2023 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 the 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 of the 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. Since taking over operational control, significant improvements have been made with more planned.

1.2 Scope

This report has been prepared independently by Geotechnology to assist RML satisfy the Permit which requires an annual review of monitoring. This report is the second produced by Geotechnology and follows on from previous annual reports that were understood to have been compiled internally by the previous site owners.

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 Figure 1.

2 SURFACE WATER

Surface water run-off from restored phases at the site is channelled into a sequence of lagoons. These lagoon systems discharge 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 the farm practice involves feeding and cutting silage several times a year.
- 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.
- 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 during 2023 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

2.2 Flow

Flow reached 1.6 cubic ft/sec during the winter period of 2023, as shown in Plate 2-2.

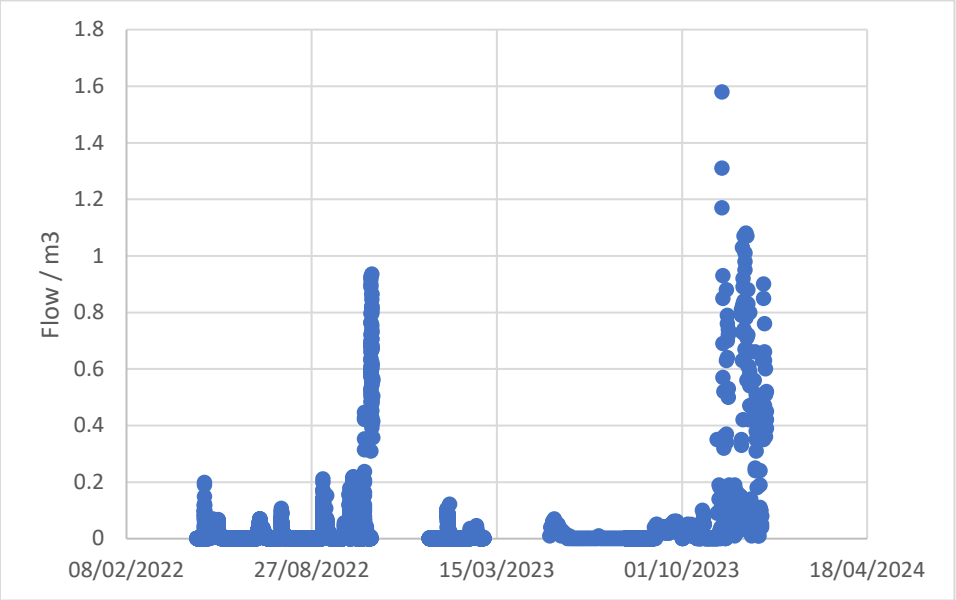

Plate 2-1 Flow gauging at D1

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 2023 is summarrised 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 forthcoming Permit Variation.

Table 3-1 Leachate extracted during 2023

	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**

3.2 Leachate Levels

All quarterly reported leachate levels were below 1m. 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. 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. This will be reviewed in the HRA.

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

4 GROUNDWATER

As shown in Figure 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 acidic pH due to the passage of groundwater along fractures containing pyrite. As the pyrite naturally oxidises and weathers it would be expected to release protons, sulphate, iron and trace metals.

4.1 Borehole Decommissioning

As part of the preparatory works for Cell 8, a groundwater monitoring borehole had to be removed. BH20 was a groundwater well that had been used to monitor groundwater levels and chemistry. It was an upgradient/cross-gradient well to the existing landfill so its loss was not significant or critical to understanding emissions or groundwater flow. Works completed to decommission BH20 are described below.

The ground surrounding the borehole was first reduced in level by 1.5m to achieve formation level. This was completed by excavating the shale bedrock with a 30 tonne 360 degree tracked excavator with a rock bucket. Excavation was progressed carefully around the borehole after the general ground level had been reduced. The result of this was a well screen sticking in the air above the formation level, as shown on Plate 4-1.

Plate 4-1 Wellscreen After Ground Level Reduction

When clay lining works were being undertaken nearby (on August 23 2023) the rock excavator carefully removed a slab of rock from the formation measuring 2m by 2m. The slab was centred on the borehole screen and was 0.8m deep. This resulted in the well sticking up from the centre of a square excavation in the formation as shown on Plate 4-2. A strap was attached to the plastic well screen to allow it to be withdrawn from the well with the excavator. This is shown on Plate 4-3. After removal, the gravel pack partially collapsed into the base of the hole.

Plate 4-2 Excavation Below Formation Around Wellscreen

Plate 4-3 Straps Used to Withdraw Casing from Well

A petrol powered mixer was bought to site and used to mix clean water with bentonite powder and cement powder (Plate 4-4). The mix ratio was 50kg bentonite to 25kg cement to 105litres of water. This mix provided a good balance between performance and flow. The bentonite cement slurry was placed from the mixer into the cleaned out borehole. It was observed that good penetration of the gravel pack was achieved.

Plate 4-4 Grout Mixing

Between mixes the grout level in the borehole fell as grout seeped into the gravel pack and surrounding fractures. The process was repeated until the borehole was completely filled and no further grout loss was seen. The borehole was cleaned the following day and the grout was observed to have achieved an initial set and remained full to the base of the borehole (Plate 4-5).

Plate 4-5 Confirmation of Complete Filling

4.2 Groundwater Quality

Comparison of the groundwater quality against the Permit emission limits is provided in the following tables. Breaches of the emissions limits are highlighted grey.

There were no breaches in 2023.

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 Figure 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
2022					
Ammoniacal Nitrogen	12 mg/l	2.1	2.9	3.7	0.11
Chloride	250 mg/l	66.7	57.5	48.5	48.1
Nickel	0.05 mg/l	0.209 (BH20)	0.144 (BH20)	0.0253	0.0108
Phenol	0.15 mg/l (0.03) mg/l	0.14 (BH20)	<0.0025	<0.01	<0.01
Cadmium	0.0095 mg/l (0.0001)mg/l	0.0023	0.0011	0.0022	0.0063
Mecoprop	0.0001 mg/l (0.00004) mg/l	<0.0001	<0.0001	<0.0001	<0.0001
Naphthalene	0.00001 mg/l	<0.00005	<0.00005	<0.00005	<0.00005
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					

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

Parameter	Emission Limit	Q1*	Q2	Q3	Q4
2022					
Cadmium	0.002mg/l	0.011 (BH105)	0.018 (BH105)	0.00099	0.001
Phenol	0.15 mg/l (0.001mg/l)	0.08 (BH105)	<0.0025	<0.0025	<0.0025
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.					

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

Parameter	Limit	Q1	Q2	Q3	Q4
2022					
Naphthalene	0.00003 mg/l	<0.00005	<0.00005	<0.00005	<0.00005
Nickel	0.02 mg/l	<0.0015	0.0069	0.0062	<0.0015
Ammoniacal Nitrogen	1.328 mg/l (0.8 mg/l)	0.75	0.1	0.07	0.36
Chloride	117 mg/l (55 mg/l)	47.7	85.6	46.4	15.9
Mecoprop	0.00003 mg/l (0.00002 mg/l)		0	0	0
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.					

Table 4-4 Comparison of BH2 with Permit Emission Limits

Parameter	Limit	Q1	Q2	Q3	Q4
2022					
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
2023					
Naphthalene	0.00006 mg/l	<0.00005	0.00002	<0.00005	<0.00005
Nickel	0.02 mg/l	<0.0015	<0.0015	<0.0015	<0.0015
Ammoniacal Nitrogen	5.2 mg/l	<0.01	0.05	0.03	0.86
Chloride	180 mg/l	29.2	22.3	29.1	20.9
Mecoprop	0.0001 mg/l	<0.0001	<0.00002	<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				

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					

5 LANDFILL GAS AND ODOUR

5.1 Production

In 2022, 4.3 Mm^3 of landfill was treated. In 2023, RML has indicated that 6.99Mm^3 was treated.

5.2 Chemistry

In-waste monitoring has revealed the maximum concentrations observed in 2023 summarised in Table 5-1.

Table 5-1 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

Landfill gas is currently utilised by the gas engine generator plant. Landfill gas engine and flare emission monitoring is undertaken quarterly and annually in accordance with Table S4.2 of the site permit and as specified in permit variation EPR/GP3630HT/V005.

Compliance limits for Oxides of Nitrogen (NOx), Carbon Monoxide and Volatile Organic Compounds (VOCs) were met at engine exhaust 1538 and 1510, as summarrised in Tables 5-2 and 5-3 during 2022 and 2023.

Table 5-2 Quarterly and Annual Monitoring of Engine 1538 (Engine 1)

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 (±408.4 - See Note)
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 5-3 Quarterly and Annual Monitoring of Engine 1510 (Engine 2)

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)
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.					

The annual measurement at the flare revealed the monitoring parameters to be below emission limits, as summarrised in Table 5-4 and reported in Appendix 1.

Table 5-4 Annual Flare 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

5.3 Trace Gas Inlet Monitoring

On 20 October 2023, trace gas analysis was undertaken of the fuel gas utilised by the gas engine generator plant. The full report is included in Appendix 1.

The compounds found to be above the analytical detection are summarised in Table 5-5. As noted previously, the monitoring shows that very few compounds were detected above the analytical detection limit and that sulphide compounds continue to dominate.

Table 5-5 Trace gas content at compound

		Mar-22	Oct-23	Units
Arsenic (as As)			403	
Acetaldehyde (Ethanal)	0	67	81	µg/m^3
Chloroethane	0	61	91	µg/m^3
1-Pentene	<	<82	532	µg/m^3
Furan	0	735	1482	µg/m^3
Dimethylsulphide	0	981	4561	µg/m^3
DCM	<	<41	42	µg/m^3
CS2	0	2615	32309	µg/m^3
1,2-dichloroethene (trans + cis)			148	
1,1-Dichloroethane	<	<20	23	µg/m^3
1,2-Dichloroethane	<	<20	84	µg/m^3
Benzene	0	531	5321	µg/m^3
Trichloroethylene	<	<20	148	µg/m^3
Toluene	<	<20	9503	µg/m^3
Styrene	<	<20	2965	µg/m^3
Hydrogen sulphide		< 151691	166860	µg/m^3
Vinyl Chloride	0	90	38	µg/m^3
Formaldehyde (Methanal)	0	67	27	µg/m^3
Ethylbenzene	0	12		µg/m^3
m/p-Xylene	0	29		µg/m^3
o-Xylene	0	8		µg/m^3

5.4 Perimeter Monitoring

Perimeter monitoring is undertaken at selected groundwater monitoring wells. A comparison of the maximum concentrations detected during 2023 with emission limits is provided in Table 5-6. 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 5-6 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,	Carbon Dioxide	No limit	0.6	0.9	3.6	3.3
BH6, BH9, BH15, BH18, BH20	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,	Carbon Dioxide	No limit	3.4	4.2	2.4	2.5
BH6, BH9, BH15, BH18, BH20	Methane	1% v/v.	0.1	0	0.3	0.1

At each of the monitored well, 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. Two slightly elevated readings were, however, detected:

1. 10ppm adjacent to the pipe which is connected to the gas extraction system at the southern end of Phase 1.
2. 3ppm at the north western edge of Phase 2 Cell 1/2N

Similar observations had previously been made in relation to other parts of the site.

The industry has moved away from the use of FIDs and so instead, this year's annual survey is being 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. Unfortunately, at the time of writing the full dataset for the detailed walkover survey is incomplete but interim results, taken from spot surveys completed on 14 and 15 December are included in Appendix 2.

Once the full surveys are processed and interpreted a separate addendum will be required, which is anticipated to be complete by 2 February 2024.

5.6 Odour

During 2023 a large number of complaints have been received and logged by the RML site team. These primarily relate to odour and have been taken very seriously by the Senior Management Team and Directors. As part of the investigation into the odour complaints, Geotechnology has undertaken a fugitive gas emission survey on 14 December 2023. The results of the survey are included in Appendix 2 and the pattern of emission indicates very low emission across Phase 1 and the capped part of Phase 2. The highest values of methane concentration were measured around the toe of the flanks (where the drainage blanket for Cells 6 and 7 were exposed) and the top of the overtipped wastes. A second survey, carried out on 15 December, used the same Inspectra Portable Laser Spectroscopy Methane Detector to measure gas concentrations around existing gas infrastructure. This survey is also provided in Appendix 2 and indicates that, with two exceptions, the gas infrastructure is not leaking gas. This survey confirms the most likely source of odour to be fugitive emission in the uncapped area which allows focussed remedial measures to be taken; these are ongoing.

Actions taken to date include meeting with local residents to understand their concerns and explain the additional monitoring and remedial steps being undertaken. Throughout, RML has worked closely with NRW and the Public Health Department of Pembrokeshire County Council. Remedial plans have been developed that are aimed at quickly resolving the issue.

6 TOPOGRAPHIC SURVEY, SETTLEMENT AND VOID SPACE

6.1 Topographic Survey

A topographic survey of the site, including the operational landfill cells and the capped area was undertaken on 17 January 2024.

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 digital surface model (DSM) which has been uploaded to the Propeller online platform which is 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 3.

6.2 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.

This volume calculation accounts for some waste material located above earlier landfill cells, which requires removal and placement into Cell 8. It should be noted that this calculation does not take any account of future landfill cells that have yet to be constructed.

The immediate capacity available in Cell 8 is 225,721m^3. Cell 9 will provide an additional 462,500m^3 void space once constructed in 2024.

6.3 Settlement

Propeller has been used to carry out a comparison of the January 2024 survey to the survey undertaken in January 2023. 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 Plate 6-1.

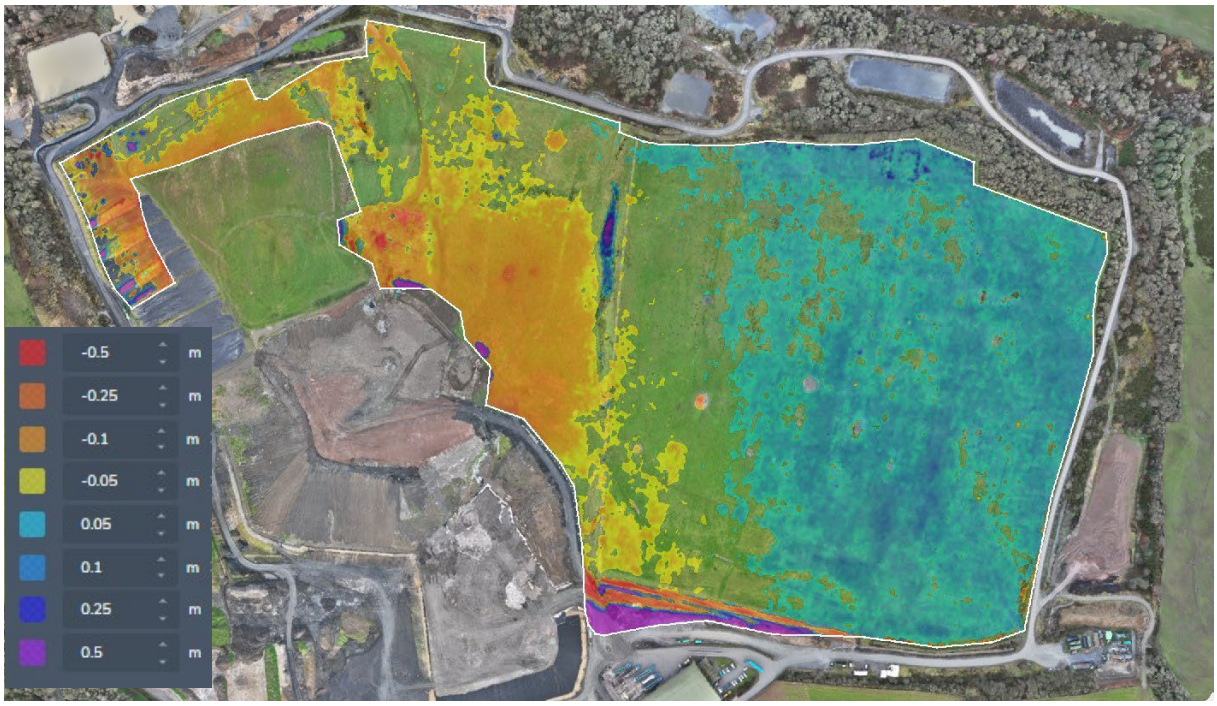

Plate 6-1 January 2023 – January 2024 Surface Model Comparison

The plate 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 eastern part of the capped Phase 1 landfill is covered in blue, indicating an increase in elevation of 0-0.25m. It is unlikely that the landfill has in fact increased in level, so this elevation change is most likely attributed to changes in vegetation between the surveys. Although efforts have been made to reduce the influence of the vegetation on the surface, this is a limitation of the survey method. There is only limited evidence of surface level reduction, located in the southwest of the capped area suggesting minimal settlement of waste at Phase 1. To assess settlement more accurately in capped areas, settlement markers would need to be installed to allow repeat measurements using manual survey methods.

A thin section of purple and red located in the southwest corner of the capped landfill is the result of improvement works undertaken over the last year which have involved the extension of a yard and installation of a new drain. These have resulted in significant changes to the surface that are not related to settlement.

The capped sections of Areas A & B show more substantial amounts of settlement, generally ranging from 0-0.25m. Some localised areas show elevation reduction in excess of 0.5m, though these appear to coincide with the removal of local features (including vegetation) during the last year.

Drawing Number 2422/1

Legend

- BH32 — Groundwater/Gas Borehole
- SP7 — Surface Water
- D2 — Discharge Point
- LM3(S) — Leachate Sump/Well
- Area Boundary
- Cell Boundary
- No Basal Liner
- 1m Mineral Liner
- 1m Mineral Liner/fml
- gcl/0.5m mineral liner/fml

NOTE

Monitoring point numbering aligns with Permit monitoring schedule.
Datum and cover levels to be re-surveyed when formal site survey control is available
Historical cell and phase boundaries have been plotted from various drawing and plans
Cell lining systems are taken from 2018 HRA update

Survey Stations

ID Easting Northing Elevation

BOREHOLE ID	EASTING	NORTHING	LEVEL (mAOD)	
BH30R	197170	221628	DATUM LEVEL	56.05
			GROUND LEVEL	55.68
BH31	197287	221461	DATUM LEVEL	57.06
			GROUND LEVEL	56.72
BH31	197286	221628	DATUM LEVEL	56.98
			GROUND LEVEL	56.61
BH37	197291	221417	DATUM LEVEL	56.61
			GROUND LEVEL	56.19
BH34	197294	221668	DATUM LEVEL	57.02
			GROUND LEVEL	56.68
BH27(TPR10)	197298	221778	DATUM LEVEL	46.06
			GROUND LEVEL	45.74
BH28	197272	221628	DATUM LEVEL	46.05
			GROUND LEVEL	45.67
BH27(TPR11)	197280	221827	DATUM LEVEL	46.11
			GROUND LEVEL	45.79
BH27(TPR12)	196980	221903	DATUM LEVEL	46.07
			GROUND LEVEL	45.67
AIGBH104	196748	221998	DATUM LEVEL	45.66
			GROUND LEVEL	45.34
BH1R	196900	221961	DATUM LEVEL	41.39
			GROUND LEVEL	41.06
BH2	196900	221882	DATUM LEVEL	42.67
			GROUND LEVEL	42.34
BH3	196922	221766	DATUM LEVEL	42.29
			GROUND LEVEL	41.96
AIGBH102	196845	221766	DATUM LEVEL	40.95
			GROUND LEVEL	40.62
BH4	196844	221716	DATUM LEVEL	37.75
			GROUND LEVEL	37.42
BH5	196755	221661	DATUM LEVEL	35.77
			GROUND LEVEL	35.44
BH6	196688	221661	DATUM LEVEL	31.83
			GROUND LEVEL	31.50
BH7	196688	221587	DATUM LEVEL	31.53
			GROUND LEVEL	31.20
BH8	196688	221528	DATUM LEVEL	31.36
			GROUND LEVEL	31.03
BH9	196688	221473	DATUM LEVEL	31.27
			GROUND LEVEL	30.94
BH10	196688	221418	DATUM LEVEL	31.98
			GROUND LEVEL	31.66
BH11	196677	221367	DATUM LEVEL	41.47
			GROUND LEVEL	41.14
BH12	196688	221307	DATUM LEVEL	41.65
			GROUND LEVEL	41.32
BH13	196728	221274	DATUM LEVEL	42.76
			GROUND LEVEL	42.43
BH14	196833	221266	DATUM LEVEL	45.04
			GROUND LEVEL	44.71
BH15	196907	221274	DATUM LEVEL	48.36
			GROUND LEVEL	48.07
BH16	196960	221305	DATUM LEVEL	52.74
			GROUND LEVEL	52.41
BH17	196960	221369	DATUM LEVEL	61.55
			GROUND LEVEL	61.23
BH18	197018	221369	DATUM LEVEL	55.97
			GROUND LEVEL	55.64
BH19	197018	221428	DATUM LEVEL	55.54
			GROUND LEVEL	55.22
BH20R	197018	221478	DATUM LEVEL	55.39
			GROUND LEVEL	55.06
BH21	197018	221537	DATUM LEVEL	55.48
			GROUND LEVEL	55.15
BH22	197018	221596	DATUM LEVEL	55.68
			GROUND LEVEL	55.35
BH23	197018	221655	DATUM LEVEL	55.84
			GROUND LEVEL	55.51
BH24R	197018	221714	DATUM LEVEL	55.91
			GROUND LEVEL	55.58
BH25R	197018	221773	DATUM LEVEL	56.06
			GROUND LEVEL	55.73
BH26	197018	221832	DATUM LEVEL	57.29
			GROUND LEVEL	56.96
BH32	196844	221832	DATUM LEVEL	49.47
			GROUND LEVEL	49.14
BH33	196844	221773	DATUM LEVEL	43.48
			GROUND LEVEL	43.15
BH35	196844	221714	DATUM LEVEL	50.76
			GROUND LEVEL	50.43
BH36	196844	221655	DATUM LEVEL	42.84
			GROUND LEVEL	42.51
BH37	196844	221596	DATUM LEVEL	38.16
			GROUND LEVEL	37.83
BH38	196844	221537	DATUM LEVEL	37.75
			GROUND LEVEL	37.42
BH39	196844	221478	DATUM LEVEL	38.08
			GROUND LEVEL	37.75
BH40	196844	221419	DATUM LEVEL	38.08
			GROUND LEVEL	37.75
BH41	196844	221360	DATUM LEVEL	41.47
			GROUND LEVEL	41.14
BH42	196844	221301	DATUM LEVEL	42.43
			GROUND LEVEL	42.10
BH43	196844	221242	DATUM LEVEL	44.73
			GROUND LEVEL	44.40
BH44	196844	221183	DATUM LEVEL	48.07
			GROUND LEVEL	47.74
BH45	196844	221124	DATUM LEVEL	52.41
			GROUND LEVEL	52.08
BH46	196844	221065	DATUM LEVEL	61.23
			GROUND LEVEL	60.90
BH47	196844	221006	DATUM LEVEL	55.22
			GROUND LEVEL	54.89
BH48	196844	220947	DATUM LEVEL	55.64
			GROUND LEVEL	55.31
BH49	196844	220888	DATUM LEVEL	55.91
			GROUND LEVEL	55.58
BH50	196844	220829	DATUM LEVEL	56.06
			GROUND LEVEL	55.73
BH51	196844	220770	DATUM LEVEL	57.29
			GROUND LEVEL	56.96
BH52	196844	220711	DATUM LEVEL	49.47
			GROUND LEVEL	49.14
BH53	196844	220652	DATUM LEVEL	43.48
			GROUND LEVEL	43.15
BH54	196844	220593	DATUM LEVEL	50.76
			GROUND LEVEL	50.43
BH55	196844	220534	DATUM LEVEL	42.84
			GROUND LEVEL	42.51
BH56	196844	220475	DATUM LEVEL	38.16
			GROUND LEVEL	37.83
BH57	196844	220416	DATUM LEVEL	37.75
			GROUND LEVEL	37.42
BH58	196844	220357	DATUM LEVEL	38.08
			GROUND LEVEL	37.75
BH59	196844	220298	DATUM LEVEL	41.47
			GROUND LEVEL	41.14
BH60	196844	220239	DATUM LEVEL	42.43
			GROUND LEVEL	42.10
BH61	196844	220180	DATUM LEVEL	44.73
			GROUND LEVEL	44.40
BH62	196844	220121	DATUM LEVEL	48.07
			GROUND LEVEL	47.74
BH63	196844	220062	DATUM LEVEL	52.41
			GROUND LEVEL	52.08
BH64	196844	220003	DATUM LEVEL	61.23
			GROUND LEVEL	60.90
BH65	196844	219944	DATUM LEVEL	55.22
			GROUND LEVEL	54.89
BH66	196844	219885	DATUM LEVEL	55.64
			GROUND LEVEL	55.31
BH67	196844	219826	DATUM LEVEL	55.91
			GROUND LEVEL	55.58
BH68	196844	219767	DATUM LEVEL	56.06
			GROUND LEVEL	55.73
BH69	196844	219708	DATUM LEVEL	57.29
			GROUND LEVEL	56.96
BH70	196844	219649	DATUM LEVEL	49.47
			GROUND LEVEL	49.14
BH71	196844	219590	DATUM LEVEL	43.48
			GROUND LEVEL	43.15
BH72	196844	219531	DATUM LEVEL	50.76
			GROUND LEVEL	50.43
BH73	196844	219472	DATUM LEVEL	42.84
			GROUND LEVEL	42.51
BH74	196844	219413	DATUM LEVEL	38.16
			GROUND LEVEL	37.83
BH75	196844	219354	DATUM LEVEL	37.75
			GROUND LEVEL	37.42
BH76	196844	219295	DATUM LEVEL	38.08
			GROUND LEVEL	37.75
BH77	196844	219236	DATUM LEVEL	41.47
			GROUND LEVEL	41.14
BH78	196844	219177	DATUM LEVEL	42.43
			GROUND LEVEL	42.10
BH79	196844	219118	DATUM LEVEL	44.73
			GROUND LEVEL	44.40
BH80	196844	219059	DATUM LEVEL	48.07
			GROUND LEVEL	47.74
BH81	196844	219000	DATUM LEVEL	52.41
			GROUND LEVEL	52.08
BH82	196844	218941	DATUM LEVEL	61.23
			GROUND LEVEL	60.90
BH83	196844	218882	DATUM LEVEL	55.22
			GROUND LEVEL	54.89
BH84	196844	218823	DATUM LEVEL	55.64
			GROUND LEVEL	55.31
BH85	196844	218764	DATUM LEVEL	55.91
			GROUND LEVEL	55.58
BH86	196844	218705	DATUM LEVEL	56.06
			GROUND LEVEL	55.73
BH87	196844	218646	DATUM LEVEL	57.29
			GROUND LEVEL	56.96
BH88	196844	218587	DATUM LEVEL	49.47
			GROUND LEVEL	49.14
BH89	196844	218528	DATUM LEVEL	43.48
			GROUND LEVEL	43.15
BH90	196844	218469	DATUM LEVEL	50.76
			GROUND LEVEL	50.43
BH91	196844	218410	DATUM LEVEL	42.84
			GROUND LEVEL	42.51
BH92	196844	218351	DATUM LEVEL	38.16
			GROUND LEVEL	37.83
BH93	196844	218292	DATUM LEVEL	37.75
			GROUND LEVEL	37.42
BH94	196844	218233	DATUM LEVEL	38.08
			GROUND LEVEL	37.75
BH95	196844	218174	DATUM LEVEL	41.47
			GROUND LEVEL	41.14
BH96	196844	218115	DATUM LEVEL	42.43
			GROUND LEVEL	42.10
BH97	196844	218056	DATUM LEVEL	44.73
			GROUND LEVEL	44.40
BH98	196844	217997	DATUM LEVEL	48.07
			GROUND LEVEL	47.74
BH99	196844	217938	DATUM LEVEL	52.41
			GROUND LEVEL	52.08
BH100	196844	217879	DATUM LEVEL	61.23
			GROUND LEVEL	60.90
BH101	196844	217820	DATUM LEVEL	55.22
			GROUND LEVEL	54.89
BH102	196844	217761	DATUM LEVEL	55.64
			GROUND LEVEL	55.31
BH103	196844	217702	DATUM LEVEL	55.91
			GROUND LEVEL	55.58
BH104	196844	217643	DATUM LEVEL	56.06
			GROUND LEVEL	55.73
BH105	196844	217584	DATUM LEVEL	57.29
			GROUND LEVEL	56.96
BH106	196844	217525	DATUM LEVEL	49.47
			GROUND LEVEL	49.14
BH107	196844	217466	DATUM LEVEL	43.48
			GROUND LEVEL	43.15
BH108	196844	217407	DATUM LEVEL	50.76
			GROUND LEVEL	50.43
BH109	196844	217348	DATUM LEVEL	42.84
			GROUND LEVEL	42.51
BH110	196844	217289	DATUM LEVEL	38.16
			GROUND LEVEL	37.83
BH111	196844	217230	DATUM LEVEL	37.75
			GROUND LEVEL	37.42
BH112	196844	217171	DATUM LEVEL	38.08
			GROUND LEVEL	37.75
BH113	196844	217112	DATUM LEVEL	41.47
			GROUND LEVEL	41.14
BH114	196844	217053	DATUM LEVEL	42.43
			GROUND LEVEL	42.10
BH115	196844	216994	DATUM LEVEL	44.73
			GROUND LEVEL	44.40
BH116	196844	216935	DATUM LEVEL	48.07
			GROUND LEVEL	47.74
BH117	196844	216876	DATUM LEVEL	52.41
			GROUND LEVEL	52.08
BH118	196844	216817	DATUM LEVEL	61.23
			GROUND LEVEL	60.90
BH119	196844	216758	DATUM LEVEL	55.22
			GROUND LEVEL	54.89
BH120	196844	216699	DATUM LEVEL	55.64
			GROUND LEVEL	55.31
BH121	196844	216640	DATUM LEVEL	55.91
			GROUND LEVEL	55.58
BH122	196844	216581	DATUM LEVEL	56.06
			GROUND LEVEL	55.73
BH123	196844	216522	DATUM LEVEL	57.29
			GROUND LEVEL	56.96
BH124	196844	216463	DATUM LEVEL	49.47
			GROUND LEVEL	49.14
BH125	196844	216404	DATUM LEVEL	43.48
			GROUND LEVEL	43.15
BH126	196844	216345	DATUM LEVEL	50.76
			GROUND LEVEL	50.43
BH127	196844	216286	DATUM LEVEL	42.84
			GROUND LEVEL	42.51
BH128	196844	216227	DATUM LEVEL	38.16
			GROUND LEVEL	37.83
BH129	196844	216168	DATUM LEVEL	37.75
			GROUND LEVEL	37.42
BH130	196844	216109	DATUM LEVEL	38.08
			GROUND LEVEL	37.75
BH131	196844	216050	DATUM LEVEL	41.47
			GROUND LEVEL	41.14
BH132	196844	215991	DATUM LEVEL	42.43
			GROUND LEVEL	42.10
BH133	196844	215932	DATUM LEVEL	44.73
			GROUND LEVEL	44.40
BH134	196844	215873	DATUM LEVEL	48.07
			GROUND LEVEL	47.74
BH135	196844	215814	DATUM LEVEL	52.41
			GROUND LEVEL	52.08
BH136	196844	215755	DATUM LEVEL	61.23
			GROUND LEVEL	60.90
BH137	196844	215696	DATUM LEVEL	55.22
			GROUND LEVEL	54.89
BH138	196844	215637	DATUM LEVEL	55.64
			GROUND LEVEL	55.31
BH139	196844	215578	DATUM LEVEL	55.91
			GROUND LEVEL	55.58
BH140	196844	215519	DATUM LEVEL	56.06
			GROUND LEVEL	55.73
BH141	196844	215460	DATUM LEVEL	57.29
			GROUND LEVEL	56.96
BH142	196844	215401	DATUM LEVEL	49.47
			GROUND LEVEL	49.14
BH143	196844	215342	DATUM LEVEL	43.48
			GROUND LEVEL	43.15
BH144	196844	215283	DATUM LEVEL	50.76
			GROUND LEVEL	50.43
BH145	196844	215224	DATUM LEVEL	42.84
			GROUND LEVEL	42.51
BH146	196844	215165	DATUM LEVEL	38.16
			GROUND LEVEL	37.83
BH147	196844	215106	DATUM LEVEL	37.75
			GROUND LEVEL	37.42
BH148	196844	215047	DATUM LEVEL	38.08
			GROUND LEVEL	37.75
BH149	196844	214988	DATUM LEVEL	41.47
			GROUND LEVEL	41.14
BH150	196844	214929	DATUM LEVEL	42.43
			GROUND LEVEL	42.10
BH151	196844	214870	DATUM LEVEL	44.73
			GROUND LEVEL	44.40
BH152	196844	214811	DATUM LEVEL	48.07
			GROUND LEVEL	47.74
BH153	196844	214752	DATUM LEVEL	52.41
			GROUND LEVEL	52.08
BH154	196844	214693	DATUM LEVEL	61.23
			GROUND LEVEL	60.90
BH155	196844	214634	DATUM LEVEL	55.22
			GROUND LEVEL	54.89
BH156	196844	214575	DATUM LEVEL	55.64
			GROUND LEVEL	55.31
BH157	196844	214516	DATUM LEVEL	55.91
			GROUND LEVEL	55.58
BH158	196844	214457	DATUM LEVEL	56.06
			GROUND LEVEL	55.73
BH159	196844	214398	DATUM LEVEL	57.29
			GROUND LEVEL	56.96
BH160	196844	214339	DATUM LEVEL	49.47
			GROUND LEVEL	49.14
BH161	196844	214280	DATUM LEVEL	43.48
			GROUND LEVEL	43.15
BH162	196844	214221	DATUM LEVEL	50.76
			GROUND LEVEL	50.43
BH163	196844	214162	DATUM LEVEL	42.84
			GROUND LEVEL	42.51
BH164	196844	214103	DATUM LEVEL	38.16
			GROUND LEVEL	37.83
BH165	196844	214044	DATUM LEVEL	37.75
			GROUND LEVEL	37.42
BH166	196844	213985	DATUM LEVEL	38.08
			GROUND LEVEL	37.75
BH167	196844	213926	DATUM LEVEL	41.47
			GROUND LEVEL	41.14
BH168	196844	213867	DATUM LEVEL	42.43
			GROUND LEVEL	42.10
BH169	196844	213808	DATUM LEVEL	44.73
			GROUND LEVEL	44.40
BH170	196844	213749	DATUM LEVEL	48.07
			GROUND LEVEL	47.74
BH171	196844	213690	DATUM LEVEL	52.41
			GROUND LEVEL	52.08
BH172	196844	213631	DATUM LEVEL	61.23
			GROUND LEVEL	60.90
BH173	196844	213572	DATUM LEVEL	55.22
			GROUND LEVEL	54.89
BH174	196844	213513	DATUM LEVEL	55.64
			GROUND LEVEL	55.31
BH175	196844	213454	DATUM LEVEL	55.91
			GROUND LEVEL	55.58
BH176	196844	213395	DATUM LEVEL	56.06
			GROUND LEVEL	55.73
BH177	196844	213336	DATUM LEVEL	57.29
			GROUND LEVEL	56.96
BH178	196844	213277	DATUM LEVEL	49.47
			GROUND LEVEL	49.14
BH179	196844	213218	DATUM LEVEL	43.48
			GROUND LEVEL	43.15
BH180	196844	213159	DATUM LEVEL	50.76
			GROUND LEVEL	50.43
BH181	196844	213100	DATUM LEVEL	42.84
			GROUND LEVEL	42.51
BH182	196844	213041	DATUM LEVEL	38.16
			GROUND LEVEL	37.83
BH183	196844	212982	DATUM LEVEL	37.75
			GROUND LEVEL	37.42
BH184	196844	212923	DATUM LEVEL	38.08
			GROUND LEVEL	37.75
BH185	196844	212864	DATUM LEVEL	41.47
			GROUND LEVEL	41.14
BH186	196844	212805	DATUM LEVEL	42.43
			GROUND LEVEL	42.10
BH187	196844	212746	DATUM LEVEL	44.73
			GROUND LEVEL	44.40
BH188	196844	212687	DATUM LEVEL	48.07
			GROUND LEVEL	47.74
BH189	196844	212628	DATUM LEVEL	52.41
			GROUND LEVEL	52.08
BH190	196844	212569	DATUM LEVEL	61.23
			GROUND LEVEL	60.90
BH191	196844	212510	DATUM LEVEL	55.22
			GROUND LEVEL	54.89
BH192	196844	212451	DATUM LEVEL	55.64
			GROUND LEVEL	55.31
BH193	196844	212392	DATUM LEVEL	55.91
			GROUND LEVEL	55.58
BH194	196844	212333	DATUM LEVEL	56.06
			GROUND LEVEL	55.73
BH195	196844	212274	DATUM LEVEL	57.29
			GROUND LEVEL	56.96
BH196	196844	212215	DATUM LEVEL	49.47
			GROUND LEVEL	49.14
BH197	196844	212156	DATUM LEVEL	43.48
			GROUND LEVEL	43.15
BH198	196844	212097	DATUM LEVEL	50.76
			GROUND LEVEL	50.43
BH199	196844	212038	DATUM LEVEL	42.84
			GROUND LEVEL	42.51
BH200	196844	211979	DATUM LEVEL	38.16
			GROUND LEVEL	37.83

Rev	Date	Status/Ammendments

CLIENT: Resources Management (UK) Ltd

PROJECT: Withyhedge Landfill Site

TITLE: **M**onitoring **Network**

DRAWING NUMBER		REVISION
2422/1		0
SCALE AT A3	DATE	DRAWN / CHECKED
1:1250	01/24	ET / AH

Geotechnology
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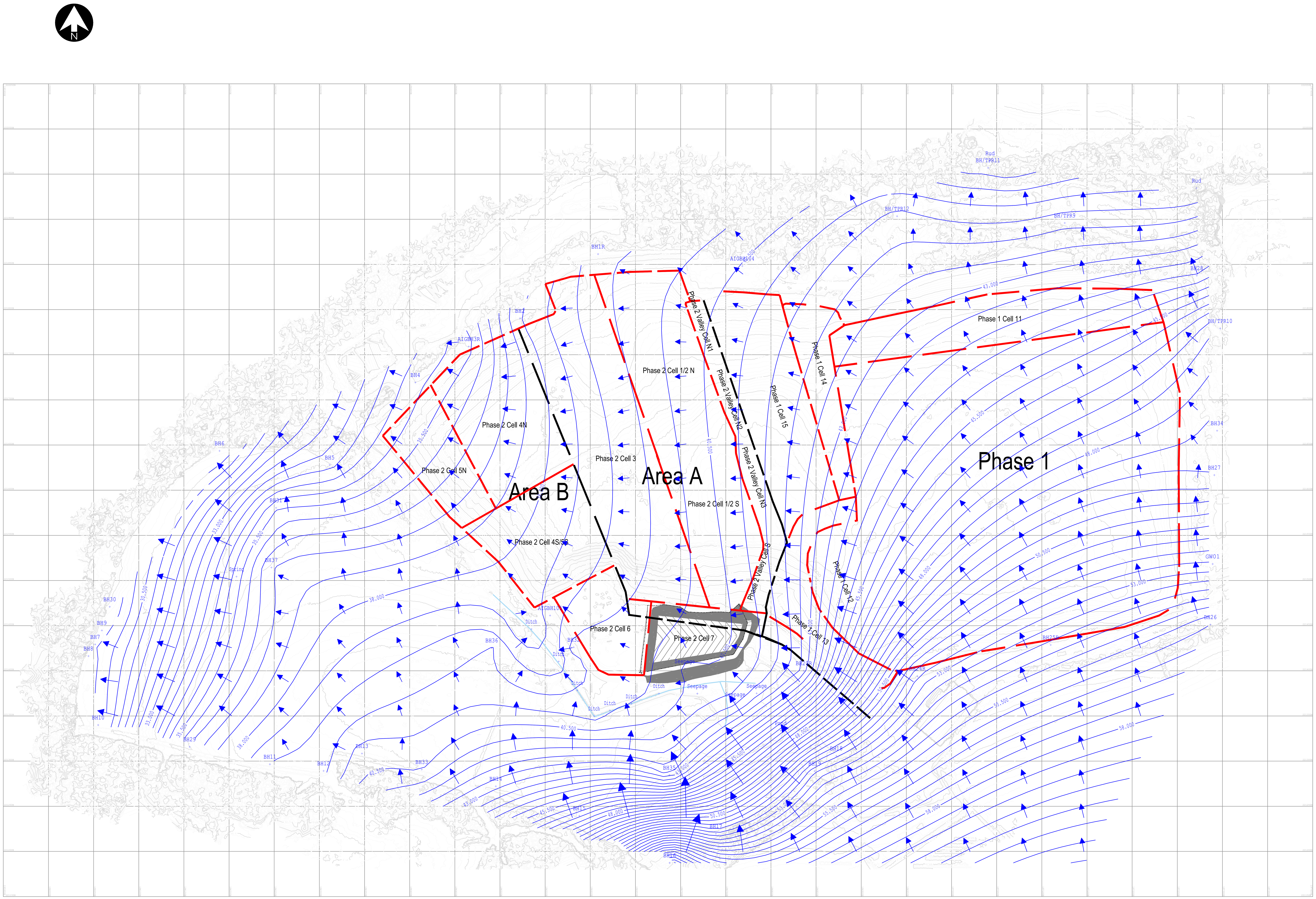

Drawing Number 2422/02

Legend

Note

All coordinates and levels are to OS Grid and Datum.

Topographic survey undertaken on 19 January 2022 by photogrammetry using DJI Phantom 4 RTK Drone, ground control points installed with Topcon Hiper SR dGPS survey equipment.

Survey imagery and ground control processed in Pix4D Photogrammetry software to generate high resolution orthomosaic and digital surface model.

Rev	Date	Status/Ammendments

CLIENT: RML Ltd

PROJECT: Withyhedge Landfill 2023 Annual Review of Monitoring

TITLE: Groundwater Contours

DRAWING NUMBER	REVISION
Figure 2	0

SCALE AT A1	DATE	DRAWN	CHECKED
1:2000	01/24	BR	

Geotechnology
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RML
RESOURCES MANAGEMENT UK LTD

LEGEND

NOTES
Image acquired by drone survey on 24 January 2023.

PROJECT
Withyhedge Landfill
2023 Annual Review of Monitoring

TITLE
Current Topography

DRAWING NUMBER
2422/03

SCALE AT A3	DATE	DRAWN
1:2000	**01/24**	**BR**

NOTE

Geo TECHNOLOGY

2023 ANNUAL REVIEW OF MONITORING

Withyhedge Landfill site
EPR: MP3330WP

Appendix 1
Engine and Flare Stack Monitoring Reports

Report Number 2422r1v1d0124

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 UK Ltd

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

EPR Permit: GP3630HT/V003

Stack Reference
Flare

Dates of the Monitoring Campaign
20th October 2023

Job Reference Number
ERE-23376

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
16th November 2023

Version
Version 1

Signature of Report Approver


CONTENTS

TITLE PAGE

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EXECUTIVE SUMMARY

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- Monitoring Dates & Times 5
- Process Details 6
- Monitoring & Analytical Methods 7
- Summary of Sampling Deviations 7
- Sampling Location 8
- Plant Photos / Sample Points 9

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 UK Ltd, Withyhedge Landfill Site
Flare
20th October 2023

Overall Aim of the Monitoring Campaign

Element were commissioned by Resource Management UK Ltd to carry out stack emissions testing on the Flare 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

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

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

Resource Management UK Ltd, Withyhedge Landfill Site

Flare

20th October 2023

where MU = Measurement Uncertainty associated with the Result

		Concentration			
Parameter	**Units**	**Result**		**MU +/-**	**Limit**
Total VOCs (as Carbon) [1]	mg/m³	1.8		0.65	10
Oxides of Nitrogen (as NO_2) [1]	mg/m³	74.1		4.1	150
Carbon Monoxide [1]	mg/m³	1.7		1.8	50
Oxygen	% v/v	**Dry**	8.2	0.30	
Water Vapour	% v/v	11.2		0.49	

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

MONITORING DATE(S) & TIMES

Resource Management UK Ltd, Withyhedge Landfill Site
Flare
20th October 2023

Parameter		Units	Concentration		Sampling Date(s)	Sampling Times	Duration mins
Total VOCs (as Carbon)	R1	mg/m^3	1.8		20/10/2023	10:10 - 11:10	60
Oxides of Nitrogen (as NO_2)	R1	mg/m^3	74.1		28/09/2023	10:10 - 11:10	60
Carbon Monoxide	R1	mg/m^3	1.7		28/09/2023	10:10 - 11:10	60
Oxygen	R1	% v/v	8.2		28/09/2023	10:10 - 11:10	60
Water Vapour	R1	% v/v	11.2		20/10/2023	10:10 - 11:10	60

All results are expressed at the respective reference conditions.

PROCESS DETAILS

Resource Management UK Ltd, Withyhedge Landfill Site
Flare
20th October 2023

Standard Operating Conditions

Parameter	Value
Process Status	Operating
Capacity (of 100%) and Tonnes / Hour	571 m3/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 visible plume

MONITORING & ANALYTICAL METHODS

Resource Management UK Ltd, Withyhedge Landfill Site
Flare
20th October 2023

	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	CAT-TP-05	MCERTS	EET	CAT-TP-05	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	MCERTS	EET	Flame Ionisation Detection by Signal 3010HM				MCERTS	0.16 mg/m³
Oxides of Nitrogen (as NO_2)	EN 14792	CAT-TP-21	MCERTS	EET	Chemiluminescence by Horiba PG-250				MCERTS	0.41 mg/m³
Carbon Monoxide	EN 15058	CAT-TP-21	MCERTS	EET	NDIR by Horiba PG-250				MCERTS	1.24 mg/m³
Oxygen	EN 14789	CAT-TP-21	MCERTS	EET	Dry Zirconia Cell by Horiba PG-250				MCERTS	0.1 %

ANALYSIS LABORATORIES

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

Element (Stockport Lab - EET)	ISO 17025 Accreditation Number: 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	1.50
Width	m	-
Area	m^2	1.77
Port Depth	cm	N/A
Orientation of Duct	-	Vertical
Number of Ports	-	N/A - Mast Use
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

Due to the nature of the access into the duct, it is not possible to conduct a full velocity profile, however no particulate phase sampling was required and all gaseous species were considered to be mixed sufficiently for the purposes of these tests. There is also no requirement to undertake a homogeneity test as per EN 15259 and as such the location cannot be compared against that or the criteria within TGN M1. The sampling location used in this instance has been approved for use by the Environment Agency.

EN 15259 Homogeneity Test Requirements

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

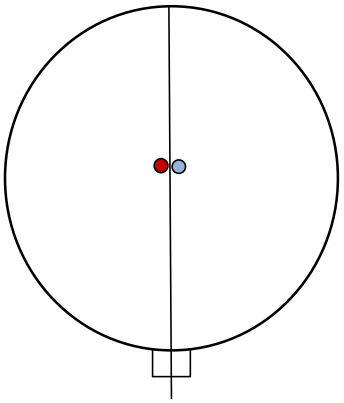
Executive Summary

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
Trainee	Joshua Cunningham	MCERTS Level 1	MM 22 1702	None

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 17.82
500g / 1Kg Check Weights	CAT 17.82
Last Impinger Arm	CAT 17.82
Callipers	-
Tubes Kit Thermocouple	-

Instrumental Analysers	
Equipment Type	**Equipment I.D.**
Horiba PG-250	CAT 9.2
Horiba PG-350E	-
Servomex 4900	-
Eco Physics CLD 822Mh	-
ABB AO2020-URAS26	-
Testo 350 XL	-
Signal 200SM	CAT 4.00168
Gasmet DX4000	-
Gasmet Sampling System	-
Signal 3010HM	CAT 8.50
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
Hioki 5043 (V)	-
Bioaerosols Temperature Logger	-
Electronic Refrigerator	-

Miscellaneous Items	
Equipment Type	**Equipment I.D.**
Digital Manometer (1)	-
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.294
Stopwatch	-
Barometer	-
Stack Thermocouple (1)	CAT 3.294
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 20.1023
20m Heated Line (2)	-
Dual Channel Heater Controller	-
Single Channel Heater Controller	CAT 20.1023
Laboratory Balance	
Tape Measure	CAT 16.144

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Water Vapour	EN 14790	CAT-TP-05
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20
Oxides of Nitrogen (as NO_2)	EN 14792	CAT-TP-21
Carbon Monoxide	EN 15058	CAT-TP-21
Oxygen	EN 14789	CAT-TP-21

WATER VAPOUR: RESULTS SUMMARY

Resource Management UK Ltd, Withyhedge Landfill Site

Flare

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	% v/v	11.2		11.2
Uncertainty	±% v/v	0.49		0.49

General Sampling Information

Parameter	Value
Standard	EN 14790
Technical Procedure	CAT-TP-05

WATER VAPOUR: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	10:10 - 11:10
Sampling Dates	-	20/10/2023
Sampling Device	-	MFC / MV
Duration	mins	60
Volume Sampled (STP, Dry)	m^3	0.3010
Volume Sampled (STP, Wet)	m^3	0.3391
Sample Flow Rate	l/min	4.81
Liquid Trap Start Mass	g	2572.9
Liquid Trap End Mass	g	2601.2
Silica Trap Start Mass	g	892.5
Silica Trap End Mass	g	894.8
Total Mass Of Water Vapour	g	30.6
Calculated Water Vapour	% v/v	11.24

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

WATER VAPOUR: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	4.8
Pre-Sampling Leak Rate	l/min	0.05
Post-Sampling Leak Rate	l/min	0.05
Allowable Leak Rate	l/min	0.10
Leak Test Acceptable	-	Yes

Water Droplets	Units	Run 1
Are Water Droplets Present	-	No

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

Silica Gel	Units	Run 1
Less than 50% Faded	%	Yes

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	No

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

WATER VAPOUR: MEASUREMENT UNCERTAINTY CALCULATIONS

	Value			Standard uncertainty			
Measured Quantities	**Symbol**	**Run 1**		**Symbol**	**Units**	**Run 1**	
Sampled Volume (STP)	V_m	0.301		uV_m	m^3	0.006	
Repeatability of Weighing	R_w	30.60		uR_w	g	0.15	
Reading of Balance	R_b	30.60		uR_b	g	0.15	
Leak	L	1.04			%	-	

	Uncertainty as a Percentage			
Measured Quantities	**Units**	**Run 1**		**Requirement of Standard**
Sampled Volume (STP)	%	2.00		≤2%
Repeatability of Weighing	%	0.49		No Requirement
Reading of Balance	%	0.50		No Requirement
Leak	%	1.04		≤2%

	Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	**Symbol**	**Units**	**Run 1**		**Run 1**	
Sampled Volume (STP)	V_m	m^3	0.3010		37.35	
Repeatability of Weighing	R_w	g	30.60		0.37	
Reading of Balance	R_b	g	30.60		0.37	
Leak	L	% v/v	0.07		1.00	

	Uncertainty in Result		
Measured Quantities	**Units**	**Run 1**	
Sampled Volume (STP)	% v/v	0.225	
Repeatability of Weighing	% v/v	0.055	
Reading of Balance	% v/v	0.056	
Leak	% v/v	0.067	

Parameter	**Units**	**Run 1**
Combined uncertainty	% v/v	0.25
Expanded uncertainty (95% confidence)	% v/v	0.49
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.49
Uncertainty if Water Droplets are present	% v/v	N/A
Reported Uncertainty	% v/v	0.49
Expanded uncertainty (95% confidence)	%	4.3
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	4.3
Uncertainty if Water Droplets are present	%	N/A
Reported Uncertainty	%	4.3

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Resource Management UK Ltd, Withyhedge Landfill Site
Flare

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	1.8		1.8
Uncertainty	±mg/m³	0.65		0.65

General Sampling Information

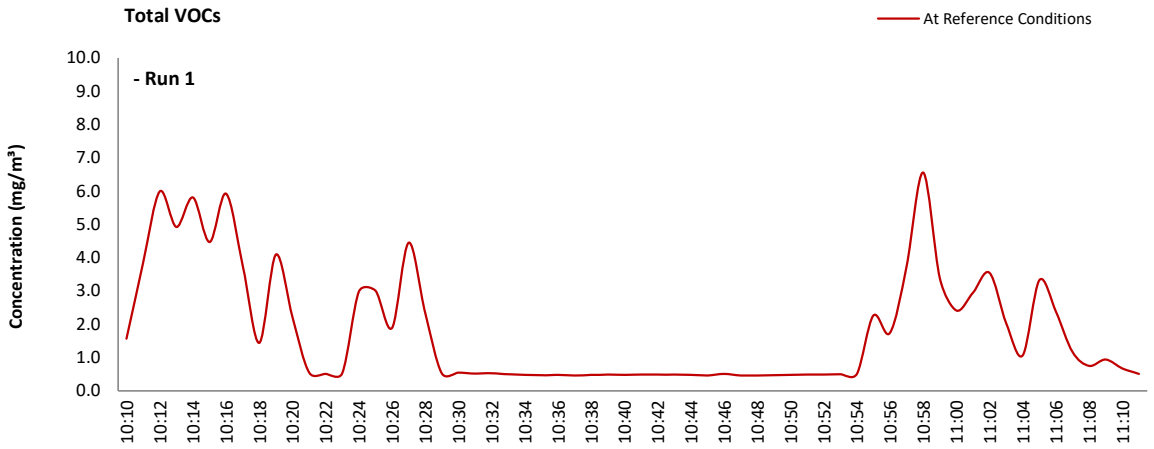
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	CAT-TP-20	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	12.0510	
Span Gas Expiry Date	19/01/2025	
Span Gas Start Pressure (bar)	50	
Gas Cylinder Concentration (ppm)	7.9	
Span Gas Set Point (ppm)	7.90	
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	-	10:10 - 11:10
Sampling Dates	-	20/10/2023
Instrument Range	ppm	100
Span Gas Value	ppm	7.9

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	0.20
CAL 1	Zero Drift	ppm	0.10
CAL 1	Zero Drift	%	1.28
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± ppm	0.40
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	7.80
CAL 1	Span Down Sampling Line (Post)	ppm	7.70
CAL 1	Span Drift	ppm	-0.10
CAL 1	Span Drift	%	-1.28
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± ppm	0.40
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	17 - 18

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	10.0		mg/m³ (REF)
Allowable MU	15.0		%
Measured concentration	1.29		mg/m³ (STP, dry)
Range Used	100.0		ppm
Range Used [A]	160.6		mg/m³
Cal gas conc.	7.9		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.	12.7		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	0.20		% of value
Zero drift	1.28		% full scale
Span drift	-1.28		% 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)	1.27		% 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	0.02		mg/m³
Drift	0.00		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)	0.01		mg/m³
Uncertainty of calibration gas	0.01		mg/m³

Measurement uncertainty		Result	RUN 1		Units
Combined uncertainty			0.23		mg/m³
Expanded uncertainty	k =	1.96	0.46		mg/m³
Uncertainty corrected to std conds. (O_2)			0.65		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	35.73		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	4.60		% 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	35.92		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	7.41		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	15.4		% 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 UK Ltd, Withyhedge Landfill Site
Flare

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	74.1		74.1
Uncertainty	±mg/m³	4.1		4.1

General Sampling Information

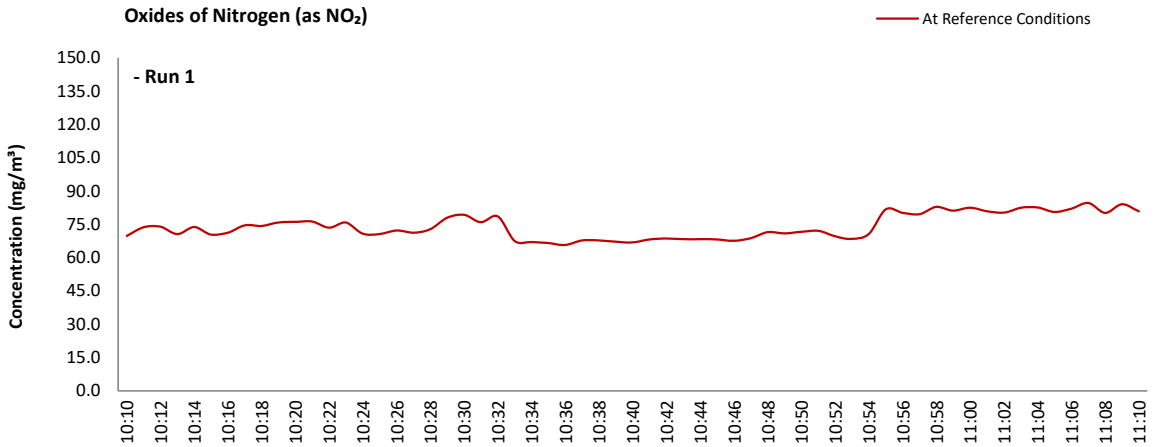
Parameter	Value	
Standard	EN 14792	
Technical Procedure	CAT-TP-21	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Date & Result of Last Converter Check	23/12/2022 - 96.3%	
Span Gas Type	Nitrogen Monoxide	
Span Gas Reference Number	12.0493	
Span Gas Expiry Date	11/01/2025	
Span Gas Start Pressure (bar)	90	
Gas Cylinder Concentration (ppm)	89.6	
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	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	-	10:10 - 11:10
Sampling Dates	-	28/09/2023
Instrument Range	ppm	100
Span Gas Value	ppm	89.6

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.5
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	ppm	0.00
CAL 1	Zero at Analyser (Post)	ppm	-0.80
CAL 1	Zero Drift	ppm	-0.80
CAL 1	Zero Drift	%	0.90
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 at Analyser (Pre)	ppm	89.20
CAL 1	Span at Analyser (Post)	ppm	87.30
CAL 1	Span Drift	ppm	-1.90
CAL 1	Zero Adj. Span Drift	%	1.23
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	17 - 18

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	150.0		mg/m³ (REF)
Allowable MU	10.0		%
Measured concentration	52.53		mg/m³ (STP, dry)
Ratio NO / NO_2	5		%
Range Used	100.0		ppm
Range Used [A]	205.2		mg/m³
Cal gas conc.	89.6		ppm
Conversion	2.05		ppm to mg/m³
MCERTS Range [B]	125.0		mg/m³
Lower of [A] or [B]	125.0		mg/m³
Cal gas conc.	183.9		mg/m³

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.40		% full scale
Repeatability at span level	0.40		% full scale
Deviation from linearity	0.17		% of value
Zero drift	-0.90		% full scale
Span drift	-1.23		% full scale
Volume or pressure flow dependence	0.40		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	0.18		% full scale/10K
Combined interference	0.60		% range
Dependence on voltage	0.40		% full scale/10V
Converter efficiency	96.3		%
Losses in the line (leak)	1.90		% 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	0.05		mg/m³
Lack of fit	0.12		mg/m³
Drift	0.00		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.11		mg/m³
Ambient temperature dependence	0.03		mg/m³
Combined interference (from MCERTS Certificate)	0.43		mg/m³
Dependence on voltage	0.05		mg/m³
Converter efficiency	0.06		mg/m³
Losses in the line (leak)	0.58		mg/m³
Uncertainty of calibration gas blending	0.42		mg/m³
Uncertainty of calibration gas	0.61		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	52.53		mg/m³
Combined uncertainty			1.14		mg/m³
Expanded uncertainty	k =	1.96	2.23		mg/m³
Uncertainty corrected to std conds. (O_2)			3.14		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	4.24		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	1.48		% 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	5.56		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	4.16		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	10.6		% 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 UK Ltd, Withyhedge Landfill Site
Flare

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	1.7		1.7
Uncertainty	±mg/m³	1.8		1.8

General Sampling Information

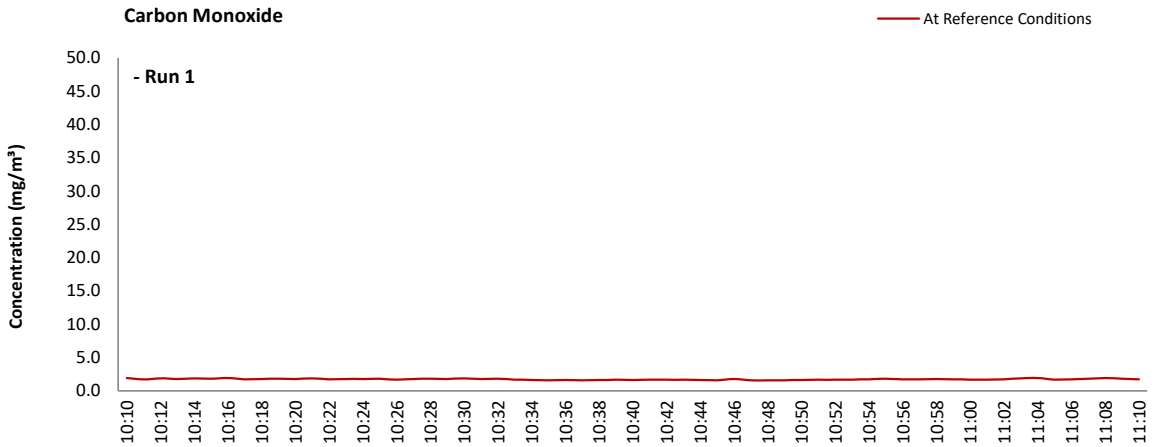
Parameter	Value	
Standard	EN 15058	
Technical Procedure	CAT-TP-21	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Carbon Monoxide	
Span Gas Reference Number	12.0493	
Span Gas Expiry Date	11/01/2025	
Span Gas Start Pressure (bar)	90	
Gas Cylinder Concentration (ppm)	153.7	
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	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	-	10:10 - 11:10
Sampling Dates	-	28/09/2023
Instrument Range	ppm	200
Span Gas Value	ppm	153.7

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.5
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	ppm	0.10
CAL 1	Zero at Analyser (Post)	ppm	1.50
CAL 1	Zero Drift	ppm	1.40
CAL 1	Zero Drift	%	0.91
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 at Analyser (Pre)	ppm	153.50
CAL 1	Span at Analyser (Post)	ppm	160.50
CAL 1	Span Drift	ppm	7.00
CAL 1	Zero Adj. Span Drift	%	3.64
CAL 1	Drift Correction Applied	2-5%	Yes
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	17 - 18

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	50.0		mg/m³ (REF)
Allowable MU	6.0		%
Measured concentration	1.24		mg/m³ (STP, dry)
Range Used	200.0		ppm
Range Used [A]	249.8		mg/m³
Cal gas conc.	153.7		ppm
Conversion	1.25		ppm to mg/m³
MCERTS Range [B]	95.0		mg/m³
Lower of [A] or [B]	95.0		mg/m³
Cal gas conc.	192.0		mg/m³

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.40		% full scale
Repeatability at span level	0.40		% full scale
Deviation from linearity	0.49		% of value
Zero drift	0.91		% full scale
Span drift	0.00		% full scale
Volume or pressure flow dependence	0.40		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	0.05		% full scale/10K
Combined interference	0.73		% range
Dependence on voltage	0.40		% full scale/10V
Losses in the line (leak)	1.63		% 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	0.05		mg/m³
Lack of fit	0.27		mg/m³
Drift	0.00		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.08		mg/m³
Ambient temperature dependence	0.01		mg/m³
Combined interference (from MCERTS Certificate)	0.40		mg/m³
Dependence on voltage	0.05		mg/m³
Losses in the line (leak)	0.01		mg/m³
Uncertainty of calibration gas blending	0.01		mg/m³
Uncertainty of calibration gas	0.01		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	1.24		mg/m³
Combined uncertainty			0.63		mg/m³
Expanded uncertainty	k =	1.96	1.24		mg/m³
Uncertainty corrected to std conds. (O_2)			1.75		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	100.00		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	2.48		% 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	100.07		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	5.02		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	7.0		% 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 UK Ltd, Withyhedge Landfill Site
Flare

Sample Runs

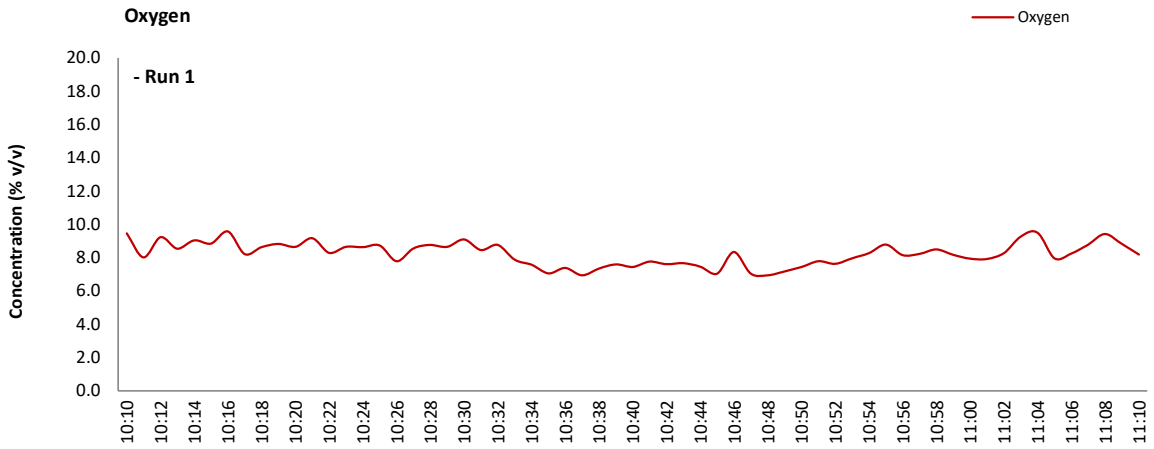
Parameter	Units	Run 1		Mean
Concentration	% v/v	8.2		8.2
Uncertainty	±% v/v	0.30		0.30

General Sampling Information

Parameter	Value	
Standard	EN 14789	
Technical Procedure	CAT-TP-21	
Probe Material	Stainless Steel	
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	12.051	
Span Gas Expiry Date	19/01/2025	
Span Gas Start Pressure (bar)	50	
Gas Cylinder Concentration (% v/v)	7.64	
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	-	10:10 - 11:10
Sampling Dates	-	28/09/2023
Instrument Range	% v/v	25.0
Span Gas Value	% v/v	7.6

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.5
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	% v/v	0.00
CAL 1	Zero at Analyser (Post)	% v/v	0.05
CAL 1	Zero Drift	% v/v	0.05
CAL 1	Zero Drift	%	0.65
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 at Analyser (Pre)	% v/v	7.70
CAL 1	Span at Analyser (Post)	% v/v	7.76
CAL 1	Span Drift	% v/v	0.06
CAL 1	Zero Adj. Span Drift	%	0.13
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	17 - 18

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	8.23		%vol
Range Used	25.0		%vol
Cal gas conc.	7.6		%vol

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.04		% full scale
Repeatability at span level	0.04		% full scale
Deviation from linearity	0.07		% of value
Zero drift	0.65		% full scale
Span drift	0.13		% full scale
Volume or pressure flow dependence	0.20		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	-0.07		% full scale/10K
Combined interference	0.56		% range
Dependence on voltage	0.02		% full scale/10V
Losses in the line (leak)	0.00		% 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	0.01		%vol
Lack of fit	0.01		%vol
Drift	0.00		%vol
Volume or pressure flow dependence	0.00		%vol
Atmospheric pressure dependence	0.02		%vol
Ambient temperature dependence	-0.01		%vol
Combined interference (from MCERTS Certificate)	0.08		%vol
Dependence on voltage	0.00		%vol
Losses in the line (leak)	0.00		%vol
Uncertainty of calibration gas	0.10		%vol

			RUN 1		Units
Measurement uncertainty		**Result**	8.23		%vol
Combined uncertainty			0.15		%vol
Expanded uncertainty	k =	1.96	0.30		%vol

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	3.60		% 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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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:	20th October 2023
Compiled By:	Darren Price *Team Leader*

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Compiled By:	Darren Price *Team Leader*
Signed:	D Price
Dated:	9th November 203

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2. PLANT DESCRIPTION

3. SAMPLING PROCEDURES

4. RESULTS

APPENDIX A: Site Information
APPENDIX B: Trace Gas Results
APPENDIX C: Trace Gas Chart
APPENDIX D: Siloxane Results

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 and siloxane components from landfill gas located at Withyhedge Landfill Site Sampling was performed on 20th October 2023.

1.2 The sampling was conducted in response to permit requirements (Permit No. GP3630HT/V003). Monitoring was conducted with reference to the Environment Agency document ôGuidance for Monitoring Trace Components in Landfill Gasõ(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 Arsenic was sampled onto an activated charcoal sorbent tube prior to analysis by inductively coupled plasma/optical emissions spectrometry (ICP/OES), in accordance with EA recommendations and SPTGN04. The results are presented in Appendix B. The analytical component of the work was conducted at MSS.

3.3 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

3.4 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.

3.5 The LFTGN04 designated ópriorityôcarbonyl components (i.e. methanal and ethanal) were sampled onto dinitrophenylhydrazine (DNPH) impregnated, silica gel sorbent tubes prior to analysis by high performance liquid chromatography (HPLC) incorporating an ultraviolet (UV) detection system, in accordance with EA recommendations and SPTGN04. The results are presented in Appendix B. The analytical component of the work was conducted at MSS.

3.6 Siloxanes sampling was affected using Element Materials Technology Environmental UK Ltd. documented internal protocol SP SILOX. This involves passing a metered volume of the gas through solid sorbent material whereby the siloxane congeners are captured and concentrated to allow analysis by gas chromatography utilising mass spectrometric detection (GC/MS). The analysis was carried out at Marchwood Scientific Services and is UKAS accredited. Sampling is not accredited due to the omission of the security and blank tubes, as requested by the client. The results are presented in Appendix D.

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 Appendix D.

APPENDIX A

Site Information & Gas Measurements

TABLE A(i): Site Information & Gas Measurements

Sample Position Details			
Date	20/10/203	**Site**	Withyhedge LFS
Ambient Temperature	15°C	**Atmospheric Pressure**	100.3mbar
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**	17°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*	31	%	-
Oxygen*	0.7	%	-
Nitrogen	17.3	%	Assumed to be balance of gas
Hydrogen Sulphide*	110	ppm	-

Notes: *Raw result obtained from tedlar bag sample

APPENDIX B

Trace Gas Results

TABLE B(i): Trace Gas Results

Trace Gases - Test 1							
	Test Duration	Flow Rate	Flowmeter	Volume	Ambient T	Barometric P	Volume
	(min)	(ml/min)	CAL Factor	(l as sampled)	(°C)	(kPa)	(l @ STP)
Arsenic	60	200	0.9926	**11.91**	15	100.3	**11.18**
Aldehydes	20	200	0.9926	**3.97**	15	100.3	**3.73**
VOC	6	50	0.9346	**0.28**	15	100.3	**0.26**
						15	

Compound	Mass of TG (ng)	LoD of TG (ng)	Concentration		Units	Analysis Notes (See below)	Analysis UKAS Acredited (Y/N)
Arsenic (as As)	4500	50		**403**	µg/m3	-	Y
Acetaldehyde (Ethanal)	300	100		**81**	µg/m3	-	Y
Formaldehyde (Methanal)		100	<	**27**	µg/m3	-	Y
Vinyl chloride		10	<	**38**	µg/m3	-	N
1,3-butadiene		10	<	**38**	µg/m3	-	Y
Methanethiol		50	<	**190**	µg/m3	-	N
Chloroethane	24	10		**91**	µg/m3	-	Y
1-pentene	140	20		**532**	µg/m3	-	Y
1,4-epoxy-1,3-butadiene (Furan)	390	10		**1482**	µg/m3	-	Y
Ethanethiol		50	<	**190**	µg/m3	-	N
1,1-dichloroethene		5	<	**19**	µg/m3	-	Y
Dimethyl sulphide	1200	10		**4561**	µg/m3	**c**	N
Dichloromethane	11	10		**42**	µg/m3	-	N
Carbon disulphide	8500	10		**32309**	µg/m3	**c**	N
1,2-dichloroethene (trans + cis)	39	10		**148**	µg/m3	-	Y
1,1-dichloroethane	6	5		**23**	µg/m3	-	Y
Propanethiol		40	<	**152**	µg/m3	-	Y
1,2-dichloroethane	22	5		**84**	µg/m3	-	Y
Carbon tetrachloride		5	<	**19**	µg/m3	-	Y
Benzene	1400	1		**5321**	µg/m3	**c**	Y
Trichloroethylene	39	5		**148**	µg/m3	-	Y
Butanethiol		40	<	**152**	µg/m3	-	Y
Dimethyl disulphide		10	<	**38**	µg/m3	-	Y
Toluene	2500	5		**9503**	µg/m3	**b**	Y
Butyric acid		10	<	**38**	µg/m3	-	Y
Ethyl butyrate		10	<	**38**	µg/m3	-	Y
2-Butoxyethanol		10	<	**38**	µg/m3	-	Y
Styrene	780	5		**2965**	µg/m3	**c**	Y

Compound	Concentration of H_2S (%)	LoD of H_2S (%)	Concentration		Units	Analysis Notes (See below)	Analysis UKAS Acredited (Y/N)
Hydrogen sulphide	0.011	0.01		**166860**	µg/m^3	-	N

*H2S value is equivalent to 110ppm

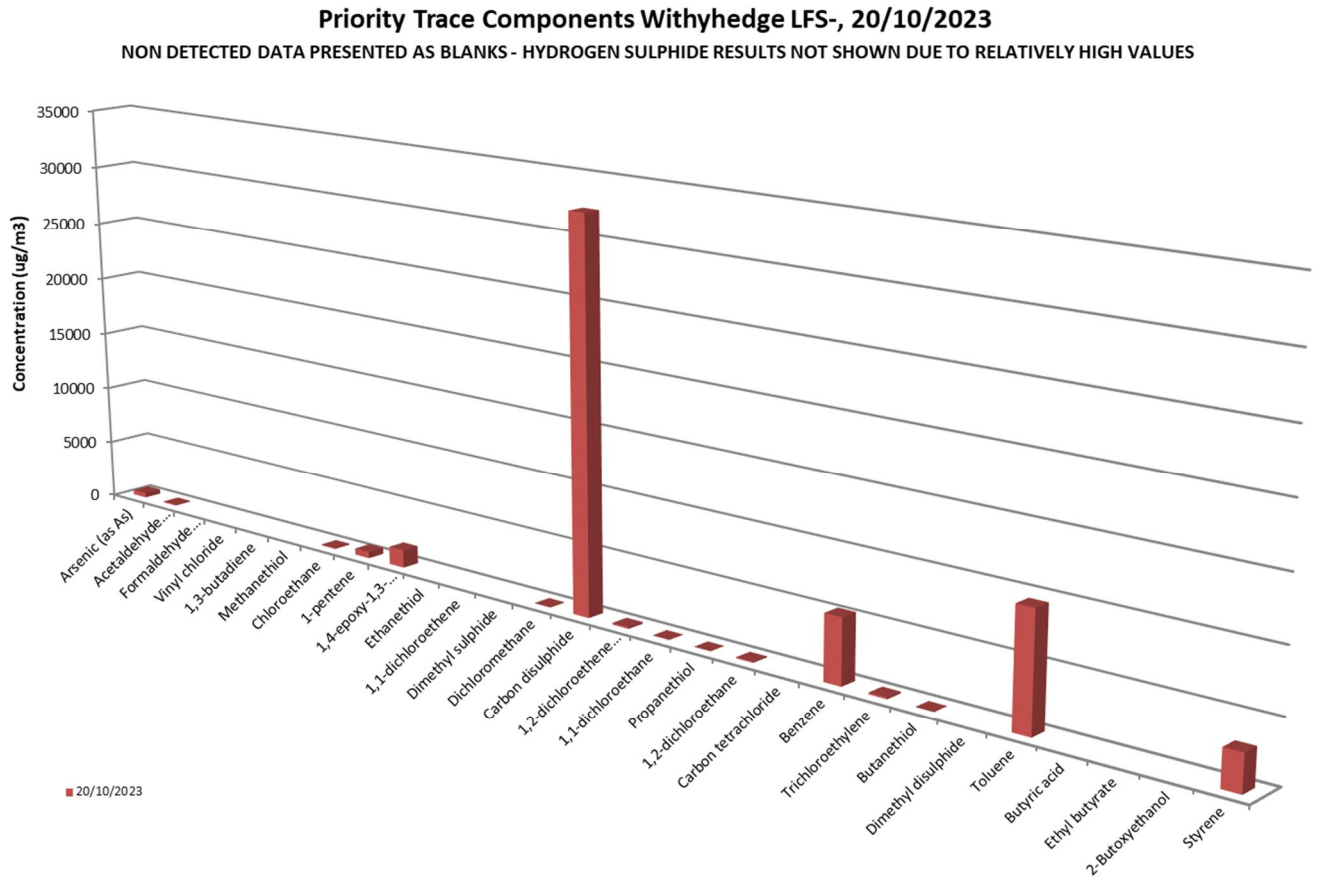
(a) – Results have been blank corrected
(b) – Results should be considered a minimum due to detector saturation
(c) – Results should be viewed with caution due to being outside of the instrument calibration range

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



APPENDIX D

Siloxane Results

TABLE D(i): Siloxane Results

Test No	**T1**
Date	**20/10/2023**
Site	**Withyhedge LFS**
Stack	**Gas Compound**
Reference Conditions - Oxygen (%)	**n/a**
- Temperature (°C)	**0**
- Pressure (kPa)	**101.3**
Job Number	**ERE-23376**
Site Team	**DP/JC**
Test Conducted By	**JC**
Data Entered By	**DP**

Test Start Time	10:53
Test End Time	11:13
Test Duration (min)	**20**
Flowmeter Rate at Start (ml/min)	200
Flowmeter Rate at End (ml/min)	200
Mean Flowmeter Rate (ml/min)	**200**
Uncorrected Volume Sampled (l)	**4.00**

Barometric Pressure (kPa)	100.3
Ambient Temperature (°C)	15
Flowmeter Calibration Factor (f)	0.9926
Stack Oxygen Level (%)	n/a
Volume Sampled @ Reference Conditions	**3.73**

Primary Tube Reference Identification Number	0
Security Tube Reference Identification Number	n/a
Blank Tube Reference Identification Numbers	n/a
Mass of Siloxane on Primary Tube (ug)	130.5
Mass of Siloxane on Security Tube (ug)	n/a
Breakthrough (Reject if > 5%)	n/a
Total Mass of Siloxane in Sample (ug)	**130.5**

Siloxane Concentration (mg/m^3 @ STP and Ref O_2)	**35.03**

TABLE D(ii): Siloxane/Silicon Congener Breakdown

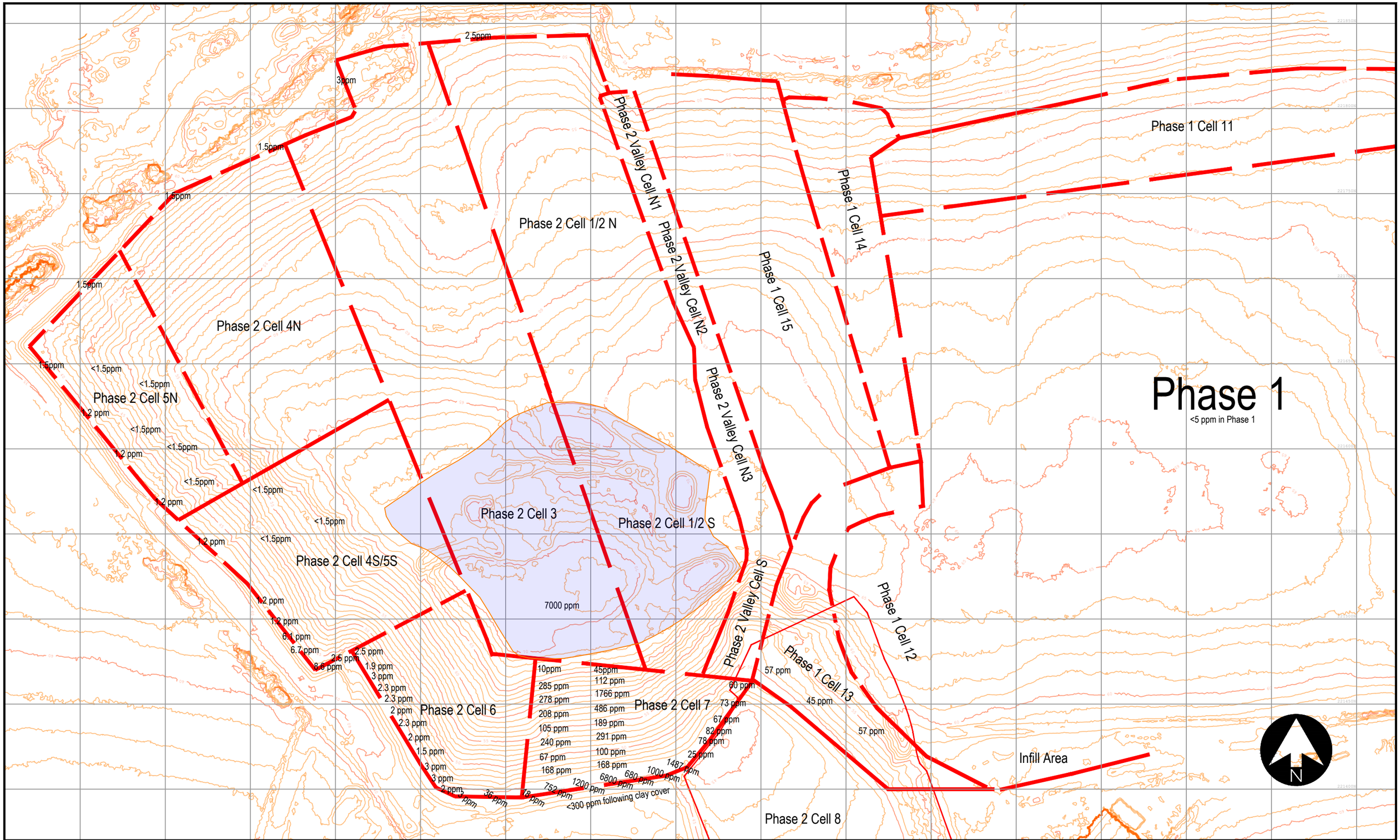
Siloxane	Siloxane Concentration (mg/m^3 @ STP)	Organic Silicon Concentration (mg/m^3 @ STP)
Decamethylcyclopentasiloxane	5.91	2.24
Decamethyltetrasiloxane	< 0.13	< 0.05
Hexamethylcyclotrisiloxane	1.66	0.63
Hexamethyldisiloxane	7.52	2.60
Octamethylcyclotetrasiloxane	18.79	7.12
Octamethyltrisiloxane	0.54	0.19
Dodecamethylcyclohexasiloxane	< 0.13	< 0.05
Dodecamethylpentasiloxane	0.35	0.13
Total Siloxane Concentration:	**35.03**	
	Total Silicon Concentration:	**13.01**

2023 ANNUAL REVIEW OF MONITORING

Withyhedge Landfill site
EPR: MP3330WP

Appendix 2
Surface Emissions Assessment

Report Number 2422r1v1d0124



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LEGEND
- Cell Boundary
- Prominent Contour (5.0m)
- Normal Contour (1.0m)

NOTES
Existing topography from 10 October 2023 Drone Survey at 1.0m contour interval.
Fugitive emission measured as CH4 concentration in ppm at 0.05m above ground level

PROJECT
Withyhedge Landfill
2023 Odour Event

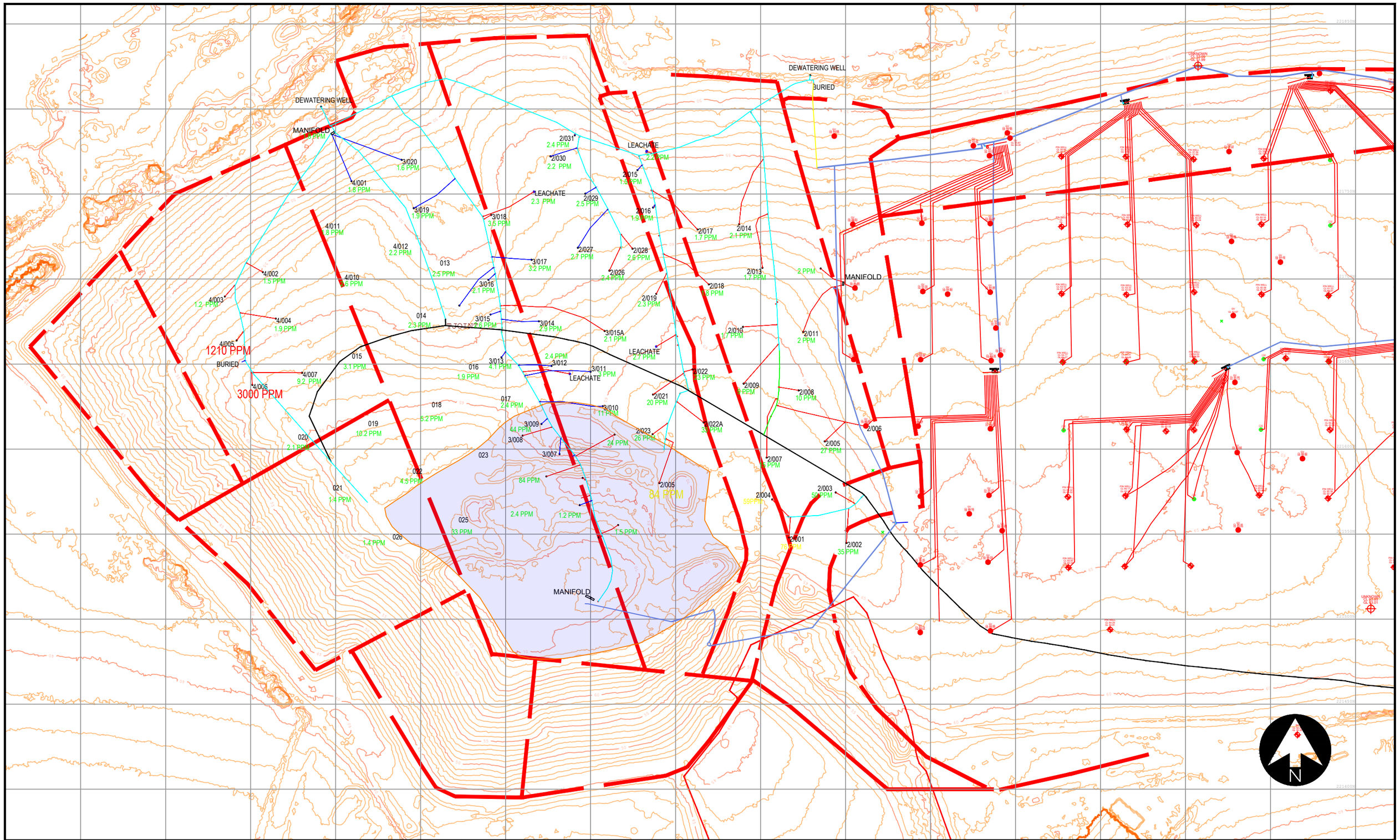
TITLE
Fugitive Gas Emission Survey
14 December 2023

DRAWING NUMBER **2423/1**

SCALE AT A3	DATE	DRAWN
1:2000	**01.24**	**BR**

NOTE

GEO TECHNOLOGY



RML
RESOURCES MANAGEMENT UK LTD

LEGEND

- Cell Boundary
- Prominent Contour (5.0m)
- Normal Contour (1.0m)

NOTES

Existing topography from 10 October 2023 Drone Survey at 1.0m contour interval.

Fugitive emission measured as max CH4 concentration in ppm around well

PROJECT

Withyhedge Landfill
2023 Odour Event

TITLE

Gas Well Emission Survey
15 December 2023

DRAWING NUMBER		
2423/2		
SCALE AT A3	DATE	DRAWN
1:2000	**01.24**	**BR**

NOTE

GEO TECHNOLOGY

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