches of the emissions limits are highlighted grey. There were no breaches in 2024.

It is evident that there are different emission limits for boreholes in close proximity along the northern and southern boundary of the landfill. Reference to Drawing 2 indicates that some of these borehole positions (BH105 and BH20) are considered upgradient of the landfill.

Table 4-1 Comparison of data maximum from TP9, TP11, TP12, AIGH BH104, BH20 with Permit emission Limits

Parameter	Emission Limit	Q1	Q2	Q3	Q4
2023					
Ammoniacal Nitrogen	12 mg/l	2.1	1.9	2	1.3
Chloride	250 mg/l	69.2	61.2	66.7	62.8
Nickel	0.05 mg/l	0.0162	0.047	0.0253	0.0177
Phenol	0.15 mg/l (0.03) mg/l	<0.0005	<0.02	<0.01	<0.01
Cadmium	0.0095 mg/l (0.0001)mg/l	<0.00011	0.0006	0.0013	0.00015
Mecoprop	0.0001 mg/l (0.00004) mg/l	<0.0001	0.0001	<0.0001	<0.0001
Naphthalene	0.00001 mg/l	<0.00005	<0.00013	<0.00005	<0.00005
Note: BH20 decommissioned August 2023					
2024					
Ammoniacal Nitrogen	12 mg/l	2.1	2	2.2	1.3
Chloride	250 mg/l	129	58.3	58.4	41.7
Nickel	0.05 mg/l	0.0017	0.041	0.021	0.0029
Phenol	0.15 mg/l (0.03) mg/l	0.1	0.08	<0.01	0.04
Cadmium	0.0095 mg/l (0.0001)mg/l	<0.00011	0.00081	<0.00011	<0.00011
Mecoprop	0.0001 mg/l (0.00004) mg/l	<0.0001	<0.0001	<0.001	<0.0001
Naphthalene	0.00001 mg/l	<0.00005	<0.00005	<0.0001	<0.0001

Table 4-2 Comparison of BH1, BH2, BH102 (now BH3), and AIGBH105 with Permit Emission Limits

Parameter	Emission Limit	Q1*	Q2	Q3	Q4
2023					
Cadmium	0.002mg/l	0.00075	0.001	0.0009	0.0006
Phenol	0.15 mg/l (0.001mg/l)	<0.0005	<0.02	<0.01	0.02
Note: BH102 previously known as BH3. Limits in brackets are superseded.					
2024					
Cadmium	0.002mg/l	0.00071	0.00055	0.002	<0.00011
Phenol	0.15 mg/l (0.001mg/l)	0.02	0.09	0.09	0.05

Table 4-3 Comparison of BH1, with Permit Emission Limits

Parameter	Limit	Q1	Q2	Q3	Q4
2023					
Naphthalene	0.00003 mg/l	<0.00005	<0.00012	<0.00005	<0.00005
Nickel	0.02 mg/l	0.0024	<0.0015	<0.0015	<0.0015
Ammoniacal Nitrogen	1.328 mg/l (0.8 mg/l)	<0.01	0.05	0.03	0.18
Chloride	117 mg/l (55 mg/l)	60.7	40.8	28.8	17.3
Mecoprop	0.00003 mg/l (0.00002 mg/l)	<0.0001	0.00003	<0.0001	<0.0001
Note: Naphthalene detection limit above emission limit. Limits in brackets are superseded.					
2024					
Naphthalene	0.00003 mg/l	<0.00005	<0.00005	0.0023	<0.0001
Nickel	0.02 mg/l	<0.0015	0.0083	0.0023	0.0021
Ammoniacal Nitrogen	1.328 mg/l (0.8 mg/l)	0.04	0.11	0.08	0.05
Chloride	117 mg/l (55 mg/l)	27.4	38.1	47.5	41.8
Mecoprop	0.00003 mg/l (0.00002 mg/l)	<0.0001	<0.0001	<0.0001	<0.0001

Table 4-4 Comparison of BH2 with Permit Emission Limits

Parameter	Limit	Q1	Q2	Q3	Q4
2023					
Naphthalene	0.00006 mg/l	<0.00005	<0.00005	<0.00005	<0.00005
Nickel	0.02 mg/l	<0.0015	<0.0015	0.0048	<0.0015
Ammoniacal Nitrogen	5.2 mg/l	0.17	0.05	0.9	0.67
Chloride	180 mg/l	40.3	43.7	96.2	31.8
Mecoprop	0.0001 mg/l	<0.00005	<0.00005	<0.00005	<0.00005
2024					
Naphthalene	0.00006 mg/l	<0.00005	<0.00005	<0.0001	<0.0001
Nickel	0.02 mg/l	<0.0015	<0.0015	<0.0015	0.0857
Ammoniacal Nitrogen	5.2 mg/l	0.04	0.13	0.22	0.07
Chloride	180 mg/l	28.5	16.1	28.4	36.3
Mecoprop	0.0001 mg/l	<0.0001	<0.0001	<0.0001	<0.0001

Table 4-5 Comparison of BH102 (now BH3) with Permit Emission Limits

Parameter	Limit	Q1	Q2	Q3	Q4
2022					
Naphthalene	0.00006 mg/l	<0.00005	<0.0005	<0.0005	<0.0005
Nickel	0.02 mg/l	0.006	0.0117	0.017	0.0114
Ammoniacal Nitrogen	55 mg/l	0.03	0.12	0.72	0.1
Chloride	310 mg/l	179	178	220	225
Mecoprop	0.0004 mg/l	<0.00005	<0.0001	<0.0001	<0.0001
2023					
Naphthalene	0.00006 mg/l	<0.00005	<0.00071	<0.00005	<0.00005
Nickel	0.02 mg/l	0.0111	0.009	0.0106	0.0132
Ammoniacal Nitrogen	55 mg/l	0.29	0.22	2.2	2.2
Chloride	310 mg/l	0.00075	0.001	0.0009	0.0006
Mecoprop	0.0004 mg/l				
2024					
Naphthalene	0.00006 mg/l	<0.00005	<0.00005	<0.0001	<0.0001
Nickel	0.02 mg/l	0.0086	0.0034	0.0097	0.0024
Ammoniacal Nitrogen	55 mg/l	0.31	1.56	0.11	0.05
Chloride	310 mg/l	131	153	151	35.2
Mecoprop	0.0004 mg/l	<0.0001	<0.0001	<0.0001	<0.0001

Table 4-6 Comparison of BH105 with Permit Emission Limits

Parameter	Emission Limit	Q1	Q2	Q3	Q4
2022					
Naphthalene	0.0001 mg/l	<0.00005	<0.00005	<0.00005	<0.00005
Nickel	0.031 mg/l	0.507	1.3	0.0164	0
Ammoniacal Nitrogen	0.5 mg/l	2.7	0.89	0.21	0.36
Chloride	50 mg/l	19.5	21.3	39.3	24
Mecoprop	0.0001 mg/l (0.00002 mg/l)	<0.0001	<0.0001	<0.0001	<0.0001
2023					
Naphthalene	0.0001 mg/l	<0.00005	0.00005	<0.00005	<0.00005
Nickel	0.031 mg/l	<0.0015	<0.0015	<0.0015	0.0024
Ammoniacal Nitrogen	0.5 mg/l	0.35	0.43	0.35	0.06
Chloride	50 mg/l	5.3	23.1	23.3	26.6
Mecoprop	0.0001 mg/l (0.00002 mg/l)	<0.0001	<0.00002	<0.0001	<0.0001
Note: Mecoprop analytical detection limit above emission limit					
2024					
Naphthalene	0.0001 mg/l	<0.00005	<0.00005	<0.0001	<0.0001
Nickel	0.031 mg/l	<0.0015	<0.0015	0.021	<0.0015
Ammoniacal Nitrogen	0.5 mg/l	0.06	0.07	0.36	0.08
Chloride	50 mg/l	24.7	25.1	48.4	14.7
Mecoprop	0.0001 mg/l (0.00002 mg/l)	<0.0001	<0.0001	<0.0001	<0.0001

5 LANDFILL GAS AND ODOUR

5.1 Production

The total amount of landfill gas treated during 2024 is summarrised in Table 5-1.

Table 5-1 Gas flow recorded by RML

Booster Unit	Operational Time	Engine Flow	Flare Flow	Total Flow (Treated Gas)
RML1 (2K)	08/10/24 - 31/12/24	1,796,000	0	1,796,000
RML2 (1k)	31/10/24 - 31/12/24	0	348,980	348,980
RML3 (Old Main)	01/01/24 - 31/10/24	3,798,266	2,491,320	6,289,586
Emergency Flare	16/06/24 - 09/10/24		1,774,312	1,774,312
TOTAL		5,594,266	4,614,612	10,208,878

The site now benefits from three gas engines, referred to as RML11, RML12 and RML34. The configuration of the 3 engines is shown in Plate 5-1. The latter engine came online late 2024 whilst the other two engines were operated all year. Improvements made during 2024 now provide additional capacity and flexibility for landfill gas management with redundancy built into the system.

Plate 5-1 From left to right, RML12, RML11 and RML34

Between 23 April and 26 June 2024, all engines were shut down and the gas was flared. This was because of the concentration of Hydrogen Sulphide, primarily from Cell 8, damaging the gas management infrastructure. Once the Hydrogen Sulphide concentrations had declined the gas once was again diverted to the engines.

5.2 Chemistry

In-waste monitoring has revealed the maximum concentrations observed in Table 5-1.

Table 5-2 Maximum concentrations of in-waste gas chemistry

	Q1	Q2	Q3	Q4
2022				
Methane	68.8	78	69.4	72.4
Carbon Dioxide	43.9	44.6	43.8	49.5
Oxygen	22.8	21.6	21.6	21.9
Carbon Monoxide	191	189	167	88
Hydrogen sulphide	2253	3782	2602	2709
2023				
Methane	72	71.4	74.9	79.5
Carbon Dioxide	43.3	47.1	52.3	52.5
Oxygen	21.6	22.3	21.4	21.5
Carbon Monoxide	131	255	618	260
Hydrogen sulphide	1676	2007	4524	8743
2024				
Methane	86.1	80	85.8	78.7
Carbon Dioxide	50.3	52.4	50.4	53.7
Oxygen	21.8	21.2	21.6	22.1
Carbon Monoxide	276	642	993	116
Hydrogen sulphide	4865	5000	8418	6174

Landfill gas engine and flare emission monitoring is undertaken as required by the Permit. The results of the monitoring of the flare and engines are summarised in Tables 5-3 to 5-8.

Compliance limits for Oxides of Nitrogen (NOx), Carbon Monoxide and Volatile Organic Compounds (VOCs) were met at each of the engine exhausts at the time of monitoring when the uncertainty of the measurement is taken into account. Flare emissions also met the limits at the time of sampling.

Table 5-3 Quarterly and Annual Monitoring of Engine 1538 (Engine 1, RML11)

Parameter	Limit	Q1	Q2 (29/6/22)	Q3	Q4
2023					
Oxides of Nitrogen	500 mg/m^3	261	406	489	426
CO	1400 mg/m^3	967	894	1000	1008
Total VOC's (annual)	1000 mg/m^3				1021 (±40%)
2024					
Oxides of Nitrogen	500 mg/m^3	449	283	473	685 (±40%)
CO	1400 mg/m^3	551	1004	955	1149
Total VOC's (annual)	1000 mg/m^3				1111 (±40%)
Note: Data supplied by RML for annual reporting. Up to 40% uncertainty assumed based on LFGTN08 (Section 4.6.1 & 4.6.2) for total uncertainty including potential variability of emissions. Measurement is above the limit but by an amount that doesn't exceed the uncertainty, regarded as approaching the limit and compliant.					

Table 5-4 Quarterly and Annual Monitoring of Engine 1510 (Engine 2, RML12)

Parameter	Limit	Q1	Q2	Q3	Q4

2023					
Oxides of Nitrogen	500 mg/m^3	Undergoing service – no data	444	411	284
CO	1400 mg/m^3		830	875	424
Total VOC's (annual)	1000 mg/m^3				1395 (±558 - See Note)
2024					
Oxides of Nitrogen	500 mg/m^3	446	493	489	690
CO	1400 mg/m^3	996	682	794	860
Total VOC's (annual)	1000 mg/m^3				1532
Note: Data supplied by RML for annual reporting. Up to 40% uncertainty assumed based on LFGTN08 (Section 4.6.1 & 4.6.2) for total uncertainty including potential variability of emissions. Measurement is above the limit but by an amount that doesn't exceed the uncertainty, regarded as approaching the limit and compliant.					

Table 5-5 Quarterly and Annual Monitoring of Engine 3, RML34 (New CAT Engine)

Parameter	Limit	Q1	Q2	Q3	Q4
2024					
Oxides of Nitrogen	500 mg/m^3				541
CO	1400 mg/m^3				809
Total VOC's (annual)	1000 mg/m^3				972
Note: Data supplied by RML for annual reporting. Up to 40% uncertainty assumed based on LFGTN08 (Section 4.6.1 & 4.6.2) for total uncertainty including potential variability of emissions. Measurement is above the limit but by an amount that doesn't exceed the uncertainty, regarded as approaching the limit and compliant.					

Table 5-6 Annual Main Flare (RML3) Stack Emission Monitoring

Parameter	Limit	Q4
2022		
Oxides of Nitrogen	150 mg/m^3	24.1
CO	50 mg/m^3	2.6
Total VOC's	10 mg/m^3	4.1
2023		
Oxides of Nitrogen	150 mg/m^3	74.1
CO	50 mg/m^3	1.7
Total VOC's	10 mg/m^3	1.8
2024		
Oxides of Nitrogen	150 mg/m^3	70.8 (May), 0.72 (Aug)
CO	50 mg/m^3	12.6 (May), 1.8 (Aug)
Total VOC's	10 mg/m^3	0.79 (May), 0.72 (Aug)

Table 5-7 New Flare Stack Emissions (RML1 & 2)

2024			
		1k Flare (RML2)	2K Flare (RML1)
Oxides of Nitrogen	150 mg/m^3	87.1	73.5
CO	50 mg/m^3	5.7	7.2
Total VOC's	10 mg/m^3	8.3	7.3

Table 5-8 Temporary Flare Stack Monitoring

Parameter	Limit	24 July 2024
Oxides of Nitrogen	150 mg/m^3	44.6
CO	50 mg/m^3	1.8
Total VOC's	10 mg/m^3	0.74

5.3 Trace Gas Inlet Monitoring

Trace gas analysis is undertaken of the fuel gas utilised by the gas engine generator plant at the gas compound. The full independent report provided by the third party that undertook the monitoring is included in Appendix 1.

The compounds found to be above the analytical detection are summarised in Table 5-7. Sulphide compounds continue to dominate in term of concentration.

Table 5-9 Trace gas content at compound

	Mar-22	Oct-23	Jun-24	
Arsenic (as As)		403		
Acetaldehyde (Ethanal)	67	81	84	µg/m3
Chloroethane	61	91	927	µg/m3
1-Pentene	<82	532	544	µg/m3
Furan	735	1482		µg/m3
Dimethylsulphide	981	4561	879	µg/m3
DCM	<41	42	320	µg/m3
CS2	2615	32309	63944	µg/m3
1,2-dichloroethene (trans + cis)		148	59	
1,1-Dichloroethane	<20	23	66	µg/m3
1,2-Dichloroethane	<20	84	591	µg/m3
Benzene	531	5321	735	µg/m3
Trichloroethylene	<20	148	74	µg/m3
Toluene	<20	9503	3357	µg/m3
Styrene	<20	2965	1007	µg/m3
Hydrogen sulphide	< 151691	166860	5160714	µg/m3
Vinyl Chloride	90	38	<16	µg/m3
Formaldehyde (Methanal)	67	27	337	µg/m3
Ethylbenzene	12			µg/m3
m/p-Xylene	29			µg/m3
o-Xylene	8			µg/m3
Dichloromethane			320	µg/m3
Dimethyl disulphide			56	µg/m3
Ethanethiol			2398	µg/m3
Propanethiol			591	µg/m3
1,1-dichloroethene			14	µg/m3
1,4-epoxy-1,3-butadiene (Furan)			78	µg/m3

5.4 Perimeter Monitoring

Perimeter monitoring is undertaken at selected groundwater monitoring wells. A comparison of the maximum concentrations detected with emission limits is provided in Table 5-8. This indicates that there has been no breach of any emission limit with perimeter gas levels indicative of no lateral gas migration and natural soil gas chemistry.

Table 5-10 Monthly Perimeter Gas Data Evaluation

Location	Parameter	Limit	Maximum concentrations			
			Q1	Q2	Q3	Q4
2022						
TP1, TP9, TP10, TP11, TP12	Carbon Dioxide	No limit	0.3	0.6	2.7	3.3
	Methane	2.30%	0.1	0.1	0	0.1
BH104	Carbon Dioxide	No limit	0.2	0.7	1	0.2
	Methane	1% v/v.	0.1	0.2	0	0.1
AIGBH105, BH1 , BH2, BH3, BH6, BH9, BH15, BH18, BH20	Carbon Dioxide	No limit	0.6	0.9	3.6	3.3
	Methane	1% v/v.	0.1	0.1	1.2	0.4
2023						
TP1, TP9, TP10, TP11, TP12	Carbon Dioxide	No limit	0.6	0.9	1.5	1
	Methane	2.30%	0.1	0	0.1	0.1
BH104	Carbon Dioxide	No limit	0.2	1.3	1.9	0.2
	Methane	1% v/v.	0.1	0	0.1	0.2
AIGBH105, BH1 , BH2, BH3, BH6, BH9, BH15, BH18, BH20	Carbon Dioxide	No limit	3.4	4.2	2.4	2.5
	Methane	1% v/v.	0.1	0	0.3	0.1
2024						
TP1, TP9, TP10, TP11, TP12	Carbon Dioxide	No limit	1.6	2.3	2.4	0.8
	Methane	2.30%	0.1	0	0.9	0.2
BH104	Carbon Dioxide	No limit	0.2	0	0.8	0.4
	Methane	1% v/v.	0	0	0.8	0
AIGBH105, BH1 , BH2, BH3, BH6, BH9, BH15, BH18, BH20	Carbon Dioxide	No limit	0.8	0.9	7.3	1.9
	Methane	1% v/v.	0.1	0	0.8	0.2

At each of the monitored wells, groundwater is typically <3m below datum level. With groundwater present at such levels, it is inevitable that both carbon dioxide and methane will be detected, potentially at very high concentrations and well beyond those recently observed. This does not necessarily mean that there is landfill gas migrating or a significant advective flux but simply localised processes within the well as gases can freely accumulate in the headspace. In this context, the data should be viewed with caution. In some cases, the slotted section of the monitoring could also be permanently below water level.

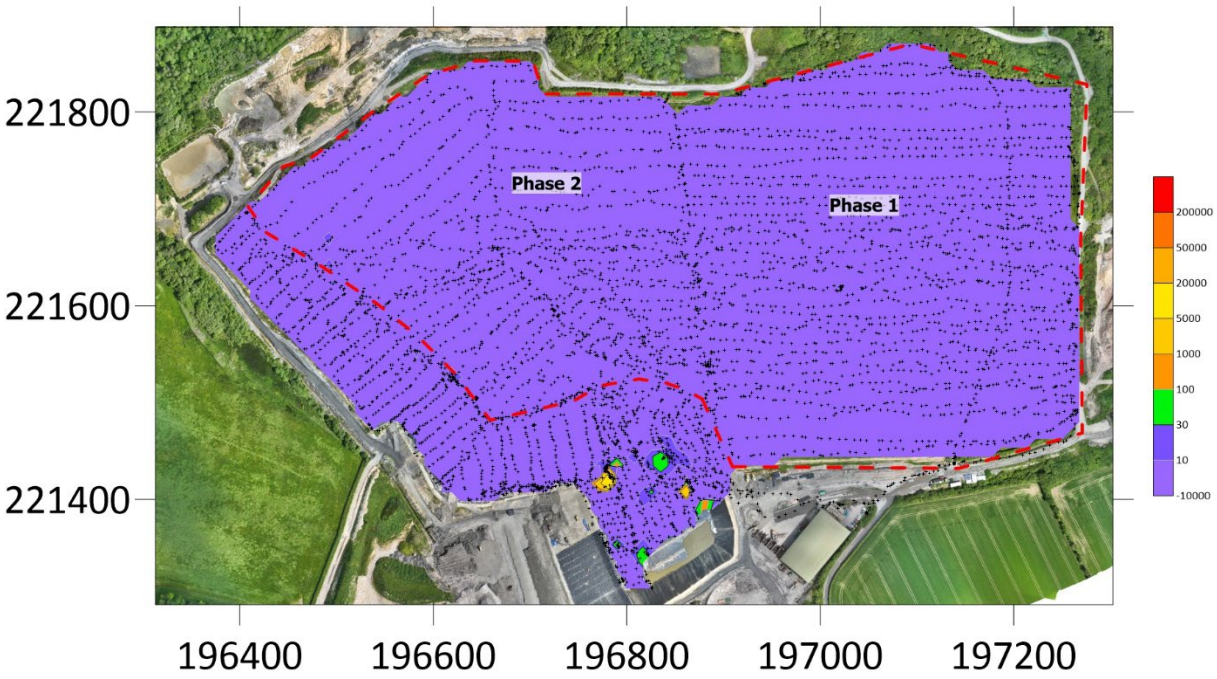
5.5 Surface Emissions Monitoring

Each year, the operator commissions an independent assessment of surface emissions, as required by the Permit. In 2022, the survey was undertaken on 12 and 13 January by a third party using an FID. All readings were below 100 ppm and no distinct features, such as stressed

vegetation, were discovered. The survey did not identify any significant faults in the gas management system.

The industry has moved away from the use of FIDs and so instead, the more recent surveys have been completed using a tuneable diode laser (TDL) that is specific to methane. As such instruments can be hand-held and fitted with GPS the methane results can be plotted as a contour map across the landfill surface, as is the case for the two surveys completed in 2024 (see Figure 5-1). Both surveys clearly show persistently very low levels (typically <5ppm) across the whole site part from small discrete areas in the temporary capping of Cell 8. These latter features are associated with infrastructure and require active management as the waste mass settles.

Given the consistency in the monitoring results, the survey of surface emissions will now be undertaken annually, as set out in the Permit.



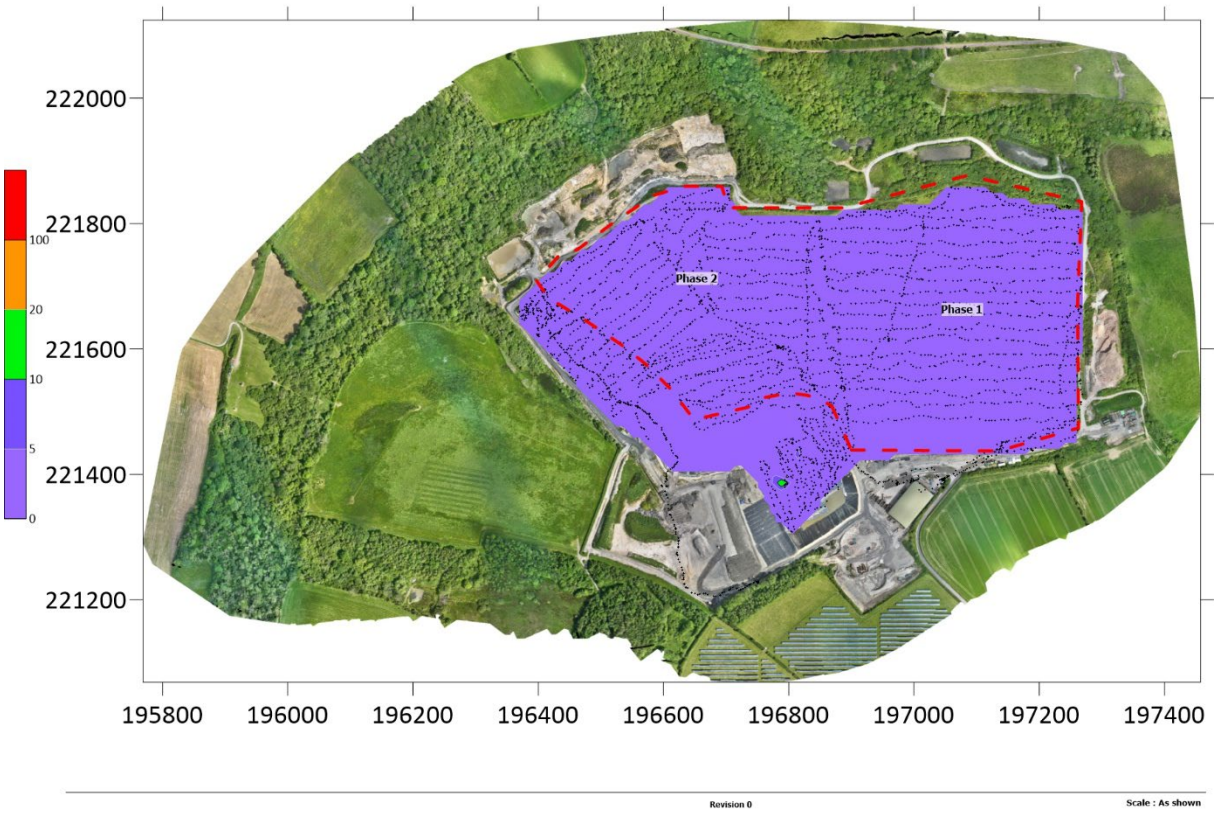


Figure 5-1 Surface Emission Surveys in 2024

5.6 Odour

During 2023 and 2024 a large number of complaints were received and logged by the RML site team. These primarily related to odour and were taken very seriously by the Senior Management Team and Directors. As part of the investigation into the odour complaints and engineering works, additional surveys of surface emissions were undertaken, air quality monitoring commenced and an audit of the causes undertaken. In combination, this lead to the development of new and additional working practices.

6 TOPOGRAPHIC SURVEY

A topographic survey of the site, including the operational landfill cells and the capped area was undertaken on 22 January 2025.

The photogrammetric survey was carried out using an unmanned aerial vehicle (UAV), commonly referred to as a drone. This survey method first requires a series of ground control points (GCPs) with ordnance survey (OS) grid coordinates to be installed throughout the site with a Topcon dGPS survey rover. In the interest of repeatability, a series of permanent GCP markers have been installed around the perimeter of the site, these same markers have now been in place for multiple surveys. The UAV has overflown the site in a grid pattern to acquire a set of overlapping high resolution aerial photographs for photogrammetry processing, the GCP locations are visible on multiple aerial photographs.

The images captured by the drone and the GCPs have been processed in Pix4D Mapper software to generate a high density point cloud representing the site. The point cloud is georeferenced to the OS grid and incorporates all site features visible on the imagery, this also includes non-topographic features such as buildings and vegetation. Further processing of the point cloud creates a digital surface model (DSM) which has been uploaded to the Propeller online platform and used to track site progress.

The point cloud has also been sampled at a grid interval of 1m and imported into LSS terrain modelling software. LSS has created a surface model by thinning out the dense point cloud and selecting the lowest point in any 1m square. The software then creates a triangulated mesh between these points and presents this triangulated surface as a contour plan. By selecting the lowest point within a 1m grid, this stage of the process aims to reduce the influence of vegetation on the surface model. A contour plan, overlain on an orthomosaic aerial image of the site is included as Drawing 1.

6.1 Void Capacity

A volumetric assessment of the remaining landfill capacity has been undertaken using a combination of LSS and Propeller. Both pieces of software are capable of calculating volumes by subtracting one surface model from another. The existing topographic surface has been compared against a temporary top of waste model for the active landfill cells in order to calculate a remaining void capacity. It should be noted that this calculation does not take any account of future landfill cells that have yet to be constructed.

A summary of the total capacity and remaining void capacity for the active cells is included below in Table 6-1. At the time of the survey, Cell 8 and Cell 9 are the only active cells, as cells 5-7 are now completely capped, with all areas that are filled to final level now fully restored. Cell 8 is currently covered with temporary capping and not accepting waste at this time.

As Cell 8 is not filled to the approved top of waste levels, it is not currently possible for the filling of Cell 9A to lap onto the western face of Cell 8. As a result, the total capacity of Cell 9 has been reported as a discrete standalone landform, with a valley separating it from Cell 8 to the east, and Cell 6 to the North. The capacity of this valley is also reported in the table.

The design of Cell 10 is currently being finalised, with an expectation that it will be submitted for approval by the end of February 2025. This should allow for construction to begin spring 2025.

Table 6-1 Phase 2 Active Cell Volumes

	Cell 8	Cell 9 (Discrete Waste Profile)	Cell 9 Valley Infill	Cell 10
Total Capacity (m^3)	244227	232589	220644	Final Design Pending
Used (m^3)	150526	9446	None	
Remaining Capacity (m^3)	93701	223143		
Available Space (%)	38.37	95.94		

Notes: Cell 8 is currently covered with temporary capping and is not accepting waste. Cell 9 valley capacity will only become available once Cell 8 is filled to final top of waste profile. Cell 9 Valley infill volume is the volume required to fill the L shaped valley separating Cell 9 from Cells 6-8.

As Cell 8 is not receiving waste at this time, the available void capacity of the landfill available for use on 22 January 2025 was 223,143m^3

6.2 Settlement

Propeller has been used to carry out a comparison of the January 2025 survey to the survey undertaken in January 2024. Propeller displays this comparison as a series of coloured height bands representing the elevation differences between surfaces, these coloured contours are overlain on the orthomosaic image from the most recent survey in Figure 6-1.

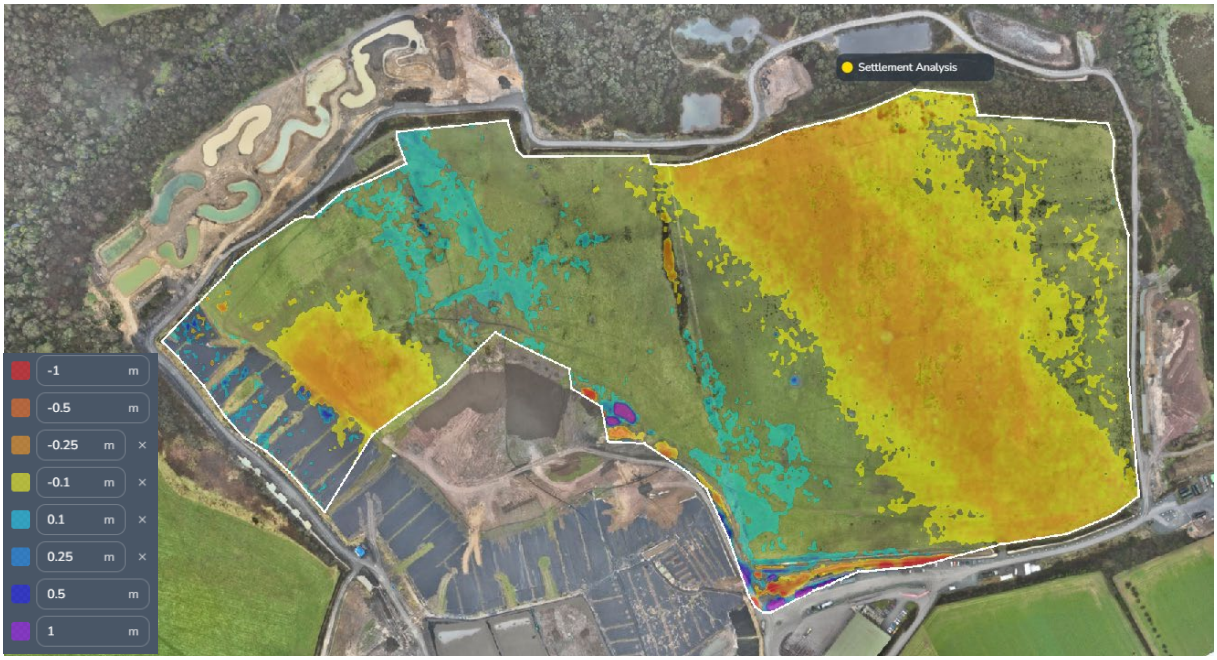


Figure 6-1 January 2025 – January 2024 Surface Model Comparison

The figure includes a legend linking colour banding to elevation difference. Blue and Purple colours represent an increase in elevation over the last year. Red and Yellow colours indicate a reduction in level during the last year.

Much of the capped Phase 1 landfill is covered in yellow and orange, indicating a decrease in elevation of 0-0.25m, most likely due to settlement and changes in vegetation height. There are also patches of blue colouring on the closed parts of landfill which indicate an elevation

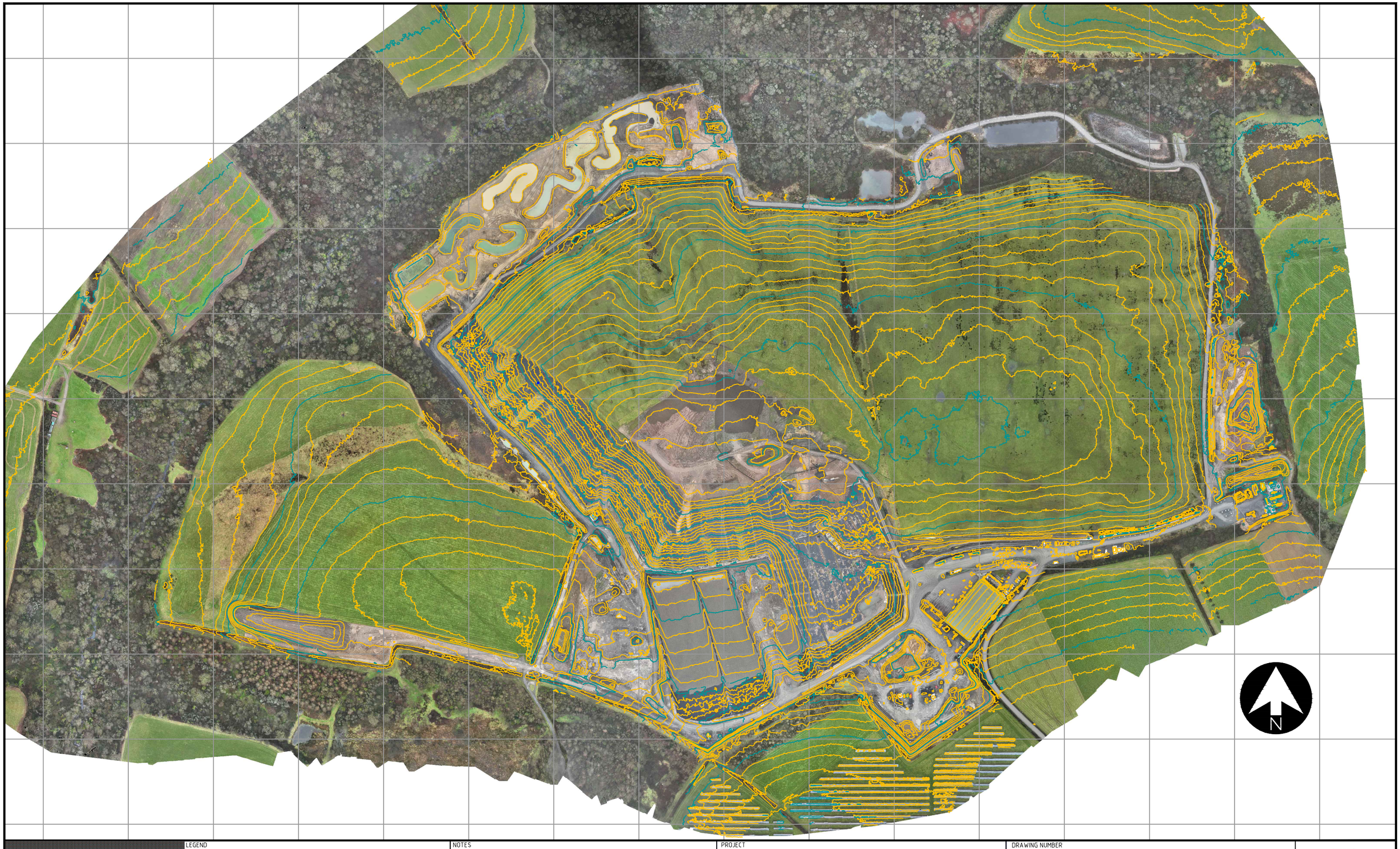
increase of approximately 0.1m. As models generated from photogrammetric drone surveys generally produce a surface model which includes features such as vegetation, the positive changes indicated in Figure 6-1 are considered to represent changes in vegetation height between the two surveys as no soil has been placed.

An attempt to determine whether this is genuine ground level change has been undertaken by comparison of the current survey to other surveys carried out prior to January 2024 and during the intervening period. These comparisons have identified alternating increases and decreases in surface elevation on the closed Phase 1 landfill, with no clear trend. This would suggest that annual measurement of settlement on the restored sections of the closed landfill is minimal, and the elevation changes identified between surveys most likely results from variable vegetation height.

There is a section of restored landfill, located in the southwest of the capped area, over the Phase 2 landfill cells, which is indicating a reduction in level of 0.3-0.4m since January 2024. When subjected to the same long term comparison described above, there is a clear downward trend in the surface elevation at this location. Given the waste in this area is significantly newer and thicker than the Phase 1 landfill, greater settlement would be expected.

A thin section of purple and red located in the southwest corner of the capped landfill is the result of ongoing improvement works which have resulted in significant changes to the surface that are not related to settlement.

Settlement of the capped areas could be more accurately assessed by installing a series of fixed settlement markers over the cap. These markers would likely take the form of a steel pin installed in the restoration soils. Repeat readings on the elevation of these pins using manual survey methods would give a more reliable measure of settlement in these vegetated areas, if this detail were required.



RML
RESOURCES MANAGEMENT UK LTD

LEGEND

Prominent Contour (5.0m)

Normal Contour (1.0m)

NOTES

Digital survey model generated using Pix4D image processing software.
Imagery acquired by DJI Mavic 3E photogrammetry survey on 22 January 2025.
Permanent site survey control installed using Topcon Hiper SR dGPS Rover.
OS Grid spacing at 100m

PROJECT

2024 Annual Review of Monitoring

TITLE

Current Topography

DRAWING NUMBER

2492/1

SCALE AT A3	DATE	DRAWN
1:4000	**02.25**	**KJT**

NOTE

Geo TECHNOLOGY

2024 ANNUAL REVIEW OF MONITORING

Withyhedge Landfill site
EPR: MP3330WP

Appendix 1
Engine and Flare Stack Monitoring Reports

Report Number 2492r1v1d0225

Element, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL
Your Element Contact: Glenn McMorrow (07966 879 182)
E: glenn.mcmorrow@element.com

Stack Emissions Testing Report Commissioned by
Resource Management Group UK Ltd

Installation Name & Address
Resource Management Group UK Ltd
Withyhege Landfill Site
Rudbaxton
Haverfordwest
SA62 4DB

EPR Permit: GP3630HT/V003

Stack Reference
RML 11 - CAT Engine

Dates of the Monitoring Campaign
30th October 2024

Job Reference Number
EMT10815

Report Written by
Darren Price Team Leader MCERTS Level 2 MM 03 176 TE1 TE2 TE3 TE4

Report Approved by
Tracy Dodds Key Account Manager MCERTS Level 2 MM 03 414 TE1 TE2 TE3 TE4

Report Date
13th November 2024

Version
Version 1

Signature of Report Approver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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

Opinions and interpretations expressed herein are outside the scope of Element's ISO 17025 accreditation.

MONITORING OBJECTIVES

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 11 - CAT Engine
30th October 2024

Overall Aim of the Monitoring Campaign

Element were commissioned by Resource Management Group UK Ltd to carry out stack emissions testing on the RML 11 - CAT Engine at Withyhege Landfill Site.

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values (ELVs) as specified in the Site's Permit.

Special Requirements

There were no special requirements.

Target Parameters

Total VOCs (as Carbon), Oxides of Nitrogen (as NO_2), Carbon Monoxide

Executive Summary

MONITORING RESULTS

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 11 - CAT Engine
30th October 2024

where MU = Measurement Uncertainty associated with the Result

		Concentration			
Parameter	**Units**	**Result**		**MU +/-**	**Limit**
Total VOCs (as Carbon) [1]	mg/m³	1111		43.9	1000
Oxides of Nitrogen (as NO_2) [1]	mg/m³	685		30.3	500
Carbon Monoxide [1]	mg/m³	1149		44.1	1400
Oxygen	% v/v	**Dry**	7.1	0.17	
Water Vapour	% v/v	9.6		0.42	

[1] Reference Conditions (REF) are: 273K, 101.3kPa, dry gas, 5% oxygen.

Executive Summary

MONITORING DATE(S) & TIMES

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 11 - CAT Engine
30th October 2024

Parameter		Units	Concentration		Sampling Date(s)	Sampling Times	Duration mins
Total VOCs (as Carbon)	R1	mg/m³	1111		30/10/2024	11:30 - 12: 30	60
Oxides of Nitrogen (as NO_2)	R1	mg/m³	685		30/10/2024	11:30 - 12:30	60
Carbon Monoxide	R1	mg/m³	1149		30/10/2024	11:30 - 12:30	60
Oxygen	R1	% v/v	7.1		30/10/2024	11:30 - 12:30	60

All results are expressed at the respective reference conditions.

PROCESS DETAILS

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 11 - CAT Engine
30th October 2024

Standard Operating Conditions

Parameter	Value
Process Status	Opertating
Capacity (of 100%) and Tonnes / Hour	100% (MCR 1140KWe)
Continuous or Batch Process	Continuous
Feedstock (if applicable)	N/A
Abatement System	None
Abatement System Running Status	N/A
Fuel	Landfill Gas
Plume Appearance	No visible plume

Executive Summary

MONITORING & ANALYTICAL METHODS

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 11 - CAT Engine
30th October 2024

	Monitoring				Analysis					
Parameter	**Standard**	**Technical Procedure**	**Sampling Status**	**Testing Lab**	**Analytical Procedure**	**Analytical Technique**	**Analysis Status**	**Analysis Lab**	**Overall Status**	**LOD (Average)**
Water Vapour	EN 14790	MD 005	MCERTS	EET	MD 005	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	MD 020	MCERTS	EET	Flame Ionisation Detection by Signal 3010HM				MCERTS	0.32 mg/m³
Oxides of Nitrogen (as NO_2)	EN 14792	MD 032	MCERTS	EET	Chemiluminescence by ECO PHYSICS CLD822 Mh				MCERTS	0.41 mg/m³
Carbon Monoxide	EN 15058	MD 021	MCERTS	EET	NDIR by Horiba PG-350E				MCERTS	0.77 mg/m³
Oxygen	EN 14789	MD 022(b)	MCERTS	EET	Wet Zirconia Cell installed in the ProtIR 204M				MCERTS	0.1 %

ANALYSIS LABORATORIES

(with short name reference as appears in the table above)

Element (Stockport Lab - EET)	ISO 17025 Accreditation Number: UKAS 4279

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
All	All	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.30
Width	m	-
Area	m^2	0.07
Port Depth	cm	20
Orientation of Duct	-	Vertical
Number of Ports	-	1
Sample Port Size	-	1" BSP

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	Permanent
Inside / Outside	Outside

Platform Details

EA Technical Guidance Note M1 / EN 15259 Platform Requirements	Value
Sufficient working area to manipulate probe and operate the measuring instruments	Yes
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	N/A
Platform has vertical base boards (approx. 0.25m high)	N/A
Platform has chains / self closing gates at top of ladders	N/A
There are no obstructions present which hamper insertion of sampling equipment	N/A
Safe Access Available	Yes
Easy Access Available	Yes

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and EN 15259, and therefore there are no improvement recommendations.

EN 15259 Homogeneity Test Requirements

There is no requirement to perform a EN 15259 Homogeneity Test on this Stack.

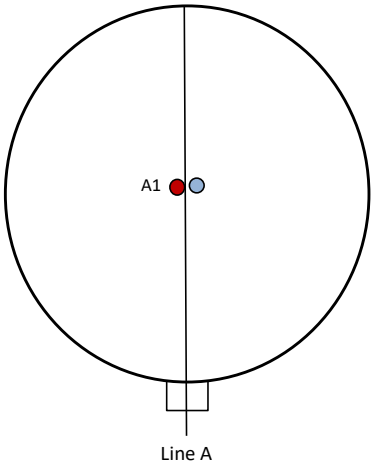
Executive Summary

PLANT PHOTOS

Photo 1

Photo 2

SAMPLE POINTS



where
- ○ = isokinetic point sampled at
- ● = isokinetic point not sampled at
- = combustion gases sample point
- = non-isokinetic sample point

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel, List of Equipment & Methods and Technical Procedures Used

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Darren Price	MCERTS Level 2	MM 03 176	TE1 TE2 TE3 TE4

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	**Equipment I.D.**
Control Box DGM (1)	-
Control Box DGM (2)	-
Box Thermocouples (1)	-
Box Thermocouples (2)	-
Umbilical (1)	-
Umbilical (2)	-
Oven Box (1)	-
Oven Box (2)	-
Heated Probe (1)	-
Heated Probe (2)	-
Heated Probe (3)	-
S-Pitot (1)	-
S-Pitot (2)	-
L-Pitot	CAT CAT 21P.T13
Site Balance	CAT 17.82
500g / 1Kg Check Weights	CAT 17.82
Last Impinger Arm	-
Callipers	-
Tubes Kit Thermocouple	-

Instrumental Analysers	
Equipment Type	**Equipment I.D.**
Horiba PG-350EU	CAT 39.39
Horiba PG-250	-
Servomex 4900	-
Eco Physics CLD 822Mh	-
ABB AO2020-URAS26	-
Testo 350 XL	-
M&C PSS5	CAT 4.00163
Gasmet DX4000	-
Gasmet Sampling System	-
Signal 3010HM	CAT 8.48
M&C PSS	CAT 12.168
Mass Flow Controller (1)	-
Mass Flow Controller (2)	-
Mass View (1)	CAT 25.106
Mass View (2)	CAT 25.107
Squirrel 2020	CAT DL#04
Easylogger EN-EL-12 Bit	-
Bioaerosols Temperature Logger	-
Electronic Refrigerator	-

Miscellaneous Items	
Equipment Type	**Equipment I.D.**
Digital Manometer (1)	-
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.295
Stopwatch	-
Barometer	CAT 13.103
Stack Thermocouple (1)	CAT 4.9909
Stack Thermocouple (2)	-
Stack Thermocouple (3)	-
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	-
15m Heated Line (1)	-
20m Heated Line (1)	CAT 20.241
20m Heated Line (2)	-
Dual Channel Heater Controller	-
Single Channel Heater Controller	CAT 20.241
Laboratory Balance	
Tape Measure	CAT 16.110

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Water Vapour	EN 14790	MD 005
Total VOCs (as Carbon)	EN 12619:2013	MD 020
Oxides of Nitrogen (as NO_2)	EN 14792	MD 032
Carbon Monoxide	EN 15058	MD 021
Oxygen	EN 14789	MD 022(b)

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 11 - CAT Engine

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	1111		1111
Uncertainty	±mg/m³	43.9		43.9

General Sampling Information

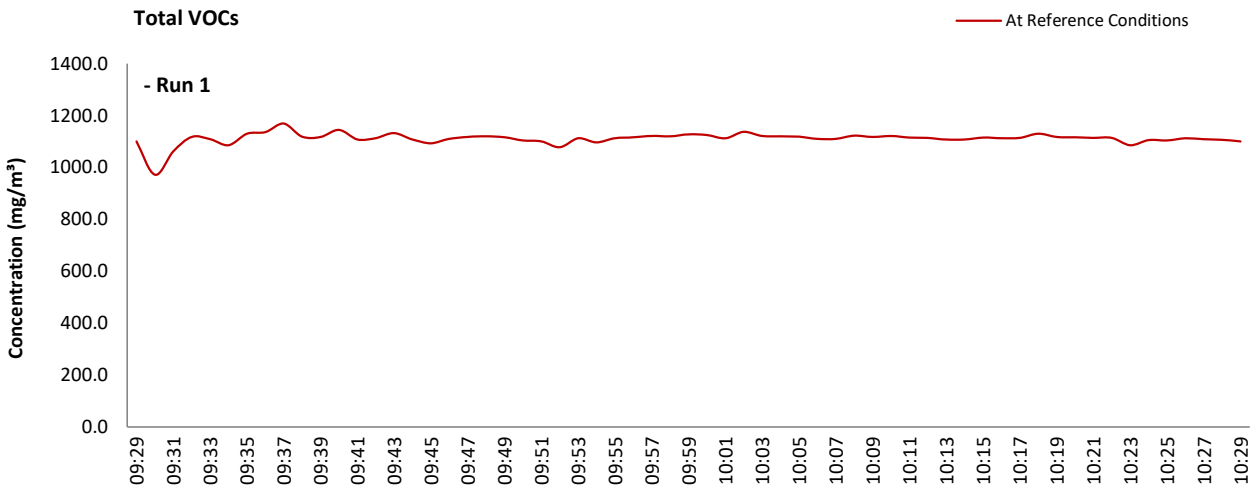
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	MD 020	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	12.0654	
Span Gas Expiry Date	01/11/2025	
Span Gas Start Pressure (bar)	140	
Gas Cylinder Concentration (ppm)	594.7	
Span Gas Set Point (ppm)	594.70	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Synthetic Air (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



TOTAL VOCs (as CARBON): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	11:30 - 12: 30
Sampling Dates	-	30/10/2024
Instrument Range	ppm	1000
Span Gas Value	ppm	594.7

Quality Assurance

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.00
CAL 1	Zero Down Sampling Line (Post)	ppm	-10.00
CAL 1	Zero Drift	ppm	-10.00
CAL 1	Zero Drift	%	-1.69
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± ppm	29.74
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	590.00
CAL 1	Span Down Sampling Line (Post)	ppm	572.00
CAL 1	Span Drift	ppm	-18.00
CAL 1	Span Drift	%	-3.05
CAL 1	Drift Correction Applied	2-5%	Yes
	Allowable Span Drift	± ppm	29.74
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 13

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run)	1	
There are no deviations associated with the sampling employed.	x	

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	1000.0		mg/m³ (REF)
Allowable MU	15.0		%
Measured concentration	963.97		mg/m³ (STP, dry)
Range Used	1000.0		ppm
Range Used [A]	1606.1		mg/m³
Cal gas conc.	594.7		ppm
Conversion	1.61		ppm to mg/m³
MCERTS Range [B]	15.0		mg/m³
Lower of [A] or [B]	15.0		mg/m³
Cal gas conc.	955.2		mg/m³

Performance characteristics	RUN 1		Units
Response time	15		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.15		% full scale
Repeatability at span level	0.80		% full scale
Deviation from linearity	0.07		% of value
Zero drift	-1.69		% full scale
Span drift	0.00		% full scale
Volume or pressure flow dependence	2.00		% of full scale
Atmospheric pressure dependence	0.80		% of value/kPa
Ambient temperature dependence	1.00		% full scale/10K
Combined interference	1.20		% range
Dependence on voltage	0.10		% full scale/10V
Losses in the line (leak)	0.84		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.10		mg/m³
Lack of fit	0.01		mg/m³
Drift	-9.35		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.03		mg/m³
Ambient temperature dependence	0.14		mg/m³
Combined interference (from MCERTS Certificate)	0.10		mg/m³
Dependence on voltage	0.01		mg/m³
Losses in the line (leak)	4.68		mg/m³
Uncertainty of calibration gas	11.13		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	963.97		mg/m³
Combined uncertainty			15.27		mg/m³
Expanded uncertainty	k =	1.96	29.93		mg/m³
Uncertainty corrected to std conds. (O_2)			34.50		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	3.10		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	2.99		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	15.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	3.95		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	4.23		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	15.2		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <15% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 15% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXIDES OF NITROGEN (as NO_2): RESULTS SUMMARY

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 11 - CAT Engine

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	685		685
Uncertainty	±mg/m³	30.3		30.3

General Sampling Information

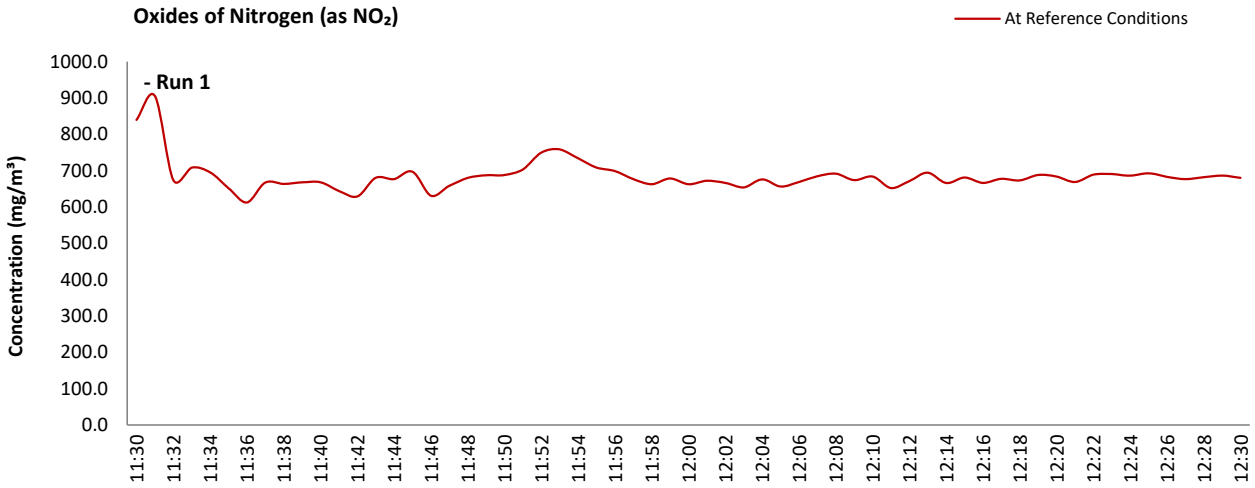
Parameter	Value	
Standard	EN 14792	
Technical Procedure	MD 032	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Date & Result of Last Converter Check	01/03/2024 - 96.7%	
Span Gas Type	Nitrogen Monoxide	
Span Gas Reference Number	12.0606	
Span Gas Expiry Date	13/12/2025	
Span Gas Start Pressure (bar)	100	
Gas Cylinder Concentration (ppm)	261.6	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A5	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

OXIDES OF NITROGEN (as NO_2): DATA TREND

Graphical Trend of Data



OXIDES OF NITROGEN (as NO_2): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	11:30 - 12:30
Sampling Dates	-	30/10/2024
Instrument Range	ppm	500
Span Gas Value	ppm	261.6

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.50
CAL 1	Zero Down Sampling Line (Post)	ppm	2.40
CAL 1	Zero Drift	ppm	1.90
CAL 1	Zero Drift	%	0.72
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	262.10
CAL 1	Span Down Sampling Line (Post)	ppm	267.90
CAL 1	Span Drift	ppm	5.80
CAL 1	Zero Adj. Span Drift	%	1.49
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 13

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1
There are no deviations associated with the sampling employed.	x

OXIDES OF NITROGEN (as NO_2): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	500.0		mg/m³ (REF)
Allowable MU	10.0		%
Measured concentration	594.05		mg/m³ (STP, dry)
Ratio NO / NO_2	5		%
Range Used	500.0		ppm
Range Used [A]	1026.1		mg/m³
Cal gas conc.	261.6		ppm
Conversion	2.05		ppm to mg/m³
MCERTS Range [B]	102.5		mg/m³
Lower of [A] or [B]	102.5		mg/m³
Cal gas conc.	536.9		mg/m³

Performance characteristics	RUN 1		Units
Response time	33		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.10		% full scale
Repeatability at span level	0.15		% full scale
Deviation from linearity	0.09		% of value
Zero drift	0.72		% full scale
Span drift	1.49		% full scale
Volume or pressure flow dependence	-0.30		% of full scale
Atmospheric pressure dependence	0.10		% of value/kPa
Ambient temperature dependence	0.06		% full scale/10K
Combined interference	0.73		% range
Dependence on voltage	0.26		% full scale/10V
Converter efficiency	96.7		%
Losses in the line (leak)	0.00		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.02		mg/m³
Lack of fit	0.05		mg/m³
Drift	7.36		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.03		mg/m³
Ambient temperature dependence	0.01		mg/m³
Combined interference (from MCERTS Certificate)	0.43		mg/m³
Dependence on voltage	0.03		mg/m³
Converter efficiency	0.57		mg/m³
Losses in the line (leak)	0.00		mg/m³
Uncertainty of calibration gas blending	4.80		mg/m³
Uncertainty of calibration gas	6.86		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	594.05		mg/m³
Combined uncertainty			11.17		mg/m³
Expanded uncertainty	k =	1.96	21.90		mg/m³
Uncertainty corrected to std conds. (O_2)			25.24		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	3.69		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	4.38		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	10.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	4.42		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	5.61		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	10.3		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <10% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 10% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

CARBON MONOXIDE: RESULTS SUMMARY

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 11 - CAT Engine

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	1149		1149
Uncertainty	±mg/m³	44.1		44.1

General Sampling Information

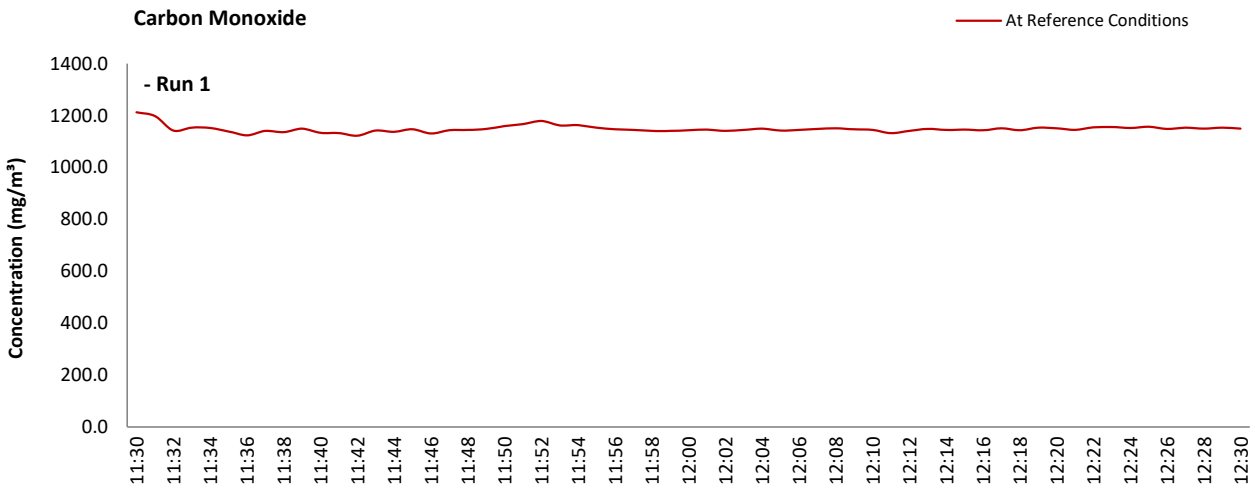
Parameter	Value	
Standard	EN 15058	
Technical Procedure	MD 021	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Carbon Monoxide	
Span Gas Reference Number	12.0606	
Span Gas Expiry Date	12/12/2025	
Span Gas Start Pressure (bar)	100	
Gas Cylinder Concentration (ppm)	1243.7	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A5	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

CARBON MONOXIDE: DATA TREND

Graphical Trend of Data



CARBON MONOXIDE: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	11:30 - 12:30
Sampling Dates	-	30/10/2024
Instrument Range	ppm	1000
Span Gas Value	ppm	1243.7

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	2.00
	Zero Down Sampling Line (Post)	ppm	0.00
	Zero Drift	ppm	-2.00
	Zero Drift	%	0.16
	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	1234.00
	Span Down Sampling Line (Post)	ppm	1241.00
	Span Drift	ppm	7.00
	Zero Adj. Span Drift	%	0.72
	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 13

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1
There are no deviations associated with the sampling employed.	x

CARBON MONOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	1400.0		mg/m³ (REF)
Allowable MU	6.0		%
Measured concentration	996.32		mg/m³ (STP, dry)
Range Used	1000.0		ppm
Range Used [A]	1249.2		mg/m³
Cal gas conc.	1243.7		ppm
Conversion	1.25		ppm to mg/m³
MCERTS Range [B]	75.0		mg/m³
Lower of [A] or [B]	75.0		mg/m³
Cal gas conc.	1553.7		mg/m³

Performance characteristics	RUN 1		Units
Response time	33		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.20		% full scale
Repeatability at span level	0.21		% full scale
Deviation from linearity	1.12		% of value
Zero drift	-0.16		% full scale
Span drift	0.72		% full scale
Volume or pressure flow dependence	0.10		% of full scale
Atmospheric pressure dependence	0.22		% of value/kPa
Ambient temperature dependence	0.20		% full scale/10K
Combined interference	-0.48		% range
Dependence on voltage	0.15		% full scale/10V
Losses in the line (leak)	0.80		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.03		mg/m³
Lack of fit	0.48		mg/m³
Drift	2.71		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.05		mg/m³
Ambient temperature dependence	0.03		mg/m³
Combined interference (from MCERTS Certificate)	-0.21		mg/m³
Dependence on voltage	0.02		mg/m³
Losses in the line (leak)	4.63		mg/m³
Uncertainty of calibration gas blending	8.05		mg/m³
Uncertainty of calibration gas	11.50		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	996.32		mg/m³
Combined uncertainty			15.04		mg/m³
Expanded uncertainty	k =	1.96	29.48		mg/m³
Uncertainty corrected to std conds. (O_2)			33.98		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	2.96		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	2.11		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	6.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	3.84		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	3.44		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	6.5		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <6% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 6% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXYGEN: RESULTS SUMMARY

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 11 - CAT Engine

Sample Runs

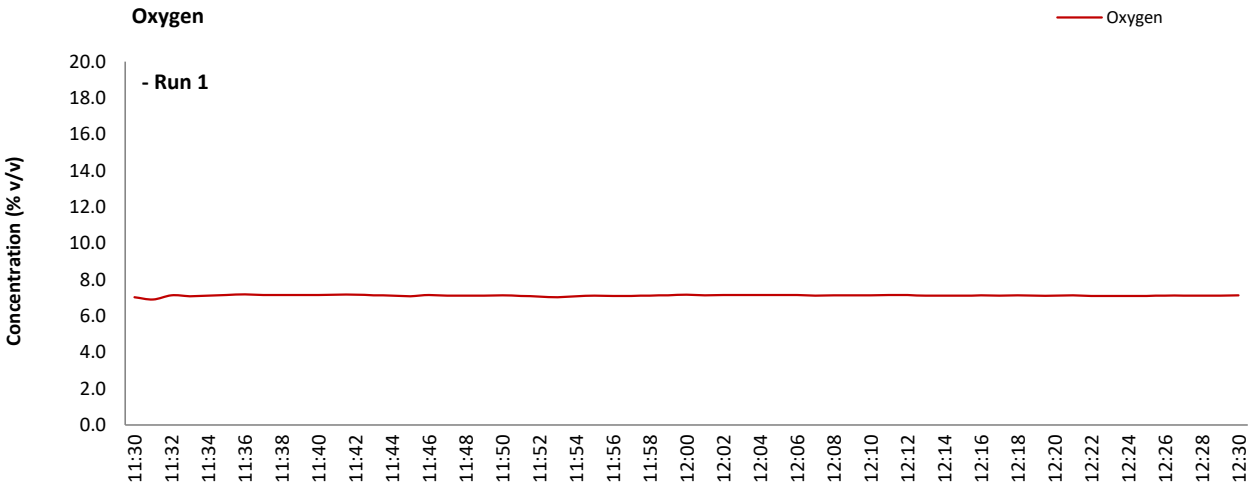
Parameter	Units	Run 1		Mean
Concentration	% v/v	7.1		7.1
Uncertainty	±% v/v	0.17		0.17

General Sampling Information

Parameter	Value	
Standard	EN 14789	
Technical Procedure	MD 022(b)	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Synthetic Air (5 Grade)	
Span Gas Reference Number	12.0654	
Span Gas Expiry Date	01/11/2025	
Span Gas Start Pressure (bar)	140	
Gas Cylinder Concentration (% v/v)	7.9	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A5	

OXYGEN: DATA TREND

Graphical Trend of Data



OXYGEN: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	11:30 - 12:30
Sampling Dates	-	30/10/2024
Instrument Range	% v/v	25.0
Span Gas Value	% v/v	7.9

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	% v/v	0.02
	Zero Down Sampling Line (Post)	% v/v	-0.02
	Zero Drift	% v/v	-0.04
	Zero Drift	%	0.50
	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	% v/v	7.95
	Span Down Sampling Line (Post)	% v/v	7.95
	Span Drift	% v/v	0.00
	Zero Adj. Span Drift	%	0.51
	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 13

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1
There are no deviations associated with the sampling employed.	x

OXYGEN: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	N/A		%vol
Allowable MU	6.0		%
Measured concentration	7.12		%vol
Range Used	25.0		%vol
Cal gas conc.	7.9		%vol

Performance characteristics	RUN 1		Units
Response time	40		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.01		% full scale
Repeatability at span level	0.01		% full scale
Deviation from linearity	0.06		% of value
Zero drift	-0.50		% full scale
Span drift	0.51		% full scale
Volume or pressure flow dependence	-0.01		% of full scale
Atmospheric pressure dependence	0.19		% of value/kPa
Ambient temperature dependence	0.09		% full scale/10K
Combined interference	0.00		% range
Dependence on voltage	0.01		% full scale/10V
Losses in the line (leak)	0.63		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		%vol
Standard deviation of repeatability at span level	0.00		%vol
Lack of fit	0.01		%vol
Drift	0.00		%vol
Volume or pressure flow dependence	0.00		%vol
Atmospheric pressure dependence	0.01		%vol
Ambient temperature dependence	0.01		%vol
Combined interference (from MCERTS Certificate)	0.00		%vol
Dependence on voltage	0.00		%vol
Losses in the line (leak)	0.03		%vol
Uncertainty of calibration gas	0.08		%vol

			RUN 1		Units
Measurement uncertainty		**Result**	7.12		%vol
Combined uncertainty			0.09		%vol
Expanded uncertainty	k =	1.96	0.17		%vol

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	2.44		% of Value
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be 0.3% vol absolute or 6% relative whichever is the lower, on a dry gas basis. Source, EN 14789.

VERSION HISTORY

Version Number	Record of changes made within this version of the document
V1	The original document issued to the client

Element, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL
Your Element Contact: Glenn McMorrow (07966 879 182)
E: glenn.mcmorrow@element.com

Stack Emissions Testing Report Commissioned by
Resource Management Group UK Ltd

Installation Name & Address
Resource Management Group UK Ltd
Withyhege Landfill Site
Rudbaxton
Haverfordwest
SA62 4DB

EPR Permit: GP3630HT/V003

Stack Reference
RML 12 - Perkins Engine

Dates of the Monitoring Campaign
30th October 2024

Job Reference Number
EMT10815

Report Written by
Darren Price Team Leader MCERTS Level 2 MM 03 176 TE1 TE2 TE3 TE4

Report Approved by
Tracy Dodds Key Account Manager MCERTS Level 2 MM 03 414 TE1 TE2 TE3 TE4

Report Date
13th November 2024

Version
Version 1

Signature of Report Approver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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

Opinions and interpretations expressed herein are outside the scope of Element's ISO 17025 accreditation.

Executive Summary

MONITORING OBJECTIVES

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 12 - Perkins Engine
30th October 2024

Overall Aim of the Monitoring Campaign

Element were commissioned by Resource Management Group UK Ltd to carry out stack emissions testing on the RML 12 - Perkins Engine at Withyhege Landfill Site.

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values (ELVs) as specified in the Site's Permit.

Special Requirements

There were no special requirements.

Target Parameters

Total VOCs (as Carbon), Oxides of Nitrogen (as NO_2), Carbon Monoxide

Executive Summary

MONITORING RESULTS

Resource Management Group UK Ltd, Withyhege Landfill Site

RML 12 - Perkins Engine

30th October 2024

where MU = Measurement Uncertainty associated with the Result

		Concentration			
Parameter	**Units**	**Result**		**MU +/-**	**Limit**
Total VOCs (as Carbon) [1]	mg/m³	1532		57.0	1000
Oxides of Nitrogen (as NO_2) [1]	mg/m³	690		30.4	500
Carbon Monoxide [1]	mg/m³	860		33.0	1400
Oxygen	% v/v	**Dry**	6.6	0.16	
Water Vapour	% v/v	10.5		0.46	

[1] Reference Conditions (REF) are: 273K, 101.3kPa, dry gas, 5% oxygen.

MONITORING DATE(S) & TIMES

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 12 - Perkins Engine
30th October 2024

Parameter		Units	Concentration		Sampling Date(s)	Sampling Times	Duration mins
Total VOCs (as Carbon)	R1	mg/m³	1532		30/10/2024	13:20 - 14:20	60
Oxides of Nitrogen (as NO_2)	R1	mg/m³	690		30/10/2024	13:20 - 14:20	60
Carbon Monoxide	R1	mg/m³	860		30/10/2024	13:20 - 14:20	60
Oxygen	R1	% v/v	6.6		30/10/2024	13:20 - 14:20	60

All results are expressed at the respective reference conditions.

PROCESS DETAILS

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 12 - Perkins Engine
30th October 2024

Standard Operating Conditions

Parameter	Value
Process Status	Opertating
Capacity (of 100%) and Tonnes / Hour	95% (MCR 400KWe)
Continuous or Batch Process	Continuous
Feedstock (if applicable)	N/A
Abatement System	None
Abatement System Running Status	N/A
Fuel	Landfill Gas
Plume Appearance	No visible plume

Executive Summary

MONITORING & ANALYTICAL METHODS

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 12 - Perkins Engine
30th October 2024

	Monitoring				Analysis					
Parameter	**Standard**	**Technical Procedure**	**Sampling Status**	**Testing Lab**	**Analytical Procedure**	**Analytical Technique**	**Analysis Status**	**Analysis Lab**	**Overall Status**	**LOD (Average)**
Water Vapour	EN 14790	MD 005	MCERTS	EET	MD 005	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	MD 020	MCERTS	EET	Flame Ionisation Detection by Signal 3010HM				MCERTS	0.32 mg/m³
Oxides of Nitrogen (as NO_2)	EN 14792	MD 032	MCERTS	EET	Chemiluminescence by ECO PHYSICS CLD822 Mh				MCERTS	0.41 mg/m³
Carbon Monoxide	EN 15058	MD 021	MCERTS	EET	NDIR by Horiba PG-350E				MCERTS	0.77 mg/m³
Oxygen	EN 14789	MD 022(b)	MCERTS	EET	Wet Zirconia Cell installed in the ProtIR 204M				MCERTS	0.1 %

ANALYSIS LABORATORIES

(with short name reference as appears in the table above)

Element (Stockport Lab - EET)	ISO 17025 Accreditation Number: UKAS 4279

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
All	All	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.30
Width	m	-
Area	m^2	0.07
Port Depth	cm	10
Orientation of Duct	-	Angled
Number of Ports	-	1
Sample Port Size	-	1/2" BSP

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	Permanent
Inside / Outside	Outside

Platform Details

EA Technical Guidance Note M1 / EN 15259 Platform Requirements	Value
Sufficient working area to manipulate probe and operate the measuring instruments	Yes
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	N/A
Platform has vertical base boards (approx. 0.25m high)	N/A
Platform has chains / self closing gates at top of ladders	N/A
There are no obstructions present which hamper insertion of sampling equipment	N/A
Safe Access Available	Yes
Easy Access Available	Yes

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and EN 15259, and therefore there are no improvement recommendations.

EN 15259 Homogeneity Test Requirements

There is no requirement to perform a EN 15259 Homogeneity Test on this Stack.

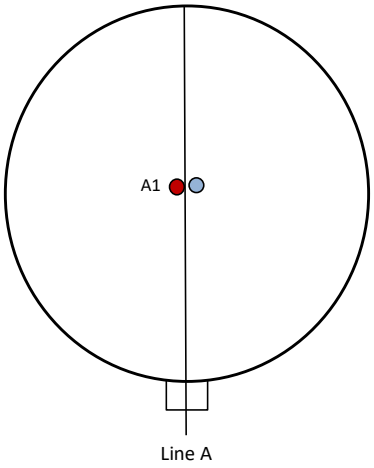
Executive Summary

PLANT PHOTOS

Photo 1

Photo 2

SAMPLE POINTS



where
- ○ = isokinetic point sampled at
- ● = isokinetic point not sampled at
- ● = combustion gases sample point
- ● = non-isokinetic sample point

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel, List of Equipment & Methods and Technical Procedures Used

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Darren Price	MCERTS Level 2	MM 03 176	TE1 TE2 TE3 TE4

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	**Equipment I.D.**
Control Box DGM (1)	-
Control Box DGM (2)	-
Box Thermocouples (1)	-
Box Thermocouples (2)	-
Umbilical (1)	-
Umbilical (2)	-
Oven Box (1)	-
Oven Box (2)	-
Heated Probe (1)	-
Heated Probe (2)	-
Heated Probe (3)	-
S-Pitot (1)	-
S-Pitot (2)	-
L-Pitot	CAT CAT 21P.T13
Site Balance	CAT 17.82
500g / 1Kg Check Weights	CAT 17.82
Last Impinger Arm	-
Callipers	-
Tubes Kit Thermocouple	-

Instrumental Analysers	
Equipment Type	**Equipment I.D.**
Horiba PG-350EU	CAT 39.39
Horiba PG-250	-
Servomex 4900	-
Eco Physics CLD 822Mh	-
ABB AO2020-URAS26	-
Testo 350 XL	-
M&C PSS5	CAT 4.00163
Gasmet DX4000	-
Gasmet Sampling System	-
Signal 3010HM	CAT 8.48
M&C PSS	CAT 12.168
Mass Flow Controller (1)	-
Mass Flow Controller (2)	-
Mass View (1)	CAT 25.106
Mass View (2)	CAT 25.107
Squirrel 2020	CAT DL#04
Easylogger EN-EL-12 Bit	-
Bioaerosols Temperature Logger	-
Electronic Refrigerator	-

Miscellaneous Items	
Equipment Type	**Equipment I.D.**
Digital Manometer (1)	-
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.295
Stopwatch	-
Barometer	CAT 13.103
Stack Thermocouple (1)	CAT 4.9909
Stack Thermocouple (2)	-
Stack Thermocouple (3)	-
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	-
15m Heated Line (1)	-
20m Heated Line (1)	CAT 20.241
20m Heated Line (2)	-
Dual Channel Heater Controller	-
Single Channel Heater Controller	CAT 20.241
Laboratory Balance	
Tape Measure	CAT 16.110

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Water Vapour	EN 14790	MD 005
Total VOCs (as Carbon)	EN 12619:2013	MD 020
Oxides of Nitrogen (as NO_2)	EN 14792	MD 032
Carbon Monoxide	EN 15058	MD 021
Oxygen	EN 14789	MD 022(b)

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 12 - Perkins Engine

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	1532		1532
Uncertainty	±mg/m³	57.0		57.0

General Sampling Information

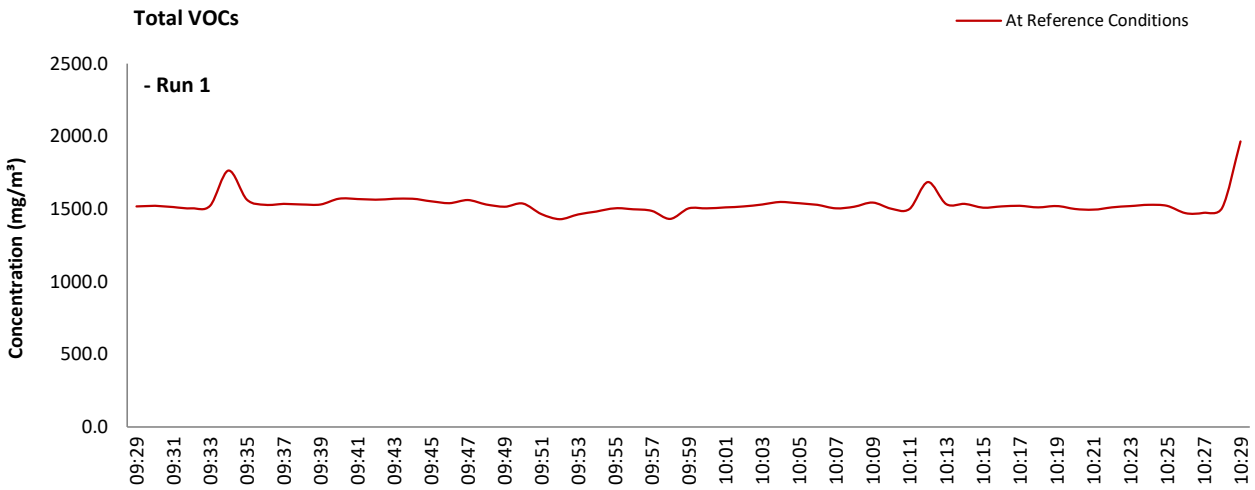
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	MD 020	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	12.0654	
Span Gas Expiry Date	01/11/2025	
Span Gas Start Pressure (bar)	140	
Gas Cylinder Concentration (ppm)	594.7	
Span Gas Set Point (ppm)	594.70	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Synthetic Air (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



TOTAL VOCs (as CARBON): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	13:20 - 14:20
Sampling Dates	-	30/10/2024
Instrument Range	ppm	1000
Span Gas Value	ppm	594.7

Quality Assurance

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.00
	Zero Down Sampling Line (Post)	ppm	-10.00
	Zero Drift	ppm	-10.00
	Zero Drift	%	-1.69
	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± ppm	29.74
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	590.00
	Span Down Sampling Line (Post)	ppm	572.00
	Span Drift	ppm	-18.00
	Span Drift	%	-3.05
	Drift Correction Applied	2-5%	Yes
	Allowable Span Drift	± ppm	29.74
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 13

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1	
There are no deviations associated with the sampling employed.	x	

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	1000.0		mg/m³ (REF)
Allowable MU	15.0		%
Measured concentration	1374.21		mg/m³ (STP, dry)
Range Used	1000.0		ppm
Range Used [A]	1606.1		mg/m³
Cal gas conc.	594.7		ppm
Conversion	1.61		ppm to mg/m³
MCERTS Range [B]	15.0		mg/m³
Lower of [A] or [B]	15.0		mg/m³
Cal gas conc.	955.2		mg/m³

Performance characteristics	RUN 1		Units
Response time	15		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.15		% full scale
Repeatability at span level	0.80		% full scale
Deviation from linearity	0.07		% of value
Zero drift	-1.69		% full scale
Span drift	0.00		% full scale
Volume or pressure flow dependence	2.00		% of full scale
Atmospheric pressure dependence	0.80		% of value/kPa
Ambient temperature dependence	1.00		% full scale/10K
Combined interference	1.20		% range
Dependence on voltage	0.10		% full scale/10V
Losses in the line (leak)	0.84		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.10		mg/m³
Lack of fit	0.01		mg/m³
Drift	-9.35		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.03		mg/m³
Ambient temperature dependence	0.14		mg/m³
Combined interference (from MCERTS Certificate)	0.10		mg/m³
Dependence on voltage	0.01		mg/m³
Losses in the line (leak)	6.67		mg/m³
Uncertainty of calibration gas	15.87		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	1374.21		mg/m³
Combined uncertainty			19.59		mg/m³
Expanded uncertainty	k =	1.96	38.39		mg/m³
Uncertainty corrected to std conds. (O_2)			42.80		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	2.79		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	3.84		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	15.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	3.72		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	4.93		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	15.2		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <15% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 15% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXIDES OF NITROGEN (as NO_2): RESULTS SUMMARY

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 12 - Perkins Engine

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	690		690
Uncertainty	±mg/m³	30.4		30.4

General Sampling Information

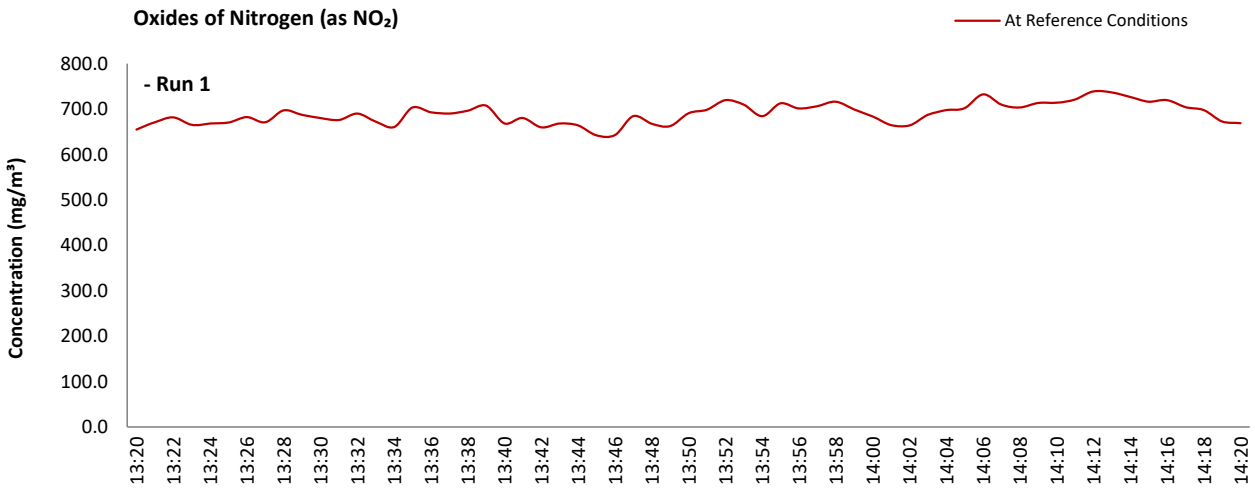
Parameter	Value	
Standard	EN 14792	
Technical Procedure	MD 032	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Date & Result of Last Converter Check	01/03/2024 - 96.7%	
Span Gas Type	Nitrogen Monoxide	
Span Gas Reference Number	12.0606	
Span Gas Expiry Date	13/12/2025	
Span Gas Start Pressure (bar)	100	
Gas Cylinder Concentration (ppm)	261.6	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A5	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

OXIDES OF NITROGEN (as NO_2): DATA TREND

Graphical Trend of Data



OXIDES OF NITROGEN (as NO_2): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	13:20 - 14:20
Sampling Dates	-	30/10/2024
Instrument Range	ppm	500
Span Gas Value	ppm	261.6

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.50
CAL 1	Zero Down Sampling Line (Post)	ppm	2.40
CAL 1	Zero Drift	ppm	1.90
CAL 1	Zero Drift	%	0.72
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	262.10
CAL 1	Span Down Sampling Line (Post)	ppm	267.90
CAL 1	Span Drift	ppm	5.80
CAL 1	Zero Adj. Span Drift	%	1.49
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 13

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1
There are no deviations associated with the sampling employed.	x

OXIDES OF NITROGEN (as NO_2): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	500.0		mg/m³ (REF)
Allowable MU	10.0		%
Measured concentration	618.77		mg/m³ (STP, dry)
Ratio NO / NO_2	5		%
Range Used	500.0		ppm
Range Used [A]	1026.1		mg/m³
Cal gas conc.	261.6		ppm
Conversion	2.05		ppm to mg/m³
MCERTS Range [B]	102.5		mg/m³
Lower of [A] or [B]	102.5		mg/m³
Cal gas conc.	536.9		mg/m³

Performance characteristics	RUN 1		Units
Response time	33		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.10		% full scale
Repeatability at span level	0.15		% full scale
Deviation from linearity	0.09		% of value
Zero drift	0.72		% full scale
Span drift	1.49		% full scale
Volume or pressure flow dependence	-0.30		% of full scale
Atmospheric pressure dependence	0.10		% of value/kPa
Ambient temperature dependence	0.06		% full scale/10K
Combined interference	0.73		% range
Dependence on voltage	0.26		% full scale/10V
Converter efficiency	96.7		%
Losses in the line (leak)	0.00		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.02		mg/m³
Lack of fit	0.05		mg/m³
Drift	7.57		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.03		mg/m³
Ambient temperature dependence	0.01		mg/m³
Combined interference (from MCERTS Certificate)	0.43		mg/m³
Dependence on voltage	0.03		mg/m³
Converter efficiency	0.59		mg/m³
Losses in the line (leak)	0.00		mg/m³
Uncertainty of calibration gas blending	5.00		mg/m³
Uncertainty of calibration gas	7.14		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	618.77		mg/m³
Combined uncertainty			11.57		mg/m³
Expanded uncertainty	k =	1.96	22.68		mg/m³
Uncertainty corrected to std conds. (O_2)			25.29		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	3.67		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	4.54		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	10.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	4.41		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	5.62		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	10.3		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <10% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 10% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

CARBON MONOXIDE: RESULTS SUMMARY

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 12 - Perkins Engine

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	860		860
Uncertainty	±mg/m³	33.0		33.0

General Sampling Information

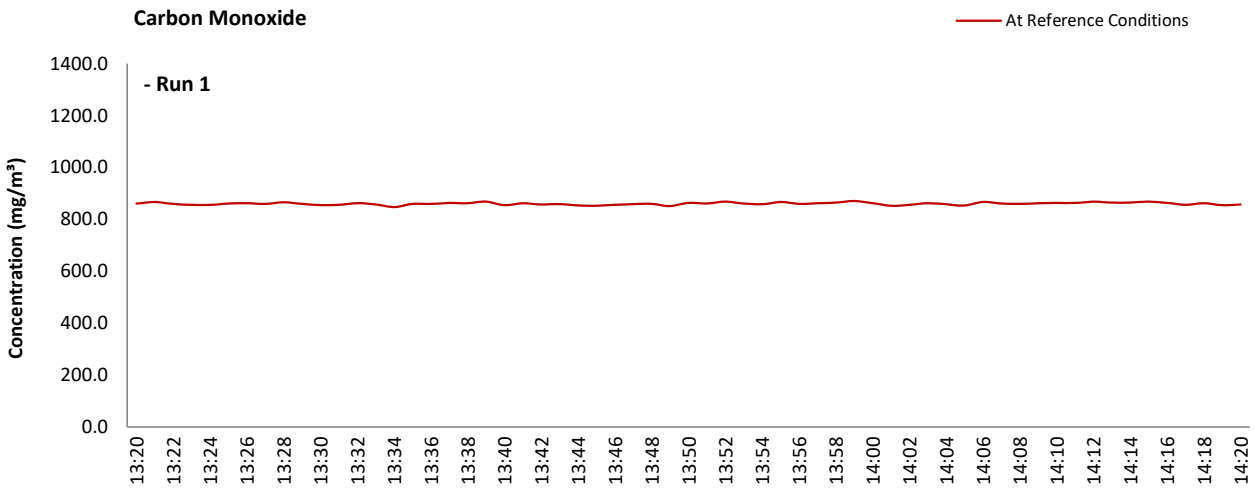
Parameter	Value	
Standard	EN 15058	
Technical Procedure	MD 021	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Carbon Monoxide	
Span Gas Reference Number	12.0606	
Span Gas Expiry Date	12/12/2025	
Span Gas Start Pressure (bar)	100	
Gas Cylinder Concentration (ppm)	1243.7	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A5	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

CARBON MONOXIDE: DATA TREND

Graphical Trend of Data



CARBON MONOXIDE: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	13:20 - 14:20
Sampling Dates	-	30/10/2024
Instrument Range	ppm	1000
Span Gas Value	ppm	1243.7

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	2.00
CAL 1	Zero Down Sampling Line (Post)	ppm	0.00
CAL 1	Zero Drift	ppm	-2.00
CAL 1	Zero Drift	%	0.16
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	1234.00
CAL 1	Span Down Sampling Line (Post)	ppm	1241.00
CAL 1	Span Drift	ppm	7.00
CAL 1	Zero Adj. Span Drift	%	0.72
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 13

Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run)	1
There are no deviations associated with the sampling employed.	x

CARBON MONOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	1400.0		mg/m³ (REF)
Allowable MU	6.0		%
Measured concentration	771.62		mg/m³ (STP, dry)
Range Used	1000.0		ppm
Range Used [A]	1249.2		mg/m³
Cal gas conc.	1243.7		ppm
Conversion	1.25		ppm to mg/m³
MCERTS Range [B]	75.0		mg/m³
Lower of [A] or [B]	75.0		mg/m³
Cal gas conc.	1553.7		mg/m³

Performance characteristics	RUN 1		Units
Response time	33		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.20		% full scale
Repeatability at span level	0.21		% full scale
Deviation from linearity	1.12		% of value
Zero drift	-0.16		% full scale
Span drift	0.72		% full scale
Volume or pressure flow dependence	0.10		% of full scale
Atmospheric pressure dependence	0.22		% of value/kPa
Ambient temperature dependence	0.20		% full scale/10K
Combined interference	-0.48		% range
Dependence on voltage	0.15		% full scale/10V
Losses in the line (leak)	0.80		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.03		mg/m³
Lack of fit	0.48		mg/m³
Drift	1.77		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.05		mg/m³
Ambient temperature dependence	0.03		mg/m³
Combined interference (from MCERTS Certificate)	-0.21		mg/m³
Dependence on voltage	0.02		mg/m³
Losses in the line (leak)	3.58		mg/m³
Uncertainty of calibration gas blending	6.24		mg/m³
Uncertainty of calibration gas	8.91		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	771.62		mg/m³
Combined uncertainty			11.60		mg/m³
Expanded uncertainty	k =	1.96	22.73		mg/m³
Uncertainty corrected to std conds. (O_2)			25.34		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	2.95		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	1.62		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	6.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	3.83		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	3.05		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	6.5		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <6% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 6% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXYGEN: RESULTS SUMMARY

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 12 - Perkins Engine

Sample Runs

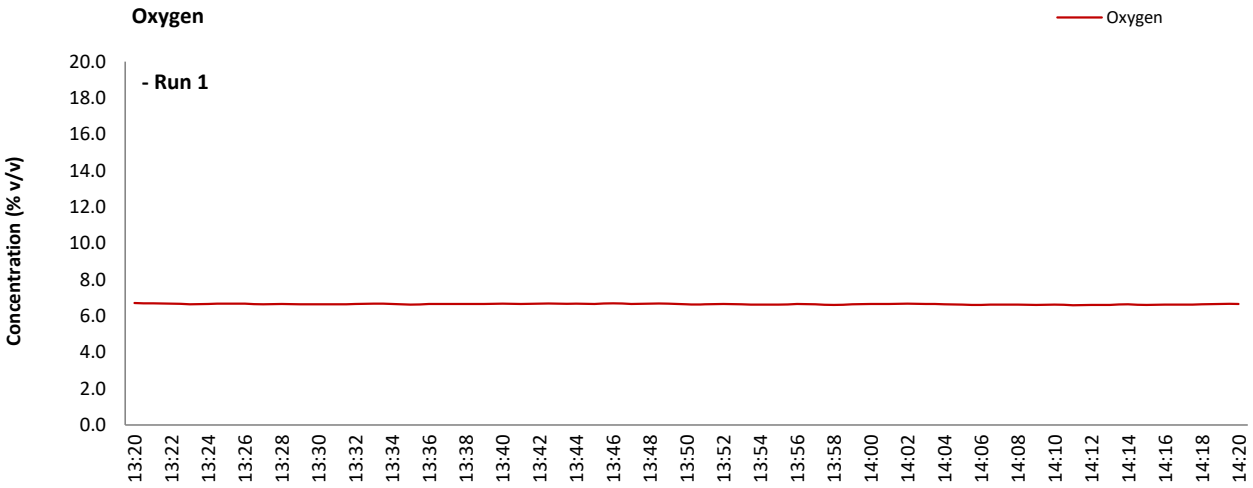
Parameter	Units	Run 1		Mean
Concentration	% v/v	6.6		6.6
Uncertainty	±% v/v	0.16		0.16

General Sampling Information

Parameter	Value	
Standard	EN 14789	
Technical Procedure	MD 022(b)	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Synthetic Air (5 Grade)	
Span Gas Reference Number	12.0654	
Span Gas Expiry Date	01/11/2025	
Span Gas Start Pressure (bar)	140	
Gas Cylinder Concentration (% v/v)	7.9	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A5	

OXYGEN: DATA TREND

Graphical Trend of Data



OXYGEN: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	13:20 - 14:20
Sampling Dates	-	30/10/2024
Instrument Range	% v/v	25.0
Span Gas Value	% v/v	7.9

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	% v/v	0.02
	Zero Down Sampling Line (Post)	% v/v	-0.02
	Zero Drift	% v/v	-0.04
	Zero Drift	%	0.50
	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	% v/v	7.95
	Span Down Sampling Line (Post)	% v/v	7.95
	Span Drift	% v/v	0.00
	Zero Adj. Span Drift	%	0.51
	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 13

Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run)	1
There are no deviations associated with the sampling employed.	x

OXYGEN: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	N/A		%vol
Allowable MU	6.0		%
Measured concentration	6.65		%vol
Range Used	25.0		%vol
Cal gas conc.	7.9		%vol

Performance characteristics	RUN 1		Units
Response time	40		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.01		% full scale
Repeatability at span level	0.01		% full scale
Deviation from linearity	0.06		% of value
Zero drift	-0.50		% full scale
Span drift	0.51		% full scale
Volume or pressure flow dependence	-0.01		% of full scale
Atmospheric pressure dependence	0.19		% of value/kPa
Ambient temperature dependence	0.09		% full scale/10K
Combined interference	0.00		% range
Dependence on voltage	0.01		% full scale/10V
Losses in the line (leak)	0.63		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		%vol
Standard deviation of repeatability at span level	0.00		%vol
Lack of fit	0.01		%vol
Drift	0.00		%vol
Volume or pressure flow dependence	0.00		%vol
Atmospheric pressure dependence	0.01		%vol
Ambient temperature dependence	0.01		%vol
Combined interference (from MCERTS Certificate)	0.00		%vol
Dependence on voltage	0.00		%vol
Losses in the line (leak)	0.02		%vol
Uncertainty of calibration gas	0.08		%vol

			RUN 1		Units
Measurement uncertainty		**Result**	6.65		%vol
Combined uncertainty			0.08		%vol
Expanded uncertainty	k =	1.96	0.16		%vol

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	2.45		% of Value
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be 0.3% vol absolute or 6% relative whichever is the lower, on a dry gas basis. Source, EN 14789.

VERSION HISTORY

Version Number	Record of changes made within this version of the document
V1	The original document issued to the client

Element, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL
Your Element Contact: Glenn McMorrow (07966 879 182)
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Stack Emissions Testing Report Commissioned by
Resource Management Group UK Ltd

Installation Name & Address
Resource Management Group UK Ltd
Withyhege Landfill Site
Rudbaxton
Haverfordwest
SA62 4DB

EPR Permit: GP3630HT/V003

Stack Reference
RML 34 - New CAT Engine

Dates of the Monitoring Campaign
30th October 2024

Job Reference Number
EMT10815

Report Written by
Darren Price Team Leader MCERTS Level 2 MM 03 176 TE1 TE2 TE3 TE4

Report Approved by
Tracy Dodds Key Account Manager MCERTS Level 2 MM 03 414 TE1 TE2 TE3 TE4

Report Date
13th November 2024

Version
Version 1

Signature of Report Approver


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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

Opinions and interpretations expressed herein are outside the scope of Element's ISO 17025 accreditation.

MONITORING OBJECTIVES

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 34 - New CAT Engine
30th October 2024

Overall Aim of the Monitoring Campaign

Element were commissioned by Resource Management Group UK Ltd to carry out stack emissions testing on the RML 34 - New CAT Engine at Withyhege Landfill Site.

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values (ELVs) as specified in the Site's Permit.

Special Requirements

There were no special requirements.

Target Parameters

Total VOCs (as Carbon), Oxides of Nitrogen (as NO_2), Carbon Monoxide

Executive Summary

MONITORING RESULTS

Resource Management Group UK Ltd, Withyhege Landfill Site

RML 34 - New CAT Engine

30th October 2024

where MU = Measurement Uncertainty associated with the Result

		Concentration			
Parameter	**Units**	**Result**		**MU +/-**	**Limit**
Total VOCs (as Carbon) [1]	mg/m³	972		40.0	1000
Oxides of Nitrogen (as NO_2) [1]	mg/m³	541		24.6	500
Carbon Monoxide [1]	mg/m³	809		30.9	1400
Oxygen	% v/v	**Dry**	7.4	0.18	
Water Vapour	% v/v	13.3		0.57	

[1] Reference Conditions (REF) are: 273K, 101.3kPa, dry gas, 5% oxygen.

Executive Summary

MONITORING DATE(S) & TIMES

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 34 - New CAT Engine
30th October 2024

Parameter		Units	Concentration		Sampling Date(s)	Sampling Times	Duration mins
Total VOCs (as Carbon)	R1	mg/m³	972		30/10/2024	09:45 - 10:45	60
Oxides of Nitrogen (as NO_2)	R1	mg/m³	541		30/10/2024	09:45 - 10:45	60
Carbon Monoxide	R1	mg/m³	809		30/10/2024	09:45 - 10:45	60
Oxygen	R1	% v/v	7.4		30/10/2024	09:45 - 10:45	60

All results are expressed at the respective reference conditions.

PROCESS DETAILS

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 34 - New CAT Engine
30th October 2024

Standard Operating Conditions

Parameter	Value
Process Status	Opertating
Capacity (of 100%) and Tonnes / Hour	100% (MCR 1140KWe)
Continuous or Batch Process	Continuous
Feedstock (if applicable)	N/A
Abatement System	None
Abatement System Running Status	N/A
Fuel	Landfill Gas
Plume Appearance	No visible plume

Executive Summary

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MONITORING & ANALYTICAL METHODS

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 34 - New CAT Engine
30th October 2024

	Monitoring				Analysis					
Parameter	**Standard**	**Technical Procedure**	**Sampling Status**	**Testing Lab**	**Analytical Procedure**	**Analytical Technique**	**Analysis Status**	**Analysis Lab**	**Overall Status**	**LOD (Average)**
Water Vapour	EN 14790	MD 005	MCERTS	EET	MD 005	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	MD 020	MCERTS	EET	Flame Ionisation Detection by Signal 3010HM				MCERTS	0.32 mg/m³
Oxides of Nitrogen (as NO_2)	EN 14792	MD 032	MCERTS	EET	Chemiluminescence by ECO PHYSICS CLD822 Mh				MCERTS	0.41 mg/m³
Carbon Monoxide	EN 15058	MD 021	MCERTS	EET	NDIR by Horiba PG-350E				MCERTS	0.77 mg/m³
Oxygen	EN 14789	MD 022(b)	MCERTS	EET	Wet Zirconia Cell installed in the ProtIR 204M				MCERTS	0.1 %

ANALYSIS LABORATORIES

(with short name reference as appears in the table above)

Element (Stockport Lab - EET)	ISO 17025 Accreditation Number: UKAS 4279

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
All	All	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.30
Width	m	-
Area	m^2	0.07
Port Depth	cm	20
Orientation of Duct	-	Vertical
Number of Ports	-	1
Sample Port Size	-	1" BSP

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	Permanent
Inside / Outside	Outside

Platform Details

EA Technical Guidance Note M1 / EN 15259 Platform Requirements	Value
Sufficient working area to manipulate probe and operate the measuring instruments	Yes
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	N/A
Platform has vertical base boards (approx. 0.25m high)	N/A
Platform has chains / self closing gates at top of ladders	N/A
There are no obstructions present which hamper insertion of sampling equipment	N/A
Safe Access Available	Yes
Easy Access Available	Yes

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and EN 15259, and therefore there are no improvement recommendations.

EN 15259 Homogeneity Test Requirements

There is no requirement to perform a EN 15259 Homogeneity Test on this Stack.

Executive Summary

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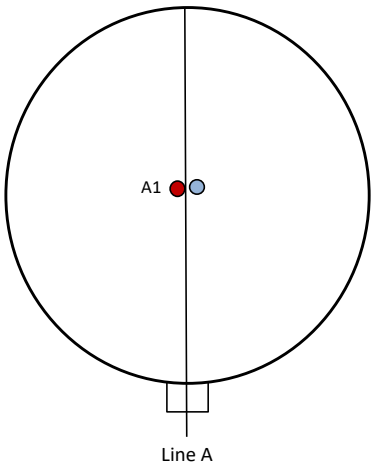
PLANT PHOTOS

Photo 1

Photo 2

SAMPLE POINTS



where
- ○ = isokinetic point sampled at
- ● = isokinetic point not sampled at
- ● = combustion gases sample point
- ● = non-isokinetic sample point

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel, List of Equipment & Methods and Technical Procedures Used

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Darren Price	MCERTS Level 2	MM 03 176	TE1 TE2 TE3 TE4

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	**Equipment I.D.**
Control Box DGM (1)	-
Control Box DGM (2)	-
Box Thermocouples (1)	-
Box Thermocouples (2)	-
Umbilical (1)	-
Umbilical (2)	-
Oven Box (1)	-
Oven Box (2)	-
Heated Probe (1)	-
Heated Probe (2)	-
Heated Probe (3)	-
S-Pitot (1)	-
S-Pitot (2)	-
L-Pitot	CAT CAT 21P.T13
Site Balance	CAT 17.82
500g / 1Kg Check Weights	CAT 17.82
Last Impinger Arm	-
Callipers	-
Tubes Kit Thermocouple	-

Instrumental Analysers	
Equipment Type	**Equipment I.D.**
Horiba PG-350EU	CAT 39.39
Horiba PG-250	-
Servomex 4900	-
Eco Physics CLD 822Mh	-
ABB AO2020-URAS26	-
Testo 350 XL	-
M&C PSS5	CAT 4.00163
Gasmet DX4000	-
Gasmet Sampling System	-
Signal 3010HM	CAT 8.48
M&C PSS	CAT 12.168
Mass Flow Controller (1)	-
Mass Flow Controller (2)	-
Mass View (1)	CAT 25.106
Mass View (2)	CAT 25.107
Squirrel 2020	CAT DL#04
Easylogger EN-EL-12 Bit	-
Bioaerosols Temperature Logger	-
Electronic Refrigerator	-

Miscellaneous Items	
Equipment Type	**Equipment I.D.**
Digital Manometer (1)	-
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.295
Stopwatch	-
Barometer	CAT 13.103
Stack Thermocouple (1)	CAT 4.9909
Stack Thermocouple (2)	-
Stack Thermocouple (3)	-
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	-
15m Heated Line (1)	-
20m Heated Line (1)	CAT 20.241
20m Heated Line (2)	-
Dual Channel Heater Controller	-
Single Channel Heater Controller	CAT 20.241
Laboratory Balance	
Tape Measure	CAT 16.110

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Water Vapour	EN 14790	MD 005
Total VOCs (as Carbon)	EN 12619:2013	MD 020
Oxides of Nitrogen (as NO_2)	EN 14792	MD 032
Carbon Monoxide	EN 15058	MD 021
Oxygen	EN 14789	MD 022(b)

SULPHUR DIOXIDE: RESULTS SUMMARY

Resource Management Group UK Ltd, Withyhege Landfill Site

RML 34 - New CAT Engine

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	2.0		2.0
Uncertainty	±mg/m³	0.12		0.12

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	13.3		13.3
Uncertainty	±% v/v	0.57		0.57

#REF!

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	< 0.05		< 0.05

General Sampling Information

Parameter	Value	
Standard	EN 14791	
Technical Procedure	MD 009	
Name of Analytical Laboratory	EET	
Analytical Laboratory's Procedure	CATR-AP-01	
ISO 17025 Accredited Analysis?	MCERTS	
Date of Sample Analysis	07/11/2024	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Impinger Material	Polyethylene	
Absorption Solution	0.3% Hydrogen Peroxide	
Positioning of Filter	Out Stack Heated Head	
Filter Size and Material	0.1µm Glass Fibre	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 34 - New CAT Engine

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	972		972
Uncertainty	±mg/m³	40.0		40.0

General Sampling Information

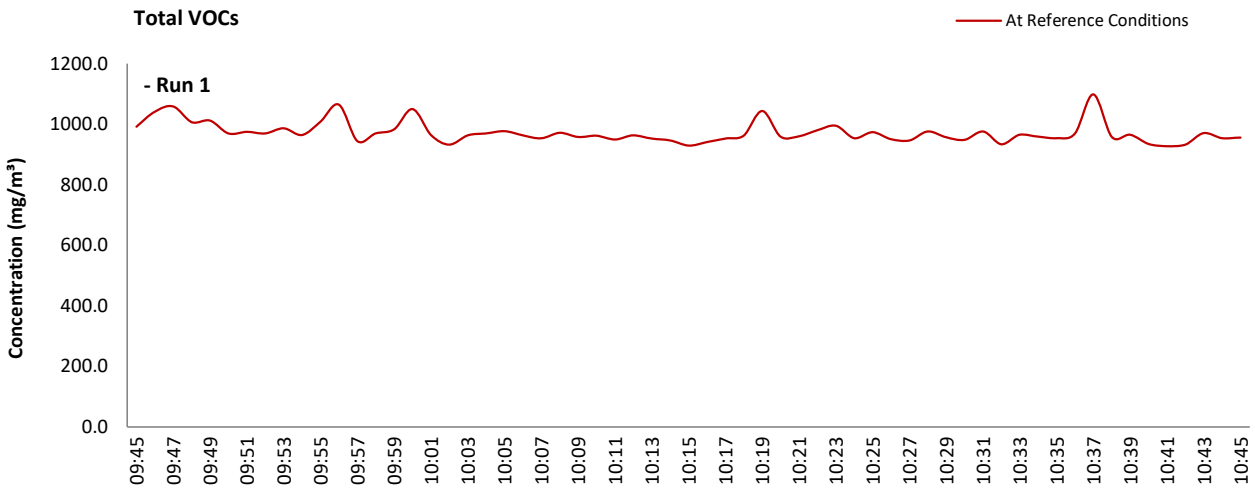
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	MD 020	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	12.0654	
Span Gas Expiry Date	01/11/2025	
Span Gas Start Pressure (bar)	140	
Gas Cylinder Concentration (ppm)	594.7	
Span Gas Set Point (ppm)	594.70	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Synthetic Air (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



TOTAL VOCs (as CARBON): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	09:45 - 10:45
Sampling Dates	-	30/10/2024
Instrument Range	ppm	1000
Span Gas Value	ppm	594.7

Quality Assurance

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.00
CAL 1	Zero Down Sampling Line (Post)	ppm	-10.00
CAL 1	Zero Drift	ppm	-10.00
CAL 1	Zero Drift	%	-1.69
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± ppm	29.74
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	590.00
CAL 1	Span Down Sampling Line (Post)	ppm	572.00
CAL 1	Span Drift	ppm	-18.00
CAL 1	Span Drift	%	-3.05
CAL 1	Drift Correction Applied	2-5%	Yes
	Allowable Span Drift	± ppm	29.74
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 13

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1	
There are no deviations associated with the sampling employed.	x	

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	1000.0		mg/m³ (REF)
Allowable MU	15.0		%
Measured concentration	824.57		mg/m³ (STP, dry)
Range Used	1000.0		ppm
Range Used [A]	1606.1		mg/m³
Cal gas conc.	594.7		ppm
Conversion	1.61		ppm to mg/m³
MCERTS Range [B]	15.0		mg/m³
Lower of [A] or [B]	15.0		mg/m³
Cal gas conc.	955.2		mg/m³

Performance characteristics	RUN 1		Units
Response time	15		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.15		% full scale
Repeatability at span level	0.80		% full scale
Deviation from linearity	0.07		% of value
Zero drift	-1.69		% full scale
Span drift	0.00		% full scale
Volume or pressure flow dependence	2.00		% of full scale
Atmospheric pressure dependence	0.80		% of value/kPa
Ambient temperature dependence	1.00		% full scale/10K
Combined interference	1.20		% range
Dependence on voltage	0.10		% full scale/10V
Losses in the line (leak)	0.84		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.10		mg/m³
Lack of fit	0.01		mg/m³
Drift	-9.35		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.03		mg/m³
Ambient temperature dependence	0.14		mg/m³
Combined interference (from MCERTS Certificate)	0.10		mg/m³
Dependence on voltage	0.01		mg/m³
Losses in the line (leak)	4.00		mg/m³
Uncertainty of calibration gas	9.52		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	824.57		mg/m³
Combined uncertainty			13.93		mg/m³
Expanded uncertainty	k =	1.96	27.31		mg/m³
Uncertainty corrected to std conds. (O_2)			32.19		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	3.31		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	2.73		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	15.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	4.11		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	4.04		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	15.2		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <15% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 15% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXIDES OF NITROGEN (as NO_2): RESULTS SUMMARY

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 34 - New CAT Engine

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	541		541
Uncertainty	±mg/m³	24.6		24.6

General Sampling Information

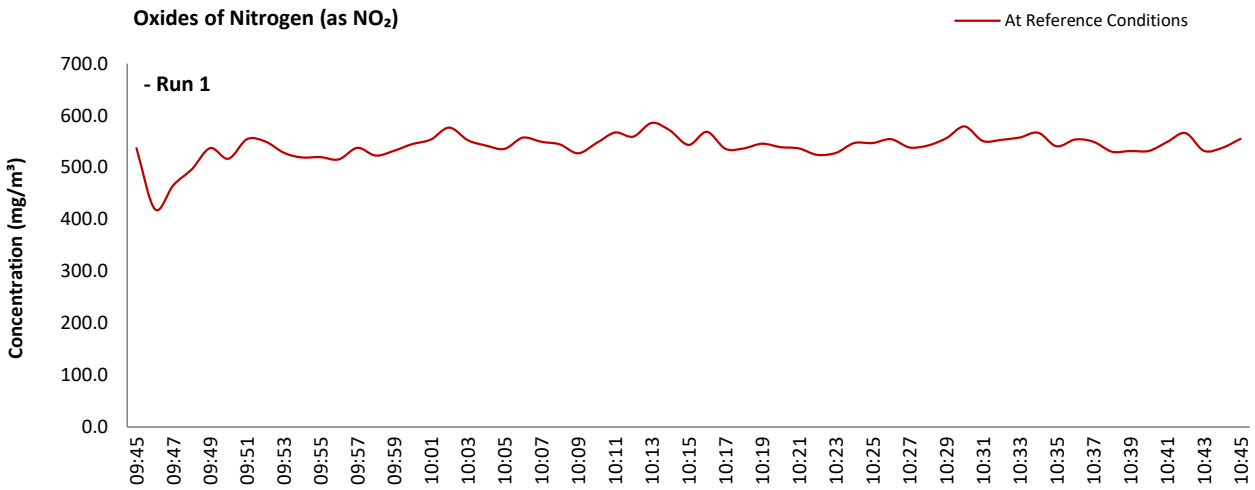
Parameter	Value	
Standard	EN 14792	
Technical Procedure	MD 032	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Date & Result of Last Converter Check	01/03/2024 - 96.7%	
Span Gas Type	Nitrogen Monoxide	
Span Gas Reference Number	12.0606	
Span Gas Expiry Date	13/12/2025	
Span Gas Start Pressure (bar)	100	
Gas Cylinder Concentration (ppm)	261.6	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A5	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

OXIDES OF NITROGEN (as NO_2): DATA TREND

Graphical Trend of Data



OXIDES OF NITROGEN (as NO_2): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	09:45 - 10:45
Sampling Dates	-	30/10/2024
Instrument Range	ppm	500
Span Gas Value	ppm	261.6

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.50
CAL 1	Zero Down Sampling Line (Post)	ppm	2.40
CAL 1	Zero Drift	ppm	1.90
CAL 1	Zero Drift	%	0.72
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	262.10
CAL 1	Span Down Sampling Line (Post)	ppm	267.90
CAL 1	Span Drift	ppm	5.80
CAL 1	Zero Adj. Span Drift	%	1.49
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 13

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1
There are no deviations associated with the sampling employed.	x

OXIDES OF NITROGEN (as NO_2): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	500.0		mg/m³ (REF)
Allowable MU	10.0		%
Measured concentration	458.84		mg/m³ (STP, dry)
Ratio NO / NO_2	5		%
Range Used	500.0		ppm
Range Used [A]	1026.1		mg/m³
Cal gas conc.	261.6		ppm
Conversion	2.05		ppm to mg/m³
MCERTS Range [B]	102.5		mg/m³
Lower of [A] or [B]	102.5		mg/m³
Cal gas conc.	536.9		mg/m³

Performance characteristics	RUN 1		Units
Response time	33		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.10		% full scale
Repeatability at span level	0.15		% full scale
Deviation from linearity	0.09		% of value
Zero drift	0.72		% full scale
Span drift	1.49		% full scale
Volume or pressure flow dependence	-0.30		% of full scale
Atmospheric pressure dependence	0.10		% of value/kPa
Ambient temperature dependence	0.06		% full scale/10K
Combined interference	0.73		% range
Dependence on voltage	0.26		% full scale/10V
Converter efficiency	96.7		%
Losses in the line (leak)	0.00		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.02		mg/m³
Lack of fit	0.05		mg/m³
Drift	6.20		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.03		mg/m³
Ambient temperature dependence	0.01		mg/m³
Combined interference (from MCERTS Certificate)	0.43		mg/m³
Dependence on voltage	0.03		mg/m³
Converter efficiency	0.44		mg/m³
Losses in the line (leak)	0.00		mg/m³
Uncertainty of calibration gas blending	3.71		mg/m³
Uncertainty of calibration gas	5.30		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	458.84		mg/m³
Combined uncertainty			8.98		mg/m³
Expanded uncertainty	k =	1.96	17.60		mg/m³
Uncertainty corrected to std conds. (O_2)			20.75		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	3.84		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	3.52		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	10.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	4.54		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	4.81		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	10.3		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <10% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 10% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

CARBON MONOXIDE: RESULTS SUMMARY

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 34 - New CAT Engine

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	809		809
Uncertainty	±mg/m³	30.9		30.9

General Sampling Information

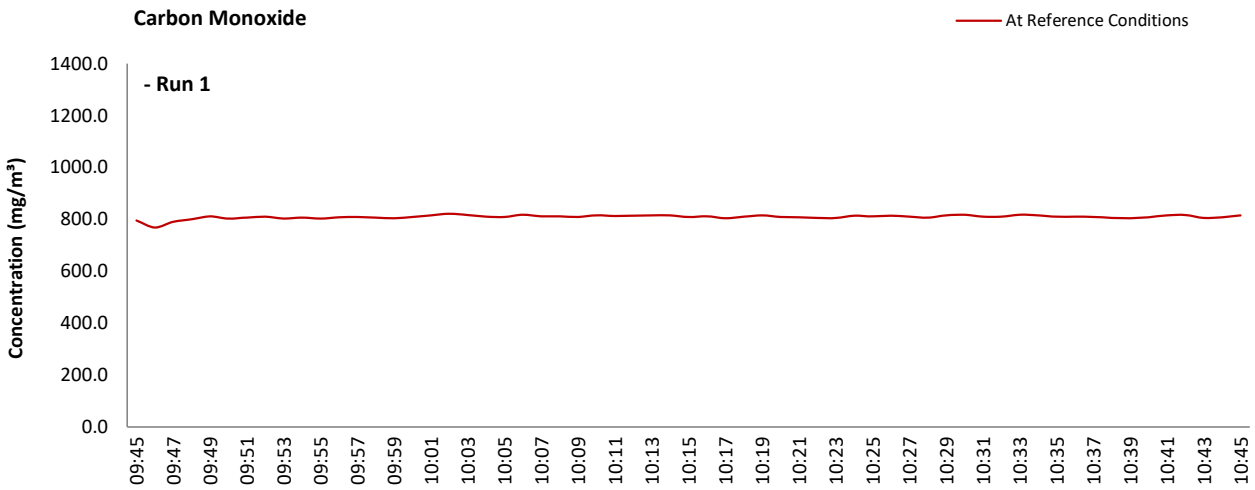
Parameter	Value	
Standard	EN 15058	
Technical Procedure	MD 021	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Carbon Monoxide	
Span Gas Reference Number	12.0606	
Span Gas Expiry Date	12/12/2025	
Span Gas Start Pressure (bar)	100	
Gas Cylinder Concentration (ppm)	1243.7	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A5	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

CARBON MONOXIDE: DATA TREND

Graphical Trend of Data



CARBON MONOXIDE: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	09:45 - 10:45
Sampling Dates	-	30/10/2024
Instrument Range	ppm	1000
Span Gas Value	ppm	1243.7

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	2.00
CAL 1	Zero Down Sampling Line (Post)	ppm	0.00
CAL 1	Zero Drift	ppm	-2.00
CAL 1	Zero Drift	%	0.16
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	1234.00
CAL 1	Span Down Sampling Line (Post)	ppm	1241.00
CAL 1	Span Drift	ppm	7.00
CAL 1	Zero Adj. Span Drift	%	0.72
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 13

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1
There are no deviations associated with the sampling employed.	x

CARBON MONOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	1400.0		mg/m³ (REF)
Allowable MU	6.0		%
Measured concentration	686.34		mg/m³ (STP, dry)
Range Used	1000.0		ppm
Range Used [A]	1249.2		mg/m³
Cal gas conc.	1243.7		ppm
Conversion	1.25		ppm to mg/m³
MCERTS Range [B]	75.0		mg/m³
Lower of [A] or [B]	75.0		mg/m³
Cal gas conc.	1553.7		mg/m³

Performance characteristics	RUN 1		Units
Response time	33		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.20		% full scale
Repeatability at span level	0.21		% full scale
Deviation from linearity	1.12		% of value
Zero drift	-0.16		% full scale
Span drift	0.72		% full scale
Volume or pressure flow dependence	0.10		% of full scale
Atmospheric pressure dependence	0.22		% of value/kPa
Ambient temperature dependence	0.20		% full scale/10K
Combined interference	-0.48		% range
Dependence on voltage	0.15		% full scale/10V
Losses in the line (leak)	0.80		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.03		mg/m³
Lack of fit	0.48		mg/m³
Drift	1.41		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.05		mg/m³
Ambient temperature dependence	0.03		mg/m³
Combined interference (from MCERTS Certificate)	-0.21		mg/m³
Dependence on voltage	0.02		mg/m³
Losses in the line (leak)	3.19		mg/m³
Uncertainty of calibration gas blending	5.55		mg/m³
Uncertainty of calibration gas	7.93		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	686.34		mg/m³
Combined uncertainty			10.30		mg/m³
Expanded uncertainty	k =	1.96	20.18		mg/m³
Uncertainty corrected to std conds. (O_2)			23.79		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	2.94		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	1.44		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	6.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	3.82		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	2.97		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	6.5		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <6% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 6% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXYGEN: RESULTS SUMMARY

Resource Management Group UK Ltd, Withyhege Landfill Site
RML 34 - New CAT Engine

Sample Runs

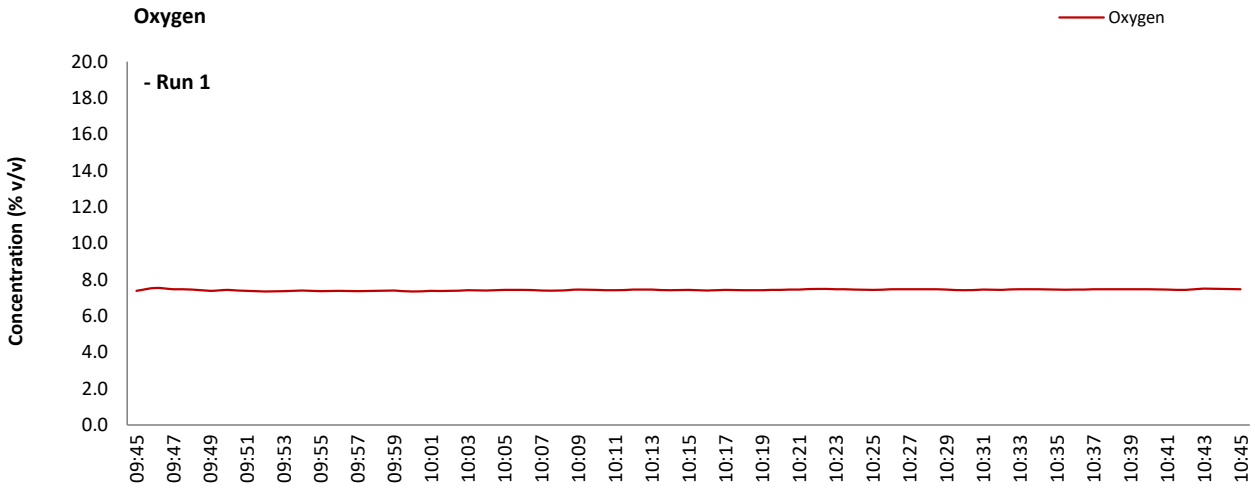
Parameter	Units	Run 1		Mean
Concentration	% v/v	7.4		7.4
Uncertainty	±% v/v	0.18		0.18

General Sampling Information

Parameter	Value	
Standard	EN 14789	
Technical Procedure	MD 022(b)	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Synthetic Air (5 Grade)	
Span Gas Reference Number	12.0654	
Span Gas Expiry Date	01/11/2025	
Span Gas Start Pressure (bar)	140	
Gas Cylinder Concentration (% v/v)	7.9	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A5	

OXYGEN: DATA TREND

Graphical Trend of Data



OXYGEN: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	09:45 - 10:45
Sampling Dates	-	30/10/2024
Instrument Range	% v/v	25.0
Span Gas Value	% v/v	7.9

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	% v/v	0.02
	Zero Down Sampling Line (Post)	% v/v	-0.02
	Zero Drift	% v/v	-0.04
	Zero Drift	%	0.50
	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	% v/v	7.95
	Span Down Sampling Line (Post)	% v/v	7.95
	Span Drift	% v/v	0.00
	Zero Adj. Span Drift	%	0.51
	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 13

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1
There are no deviations associated with the sampling employed.	x

OXYGEN: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	N/A		%vol
Allowable MU	6.0		%
Measured concentration	7.43		%vol
Range Used	25.0		%vol
Cal gas conc.	7.9		%vol

Performance characteristics	RUN 1		Units
Response time	40		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.01		% full scale
Repeatability at span level	0.01		% full scale
Deviation from linearity	0.06		% of value
Zero drift	-0.50		% full scale
Span drift	0.51		% full scale
Volume or pressure flow dependence	-0.01		% of full scale
Atmospheric pressure dependence	0.19		% of value/kPa
Ambient temperature dependence	0.09		% full scale/10K
Combined interference	0.00		% range
Dependence on voltage	0.01		% full scale/10V
Losses in the line (leak)	0.63		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		%vol
Standard deviation of repeatability at span level	0.00		%vol
Lack of fit	0.01		%vol
Drift	0.00		%vol
Volume or pressure flow dependence	0.00		%vol
Atmospheric pressure dependence	0.01		%vol
Ambient temperature dependence	0.01		%vol
Combined interference (from MCERTS Certificate)	0.00		%vol
Dependence on voltage	0.00		%vol
Losses in the line (leak)	0.03		%vol
Uncertainty of calibration gas	0.09		%vol

		RUN 1		Units
Measurement uncertainty	**Result**	7.43		%vol
Combined uncertainty		0.09		%vol
Expanded uncertainty k =	1.96	0.18		%vol

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	2.44		% of Value
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be 0.3% vol absolute or 6% relative whichever is the lower, on a dry gas basis. Source, EN 14789.

VERSION HISTORY

Version Number	Record of changes made within this version of the document
V1	The original document issued to the client

Element, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL
Your Element Contact: Glenn McMorrow (07966 879 182)
E: glenn.mcmorrow@element.com

Stack Emissions Testing Report Commissioned by
Resource Management Group Ltd

Installation Name & Address
Resource Management Group Ltd
Withyhedge Landfill Site
Rudbaxton Landfill Site
Haverfordwest
SA62 4DB

EPR Permit: GP3630HT/V003

Stack Reference
Temporary Flare Stck

Dates of the Monitoring Campaign
24th July 2024

Job Reference Number
EMT10244

Report Written by
Darren Price Team Leader MCERTS Level 2 MM 03 176 TE1 TE2 TE3 TE4

Report Approved by
Duncan Scott Technical Report Writer MCERTS Level 2 MM 17 1425 TE1 TE2 TE3 TE4

Report Date
12th August 2024

Version
Version 1

Signature of Report Approver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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

MONITORING OBJECTIVES

Resource Management Group Ltd, Withyhedge Landfill Site
Temporary Flare Stck
24th July 2024

Overall Aim of the Monitoring Campaign

Element were commissioned by Resource Management Group Ltd to carry out stack emissions testing on the Temporary Flare Stck at Withyhedge Landfill Site.

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values (ELVs) as specified in the Site's Permit.

Special Requirements

There were no special requirements.

Target Parameters

Sulphur Dioxide, Total VOCs (as Carbon), Oxides of Nitrogen (as NO_2), Carbon Monoxide

Executive Summary

MONITORING RESULTS

Resource Management Group Ltd, Withyhedge Landfill Site

Temporary Flare Stck

24th July 2024

where MU = Measurement Uncertainty associated with the Result

		Concentration			
Parameter	**Units**	**Result**		**MU +/-**	**Limit**
Sulphur Dioxide [1]	mg/m³		2919	224	-
Total VOCs (as Carbon) [1]	mg/m³		0.74	0.85	10
Oxides of Nitrogen (as NO_2) [1]	mg/m³		44.6	2.4	150
Carbon Monoxide [1]	mg/m³		1.8	2.14	50
Oxygen	% v/v	**Dry**	12.5	0.29	
Water Vapour	% v/v		9.7	0.41	

[1] Reference Conditions (REF) are: 273K, 101.3kPa, dry gas, 3% oxygen.

Executive Summary

MONITORING DATE(S) & TIMES

Resource Management Group Ltd, Withyhedge Landfill Site
Temporary Flare Stck
24th July 2024

Parameter		Units	Concentration		Sampling Date(s)	Sampling Times	Duration mins
Sulphur Dioxide	R1	mg/m³	2919		24/07/2024	11:55 - 12:25	30
Total VOCs (as Carbon)	R1	mg/m³	0.74		24/07/2024	12:45 - 13:45	60
Oxides of Nitrogen (as NO_2)	R1	mg/m³	44.6		24/07/2024	12:45 - 13:45	60
Carbon Monoxide	R1	mg/m³	1.8		24/07/2024	12:45 - 13:45	60
Oxygen	R1	% v/v	12.2		24/07/2024	12:45 - 13:45	60

All results are expressed at the respective reference conditions.

PROCESS DETAILS

Resource Management Group Ltd, Withyhedge Landfill Site

Temporary Flare Stck

24th July 2024

Standard Operating Conditions

Parameter	Value
Process Status	Operating
Capacity (of 100%) and Tonnes / Hour	1000 m^3/hr
Continuous or Batch Process	Continuous
Feedstock (if applicable)	N/A
Abatement System	None
Abatement System Running Status	N/A
Fuel	Landfill Gas
Plume Appearance	No visble plume

Executive Summary

MONITORING & ANALYTICAL METHODS

Resource Management Group Ltd, Withyhedge Landfill Site
Temporary Flare Stck
24th July 2024

	Monitoring				Analysis					
Parameter	**Standard**	**Technical Procedure**	**Sampling Status**	**Testing Lab**	**Analytical Procedure**	**Analytical Technique**	**Analysis Status**	**Analysis Lab**	**Overall Status**	**LOD (Average)**
Sulphur Dioxide	EN 14791	MD 009	MCERTS	EET	MD 101	IC	17025	EET	17025	0.4 mg/m³
Water Vapour	EN 14790	MD 005	MCERTS	EET	MD 005	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	MD 020	MCERTS	EET	Flame Ionisation Detection by Signal 3010HM				MCERTS	0.32 mg/m³
Oxides of Nitrogen (as NO_2)	EN 14792	MD 032	MCERTS	EET	Chemiluminescence by ECO PHYSICS CLD822 Mh				MCERTS	0.41 mg/m³
Carbon Monoxide	EN 15058	MD 021	MCERTS	EET	NDIR by Horiba PG-350E				MCERTS	0.77 mg/m³
Oxygen	EN 14789	MD 022(b)	MCERTS	EET	Wet Zirconia Cell installed in the ProtIR 204M				MCERTS	0.1 %

ANALYSIS LABORATORIES

(with short name reference as appears in the table above)

Element (Stockport Lab - EET)	ISO 17025 Accreditation Number: UKAS 4279

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
All Parameters	All	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	2.0
Width	m	-
Area	m^2	3.14
Port Depth	cm	N/A
Orientation of Duct	-	Vertical
Number of Ports	-	N/A
Sample Port Size	-	N/A

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	On Ground
Inside / Outside	Outside

Platform Details

EA Technical Guidance Note M1 / EN 15259 Platform Requirements	Value
Sufficient working area to manipulate probe and operate the measuring instruments	Yes
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	N/A
Platform has vertical base boards (approx. 0.25m high)	N/A
Platform has chains / self closing gates at top of ladders	N/A
There are no obstructions present which hamper insertion of sampling equipment	Yes
Safe Access Available	Yes
Easy Access Available	Yes

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and EN 15259, and therefore there are no improvement recommendations.

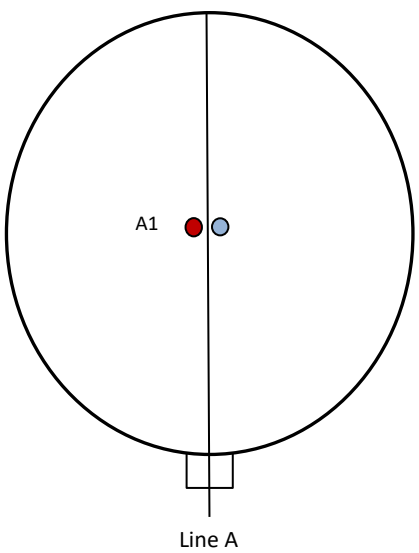
EN 15259 Homogeneity Test Requirements

There is no requirement to perform a EN 15259 Homogeneity Test on this Stack.

PLANT PHOTOS

Photo 1

SAMPLE POINTS



where ○ = isokinetic point sampled at
● = isokinetic point not sampled at
● = combustion gases sample point
● = non-isokinetic sample point

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel, List of Equipment & Methods and Technical Procedures Used

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Darren Price	MCERTS Level 2	MM 03 176	TE1 TE2 TE3 TE4
Team Leader	Matt Hopes	MCERTS Level 2	MM 06 688	TE1 TE2 TE3 TE4

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	**Equipment I.D.**
Control Box DGM (1)	-
Control Box DGM (2)	-
Box Thermocouples (1)	-
Box Thermocouples (2)	-
Umbilical (1)	-
Umbilical (2)	-
Oven Box (1)	-
Oven Box (2)	-
Heated Probe (1)	-
Heated Probe (2)	-
Heated Probe (3)	-
S-Pitot (1)	-
S-Pitot (2)	-
L-Pitot	-
Site Balance	CAT 17.53
500g / 1Kg Check Weights	CAT 17.53
Last Impinger Arm	-
Callipers	-
Tubes Kit Thermocouple	-

Instrumental Analysers	
Equipment Type	**Equipment I.D.**
Horiba PG-350EU	CAT 39.39
Horiba PG-250	-
Servomex 4900	-
Eco Physics CLD 822Mh	-
ABB AO2020-URAS26	-
Testo 350 XL	-
Signal 200SM	CAT 4.00163
Gasmet DX4000	-
Gasmet Sampling System	-
Signal 3010HM	CAT 8.53
M&C PSS	CAT 12.202
Mass Flow Controller (1)	-
Mass Flow Controller (2)	-
Mass View (1)	CAT 25.106
Mass View (2)	CAT 25.107
Hioki 5043 (V)	CAT 11.131
Hioki 5031 (mA)	-
Bioaerosols Temperature Logger	-
Electronic Refrigerator	-

Miscellaneous Items	
Equipment Type	**Equipment I.D.**
Digital Manometer (1)	-
Digital Manometer (2)	-
Digital Temperature Meter	-
Stopwatch	CAT 14.53
Barometer	CAT Met Office
Stack Thermocouple (1)	-
Stack Thermocouple (2)	-
Stack Thermocouple (3)	-
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	-
15m Heated Line (1)	-
20m Heated Line (1)	CAT 20.242
20m Heated Line (2)	-
Dual Channel Heater Controller	-
Single Channel Heater Controller	CAT 20.242
Laboratory Balance	
Tape Measure	CAT 16.144

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Sulphur Dioxide	EN 14791	MD 009
Water Vapour	EN 14790	MD 005
Total VOCs (as Carbon)	EN 12619:2013	MD 020
Oxides of Nitrogen (as NO_2)	EN 14792	MD 032
Carbon Monoxide	EN 15058	MD 021
Oxygen	EN 14789	MD 022(b)

APPENDIX 2

SULPHUR DIOXIDE: RESULTS SUMMARY

Resource Management Group Ltd, Withyhedge Landfill Site

Temporary Flare Stck

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	2919		2919
Uncertainty	±mg/m³	224		224

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	9.7		9.7
Uncertainty	±% v/v	0.41		0.41

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	< 0.33		< 0.33

General Sampling Information

Parameter	Value	
Standard	EN 14791	
Technical Procedure	MD 009	
Name of Analytical Laboratory	EET	
Analytical Laboratory's Procedure	MD 101	
ISO 17025 Accredited Analysis?	17025	
Date of Sample Analysis	30/07/2024	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Impinger Material	Polyethylene	
Absorption Solution	0.3% Hydrogen Peroxide	
Positioning of Filter	Out Stack Heated Head	
Filter Size and Material	0.1µm Glass Fibre	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 3% oxygen.

SULPHUR DIOXIDE: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	11:55 - 12:25
Sampling Dates	-	24/07/2024
Sampling Device	-	MFC / MV
Duration	mins	30
Volume Sampled (STP, Dry)	m^3	0.1072
Volume Sampled (STP, Wet)	m^3	0.1186
Volume Sampled (REF)	m^3	0.0472
Sample Flow Rate	l/min	3.49
Laboratory Result for Front Impingers	µg/ml	466.30
Laboratory Result for Back Impinger	µg/ml	3.08
Volume in Front Impingers	ml	295.0
Volume in Back Impinger	ml	82.6
Mass in Front Impingers	µg	137558.5
Mass in Back Impinger	µg	254.4
Total Mass Collected	µg	137812.9
Calculated Concentration	mg/m^3	2919.18
Liquid Trap Start Mass	g	1578.9
Liquid Trap End Mass	g	1586.6
Silica Trap Start Mass	g	1519.0
Silica Trap End Mass	g	1520.5
Total Mass Of Water Vapour	g	9.2
Calculated Water Vapour	% v/v	9.7

Where: MFC stands for Mass Flow Controller, MV stands for Mass View Flowmeter

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	24/07/2024
Average Volume Sampled (REF)	m^3	0.0472
Laboratory Result for Impingers	µg/ml	< 0.050
Volume in Impingers	ml	315.5
Total Mass Collected	µg	< 15.8
Calculated Concentration	mg/m^3	< 0.33

SULPHUR DIOXIDE: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	3.5
Pre-Sampling Leak Rate	l/min	0.020
Post-Sampling Leak Rate	l/min	0.020
Allowable Leak Rate	l/min	0.070
Leak Test Acceptable	-	Yes

Absorption Efficiency	Units	Run 1
Absorption Efficiency	%	99.8
Allowable Absorption Efficiency	%	95
Absorption Efficiency Acceptable	-	Yes

Water Droplets	Units	Run 1
Are Water Droplets Present	-	No

MU (Concurrent Water Vapour)	Units	Run 1
Measurement Uncertainty (MU)	%	4.3
Allowable MU	%	20.0
MU Acceptable	%	Yes

Silica Gel (Concurrent Water Vapour)	Units	Run 1
Less than 50% Faded	%	Yes

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	3.0
Pre-Sampling Leak Rate	l/min	0.040
Post-Sampling Leak Rate	l/min	0.040
Allowable Leak Rate	l/min	0.060
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1
Allowable Blank	mg/m^3	N/A
Blank Acceptable	-	N/A

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
There are no deviations associated with the sampling employed.	wx	

SULPHUR DIOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

	Value			Standard uncertainty		
Measured Quantities	**Symbol**	**Run 1**		**Symbol**	**Units**	**Run 1**
Sampled Volume (STP)	V_m	0.1072		uV_m	m^3	0.0021
Leak	L	0.57		uL	%	-
Laboratory Result	L_r	0.90		uL_r	%	-

	Uncertainty as a Percentage		
Measured Quantities	**Units**	**Run 1**	**Requirement of Standard**
Sampled Volume (STP)	%	2.0	≤2%
Leak	%	0.57	≤2%
Laboratory Result	%	0.90	No Requirement

	Uncertainty in Measurement Units			Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 1**
Sampled Volume (STP)	V_m	m^3	0.1072	27242
Leak	L	mg/m^3	9.653	1.0
Laboratory Result	L_r	mg/m^3	26.273	1.0

	Uncertainty in Result	
Measured Quantities	**Units**	**Run 1**
Sampled Volume (STP)	mg/m^3	58.384
Leak	mg/m^3	9.6526
Laboratory Result	mg/m^3	26.2726

	Oxygen Correction Part of MU Budget	
Measured Quantities	**Units**	**Run 1**
O_2 Correction Factor	-	2.27
Stack Gas O_2 Content	% v/v	13.07
MU for O_2 Correction	-	0.14
Overall MU For O_2 Measurement	%	6.31

Parameter	**Units**	**Run 1**
Combined uncertainty	mg/m^3	64.7
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m^3	127
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m^3	224
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m^3	224
Reported Uncertainty	mg/m^3	224
Expanded uncertainty (95% confidence), without Oxygen Correction	%	4.3
Expanded uncertainty (95% confidence), with Oxygen Correction	%	7.7
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	7.7
Reported Uncertainty	%	7.7
Reported Uncertainty as % of ELV	%	N/A

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Resource Management Group Ltd, Withyhedge Landfill Site
Temporary Flare Stck

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	0.74		0.74
Uncertainty	±mg/m³	0.85		0.85

General Sampling Information

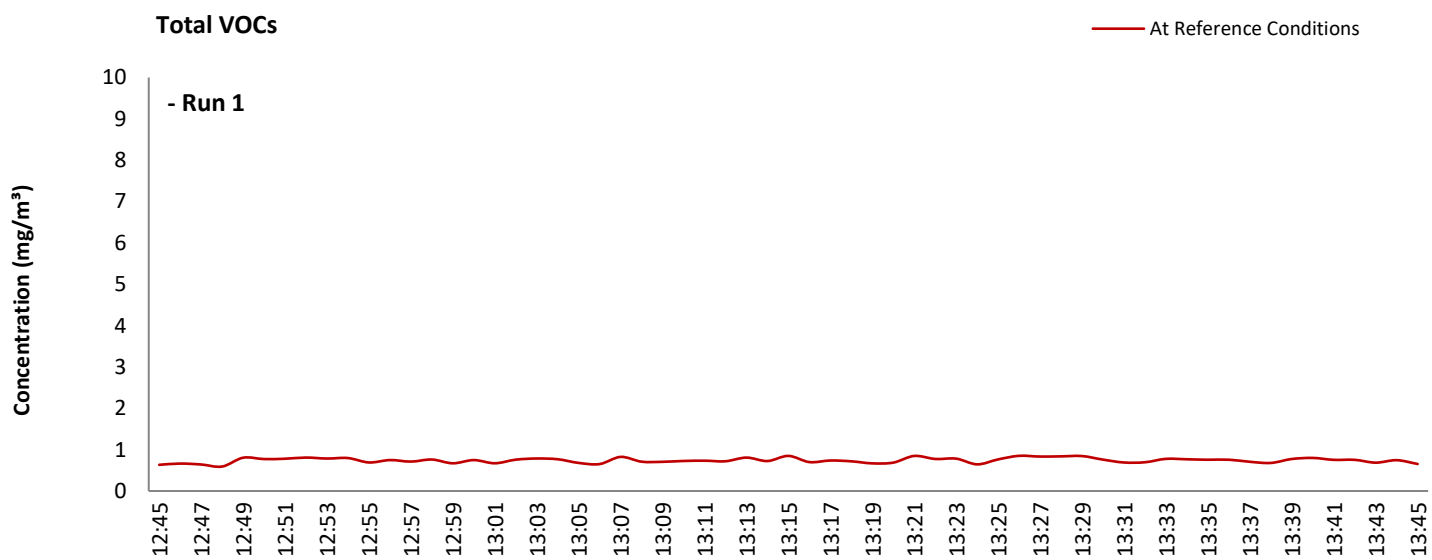
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	MD 020	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	CYL 12.0533	
Span Gas Expiry Date	24/01/2025	
Span Gas Start Pressure (bar)	120	
Gas Cylinder Concentration (ppm)	8.3	
Span Gas Set Point (ppm)	8.30	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Synthetic Air (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 3% oxygen.

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



TOTAL VOCs (as CARBON): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:45 - 13:45
Sampling Dates	-	24/07/2024
Instrument Range	ppm	1000
Span Gas Value	ppm	8.3

Quality Assurance

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	-0.10
CAL 1	Zero Down Sampling Line (Post)	ppm	0.10
CAL 1	Zero Drift	ppm	0.20
CAL 1	Zero Drift	%	2.41
CAL 1	Drift Correction Applied	2-5%	Yes
	Allowable Zero Drift	± ppm	0.42
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	8.3
CAL 1	Span Down Sampling Line (Post)	ppm	8.4
CAL 1	Span Drift	ppm	0.10
CAL 1	Span Drift	%	1.2
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± ppm	0.42
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	19 - 20

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run)	1	
There are no deviations associated with the sampling employed.	x	

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	10.0		mg/m³ (REF)
Allowable MU	15.0		%
Measured concentration	0.36		mg/m³ (STP, dry)
Range Used	1000.0		ppm
Range Used [A]	1606.1		mg/m³
Cal gas conc.	8.3		ppm
Conversion	1.61		ppm to mg/m³
MCERTS Range [B]	15.0		mg/m³
Lower of [A] or [B]	15.0		mg/m³
Cal gas conc.	13.3		mg/m³

Performance characteristics	RUN 1		Units
Response time	15		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.15		% full scale
Repeatability at span level	0.80		% full scale
Deviation from linearity	0.13		% of value
Zero drift	0.0		% full scale
Span drift	1.2		% full scale
Volume or pressure flow dependence	2.0		% of full scale
Atmospheric pressure dependence	0.80		% of value/kPa
Ambient temperature dependence	1.0		% full scale/10K
Combined interference	1.2		% range
Dependence on voltage	0.10		% full scale/10V
Losses in the line (leak)	0.0		% of value
Uncertainty of calibration gas	2.0		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.10		mg/m³
Lack of fit	0.011		mg/m³
Drift	0.0025		mg/m³
Volume or pressure flow dependence	0.0017		mg/m³
Atmospheric pressure dependence	0.035		mg/m³
Ambient temperature dependence	0.14		mg/m³
Combined interference (from MCERTS Certificate)	0.10		mg/m³
Dependence on voltage	0.012		mg/m³
Losses in the line (leak)	0.0		mg/m³
Uncertainty of calibration gas	0.0041		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	0.36		mg/m³
Combined uncertainty			0.21		mg/m³
Expanded uncertainty	k =	1.96	0.41		mg/m³
Uncertainty corrected to std conds. (O_2)			0.85		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	114.55		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	4.10		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	15.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	114.57		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	8.78		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	15.2		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <15% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 15% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXIDES OF NITROGEN (as NO_2): RESULTS SUMMARY

Resource Management Group Ltd, Withyhedge Landfill Site
Temporary Flare Stck

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	44.6		44.6
Uncertainty	±mg/m³	2.4		2.4

General Sampling Information

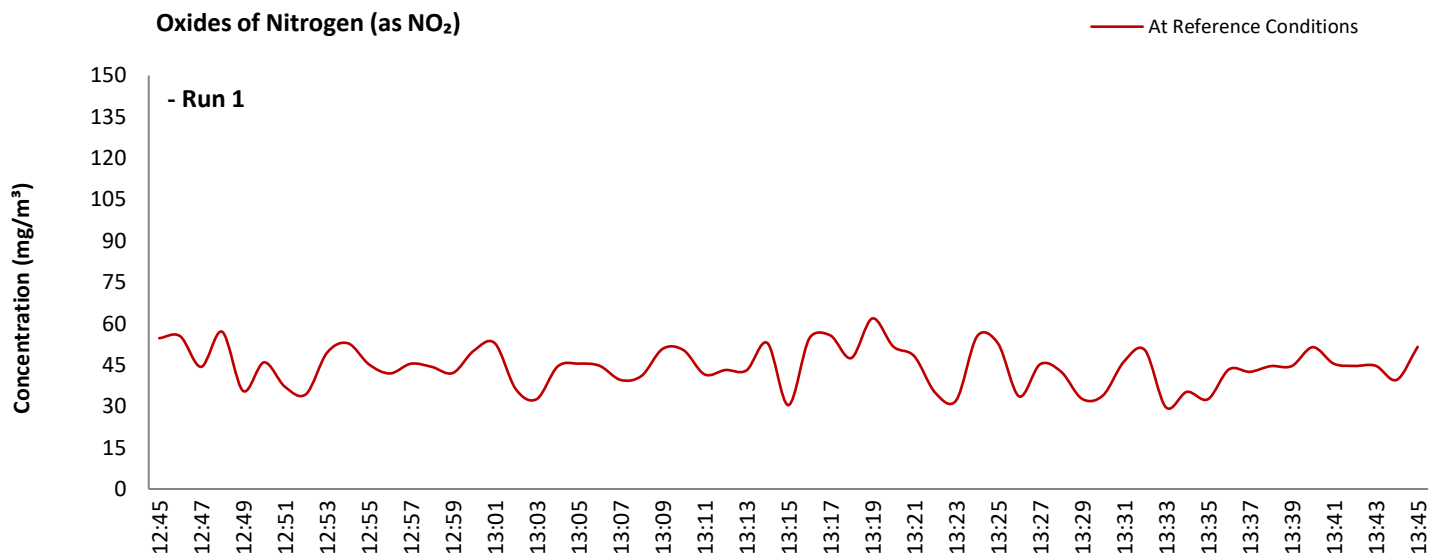
Parameter	Value	
Standard	EN 14792	
Technical Procedure	MD 032	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Date & Result of Last Converter Check	01/03/2024 - 96.7%	
Span Gas Type	Nitrogen Monoxide	
Span Gas Reference Number	CYL 12.0531	
Span Gas Expiry Date	19/01/2025	
Span Gas Start Pressure (bar)	60	
Gas Cylinder Concentration (ppm)	82.1	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 3% oxygen.

OXIDES OF NITROGEN (as NO_2): DATA TREND

Graphical Trend of Data



OXIDES OF NITROGEN (as NO_2): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:45 - 13:45
Sampling Dates	-	24/07/2024
Instrument Range	ppm	100
Span Gas Value	ppm	82.1

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.0
	Zero Down Sampling Line (Post)	ppm	0.0
	Zero Drift	ppm	0.0
	Zero Drift	%	0.0
	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.0
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	82.2
	Span Down Sampling Line (Post)	ppm	82.3
	Span Drift	ppm	0.10
	Zero Adj. Span Drift	%	0.12
	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.0
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	19 - 20

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run)	1	

OXIDES OF NITROGEN (as NO_2): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	150.0		mg/m³ (REF)
Allowable MU	10.0		%
Measured concentration	21.75		mg/m³ (STP, dry)
Ratio NO / NO_2	5		%
Range Used	100.0		ppm
Range Used [A]	205.2		mg/m³
Cal gas conc.	82.1		ppm
Conversion	2.05		ppm to mg/m³
MCERTS Range [B]	102.5		mg/m³
Lower of [A] or [B]	102.5		mg/m³
Cal gas conc.	168.5		mg/m³

Performance characteristics	RUN 1		Units
Response time	33		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.10		% full scale
Repeatability at span level	0.15		% full scale
Deviation from linearity	0.090		% of value
Zero drift	0.0		% full scale
Span drift	0.12		% full scale
Volume or pressure flow dependence	-0.30		% of full scale
Atmospheric pressure dependence	0.10		% of value/kPa
Ambient temperature dependence	0.057		% full scale/10K
Combined interference	0.73		% range
Dependence on voltage	0.26		% full scale/10V
Converter efficiency	96.7		%
Losses in the line (leak)	0.0		% of value
Uncertainty of calibration gas blending	1.4		% of value
Uncertainty of calibration gas	2.0		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.019		mg/m³
Lack of fit	0.053		mg/m³
Drift	0.015		mg/m³
Volume or pressure flow dependence	-0.0018		mg/m³
Atmospheric pressure dependence	0.030		mg/m³
Ambient temperature dependence	0.0082		mg/m³
Combined interference (from MCERTS Certificate)	0.43		mg/m³
Dependence on voltage	0.030		mg/m³
Converter efficiency	0.021		mg/m³
Losses in the line (leak)	0.0		mg/m³
Uncertainty of calibration gas blending	0.18		mg/m³
Uncertainty of calibration gas	0.25		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	21.75		mg/m³
Combined uncertainty			0.54		mg/m³
Expanded uncertainty	k =	1.96	1.05		mg/m³
Uncertainty corrected to std conds. (O_2)			2.15		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	4.82		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	0.70		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	10.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	5.34		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	2.70		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	10.3		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <10% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 10% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

CARBON MONOXIDE: RESULTS SUMMARY

Resource Management Group Ltd, Withyhedge Landfill Site
Temporary Flare Stck

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	1.8		1.8
Uncertainty	±mg/m³	2.1		2.1

General Sampling Information

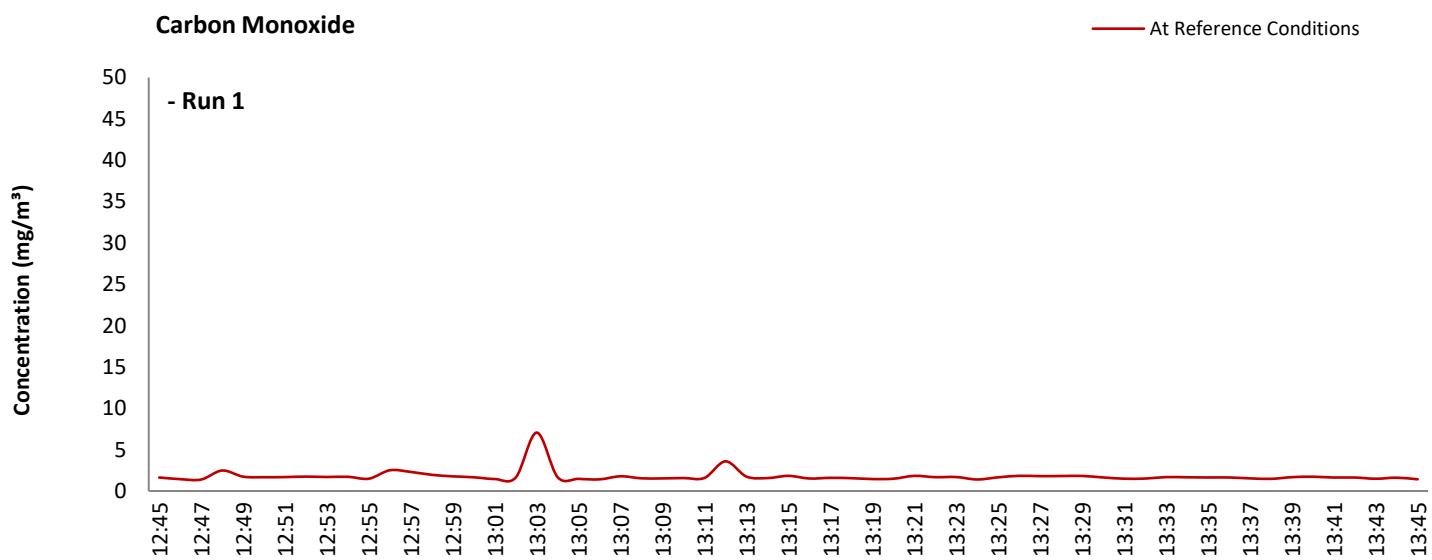
Parameter	Value	
Standard	EN 15058	
Technical Procedure	MD 021	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Carbon Monoxide	
Span Gas Reference Number	CYL 12.0531	
Span Gas Expiry Date	19/01/2025	
Span Gas Start Pressure (bar)	60	
Gas Cylinder Concentration (ppm)	152.3	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 3% oxygen.

CARBON MONOXIDE: DATA TREND

Graphical Trend of Data



CARBON MONOXIDE: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:45 - 13:45
Sampling Dates	-	24/07/2024
Instrument Range	ppm	200
Span Gas Value	ppm	152.3

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	-0.30
CAL 1	Zero Down Sampling Line (Post)	ppm	1.0
CAL 1	Zero Drift	ppm	1.3
CAL 1	Zero Drift	%	0.86
CAL 1	Drift Correction Applied	2-5%	Yes
	Allowable Zero Drift	± %	5.0
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	151.3
CAL 1	Span Down Sampling Line (Post)	ppm	151.6
CAL 1	Span Drift	ppm	0.30
CAL 1	Zero Adj. Span Drift	%	0.66
CAL 1	Drift Correction Applied	2-5%	Yes
	Allowable Span Drift	± %	5.0
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	19 - 20

Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run)	1

CARBON MONOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	50.0		mg/m³ (REF)
Allowable MU	6.0		%
Measured concentration	0.87		mg/m³ (STP, dry)
Range Used	200.0		ppm
Range Used [A]	249.8		mg/m³
Cal gas conc.	152.3		ppm
Conversion	1.25		ppm to mg/m³
MCERTS Range [B]	75.0		mg/m³
Lower of [A] or [B]	75.0		mg/m³
Cal gas conc.	190.3		mg/m³

Performance characteristics	RUN 1		Units
Response time	33		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.20		% full scale
Repeatability at span level	0.21		% full scale
Deviation from linearity	1.12		% of value
Zero drift	0.86		% full scale
Span drift	-0.66		% full scale
Volume or pressure flow dependence	0.10		% of full scale
Atmospheric pressure dependence	0.22		% of value/kPa
Ambient temperature dependence	0.20		% full scale/10K
Combined interference	-0.48		% range
Dependence on voltage	0.15		% full scale/10V
Losses in the line (leak)	0.66		% of value
Uncertainty of calibration gas blending	1.4		% of value
Uncertainty of calibration gas	2.0		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.027		mg/m³
Lack of fit	0.48		mg/m³
Drift	0.00		mg/m³
Volume or pressure flow dependence	0.00043		mg/m³
Atmospheric pressure dependence	0.048		mg/m³
Ambient temperature dependence	0.029		mg/m³
Combined interference (from MCERTS Certificate)	-0.21		mg/m³
Dependence on voltage	0.017		mg/m³
Losses in the line (leak)	0.0033		mg/m³
Uncertainty of calibration gas blending	0.0070		mg/m³
Uncertainty of calibration gas	0.010		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	0.87		mg/m³
Combined uncertainty			0.53		mg/m³
Expanded uncertainty	k =	1.96	1.04		mg/m³
Uncertainty corrected to std conds. (O_2)			2.14		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	119.96		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	2.08		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	6.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	119.98		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	4.85		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	6.4		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <6% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 6% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXYGEN: RESULTS SUMMARY

Resource Management Group Ltd, Withyhedge Landfill Site
Temporary Flare Stck

Sample Runs

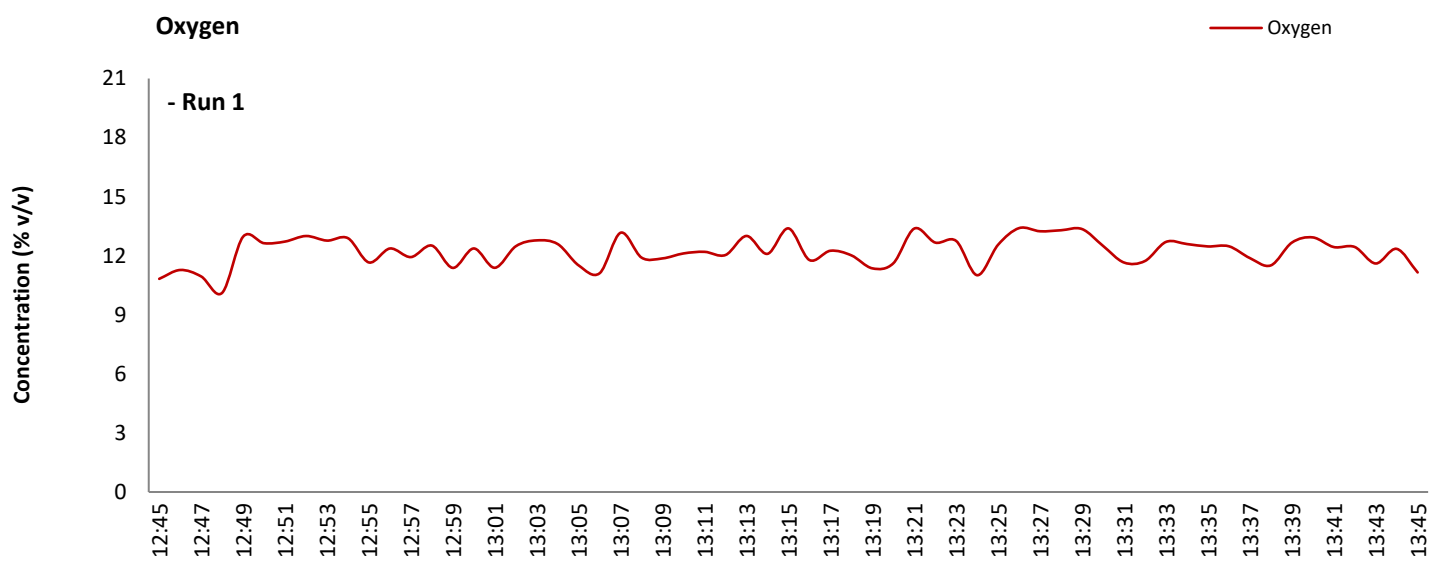
Parameter	Units	Run 1		Mean
Concentration	% v/v	12.2		12.2
Uncertainty	±% v/v	0.28		0.28

General Sampling Information

Parameter	Value	
Standard	EN 14789	
Technical Procedure	MD 022(b)	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Synthetic Air (5 Grade)	
Span Gas Reference Number	CYL 12.0533	
Span Gas Expiry Date	24/01/2025	
Span Gas Start Pressure (bar)	120	
Gas Cylinder Concentration (% v/v)	7.8	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

OXYGEN: DATA TREND

Graphical Trend of Data



OXYGEN: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:45 - 13:45
Sampling Dates	-	24/07/2024
Instrument Range	% v/v	25.0
Span Gas Value	% v/v	7.8

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	% v/v	0.020
CAL 1	Zero Down Sampling Line (Post)	% v/v	0.010
CAL 1	Zero Drift	% v/v	-0.010
CAL 1	Zero Drift	%	0.13
CAL 1	Drift Correction Applied	2-5%	Yes
	Allowable Zero Drift	± %	5.0
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	% v/v	7.88
CAL 1	Span Down Sampling Line (Post)	% v/v	7.84
CAL 1	Span Drift	% v/v	-0.040
CAL 1	Zero Adj. Span Drift	%	0.38
CAL 1	Drift Correction Applied	2-5%	Yes
	Allowable Span Drift	± %	5.0
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	19 - 20

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run)	1	

OXYGEN: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	N/A		%vol
Allowable MU	6.0		%
Measured concentration	12.23		%vol
Range Used	25.0		%vol
Cal gas conc.	7.8		%vol

Performance characteristics	RUN 1		Units
Response time	40		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.010		% full scale
Repeatability at span level	0.010		% full scale
Deviation from linearity	0.060		% of value
Zero drift	-0.13		% full scale
Span drift	-0.38		% full scale
Volume or pressure flow dependence	-0.010		% of full scale
Atmospheric pressure dependence	0.19		% of value/kPa
Ambient temperature dependence	0.090		% full scale/10K
Combined interference	0.0		% range
Dependence on voltage	0.0060		% full scale/10V
Losses in the line (leak)	0.0		% of value
Uncertainty of calibration gas	2.0		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		%vol
Standard deviation of repeatability at span level	0.0013		%vol
Lack of fit	0.0087		%vol
Drift	0.0		%vol
Volume or pressure flow dependence	-0.000014		%vol
Atmospheric pressure dependence	0.014		%vol
Ambient temperature dependence	0.013		%vol
Combined interference (from MCERTS Certificate)	0.0		%vol
Dependence on voltage	0.00069		%vol
Losses in the line (leak)	0.0		%vol
Uncertainty of calibration gas	0.14		%vol

			RUN 1		Units
Measurement uncertainty		**Result**	12.23		%vol
Combined uncertainty			0.14		%vol
Expanded uncertainty	k =	1.96	0.28		%vol

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	2.29		% of Value
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be 0.3% vol absolute or 6% relative whichever is the lower, on a dry gas basis. Source, EN 14789.

VERSION HISTORY

Version Number	Record of changes made within this version of the document
V1	The original document issued to the client

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UKAS TESTING
4279

ANALYSIS OF THE TRACE COMPONENTS FROM THE LANDFILL GAS

AT

Withyhedge Landfill Site

Rudbaxton
Haverfordwest
Pembrokeshire
SA62 4DB

Commissioned by: David Banner

Of

Resource Management UK Ltd

Date of Survey:	18th June 2024
Compiled By:	Matthew Hopes *Team Leader*

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Compiled By:	Matthew Hopes *Team Leader*
Signed:	
Dated:	11th July 2024

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3. SAMPLING PROCEDURES

4. RESULTS

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

1. INTRODUCTION

1.1 Element Materials Technology Environmental UK Limited was commissioned by David Banner, on behalf of Resource Management UK Ltd, to measure the trace gas landfill gas located at Withyhedge Landfill Site Sampling was performed on 18th June 2024.

1.2 The sampling was conducted in response to a request from the client for additional testing. 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 gas engine generator 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 Hydrogen sulphide and bulk gases was sampled into a foil bag with analysis by GC/TCD/FID (by MSS) in accordance with SPTGN04. The results are presented in Appendix B

3.3 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 Materials Technology Environmental UK protocol, SPTGN04. The analytical component of the work was conducted at Marchwood Scientific Services. The results are presented in Appendix B.

3.4 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.

4. RESULTS

4.1 Measured concentrations of the EA 'priority' and extended suite trace components for the landfill gas are given in Appendix B and shown graphically in Appendix C.

4.2 Measured concentrations of the siloxane components for the landfill gas are given in **Error! Reference source not found.**.

APPENDIX A

Site Information & Gas Measurements

TABLE A(i): Site Information & Gas Measurements

Sample Position Details			
Date	18/06/2024	**Site**	Withyhedge LFS
Ambient Temperature	15°C	**Atmospheric Pressure**	1016 mbar
Monitoring Organisation	Element Ltd	**Analytical Laboratory**	Marchwood Scientific Services Ltd
Location of Sampling Point	Inlet to gas utilisation plants	**Area of Influence of collection system sampled**	All capped areas of the site
Type of Sampling Point	Nipple & Tap	**Temperature of gas**	16°C, at sample flow meter
Vacuum on Sampling	None - Positive pressure at sampling location.	**Type of waste**	Domestic, Industrial, Commercial & Hazardous
		Age of Waste	Unknown
Status of Gas System	Fully Operational, Steady State	**Other**	-

Parameter	Concentration	Units	Comments
Methane*	51	%	-
Carbon Dioxide*	37	%	-
Oxygen*	1.7	%	-
Nitrogen	10	%	Assumed to be balance of gas
Hydrogen Sulphide*	3300	ppm	-

Notes: *Raw result obtained from tedlar bag sample

APPENDIX B

Trace Gas Results

TABLE B(i): Trace Gas Results

Trace Gases - Test 1 - 18/06/2024							
	Test Duration	Flow Rate	Flowmeter	Volume	Ambient T	Barometric P	Volume
	(min)	(ml/min)	CAL Factor	(l as sampled)	(°C)	(kPa)	(l @ STP)
Aldehydes (9251 806 448)	20	186	1.0232	**3.80**	15	100.3	**3.57**
VOC (600 804)	5	127	1.0474	**0.67**	15	100.3	**0.63**

Compound	Mass of TG (ng)	LoD of TG (ng)	Concentration		Units	Analysis Notes (See below)	Analysis UKAS Acredited (Y/N)
Acetaldehyde (Ethanal)	300	100		**84**	µg/m3	-	Y
Formaldehyde (Methanal)	1200	100		**337**	µg/m3	-	Y
Vinyl chloride		10	<	**16**	µg/m3	-	N
1,3-butadiene		10	<	**16**	µg/m3	-	Y
Methanethiol		50	<	**80**	µg/m3	-	N
Chloroethane	580	10		**927**	µg/m3	-	Y
1-pentene	340	20		**544**	µg/m3	-	Y
1,4-epoxy-1,3-butadiene (Furan)	49	10		**78**	µg/m3	-	Y
Ethanethiol	1500	50		**2398**	µg/m3	-	N
1,1-dichloroethene	9	5		**14**	µg/m3	-	Y
Dimethyl sulphide	550	10		**879**	µg/m3	**c**	N
Dichloromethane	200	10		**320**	µg/m3	-	N
Carbon disulphide	40000	50		**63944**	µg/m3	**b**	N
1,2-dichloroethene (trans + cis)	37	10		**59**	µg/m3	-	Y
1,1-dichloroethane	41	5		**66**	µg/m3	-	Y
Propanethiol	370	40		**591**	µg/m3	-	Y
1,2-dichloroethane	370	5		**591**	µg/m3	-	Y
Carbon tetrachloride		5	<	**8**	µg/m3	-	Y
Benzene	460	1		**735**	µg/m3	-	Y
Trichloroethylene	46	5		**74**	µg/m3	-	Y
Butanethiol		40	<	**64**	µg/m3	-	Y
Dimethyl disulphide	35	10		**56**	µg/m3	-	Y
Toluene	2100	5		**3357**	µg/m3	**b**	Y
Butyric acid		10	<	**16**	µg/m3	-	Y
Ethyl butyrate		10	<	**16**	µg/m3	-	Y
2-Butoxyethanol		10	<	**16**	µg/m3	-	Y
Styrene	630	5		**1007**	µg/m3	-	Y
Compound	**Concentration in ppm**	**LOD of TG (ppm)**	**Concentration**		**Units**	**Analysis Notes (See below)**	**Analysis UKAS Acredited (Y/N)**
Hydrogen sulphide*	3400	10		**5160714**	µg/m3	-	N

*H2S value is equivalent to 124 ppm, values in highlighted box are expressed as ppm and not ng

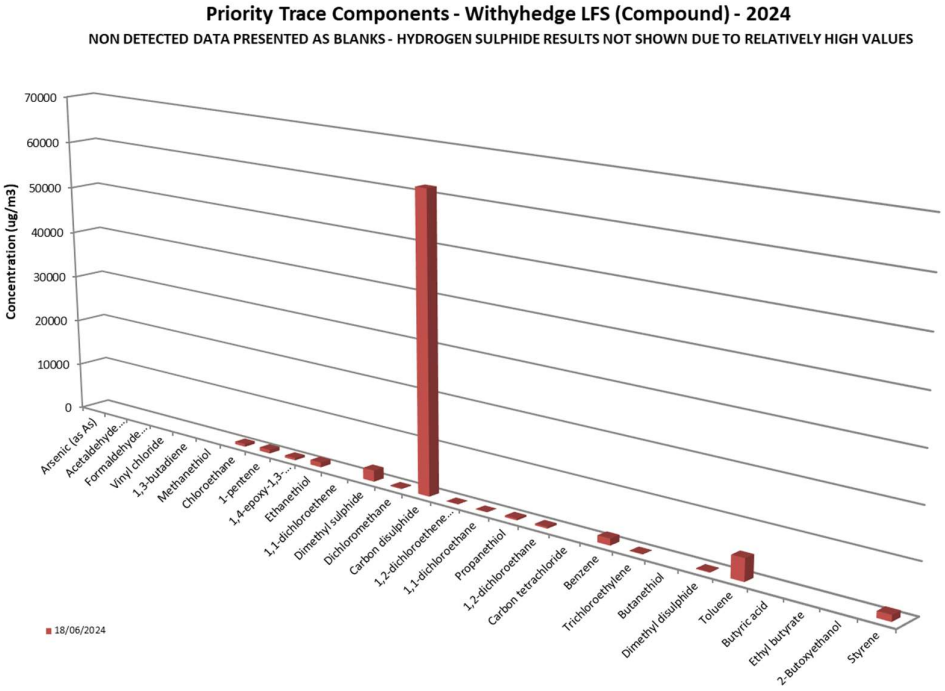
(a) – Results have been blank corrected
(b) – Results should be considered a minimum due to detector saturation
(c) – Results should be viewed with caution due to being outside of the instrument calibration range

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

APPENDIX C

Trace Gas Chart

TABLE C(i): Trace Gas Chart



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