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QUERCIA LIMITED

CLAYTON HALL LANDFILL

LANDFILL GAS RISK ASSESSMENT

DECEMBER 2024

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LANDFILL GAS RISK ASSESSMENT

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APPENDICES

1 INTRODUCTION

1.1.1 Wardell Armstrong LLP have been commissioned by OPES to prepare an Environmental Permit Variation Application to their Clayton Hall Landfill Site, Dawson Lane, Whittle-le-Woods, Chorley, PR6 7DT. The application seeks to extend the permit boundary for further landfill development. This Landfill Gas Risk Assessment (LFGRA) supports the application.

1.1.2 The Site comprises a non-hazardous waste landfill regulated under Environmental Permit EPR/BV1364ID.

1.1.3 This LFGRA will appraise the current risk of the Clayton Hall gas source term and its potential impact on sensitive receptors in the vicinity as well as the potential impact of the landfill extension. A conceptual site model will be developed and GasSim modelling will be utilised to support this assessment.

1.1.4 This report has been compiled with reference to the following documents and guidance:

- Environment Agency Guidance *Management of landfill gas: LFTGN 03*;
- Wardell Armstrong (2024) Hydrogeological Risk Assessment;
- Golder (2019) GasSim 2.5 Model Build and Tier 1 Assessment;
- The Arley Consulting Company Limited (2018-2023) Annual Environmental Monitoring & Performance Reviews;
- Environmental monitoring data provided by the Operator.

2 SITE SETTING AND HISTORY

2.1 Site Setting

2.1.1 Clayton Hall Landfill is located approximately 9km south of Preston, and approximately 4km north of Chorley town centre. The Landfill is centred on National Grid Reference (NGR) SD 567 219 and is situated on the edge of an urban area.

2.1.2 The town of Clayton le-Woods bounds the site to the west with the closest residential receptors located off Spring Meadow, approximately 30m from the site.

2.1.3 Cuerden Valley Park is located to the east of the site.

2.1.4 The Bryning Brook is the closest surface water course in the vicinity of Clayton Hall, the brook flows in a westerly direction approximately 40m to the south of the site.

2.1.5 The River Lostock is approximately 60m east of the site at its closest point, Clayton Brook is a tributary of the River Lostock and converges with the river some 1.8km north of the site.

2.1.6 The site is located in a relatively flat area with the local topography falling slightly to the east in association with the valley of the River Lostock. Clayton Hall Landfill is in the void of a former sand quarry and the land is being restored via landfilling in line with the original topography.

2.1.7 Quarrying extended to a depth of approximately 42-55mAOD with the surrounding topography around 70-80mAOD rising in the northeast at Clayton Green to over 100mAOD.

Figure 1 – Local Topography[1]

2.2 Landfill Development

2.2.1 Landfilling at Clayton Hall has taken place since the 1970s under Waste Management Licence (WML) 74 which was granted in 1977. This was varied in 1991 to include Cell 1 – Cell 4.

2.2.2 A PPC application was submitted for Cells 3 and 4 of the Site covering approximately 6.6ha with the historical areas of landfilling situated to the north and west of this area. The Permit was granted in 2004, reference EPR/BV1364ID and was most recently varied for the eighth time in 2019 with the current reference being EPR/BV1364ID/V008.

[1]https://en-gb.topographic-map.com/

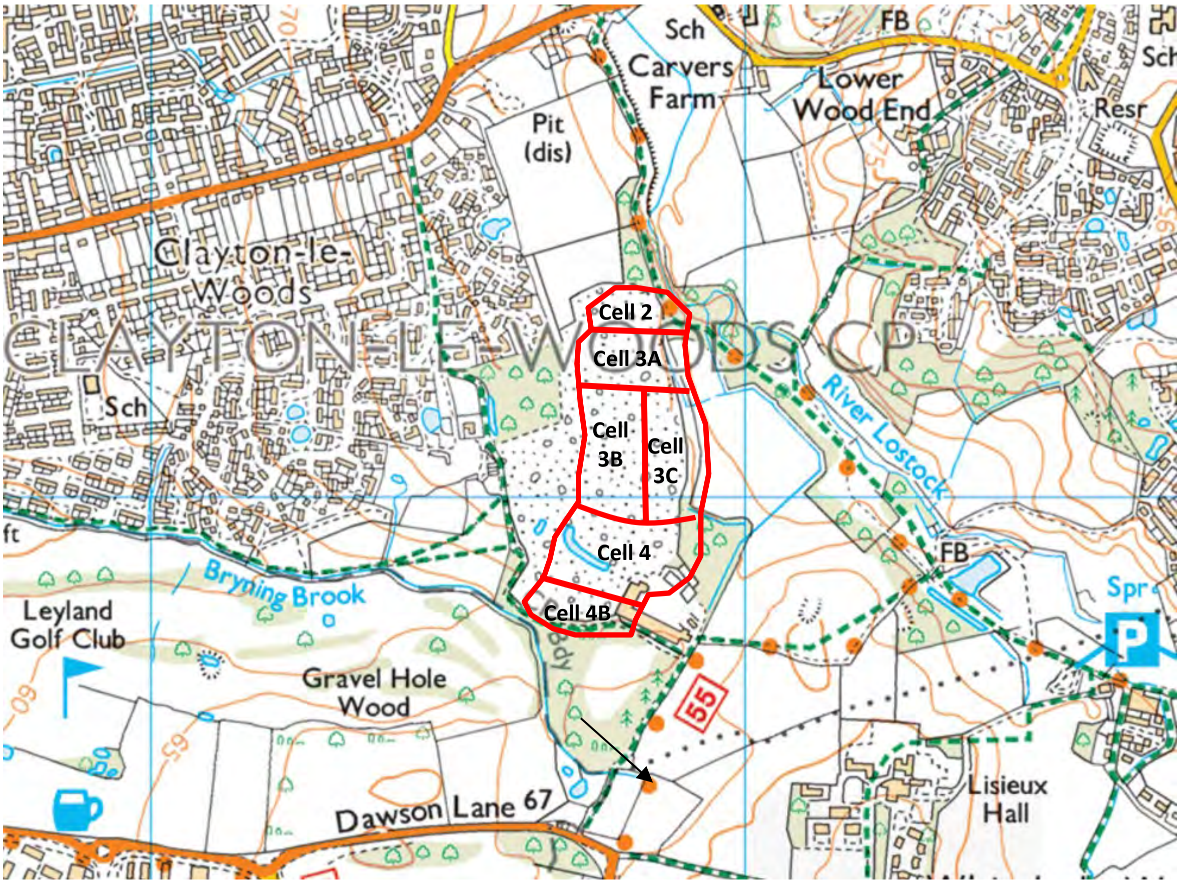


Figure 2 – Site Layout and Phasing

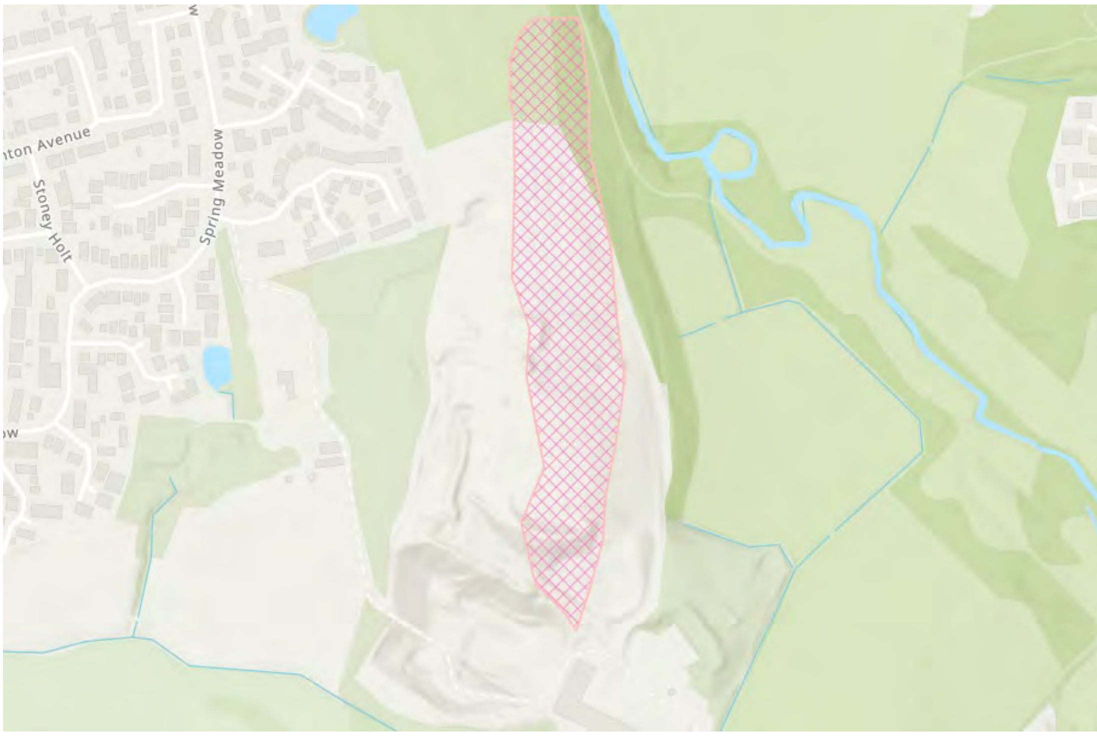


Figure 3 – Area of Historic Landfilling Prior to PPC Permit

2.2.3 A summary of cell filling is as follows:

- Cell 1 received wastes in 1991, wastes were removed from Cell 1 and deposited in Cell 3 to allow further quarrying and the construction of Cell 4;
- Cell 2 commenced filling in 1993 and received inert quarry waste;
- Cell 3 tipping first started in 1994 . Cell 3 was completed in Phases A-C;
- Cell 4 was constructed in 2002;
- Cell 4B Phase 4, a proposed extension of Cell 4 located to the south.

2.2.4 Cells 1 and 2 are closed and do not form part of the site's Environmental Permit.

3 SOURCE TERM CHARACTERISATION

3.1 Waste Deposits

3.1.1 Waste first deposited into Cell 3 was estimated to contain approximately 50% domestic, 35% industrial and 15% inert wastes[2].

3.1.2 A GasSim model was completed by Golders for the site in 2019, this has been updated to form the basis of the 2024 assessment. The model has been revised to include the new Cell 4B extension and updated with the waste return tonnages and predicted tonnages for the new cell, based on current inputs.

Table 1 – Approximate Waste Input Summary

Phase	Year	Tonnage	Wate type (approximate percentage)
Cell 3A	1994-2016	464,175	50% domestic, 35% industrial and 15% inert
Cell 3B	1997-1999	71,850	50% domestic, 35% industrial and 15% inert
Cell 3 C	1996-2019	495,160	50% domestic, 35% industrial and 15% inert
Cell 4A	2005-2018	861,525	15% Domestic, 23% Commercial, 23% Industrial, 25% inert
Cell 4B Phase 1	2019-2024	160,000	15% Domestic, 23% Commercial, 23% Industrial, 25% inert
Cell 4B Phase 2	2020-2024	90,740	15% Domestic, 23% Commercial, 23% Industrial, 25% inert
Cell 4B Phase 3	2022-2024	23,090	15% Domestic, 23% Commercial, 23% Industrial, 25% inert
Cell 4B Extension	2025-2027	45,000	Predicted 33% commercial, 33% industrial 33% Inert

3.2 Installation Design

Basal Engineering

3.2.1 Basal and sidewall engineering comprises the following.

Table 2 – Engineering Summary

Cell	Basal Engineering	Hydraulic Conductivity	Sidewall
Cell 3A	2.0 m thick clay Liner	$1x10^{-9}$m/s	HDPE and GCL
Cell 3B	0.3m bentonite enriched soil (BES) overlain by 0.002m HDPE geomembrane.	BES: $1x10^{-10}$ m/s HDPE: $1x10^{-14}$ to $1x10^{-12}$ m/s.	GCL overlain by 2mm HDPE
Cell 3C	0.3m bentonite enriched soil (BES) layer overlain by a 0.002 m HDPE geomembrane.	GCL: 1x10-9m/s HDPE: $1x10^{-14}$ to $1x10^{-12}$ m/s.	GCL overlain by 2mm HDPE
Cell 4A and 4B Phases 1-3	0.006 m geosynthetic clay liner (GCL) 0.002 m HDPE geomembrane.	HDPE: $1x10^{-14}$ to $1x10^{-12}$ m/s.	HDPE and GCL
Cell 4B Extension	0.5m compacted clay underlying 0.002m HDPE	Clay: 5×10^{-10} m/s	0.002m Double textured HDPE & protection geotextile

∗Proposed

[2] EDGE Consultants (2003) Landfill Gas Risk Assessment

Leachate Management

3.2.2 Leachate is managed at the site via a series of leachate extraction wells including vertical wells and side slope risers. The extraction wells are fed via gravity drainage across the falls of the cell bases.

3.2.3 The permit requires the leachate head to be maintained below 3m across the site.

3.2.4 There are currently 7 leachate extraction points across the site: L3A, L3B, L3C, L4A and L4B. Leachate is automatically extracted from the landfill cells via air pumps and transported to the Leachate Treatment Plant (LTP) for processing prior to discharge to foul sewer.

3.2.5 Cell 4B Phase 4 will contain a gravel drainage blanket and leachate collection pipework across the cell base and gravel 2m up the side slopes.

Capping

3.2.6 The northern extent of Cell 3A and Cell 3C are permanently capped. The capping system for these cells, and proposed for the remaining cells, comprises a 300mm regulating layer, 1mm geomembrane, protection geotextile, 1000mm restoration soils. On slopes steeper than 1 in 4 drainage geocomposite is placed under the restoration soils.

3.3 Landfill Gas Management and Monitoring Infrastructure

3.3.1 Landfill gas at Clayton Hall is managed by a third-party gas contractor, YLEM. The gas management company are responsible for the operation, management and monitoring of the in-waste gas collection system.

3.3.2 Landfill gas is managed via an in-waste gas collection system and a Gas Utilisation Plant. In waste wells will be monitored on a monthly basis and vacuum pressure will be controlled depending on well conditions, oxygen will be maintained below the 5%v/v range. If gas quality of the extracted gas is out of specification, the system will be rebalanced.

3.3.3 In-waste wells is monitored for gas composition, pressure and flow. The relationship between vacuum and flow is reviewed across the wells to ensure the correct level of extraction is placed on each of the wells.

3.3.4 All gas monitoring and abstraction infrastructure has been installed under third party CQA supervision.

3.4 Abstraction and Utilisation Infrastructure

3.4.1 The Gas Utilisation Plant (GUP) includes a Biogas 1000m^3/hr high temperature flare and a Caterpillar 3516 spark ignition engine. The landfill gas engine operates on a continuous basis with any planned or emergency downtime covered by use of the flare.

3.4.2 The flare will operate as contingency for any unplanned incidents or planned repairs of the gas engine. In the event of engine failure landfill gas will be diverted automatically to the flare.

3.4.3 There is also a Gas Booster installed at the GUP which creates sufficient suction to provide adequate delivery pressure to the flare/generator and a minimum 10mb vacuum to all wells connected to the gas extraction system. The booster is connected to the incoming gas mains through a separation vessel and manifold.

3.5 Gas Abstraction Optimisation

3.5.1 Condensate dewatering points are installed at low points in the gas collection system to ensure pipework is drained and can effectively transport gas to the utilisation plant.

3.5.2 Dewatering points are in the form of drainage outlets where condensate is released back into the waste or collection vessels (knock out pots) containing an automatic pumping system, controlled by float switches.

3.5.3 A Demister Pot removes liquid from the gas stream prior to utilisation within the Gas Compound.

3.6 GasSim Model

3.6.1 The Golders 2019 GasSim model has been updated to reflect actual waste inputs into Cell 4A Phases 1-3 from the annual waste returns as well as the Cell 4B extension. This GasSimV2.5 model has been used to carry out a Tier 1 assessment to screen landfill emissions and identify any associated risk to nearby receptors.

3.6.2 Tier 1 results are presented in Appendix 2 and show that potential further modelling is required for arsenic, hydrogen sulphide and sulphur dioxide for short term emissions.

3.6.3 In-waste hydrogen sulphide data has been used for the model and the sulphur dioxide concentration has been calculated using these figures. As the source term declines the H_2S production at the site will also reduce meaning any risk from this gas will continue to decrease over time.

3.7 Extracted Gas Volume and Quality

3.7.1 In 2023 the annual combustion in the gas engine was 1,453,372m^3 and 59,520m^3 was treated through the flare.

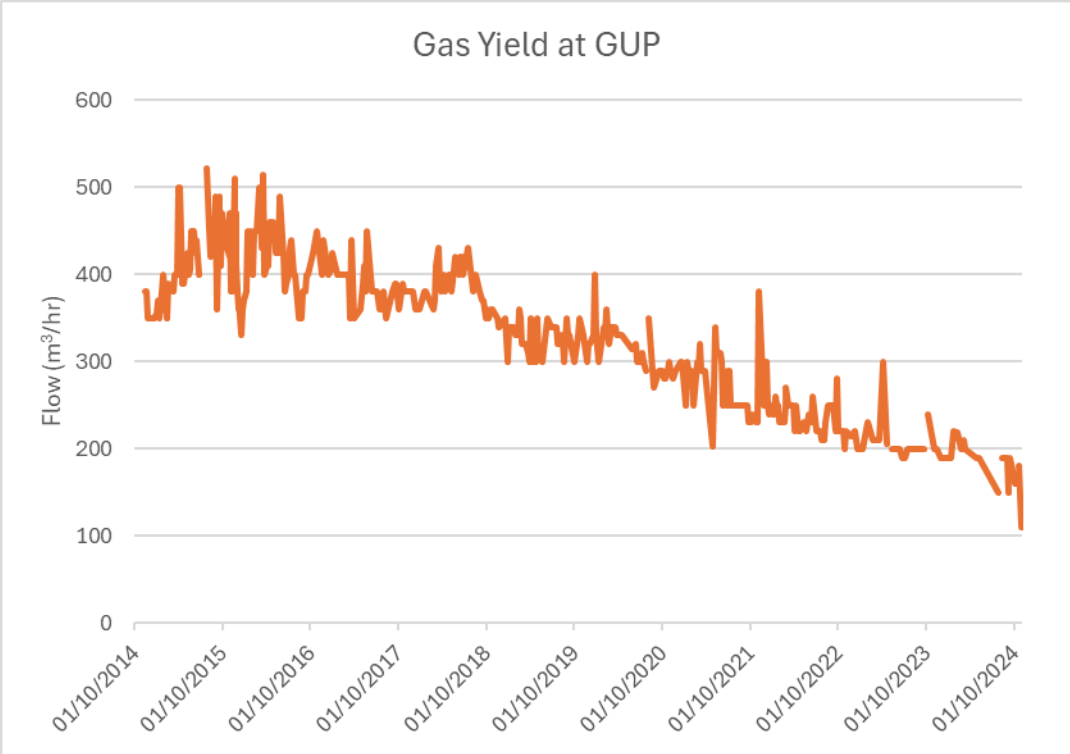


Figure 4 – Gas Utilisation Rate at GUP

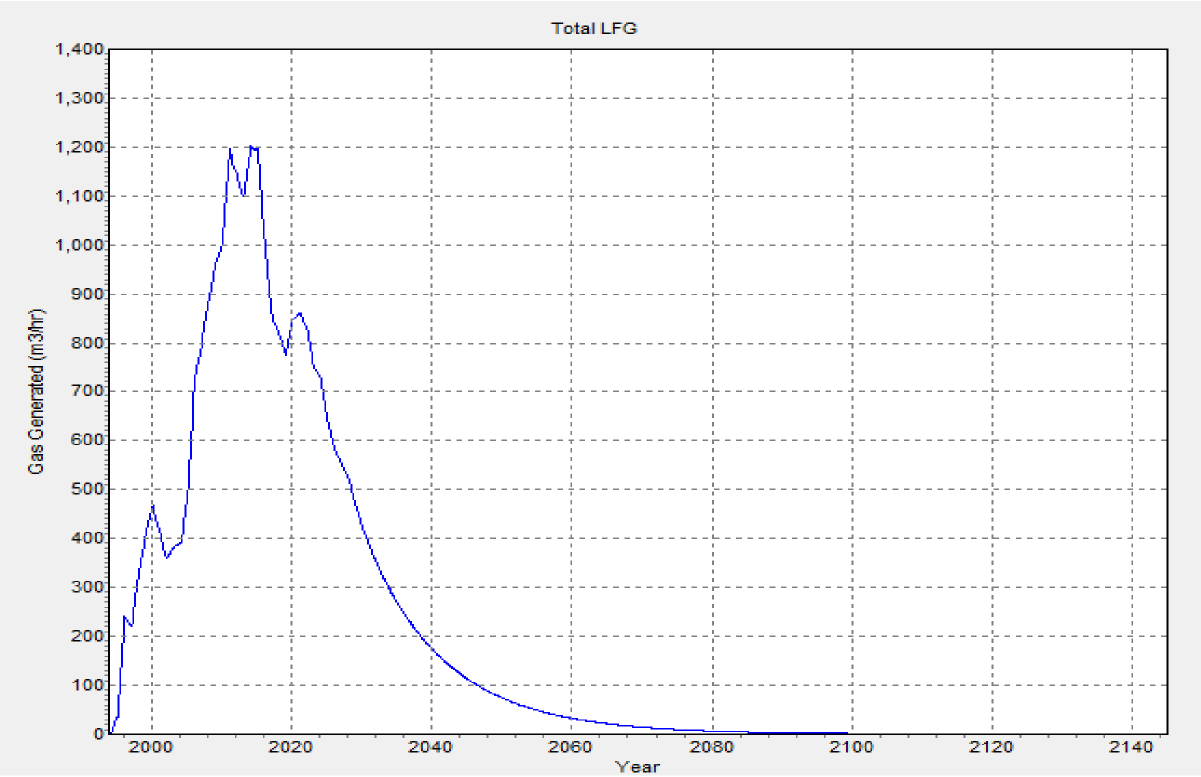


Figure 5 – Gas Sim Curve for Predicted Landfill Gas Production Rates

3.7.2 The predicted GasSim generation volumes are higher than the actual recorded flows at the GUP. The most recent 2024 GasSim model predicts gas flow at the GUP to be 730m^3/hr at the 95th percentile (Figure 5) the current gas yield at the plant is on average ~185m^3/hr for the 2024 period. This is significantly less that the predicted volume and is in part caused by damage to gas management infrastructure which is inhibiting abstraction rates.

3.7.3 Gas generation for the Cell 4B Phase 4 extension is predicted to peak in 2028 following the permanent capping of the cells, expected in 2027. Cell 4B extension is predicted to generate 52.5m^3/hr total landfill gas at the height of gas production.

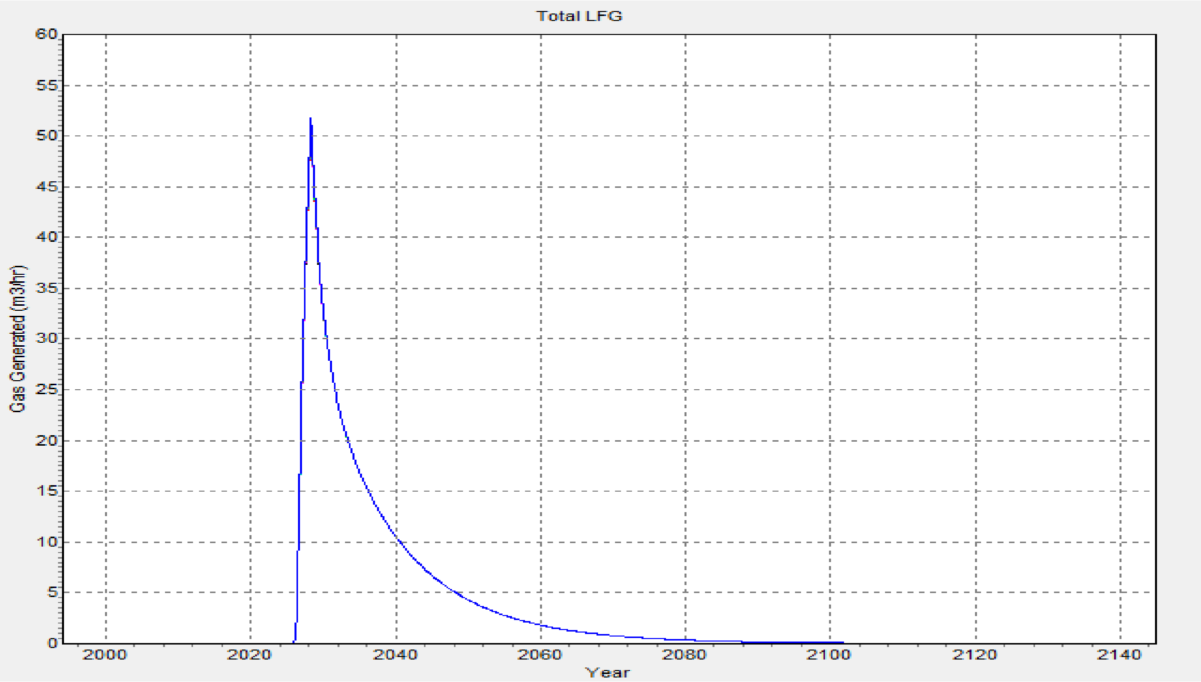


Figure 6 – GasSim Curve for Predicted Landfill Gas Production Rates in Cell 4B Phase 4

Extension

3.7.4 Recent gas quality data at the utilisation plant shows that there is a 1.3:1 ratio of methane to carbon dioxide. The typical gas composition from a non-hazardous landfill is a ratio of 1.5:1 methane to carbon dioxide.

3.7.5 Clayton Hall is producing gas of a quality that would be expected for the age and nature of the site. Given that capping has been undertaken progressively across the site and the site is still operational, not all waste will be at the methanogenic stage of decomposition. Therefore, the ratios of methane to carbon dioxide are slightly lower due the acetogenic nature of the youngest parts of the site.

3.7.6 Furthermore, the nature of the wastes placed in the newer areas of the site are predominantly inert and construction demolition waste typically comprising frag like materials. These have lower gas generation potential than the previously deposited waste types which contained a component of domestic waste.

3.7.7 Methane at the GUP is reported between 35% and 59%v/v with an average of 48%v/v whilst carbon dioxide is reported in the 28%v/v to 44% v/v range.

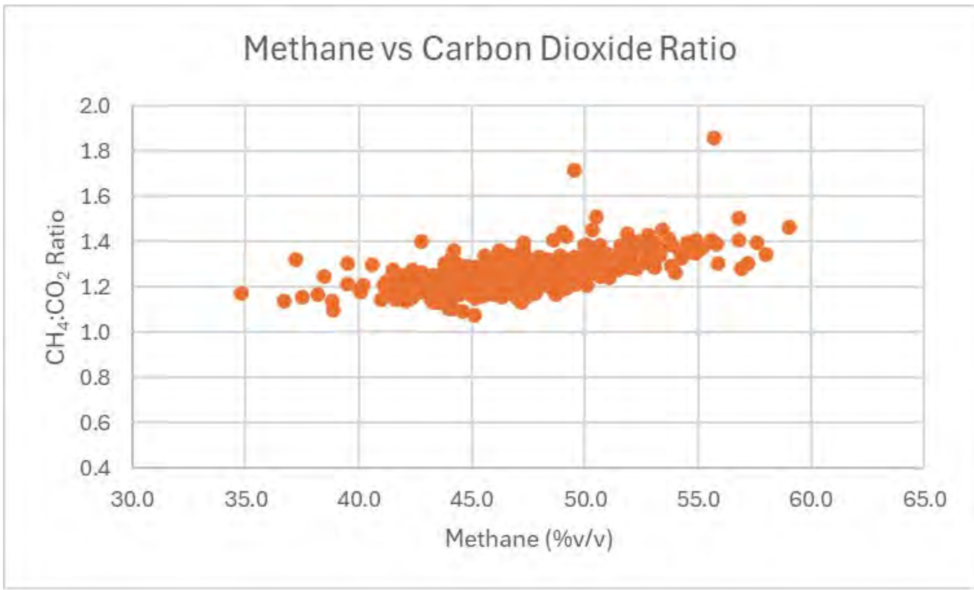


Figure 7 – Landfill Gas Quality at GUP

4 PATHWAY CHARACTERISATION

4.1 Geology

Superficial

4.1.1 Superficial strata comprise Devensian Glaciofluvial deposits of sand and gavel underlain by Glacial Till.

4.1.2 The glaciofluvial deposits extend approximately 17m to 23m below the engineered lined base of the landfill which lies at 42mAOD. The superficial material was deposited by melt water streams during the Quaternary Period. The deposits include mostly coarse-grained sand and gravel with some finer-grained layers of clay and silt and organic lenses.

Figure 8 – Superficial Geology (Extract from BGS Map Viewer[3])

[3] https://geologyviewer.bgs.ac.uk/?_ga=2.62116140.1491605961.1711452463-1572329018.1711452463

Bedrock

4.1.3 Bedrock geology under the site is Sherwood Sandstone Group, a moderately weak medium grained sandstone at times part pebbly and conglomeratic in the lower part, with subordinate red mudstone and siltstone layers.

4.1.4 The Sherwood sandstone has a gradational into the Tarporley Siltstone Formation which is shown on Figure 9 where the Tarporley siltstone is dominant over the sandstone to the northwest of the site.

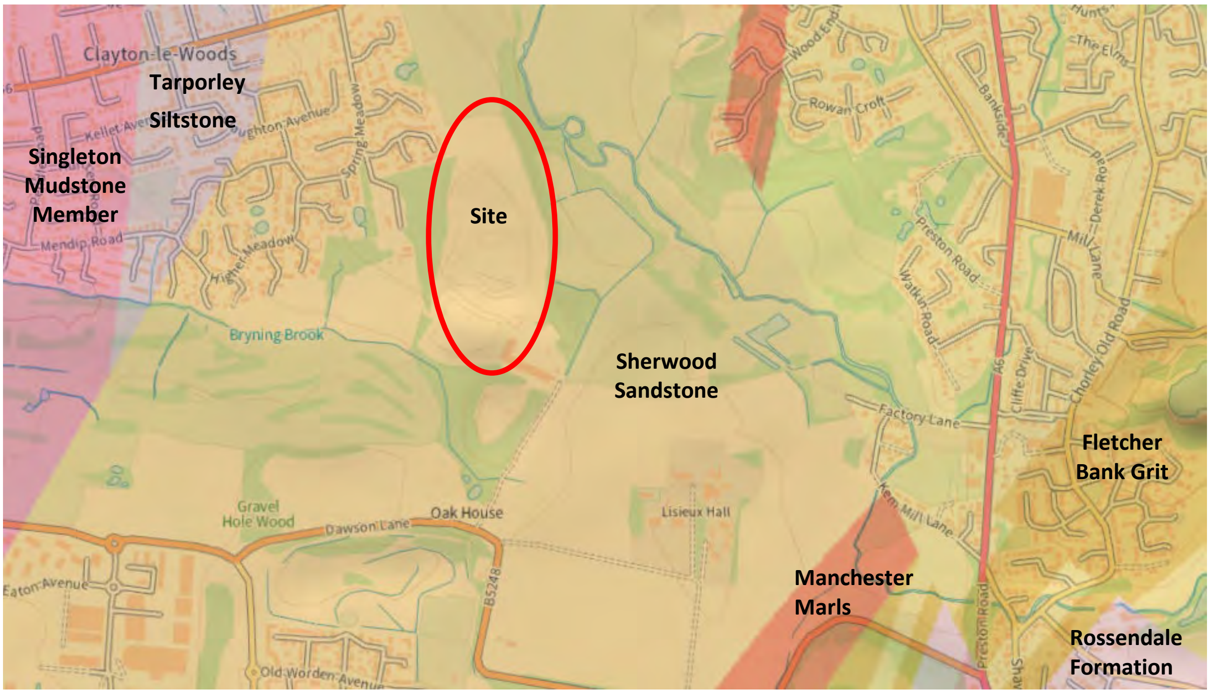


Figure 9 – Bedrock Geology (Extract from BGS Map Viewer[4])

4.2 Site Investigations

4.2.1 A number of site investigations have been undertaken at the Clayton Hall, these include the installation of groundwater monitoring infrastructure at the locations of which are shown on Drawing 08469/15D (prepared by TACCL, dated January 2009).

4.2.2 Borehole logs indicate that the glaciofluvial deposits comprise horizons of permeable sands and/or gravels which are interbedded with clays which typically have thickness of between approximatly20-40m.

[4] https://geologyviewer.bgs.ac.uk/?_ga=2.62116140.1491605961.1711452463-1572329018.1711452463

4.3 Anthropogenic Activity

Historical Landfill

4.3.1 There has been historic landfilling associated with the sand quarrying since the 1970s. The area of historic landfilling extends to follow the areas of Glaciofluvial sand and gravel deposits. Part of the historical landfilling is not covered by the Environmental Permit however, the waste mass extends further than the currently permitted site to the north south.

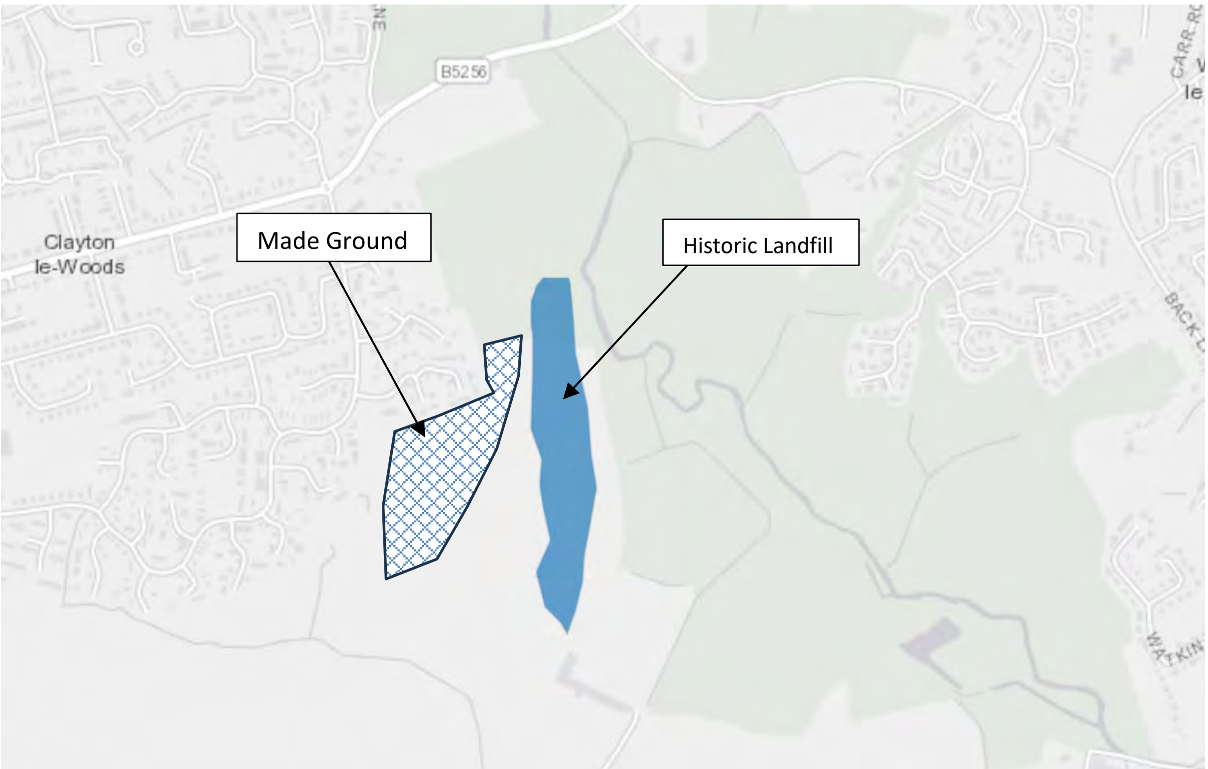


Figure 10 – Historic Landfilling

4.3.2 Historic landfilling is also present to the west of the site as demonstrated during the installation of perimeter gas monitoring locations GS04 which contained 1.5m of made ground and GS03 which proved 5.5m of made ground comprising gravely clay with concrete, slag, linoleum, brick, timber and ceramic fragments.

4.3.3 Made ground is potentially present in GS05 however this was only logged as "*possible made ground*".

4.3.4 Made ground is also present to the south of the site adjacent to the site office, garage and other associated buildings. Stone fill is also recorded as present on GS06 and GS12 and is most likely from gravelled areas of the site for vehicle parking and access.

4.4 Hydrogeology and Hydrology

4.4.1 The River Lostock is located 25m east of the Site at its closest point and flows south to north at between 65m AOD to 55m AOD in the vicinity of the Site.

4.4.2 The Bryning Brook is located adjacent to the south of the Site and flows in a westerly direction past the Site access road at approximatly70m AOD. The Bryning Brook joins with the Bannister Brook, Bow Brook and Mill Brook before joining the River Lostock approximately 5.5km downstream from the Site.

4.4.3 Field drains run along the edge of agricultural land to the east of the Site at three points along the foot of the slope bounding the Site to the east, and merge to form a small tributary that feeds into the River Lostock to the east of the Site.

4.4.4 There are several issues/springs in the vicinity of the site, one being the source of the Bryning Brook approximately 270m south of the site. Another is located in the area of woodland adjacent to the eastern boundary of the site which feeds into the River Lostock.

4.4.5 The glaciofluvial deposits are classified as a Secondary A Aquifer, comprising permeable layers that can support local water supplies, and may form an important source of base flow to rivers.

4.4.6 The underlying bedrock geology is a Principal Aquifer, defined as layers of rock that have a high intergranular and/or fracture permeability, meaning they usually provide a high level of water storage, and may support water supply and/or river baseflow on a strategic scale.

4.4.7 Shallow/perched groundwater has been identified in the glaciofluvial deposits however it considered that there is no consistent water table within the drift deposits given the discontinuous nature or permeable lenses. Groundwater will be limited to the presence of aquitard lenses.

4.4.8 The groundwater table lies within the deeper glaciofluvial sands and the underlying Sherwood Sandstone, typically lies between 38m and 40m AOD i.e. approximately 2 to 4m below the engineered landfill base.

4.4.9 Groundwater monitoring points are screened into the different strata to provide information about the groundwater level in relation to the host geology. The monitoring points are screened as follows:

- Glaciofluvial Deposits: BH3, BH102S, BH103A and BH106S;

- Sherwood Sandstone: BH102D, BH106A, BH111A, BH118A, BH124.

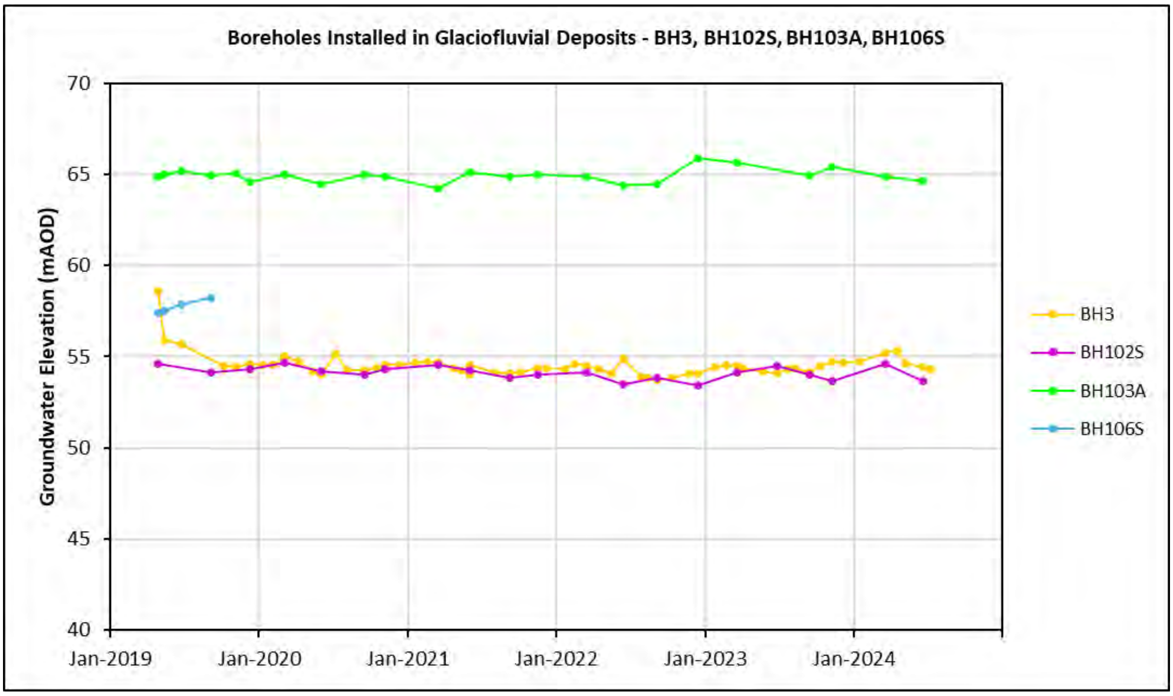


Figure 11 – Groundwater Levels in the Superficial Deposits

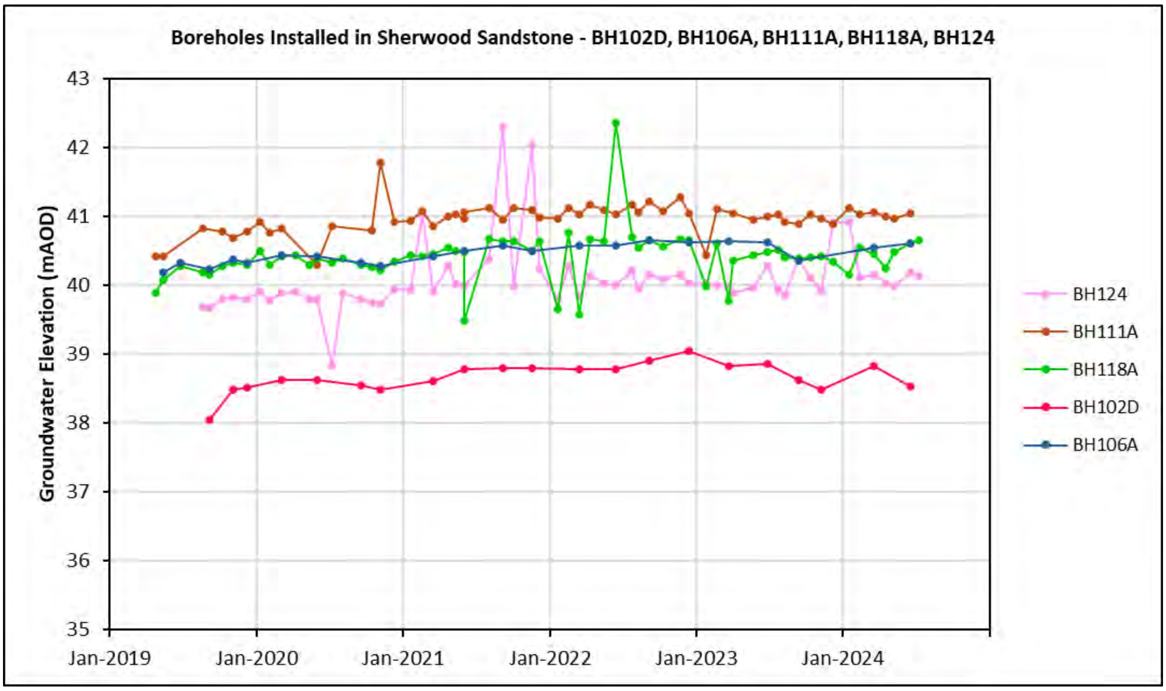


Figure 12 – Groundwater Levels in the Bedrock

5 RECEPTORS

5.1 Proposed Landfill Development

5.1.1 The proposed extension to Cell 4B is shown on Figure 13. This area of the landfill will be a continuation Cell 4B. The current existing temporary bund shall be removed from Cell 4B and the clay and HDPE liners tied in with the existing Cell 4B basal containment.

5.1.2 The drainage blanket and pipework will be continuous with the existing Cell 4B leachate management and will be extracted via the existing sump. Two monitoring wells will be placed in the extension area to record leachate level and quality in Cell 4B.

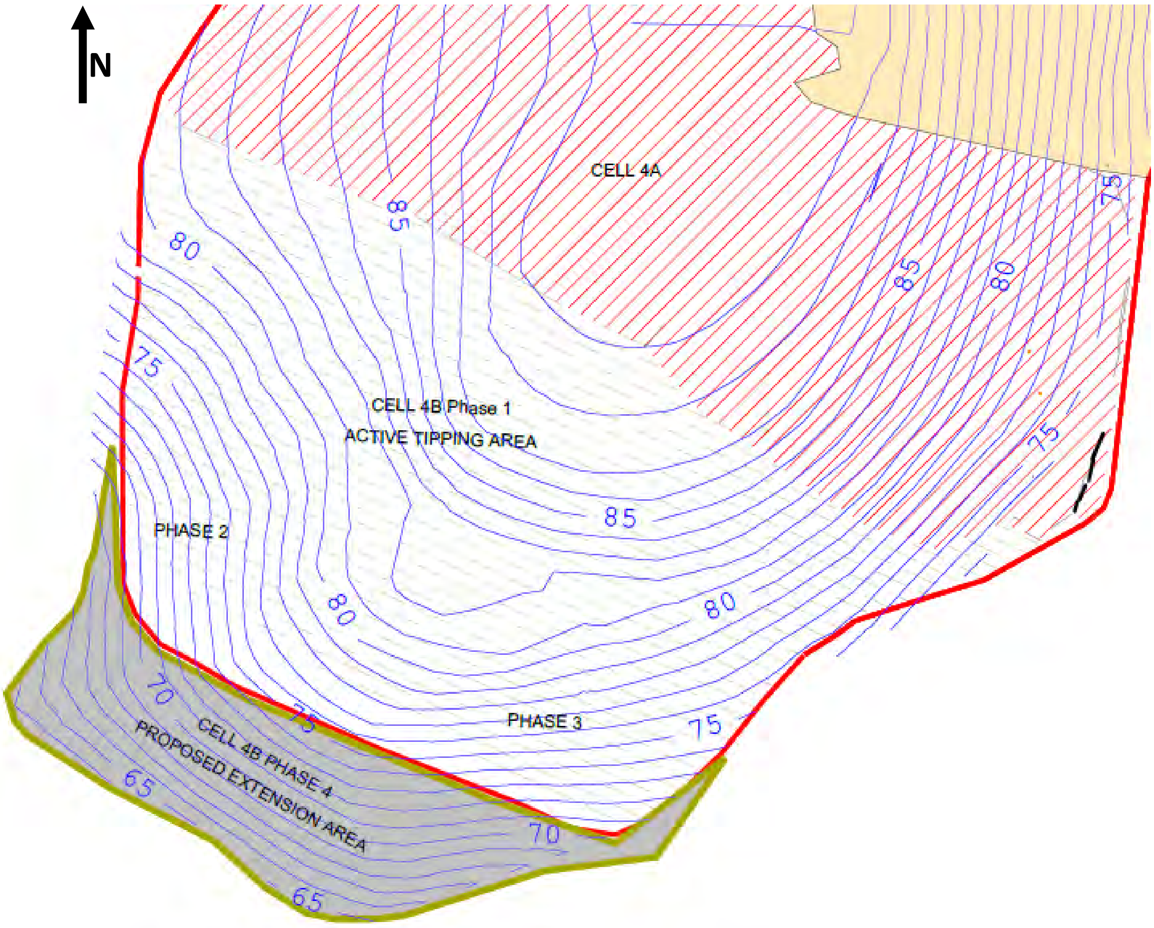


Figure 13 – Cell 4B proposed Extension Area

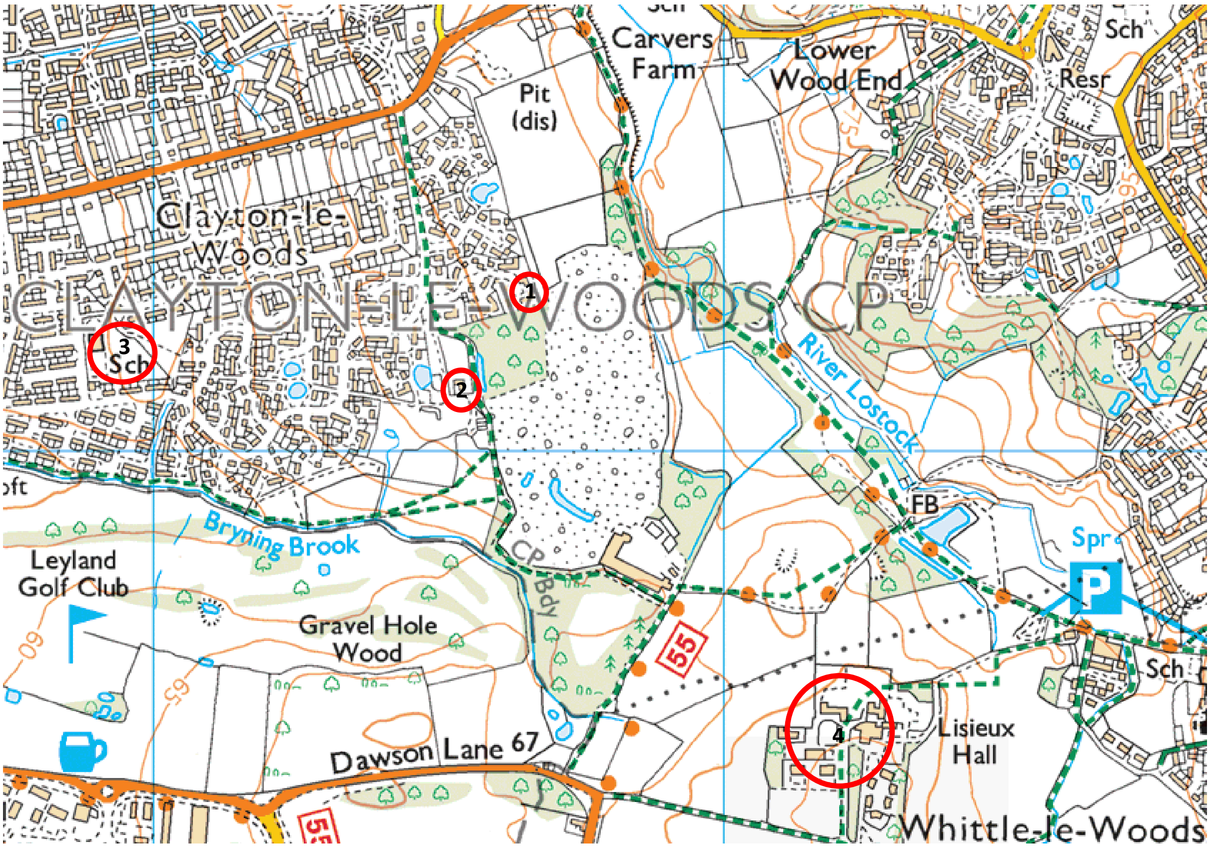
5.2 Off Site Receptors

5.2.1 The Cell 4B extension will be located to the southwest of the site and therefore receptors to the west and south of the site are considered to be at the highest risk of landfill gas migration from the proposed site development.

5.2.2 These receptors have the potential to be impacted by landfill gas migration. This adverse impact could be direct or indirect, for example the occupants of a building may be at risk of asphyxiation or explosive atmosphere may occur where gas is accumulating within the building.

Table 3 – Receptor Location Summary

No.	Name	Type	Distance	Direction
1	Houses off Spring Meadow	Residential	20m	NW
2	Oak House	Residential	70m	W
3	Happy House Preschool and Nursery	Public	250m	W
4	Lisieux Hall Assisted Living	Residential	440m	SE



*Receptors chosen for proximity to the site and act as a proxy for receptors of the same type at greater distance

Figure 14 – Receptor Locations

5.2.3 A review DEFRA's Magic Map[5] did not identify any statutory designated sites such as National Nature Reserves, National parks, Ramsar Sites, Sites of Special Scientific

[5] https://magic.defra.gov.uk/MagicMap.aspx

Interest (SSSI), Special Areas of Conservation (SAC), Special Protection Areas within 1km of the site.

5.2.4 The closest designated site is an area of Lowland Meadows, protected under the Priority Habitat Inventory some 380m east of the site.

5.3 Landfill Gas Monitoring Regime

5.3.1 Perimeter gas monitoring is undertaken by the site operator.

5.3.2 Perimeter boreholes are typically monitored on a monthly basis using a portable, certified gas analyser with the exception of GS04 which is monitored on a weekly basis. Where exceedance of Permit Limits and Action Levels are reported the frequency of gas monitoring increases accordingly.

Monitoring Point ID	Methane (%v/v)		Carbon Dioxide (%v/v)	
	Action Level	Compliance Level	Action Level	Compliance Level
GS000013	0.5	1.0	3.8	4.3
GS000012	0.5	1.0	1.4	1.9
GS000011	0.5	1.0	1.8	2.3
GS000010	0.5	1.0	1.3	1.8
GS000009	0.5	1.0	1.3	1.8
GS000008	0.5	1.0	1.4	1.9
GS000007	0.5	1.0	1.3	1.8
GS000006	0.5	1.0	2.3	2.8
GS000005	5.3	5.8	7.2	n/a
GS000004	1.3	1.8	1.9	2.4
GS000003	1.0	1.5	1.5	2.0
GS000002	n/a	n/a	n/a	n/a
GS000001	28.5	n/a	21.1	n/a

5.4 Monitoring Data Overview

5.4.1 Perimeter gas data reviewed in this assessment is available from 2003-2010, 2014 and 2020-2024 and is summarised in Table 4 and Table 5 below. All ground gas profile graphs are displayed in Appendix 1.

Table 4 – Ground Gas Summary (2003-2014)

Monitoring Point	Methane (%v/v)			Carbon Dioxide (%v/v)		
	Min	Ave	Max	Min	Ave	Max
GS000001	0.0	4.9	63.1	0.0	5.0	37.6
GS000002	0.0	21.9	81.0	0.0	10.7	39.2
GS000003	0.0	1.8	57.8	0.0	1.0	27.2

Table 4 – Ground Gas Summary (2003-2014)						
Monitoring Point	Methane (%v/v)			Carbon Dioxide (%v/v)		
	Min	Ave	Max	Min	Ave	Max
GS000004	0.0	0.1	2.1	0.0	0.3	4.4
GS000005	0.0	2.3	70.1	0.0	1.4	12.6
GS000006	0.0	0.2	11.7	0.0	0.6	5.7
GS000007	0.0	0.0	0.4	0.0	0.2	3.0
GS000008	0.0	0.0	0.3	0.0	0.1	6.6
GS000009	0.0	0.0	0.4	0.0	0.0	0.5
GS000010	0.0	0.0	0.4	0.0	0.1	1.6
GS000011	0.0	0.0	0.4	0.0	0.3	1.8
GS000012	0.0	0.0	0.4	0.0	0.1	2.5
GS000013	0.0	0.0	1.7	0.0	0.6	5.2

Table 5 – Ground Gas Summary (2020-2024)						
Monitoring Point	Methane (%v/v)			Carbon Dioxide (%v/v)		
	Min	Ave	Max	Min	Ave	Max
GS000001	0.0	18.2	62.1	0.1	14.4	42.2
GS000002	0.0	6.2	66.5	0.1	4.4	11.9
GS000003	0.0	7.1	43.5	0.0	5.7	28.4
GS000004	0.0	8.9	57.1	0.1	9.9	36.3
GS000005	0.0	9.1	85.0	0.1	3.0	8.7
GS000006	0.0	18.8	57.8	0.1	15.8	39.5
GS000007	0.0	0.2	12.9	0.1	0.4	3.1
GS000008	0.0	0.0	0.3	0.1	0.6	3.5
GS000009	0.0	0.0	0.3	0.0	0.1	0.5
GS000010	0.0	0.0	0.3	0.0	0.2	1.2
GS000011	0.0	0.0	0.3	0.1	1.4	4.6
GS000012	0.0	0.0	0.3	0.0	1.0	12.6
GS000013	0.0	0.0	0.3	0.0	3.0	17.2

5.4.2 Historical ground gas data from the 2003-2010 period shows elevated methane and carbon dioxide present in GS01-03 and in GS05. Carbon Dioxide is ubiquitous in the perimeter wells with GS06-13 reporting carbon dioxide in the expected range from background conditions.

5.4.3 When comparing the historical data to the current gas monitoring data there is a clear shift in several ground gas regimes to more persistently elevated methane and carbon dioxide as discussed below. This can be largely attributed to changes in the gas management efficiency and maintenance on site.

5.4.4 Gas flows for each monitoring location are displayed in Table 6 for the period 2020 to 2024. Whilst flow measurements within a well cannot be solely used to determine outward migration pressure from the site reaching perimeter locations it can be a good indicator of well conditions and gas pressure within each individual location.

Table 6 – Gas Flow Summary (2020-2024)			
Monitoring Point	Flow l/hr		
	Min	Ave	Max
GS000001	-4.1	-0.8	0.7
GS000002	-5.7	-0.9	0.4
GS000003	-26.0	-14.0	2.8
GS000004	-5.5	-0.3	8.3
GS000005	-3.7	-0.1	4.1
GS000006	-1.9	0.1	4.0
GS000007	-2.4	-0.1	3.7
GS000008	-3.1	-0.1	4.0
GS000009	-0.7	0.1	4.1
GS000010	-3.7	-0.2	4.0
GS000011	-1.2	0.0	4.1
GS000012	-1.8	0.0	2.1
GS000013	-1.1	0.0	2.3

5.4.5 Average flows appear typical with the exception of GS03. However, at a number of perimeter locations on occasions there appears to be a driving gas pressure with elevated flows reported.

5.4.6 Negative flows are often associated with changes in atmospheric pressure and groundwater level in the morning wells which have a direct impact of pressure in the well head space. Negative flows are often recorded when atmospheric gases are drawn into the monitoring point however in several instances at Clayton Hall the converse is true and negative flows are reported in conjunction with elevated methane and carbon dioxide.

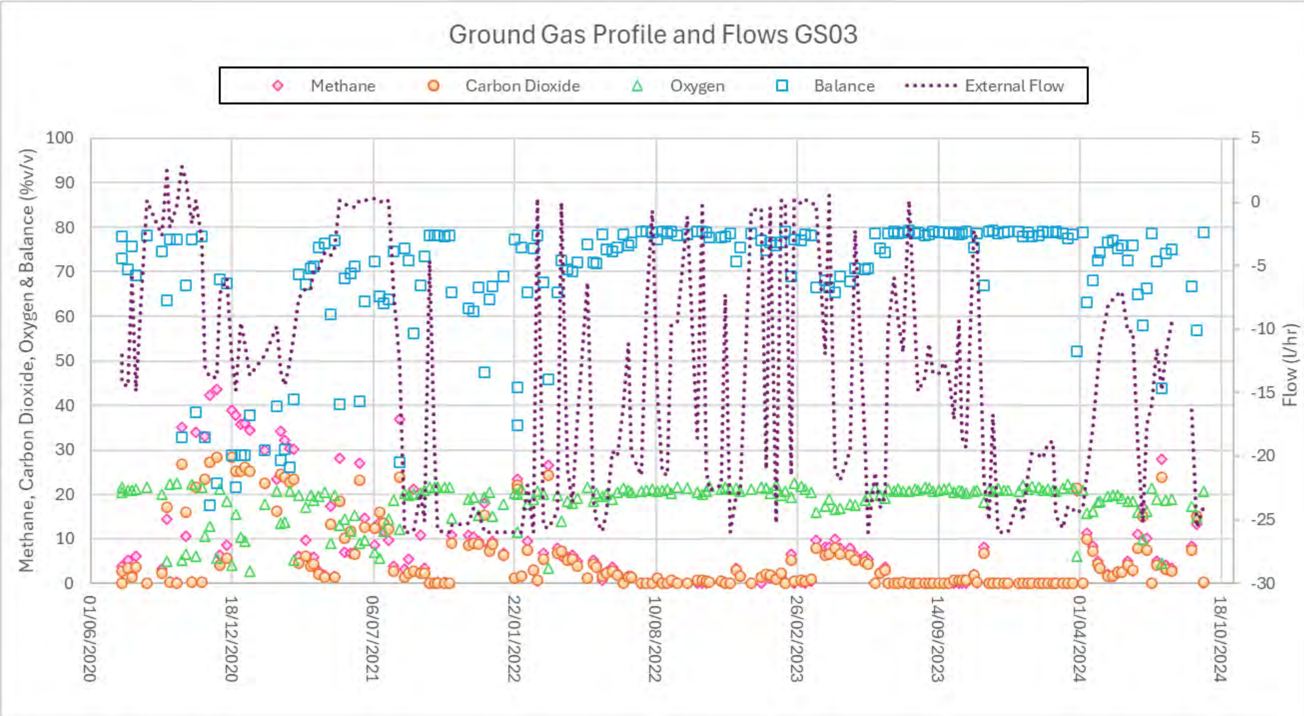


Figure 15 – Gas Flows GS03

5.5 Perimeter Wells Located in Made Ground

5.5.1 Due to historic uncontained landfilling around the extents of the currently permitted site there are several areas of made ground containing landfill wastes. These waste deposits are variable in nature with some borehole descriptions more representative of inert material (GS05) and other areas with strong landfill odour and more variable waste types including plastic, fabric, paper and timber (GS03, GS04 and GS02).

5.5.2 As waste is present in these locations there is likely to be an in-situ contribution from the decaying putrescible content to the perimeter gas regime. It is not possible to attribute the gas to a single source, either the made ground or potential of landfill gas migration form the currently permitted landfill cells.

5.5.3 Methane is present in the perimeter boreholes to the northwest of the site associated with areas of historic landfilling, as established in borehole logs GS02, GS03 and GS04. Where methane is present it is observed with carbon dioxide, a signature representative of potential landfill gas migration.

5.5.4 There is an overarching declining methane trend in both GS03 and GS04 however, this is not linear and there has been a resurgence of methane in GS03 in 2024 a similar increase is also evident in GS04. Furthermore, elevated methane has been reported in GS02 in 2024.

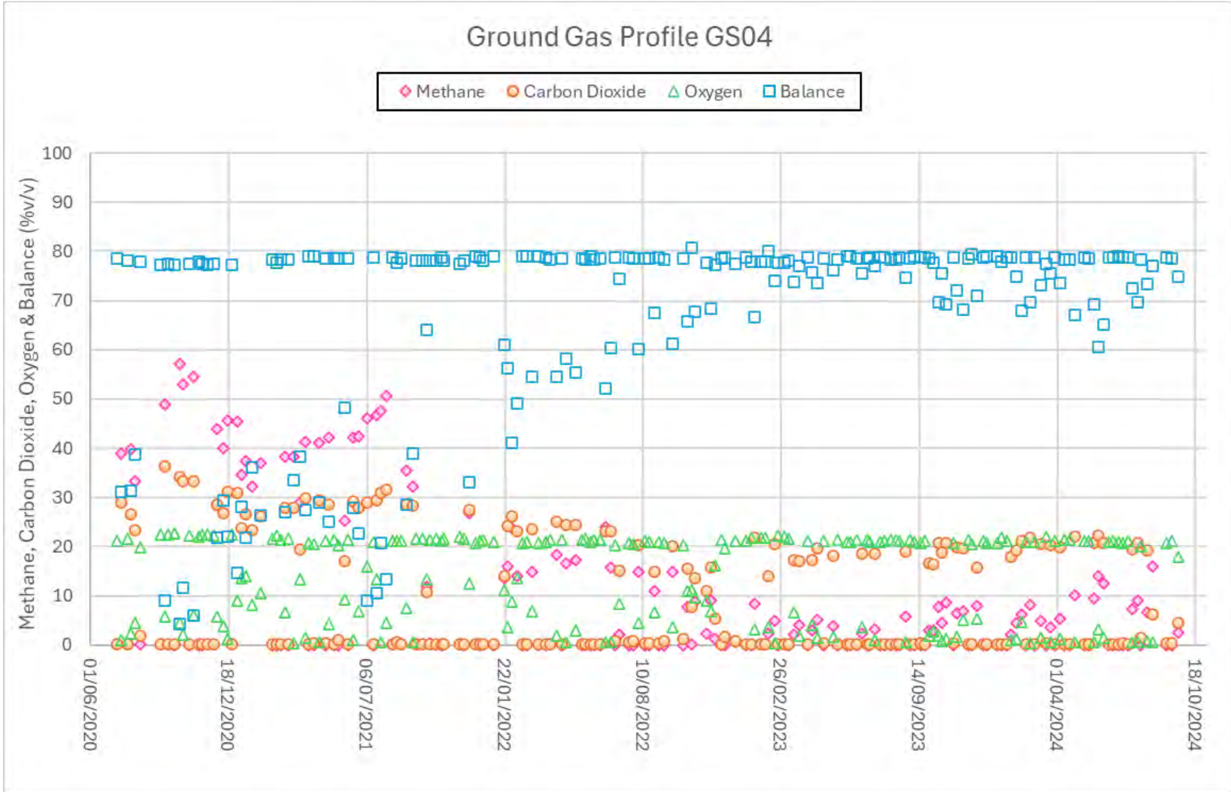


Figure 16 – Ground Gas Profile GS04

5.5.5 Carbon dioxide in GS04 is more variable and fluctuates significantly more than in GS03. The fluctuating nature of the gas suggests there is not a steady positive pressure impacting on the gas concentrations observed in GS04 and instead it is more affected by atmospheric pressure changes and ground conditions.

5.5.6 Methane observed in GS04 is limited by groundwater levels, where groundwater is elevated methane concentrations are reduced in the monitoring well. Methane is less soluble than carbon dioxide and therefore during periods of elevated groundwater methane is not observed at high concentrations. BH103A is screened within the superficial deposits suggesting that the main potential pathway to GS04 is through the superficial strata at the site.

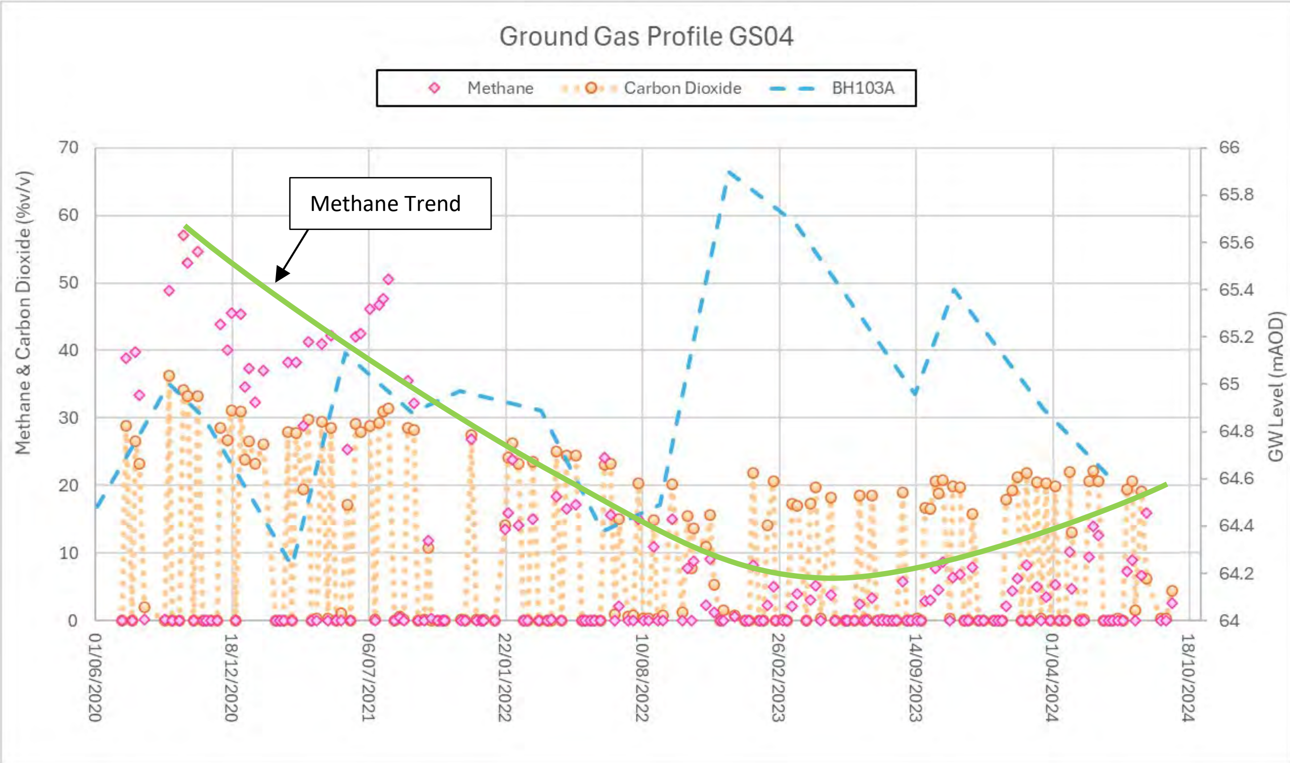


Figure 17 – Methane and Carbon Dioxide GS04

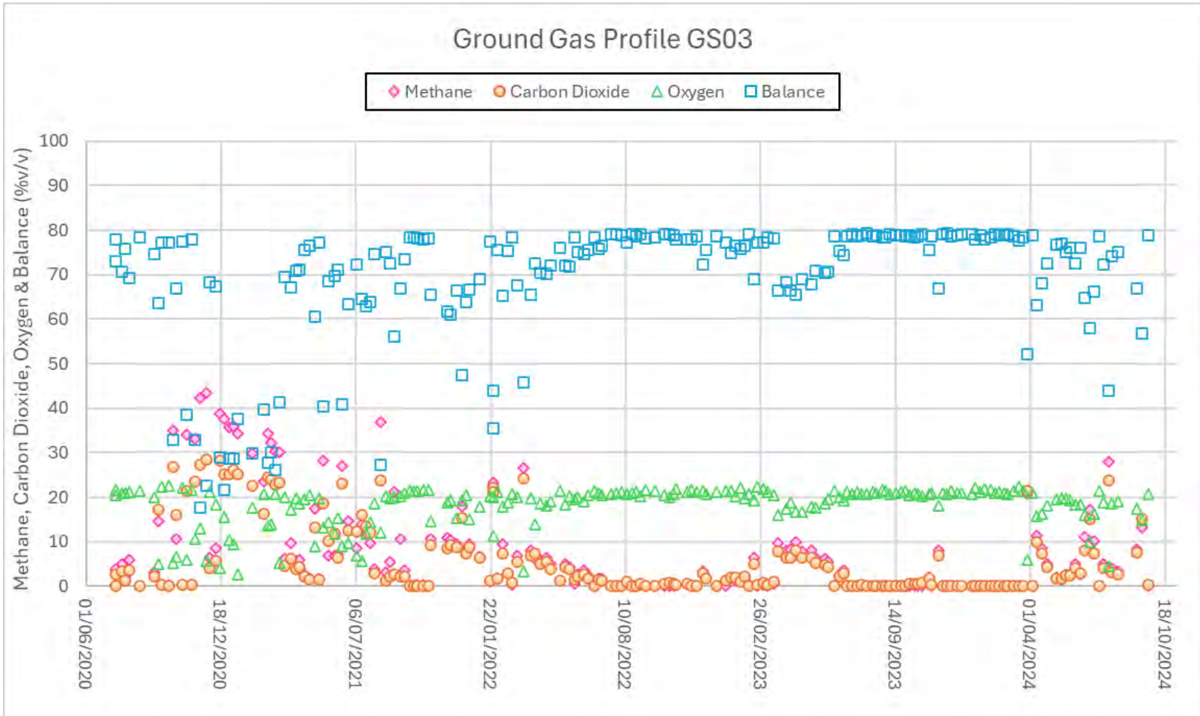


Figure 18 – Ground Gas Profile GS03

5.5.7 Where methane and carbon dioxide have been elevated in GS03 they have purged the atmospheric gases from the borehole possibly indicating the presence of positive gas pressure. Where this has been reported as negative flow within the borehole it is likely that the pressure of the gas flow or damp within the borehole has cause the gas analyser to miscalculate the flow.

5.5.8 GS02 is located directly to the north of Cell 3A in an area of made ground, described as *Landfill Waste* with a strong odour. The gas regime in this borehole is highly variable with elevated methane and carbon dioxide reported in tandem.

5.5.9 GS02 shows a converse pattern to neighbouring GS03, where gas concentrations are elevated in one location they are low in the other and vice versa. This is most likely linked to sub surface sealing and the groundwater flow regime at the site opening and closing permeable pathways within the surrounding geology.

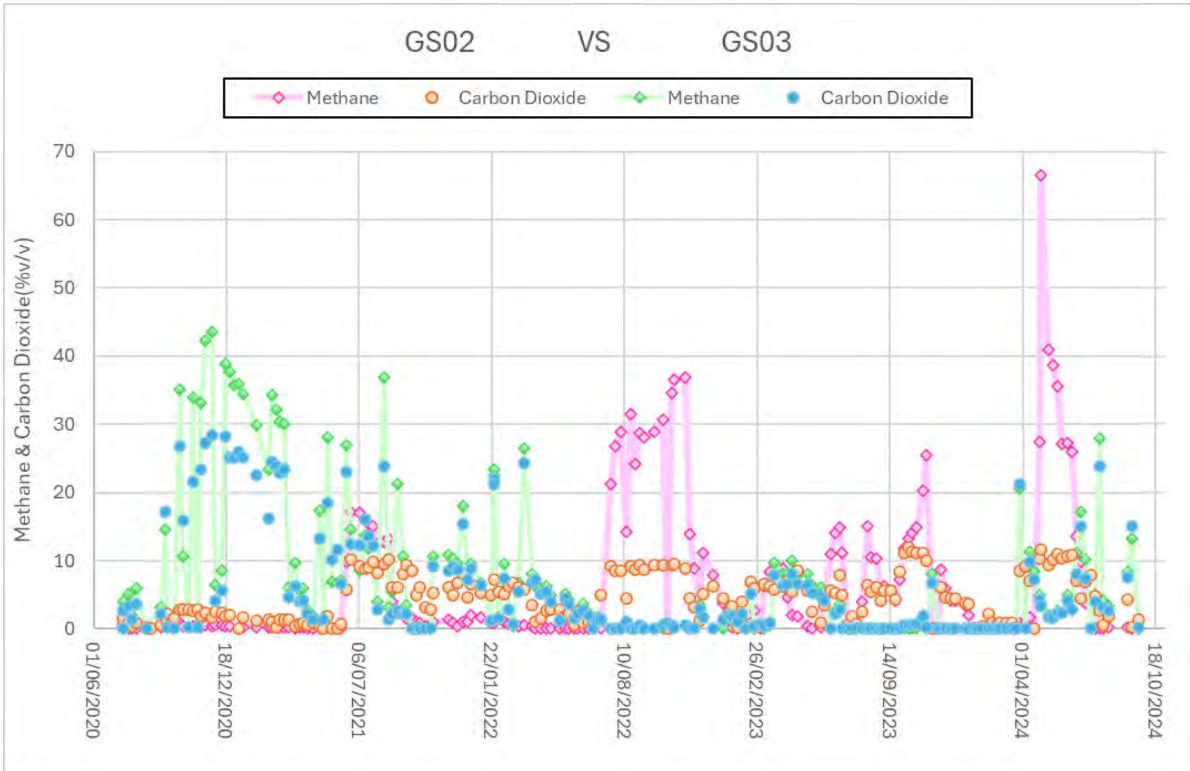


Figure 19 – Gas Comparison GS02 and GS03

5.5.10 GS02 and GS03 are also located next to the Northern Flare which extracts gas from historical areas of landfilling. Variable suction on gas extraction wells in this area of historical landfilling may also cause different flow dynamics through the made ground and result in different gas regimes at these two adjacent locations.

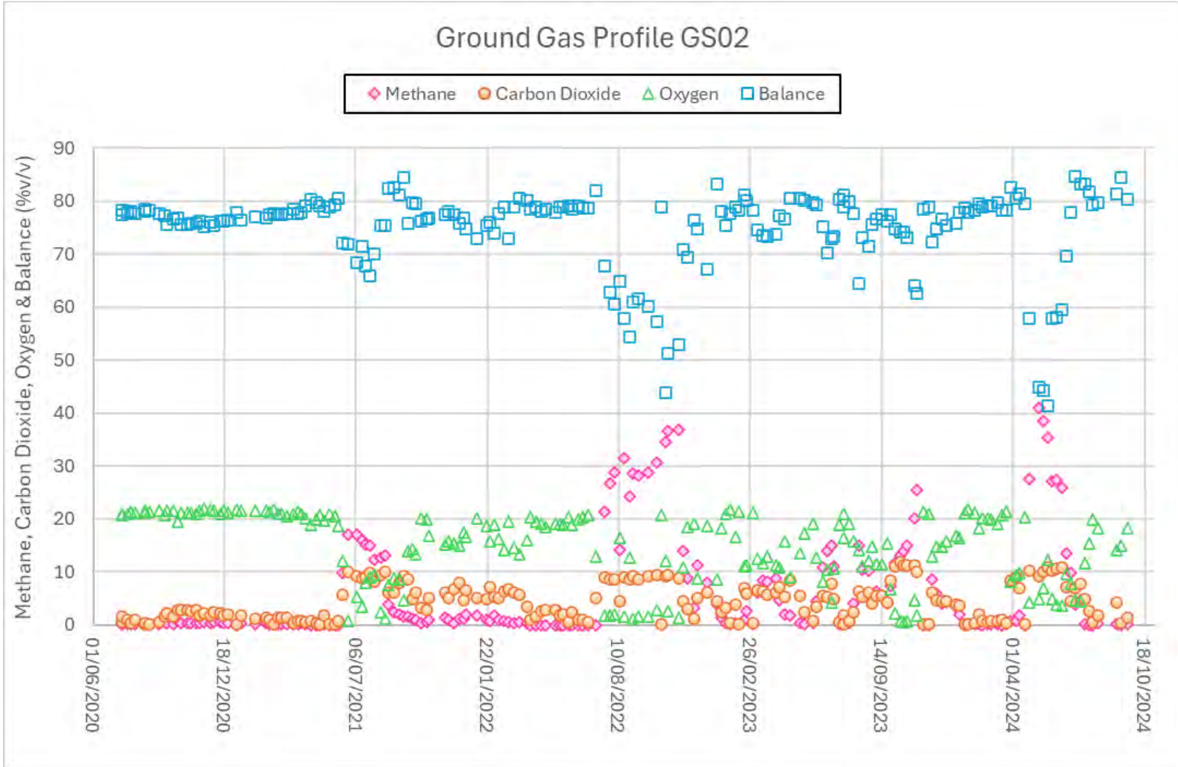


Figure 20 – Ground Gas Profile GS02

5.5.11 GS11 is located adjacent to the site office building on the southeast corner of the site on an area of sandy, gravelly clay 1.5m in thickness, which is likely to form part of the development platform for the site buildings.

5.5.12 The ground gas profile in GS011 is typical of a background soil respiration profile where seasonally cyclic carbon dioxide trends are likely a product of natural soil microbial respiration. This involves the consumption of oxygen in the soil by microbes and vegetation roots and its conversion to carbon dioxide:

$$O_2 + C \rightarrow CO_2$$

5.5.13 A portion of the carbon dioxide is lost to soil moisture and biological uptake therefore, to equalise the gas pressure there is continued ingress of air into the sub-surface, which also sustains the process by replenishing oxygen availability. As oxygen is continually consumed by microbial respiration, nitrogen in the soil becomes enriched above atmospheric concentrations.

5.5.14 This demonstrated in GS011 whereby there is an increase of carbon dioxide associated with a reduction on oxygen and a slight increase in nitrogen as shown in Figure 21 below. The cyclic observations are likely a result of favourable conditions for respiration resulting in periods of increased biological activity and greater carbon dioxide production.

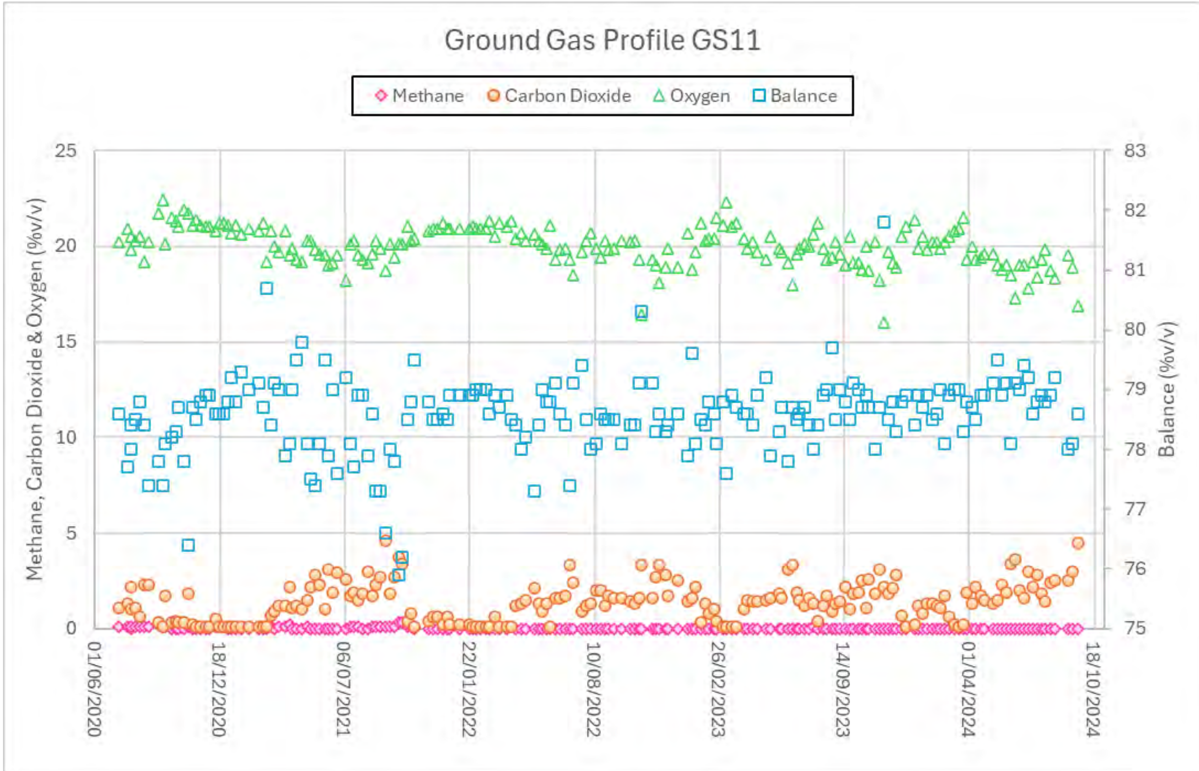


Figure 21 – Soil Respiration Profile

5.6 Perimeter wells in "Possible Made Ground"

5.6.1 A cyclic carbon dioxide trend can be observed in GS05 with elevated methane reported on an annual basis reaching approximatly80%v/v. These annual spikes in methane are observed in winter typically between November and March each year.

5.6.2 There appears to be no correlation with groundwater levels in this area as methane spikes are reported even when the groundwater level has been relatively stable over the 2022 to 2023 period.

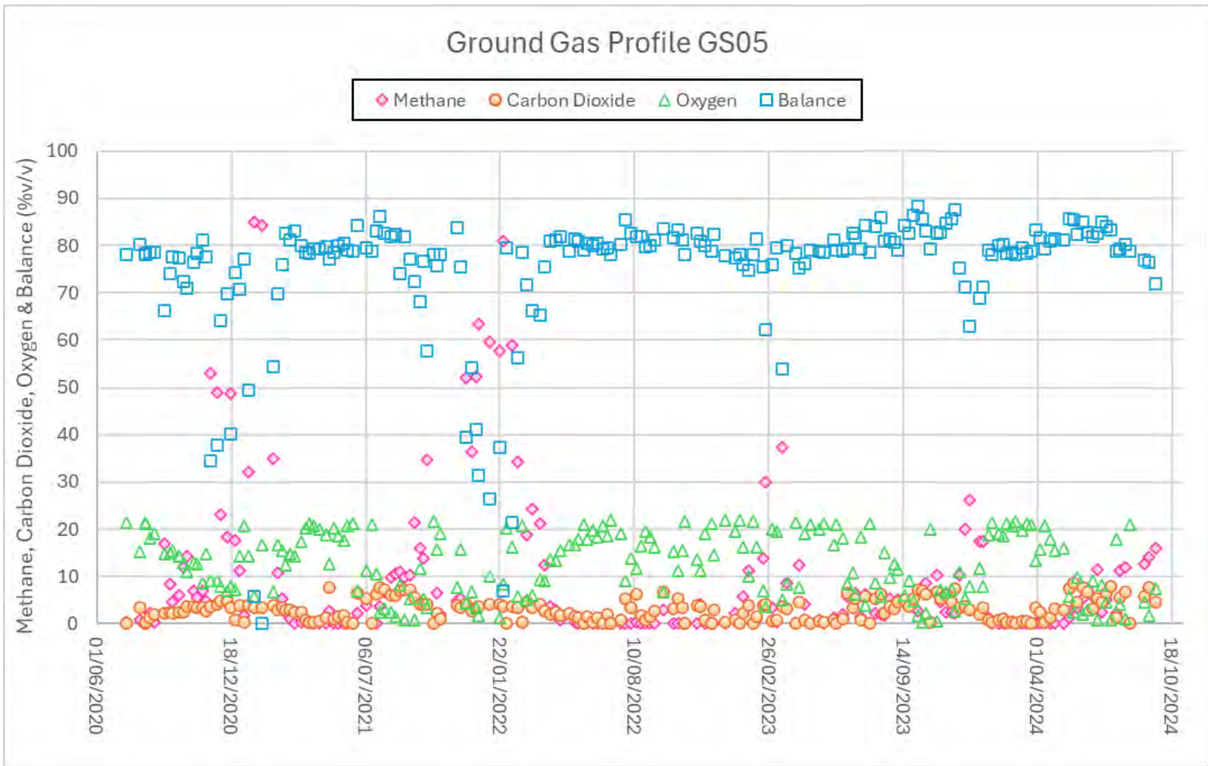


Figure 22 – Ground Gas Profile GS05

5.6.3 GS09 contains atmospheric gases within the borehole at the expected levels and negligible methane and carbon dioxide reported at 0.0-0.3%v/v and 0.0-0.5%v/v respectively. GS09 is located directly to the south of the site in an area of predominantly clay. The response zone was installed within the *"possible made ground"* comprising clay with timber fragments. This fill material is likely to comprise low permeability clays and silts and act as a barrier to any potential landfill gas migration form the site.

5.7 Perimeter wells in Natural Ground

5.7.1 GS06 shows a signature comparable to landfill gas composition with atmospheric gases reduced in the borehole when elevated methane and carbon dioxide are present. This monitoring point is located on the southwest edge of the site in the area which will contain the Cell 4B extension.

5.7.2 Elevated gas concentrations at this location are relatively persistent and due to the proximity to the waste mass the composition of the gas could be comparable to that being generated by the site showing that there is potentially minimal dispersion occurring between the site and the monitoring well.

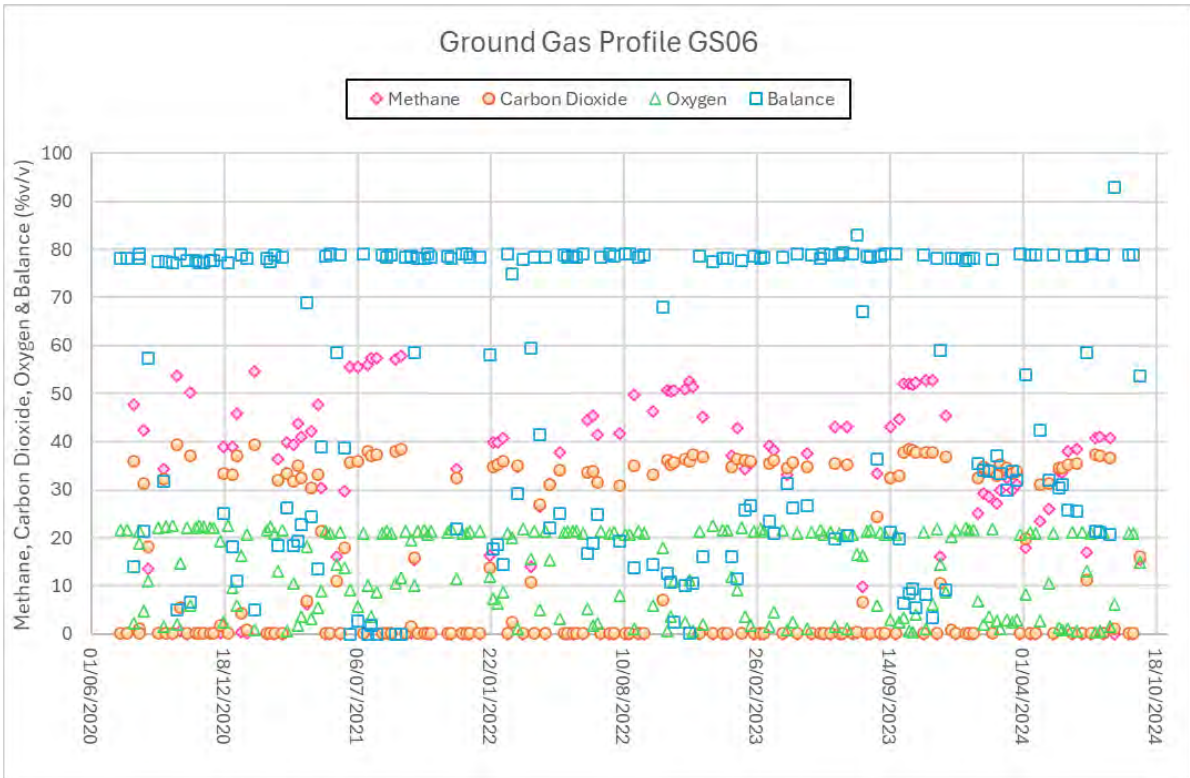


Figure 23 – Ground Gas Profile GS06

5.7.3 The ground gas profile for GS07 shows ground gas compositions generally representative of background conditions. Located at distance from the site in the southwest corner, it demonstrates that sub-surface lateral flow from the site in this direction is not backed by a positive pressure strong enough to be able to consistently reach this monitoring location.

5.7.4 There have been two isolated methane spikes once in 2020 and again in 2022 however these were short lived incidents whereby methane reached approximately5%v/v in 2020 and 13%v/v in 2022 and then returned to 0%v/v. These spikes in methane were not accompanied by elevated carbon dioxide. Both of these reported cases of elevated methane occurred at a time of falling barometric pressure.

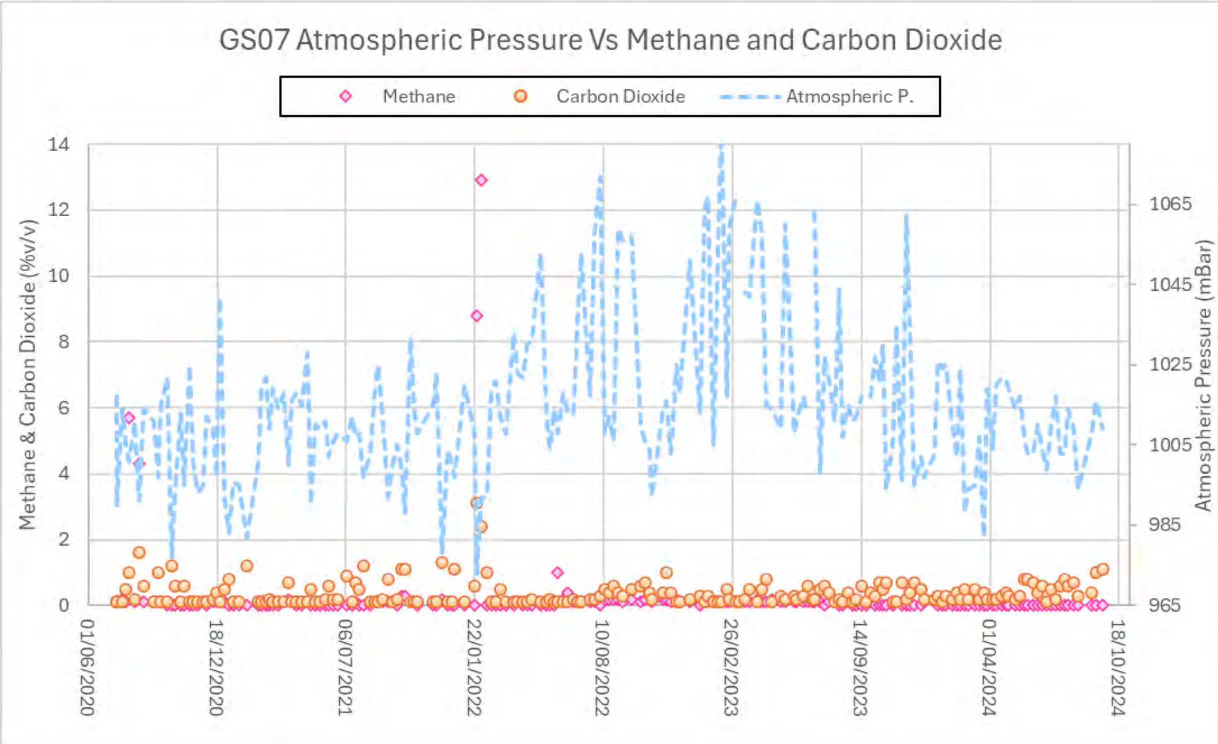


Figure 24 – Atmospheric Pressure Influence at GS07

5.7.5 GS08 is located adjacent to GS07 in the southwest corner of the site. The ground gas regime in this location is typical of background concentrations and there is no evidence of any influence from either recent or historic deposits in this location.

5.7.6 Methane is largely absent from GS10 with negligible concentrations recorded in 2021 in the 0.1-0.3%v/v range. Carbon dioxide is consistently reported in the 0.1-0.5%v/v range with a maximum of 1.2%v/v observed in 2023, this minor increase in carbon dioxide was reported in the absence of methane. There is no evidence of any impact from waste deposits at this location and the ground gas regime is thought to be representative of the host geology which comprises a significant thickness of firm brown clay. This strata would provide suitable protection from any potential lateral gas migration due to its low permeability and cohesive nature.

5.7.7 The ground gas profile at GS12 is largely representative of expected background levels, carbon dioxide is typically observed in the 0.1-5%v/v range whilst a maximum of 0.3%v/v methane has been reported for the 2020-2024 period.

5.7.8 Gas Monitoring point GS13 has a cyclic carbon dioxide trend with significant oscillation. GS13 is located along the eastern boundary of the site and contains a sand lens between 57.76mAOD and 53.16mAOD.

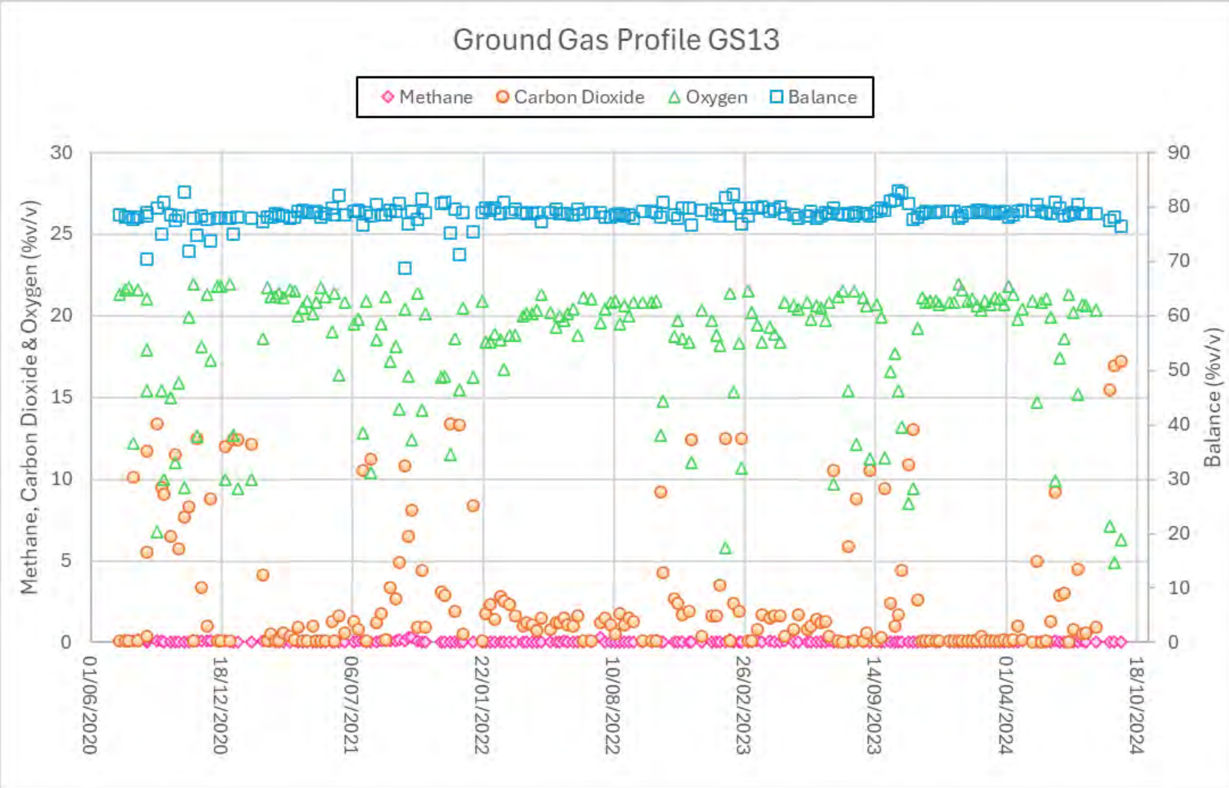


Figure 25 – Ground Gas Profile GS13

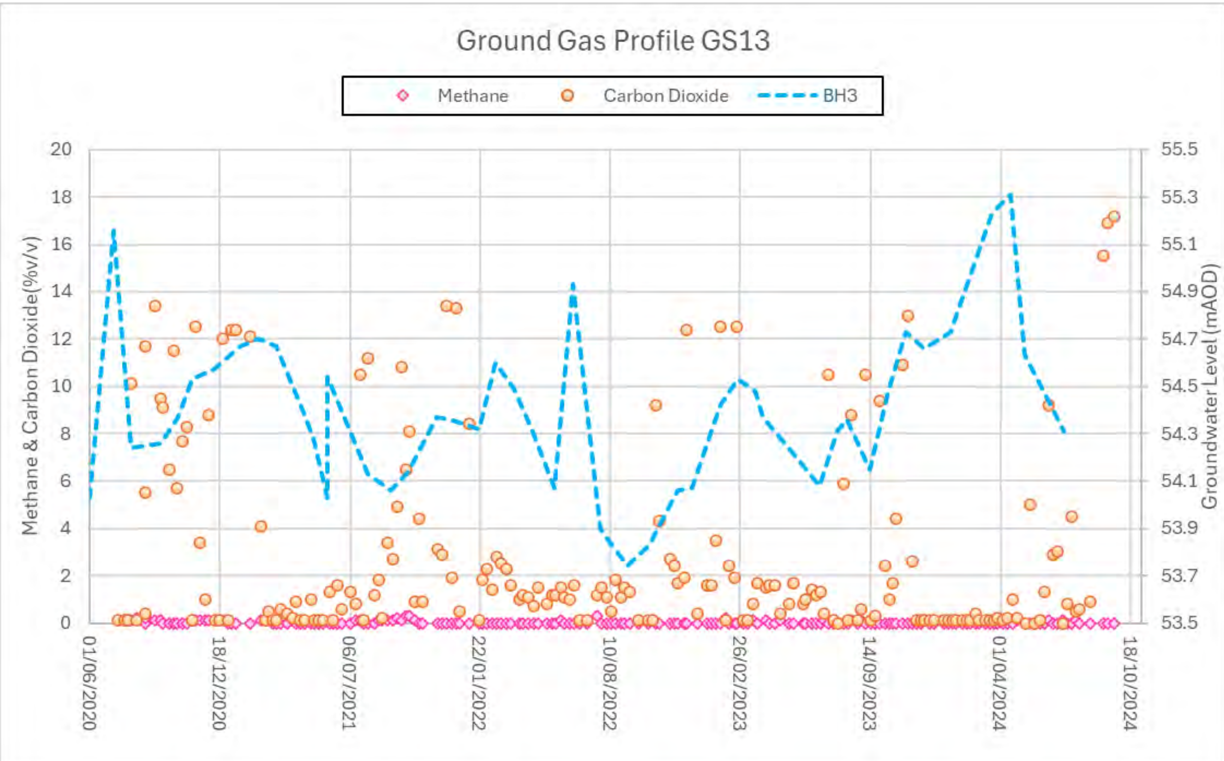


Figure 26 – Groundwater and Gas GS13

5.7.9 There is a correlation between groundwater elevation and carbon dioxide observed within the GS13. As the groundwater level decreases more carbon dioxide is reported within the borehole suggesting that a preferential pathway within the sand lens opens as this layer becomes desaturated by seasonally falling groundwater levels.

5.7.10 Carbon dioxide is reported in excess of 15%v/v when groundwater falls during the summer months and typically below 5%v/v when groundwater is elevated in the winter. Historically carbon dioxide was not reported at elevated concentrations in GS13, in the 2003-2010 period carbon dioxide was typically observed in the 0-5%v/v range which is consistent with the expected background concentrations.

5.7.11 During 2020-2024 carbon dioxide in the summer months is higher than what would typically be expected for background conditions. It is possible that a component of Biological Methane Oxidation (BMO) may occur at this location, however, there is no definitive evidence to confirm this.

5.7.12 Carbon Dioxide is more water soluble than methane so is more likely to travel in the groundwater compared to methane, possibly the reason for increased carbon dioxide reported at these locations in the absence of methane.

5.8 Leachate Management and Monitoring

5.8.1 Leachate is managed at the site by an extraction network and is processed in the leachate treatment plant.

5.8.2 Leachate level limits are specified in Table S3.1 of the Environmental Permit. Leachate compliance points L3A, L3B, L3C, L4A and L4B have a leachate limit of 3m head on the cell base.

5.8.3 Leachate levels are typically maintained in compliance with the permit however sporadic exceedances are noted in all cells, these exceedances are not however sustained for long periods of time. Effective leachate management is imperative to ensuring optimal landfill gas extraction from in waste wells as if the response zone of the gas wells become saturated gas will not be extracted from the waste mass effectively. A review of the leachate management system is programmed for early 2025 to improve leachate management efficiency.

6 CONCEPTUAL SITE MODEL

6.1.1 Information relating to the landfill gas source term, potential migration pathways and receptor information enables construction of a Conceptual Site Model (CSM), to assess the likely impact of the landfill site on the environment and human health.

6.1.2 A simple conceptual model can be constructed for the site, based on the relationship:

Source →Pathway →Receptor

6.1.3 Where:

- the Source is the landfilled wastes;
- the Pathway is the glacial deposits and made ground; and
- the Receptor is the housing estate.

6.1.4 Landfill gas can migrate from the site via the surrounding geological strata to a receptor via either diffusion or advection. As the permitted site benefits from engineered containment diffusion is the main mechanism for gas migration at the site is diffusion through the containment barrier.

6.1.5 Concentration gradients between the internal wastes and surrounding ground gas external to the site will cause diffusion, which can happen through a clay liner or through defects in a composite liner, where there are defects or damage to the HDPE.

6.1.6 As there are significant areas of unlined, historic landfill surrounding the site to the north, west and south there is a potential gas source from these wastes as well as a permeable pathway as the nature of the placed wastes in these areas is not cohesive.

6.2 Risk Pathway Screening

6.2.1 There is evidence of a ground gas signature in several perimeter monitoring locations around the site that could have been influenced by waste deposits. These wells are typically situated to the east and north of the site and are adjacent with the earliest areas of landfilling.

6.2.2 Made ground around the site may contain preferential migration pathways due to the unconsolidated nature of the wastes and placement of more permeable materials.

6.2.3 Where carbon dioxide was reported as present in the absence of methane at GS08, GS09, GS10 and GS11 along the south-eastern section of the site it was potentially representative of either biological methane oxidation, or background conditions associated with soil respiration.

6.2.4 Ongoing issues with the gas extraction system including the loss of Gas Manifold 1 in the northwest area of the landfill have impacted on the efficiency of the gas control in this area of the site. A resurgence of methane and carbon dioxide in 2024 may potentially be attributed to the loss of this manifold along with several of the in-waste gas extraction wells.

6.3 Receptor Risk Screening

Carbon Dioxide and Methane

6.3.1 Atmospheric carbon dioxide is between 0.036% and 0.041%v/v. Exhaled air contains 4.0% - 5.3% carbon dioxide which is generally equivalent to the average concentrations observed within the ground along the eastern perimeter of the site. Carbon dioxide has a density of 1.98 kg/m^3, which is approximately 1.5 times that of air (at 1.29kg/m^3).

6.3.2 The HSE identify in their *Assessment of the Dangerous Toxic Load (DTL) for Specified Level of Toxicity (SLOT) and Significant Likelihood of Death (SLOD)*[6] that the Specified Level of Toxicity (SLOT), where there would be 1 to 5% fatalities, is 6.3%v/v CO_2 after an hour's continuous exposure, although symptoms ranging in seriousness from headaches to respiratory difficulties can occur at atmospheric concentrations of 3% after an hour's continuous exposure.

6.3.3 For a receptor to be at risk from the migration of landfill gas derived carbon dioxide there must be a carbon dioxide flux from the ground into a building where:

- the ground gas CO_2 flux is greater than the air exchange rate within the building or cellar; and
- the ground gas CO_2 concentration is >6%v/v.

6.3.4 Methane has a water solubility of 25mg/l, whilst carbon dioxide is significantly more soluble at 145,000mg/l under non-acidic conditions.

6.3.5 Methane in the atmosphere within a range of 5 to 15%v/v is explosive. Methane higher than 15%v/v, which is present in both perimeter and in-waste boreholes, when released into the air can dilute causing concentrations to drop into the explosive range or can cause asphyxiation if oxygen is depleted.

[6] https://www.hse.gov.uk/chemicals/haztox.htm

Overall Risk

6.3.6 The overall potential risk to the adjacent receptors is arrived at by considering the probability that landfill gas migration will occur in combination with the consequence of exposure.

6.3.7 A simple risk matrix can be used to combine the probability of occurrence (i.e. low, medium or high) against the likely consequence or impact which also uses a scale of low, medium or high. This approach provides for a systematic assessment of risk. It is noted all such risk matrices are subject to limitations and the ratings need to be interpreted with recognition of the restrictions.

Table 7 – Risk Matrix

		Consequence		
		Low	**Medium**	**High**
Probability of Occurrence	**Low**	Low	Low	Medium
	Medium	Low	Medium	High
	High	Medium	High	High

6.3.8 The risk matrix does not allow for low residual risk where the consequence of exposure is high. The consequences of landfill gas migration are well known and include fire, explosion, asphyxiation, odour and ecotoxicity/toxicity. Therefore, the consequence of landfill gas migration is always high.

6.3.9 Given the distinctive landfill gas signature present within a number of perimeter boreholes the likelihood of gas migration at Clayton Hall is considered high.

6.3.10 With the addition of the landfill extension there is likely to be a slightly increased gas risk in the south of the site where currently evidence of landfill gas migration is not apparent. If gas management infrastructure is maintained in this area of the site then migration in a southerly direction may not be observed.

6.3.11 This results in the overall risk of landfill gas migration from the site being high. However, the site operator has plans in place to improve gas extraction on other parts of the site and bring this risk down.

6.3.12 In terms of the new landfill area the risk is considered to be low. Because this is a new cell it will have a high quality liner installed with third party quality assurance which will impede any lateral gas flow. The new area will have systems in place to manage leachate effectively and gas extraction wells will be installed and connected into the gas management system.

6.3.13 The new area should not cause any increase in risk from the permitted site.

6.4 Recommendations/Proposed Actions

6.4.1 A further extension to the site could increase the gas risk to the south of the site where there is currently less observed impact from recent and historic waste deposits. However, by placing new wastes in this area, it would increase the potential likelihood of migration in this direction.

6.4.2 This will be mitigated by the site liner and by installing an adequate leachate management system and gas extraction boreholes which will be connected to the existing gas management system.

6.4.3 An efficient gas abstraction system and suitable cap should result in a low gaseous emissions from the site. Where areas of the site do not meet emissions standards at present the site operator is working towards improvements.

6.4.4 Wardell Armstrong recommend that this should include a review of capping and perimeter monitoring points as well as the extraction system itself.

6.4.5 Discussions have been undertaken with the operator and they have committed to implementing improvements to both the gas and leachate management systems across the site, both in the short and long term, with the aim of improving the efficiency of both systems. This review will occur concurrently with the determination of the application to extend the site into Phase 4.

7 CONCLUSION

7.1.1 There are presently several perimeter monitoring locations that indicate relatively high concentrations of both methane and carbon dioxide, which may have been impacted by historical and/or more recent waste deposits.

7.1.2 It is required by the Environmental Permit that everything practicable must be done at Clayton Hall Landfill in order to control landfill gas, therefore it is proposed that landfill gas at the site going forward will be managed to a suitable standard to reduce the likelihood of any off-site migration. The Operator is currently undertaking a review of the gas management infrastructure with the aim of improving the efficiency of the gas control system and has agreed with the Environment Agency that regular updates will be provided as part of the quarterly and annual reviews,

7.1.3 Whilst the new Cell 4B extension area will not significantly increase the gas risk from the site due to the relatively small extension size, it is still advised to move forward with measures to improve control of the Clayton Hall gas field.

7.1.4 GasSim Tier 1 screening shows that there are several types of emissions that may require further assessment. Once the programme of remedial measures is finished, updated in-waste data and gas collection rates at the GUP will be established and a revised GasSim model can be produced to assess the success of the remedial works.

APPENDICES

APPENDIX 1

Time Series Graphs

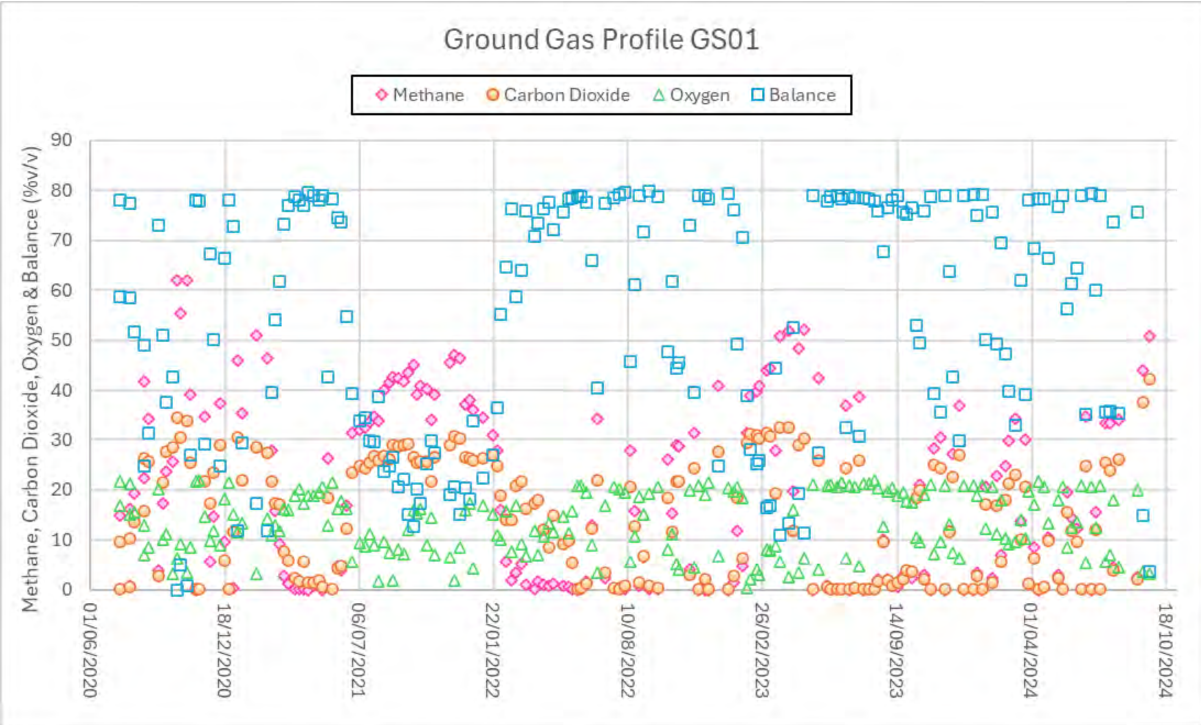


Figure 1: GS01 Ground Gas Profile

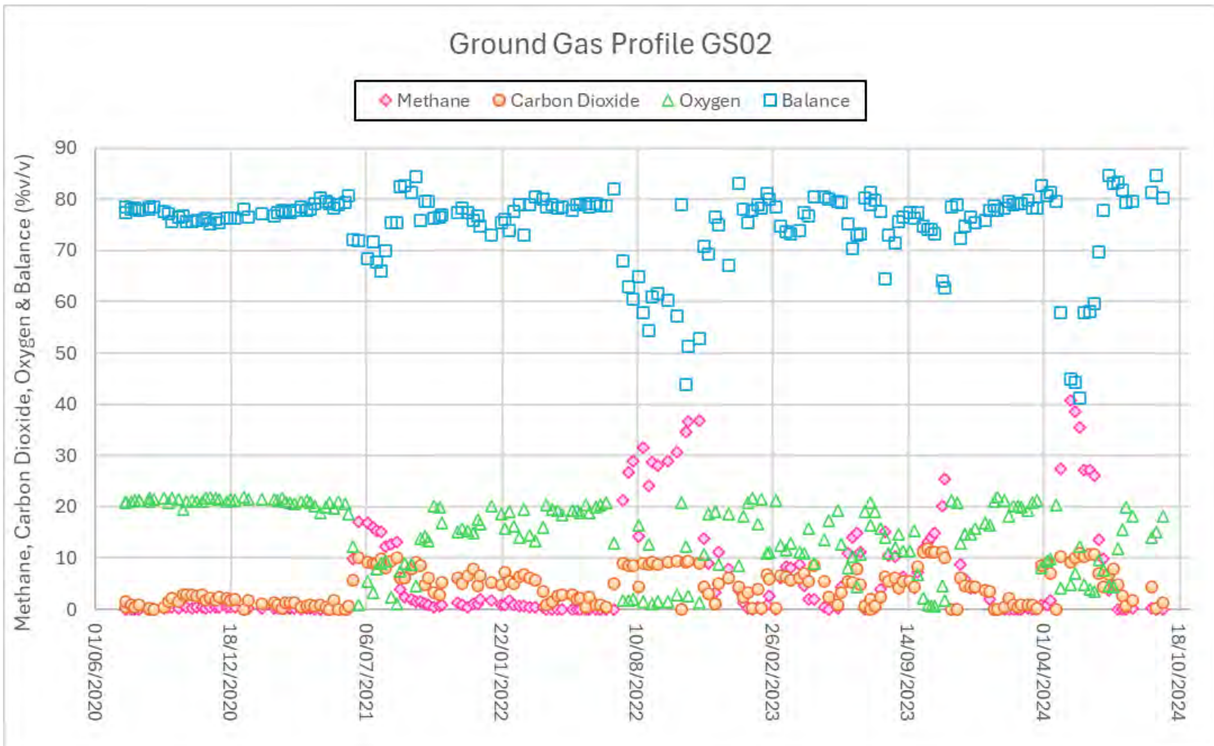


Figure 2: GS02 Ground Gas Profile

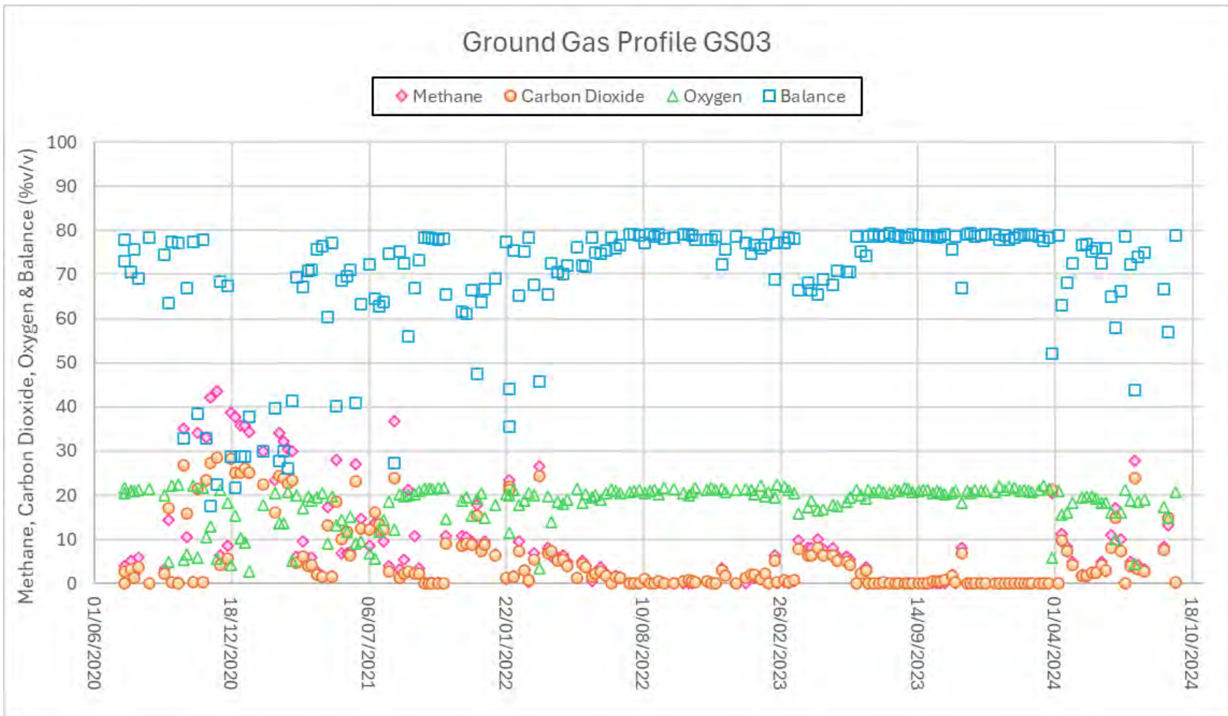


Figure 3: GS03 Ground Gas Profile

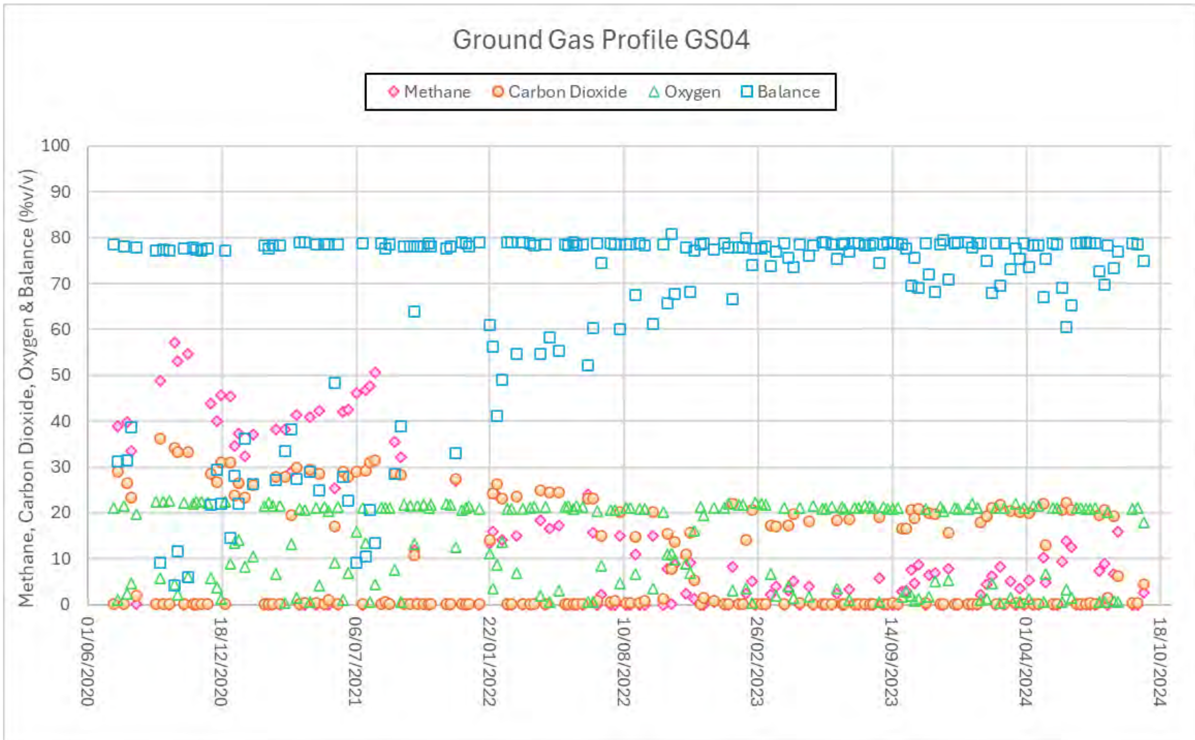


Figure 4: GS04 Ground Gas Profile

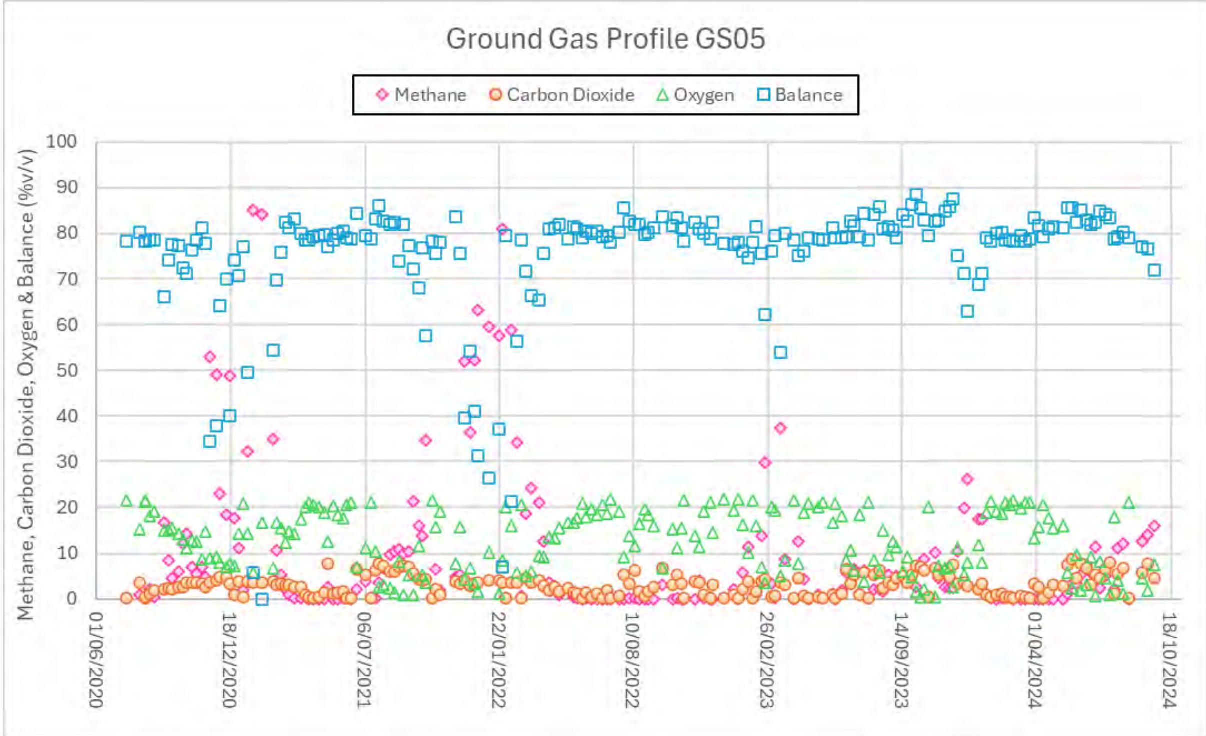


Figure 5: GS05 Ground Gas Profile

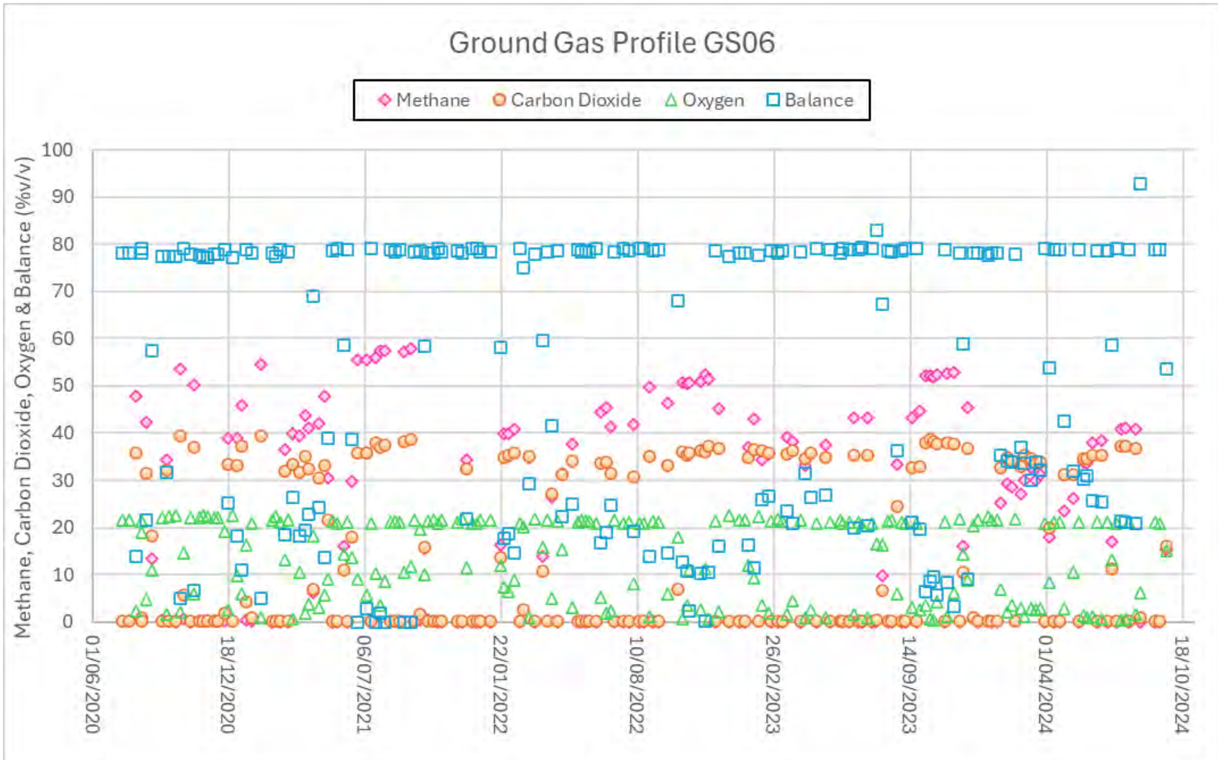


Figure 6: GS06 Ground Gas Profile

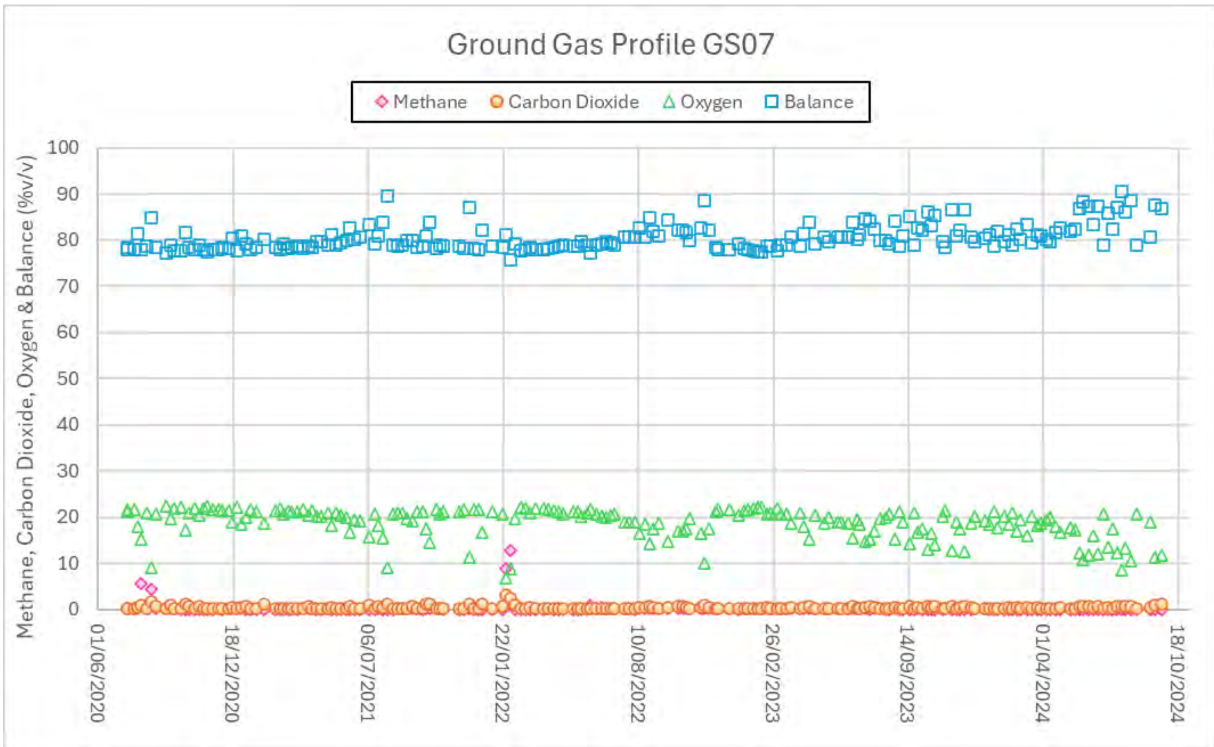


Figure 7: GS07 Ground Gas Profile

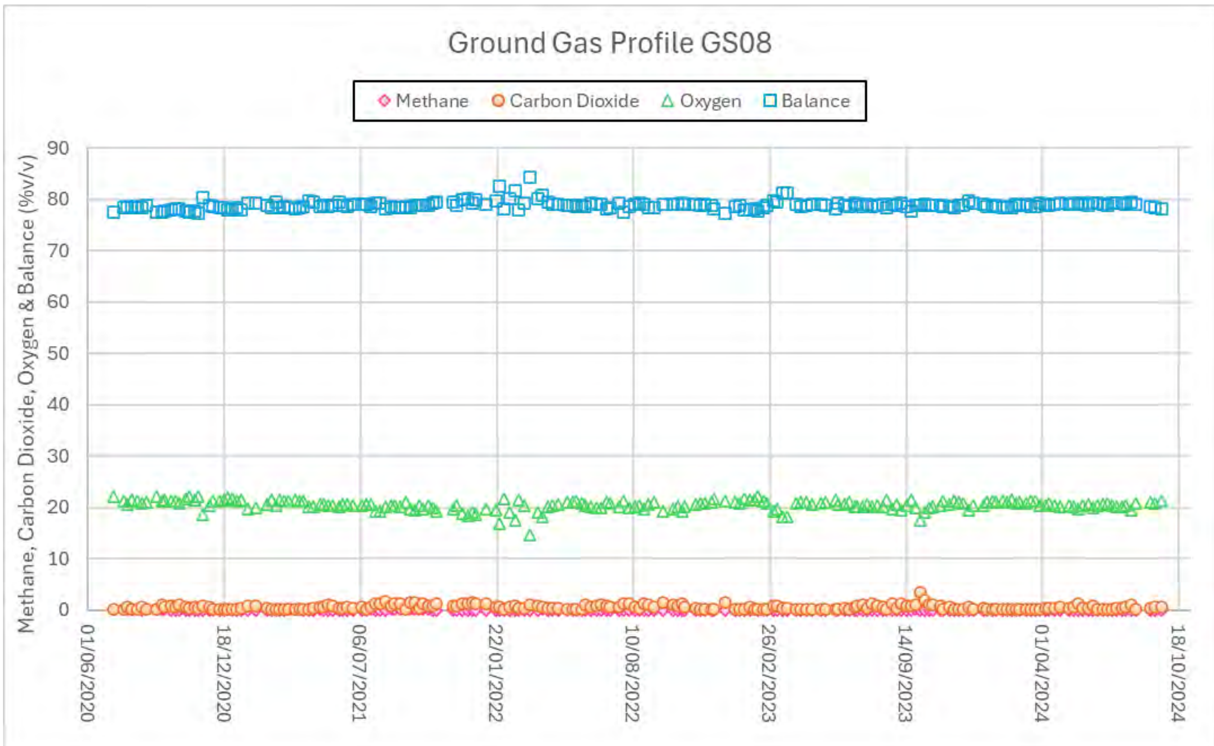


Figure 8: GS08 Ground Gas Profile

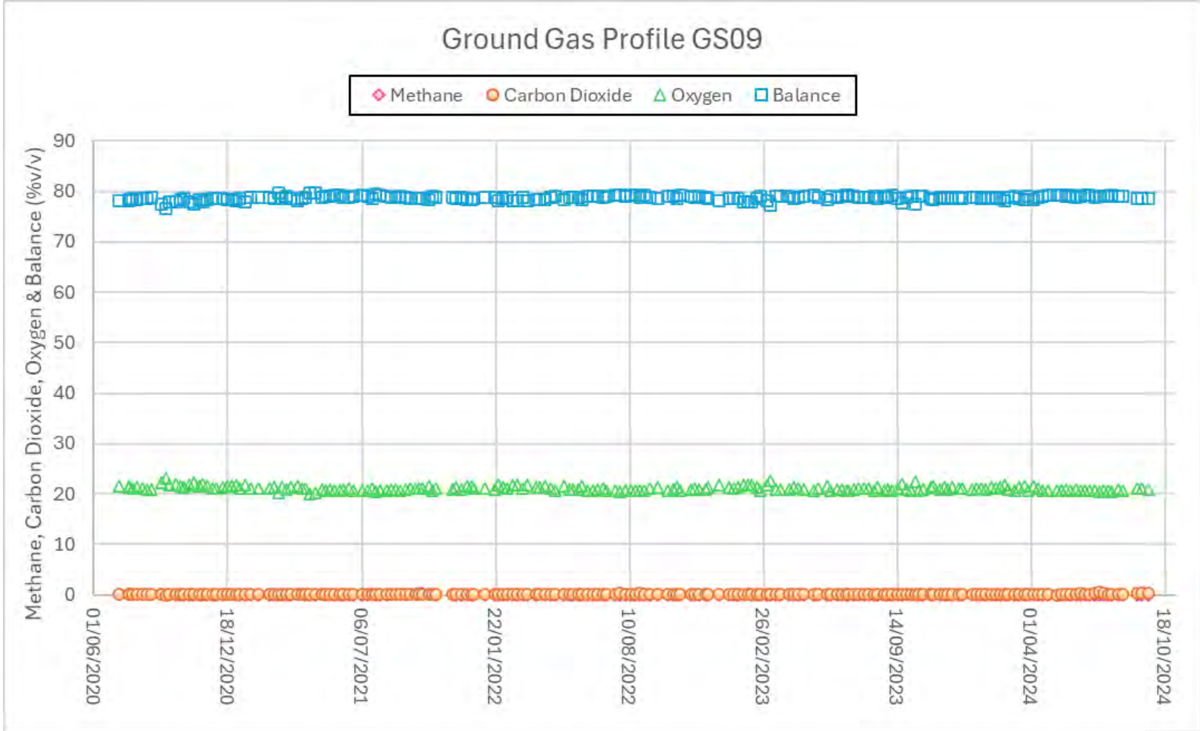


Figure 9: GS09 Ground Gas Profile

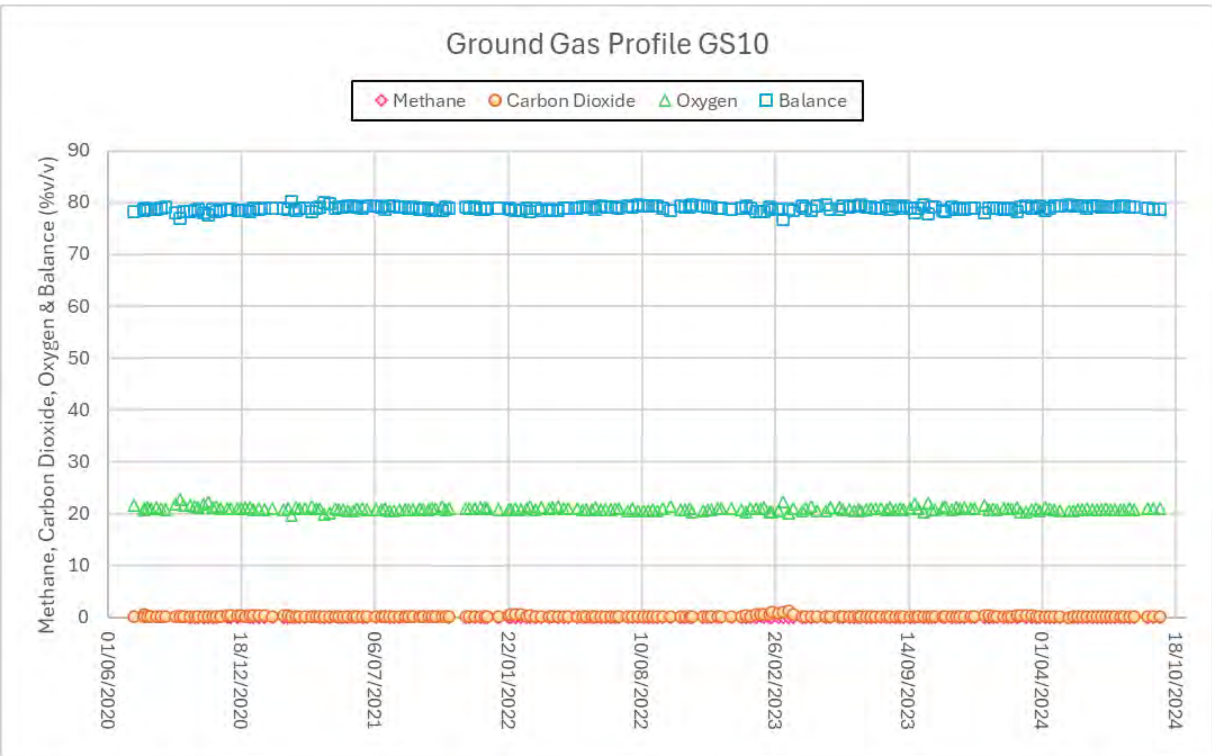


Figure 10: GS10 Ground Gas Profile

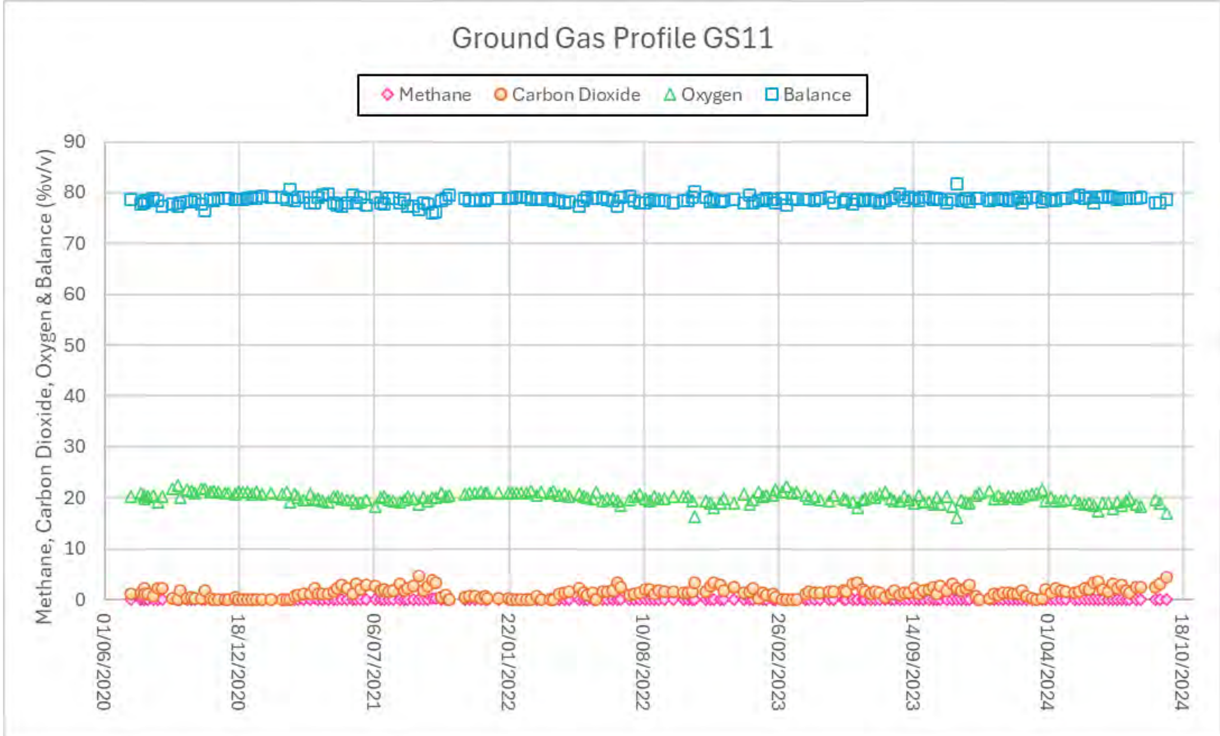


Figure 11: GS11 Ground Gas Profile

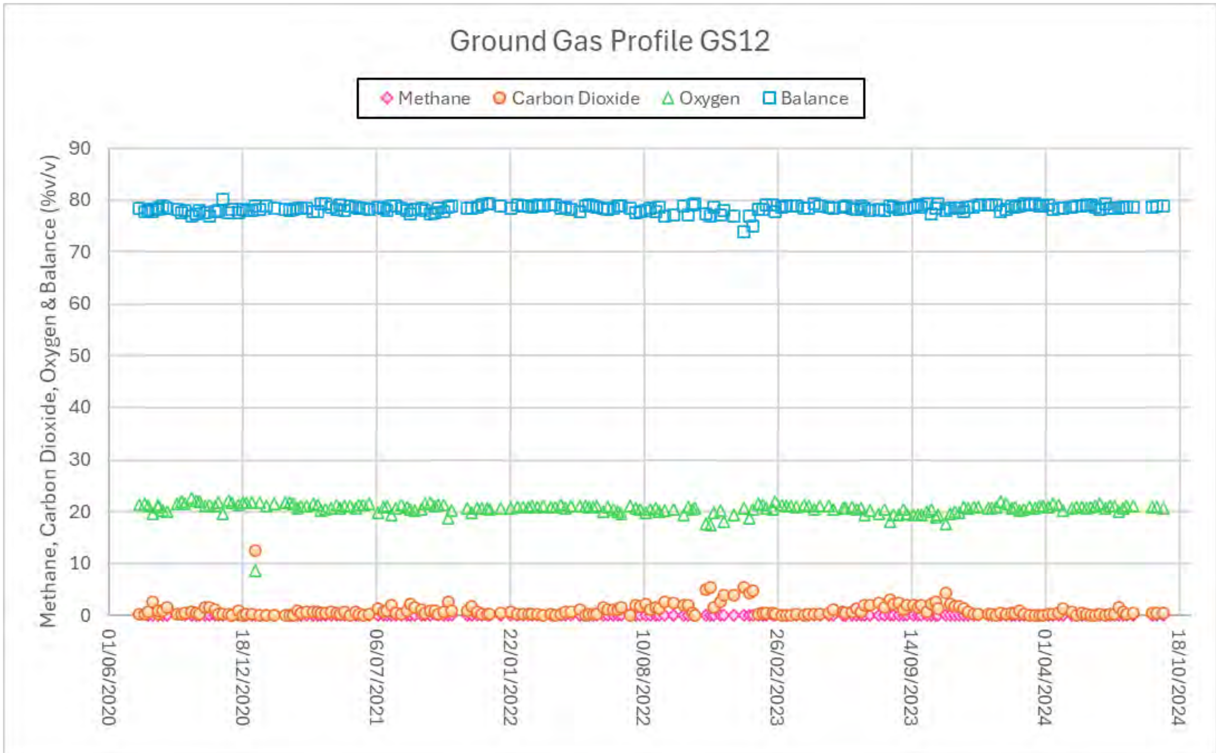


Figure 12: GS12 Ground Gas Profile

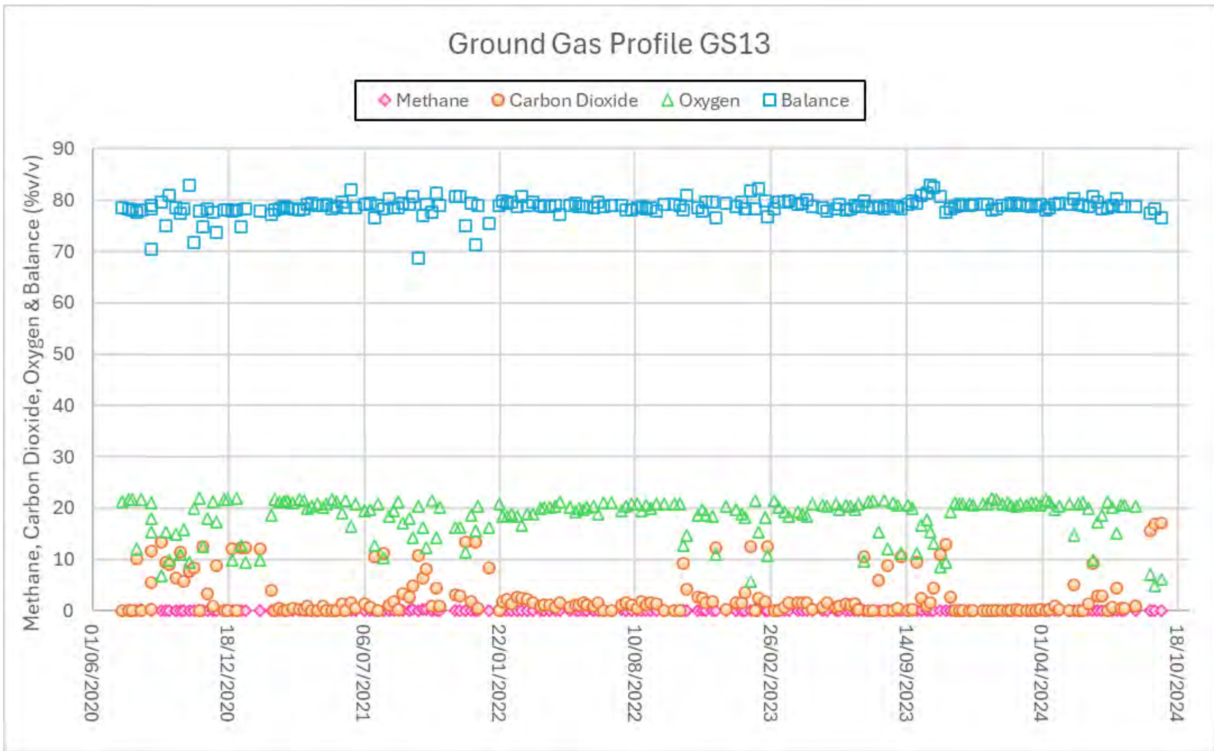


Figure 13: GS13 Ground Gas Profile

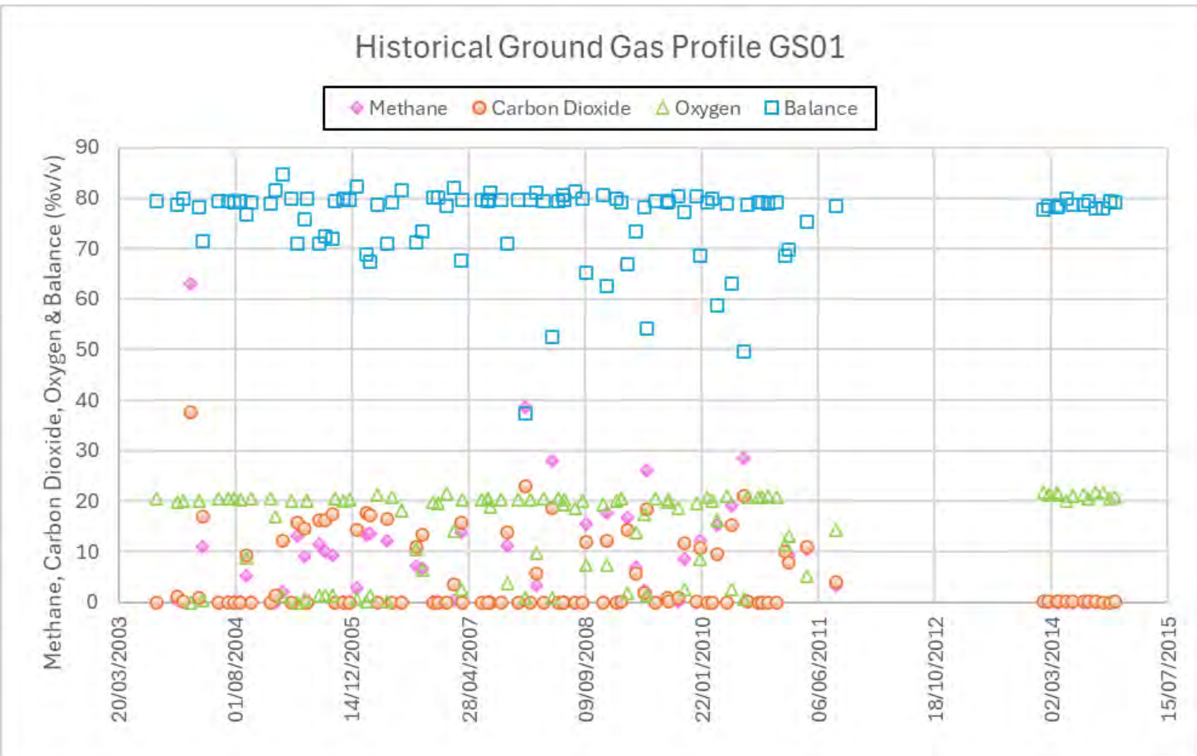


Figure 14: Historical Ground Gas Profile GS01

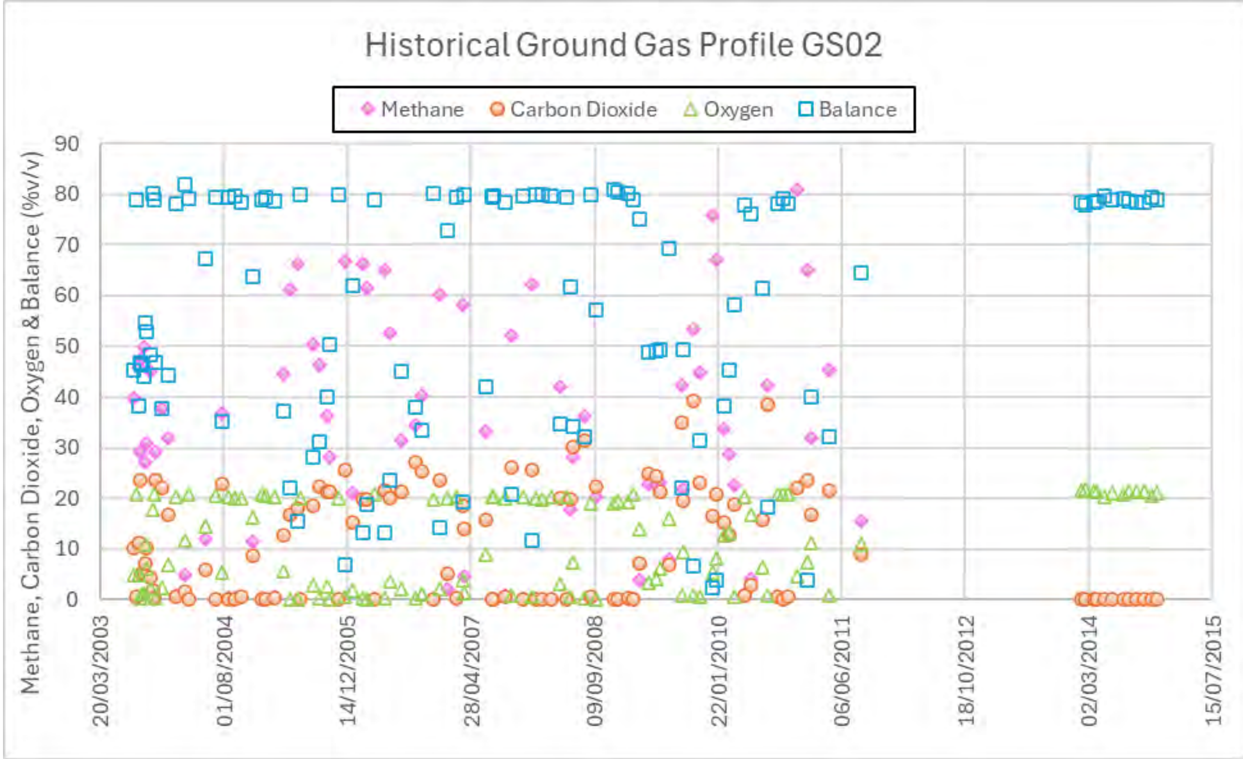


Figure 15: Historical Ground Gas Profile GS02

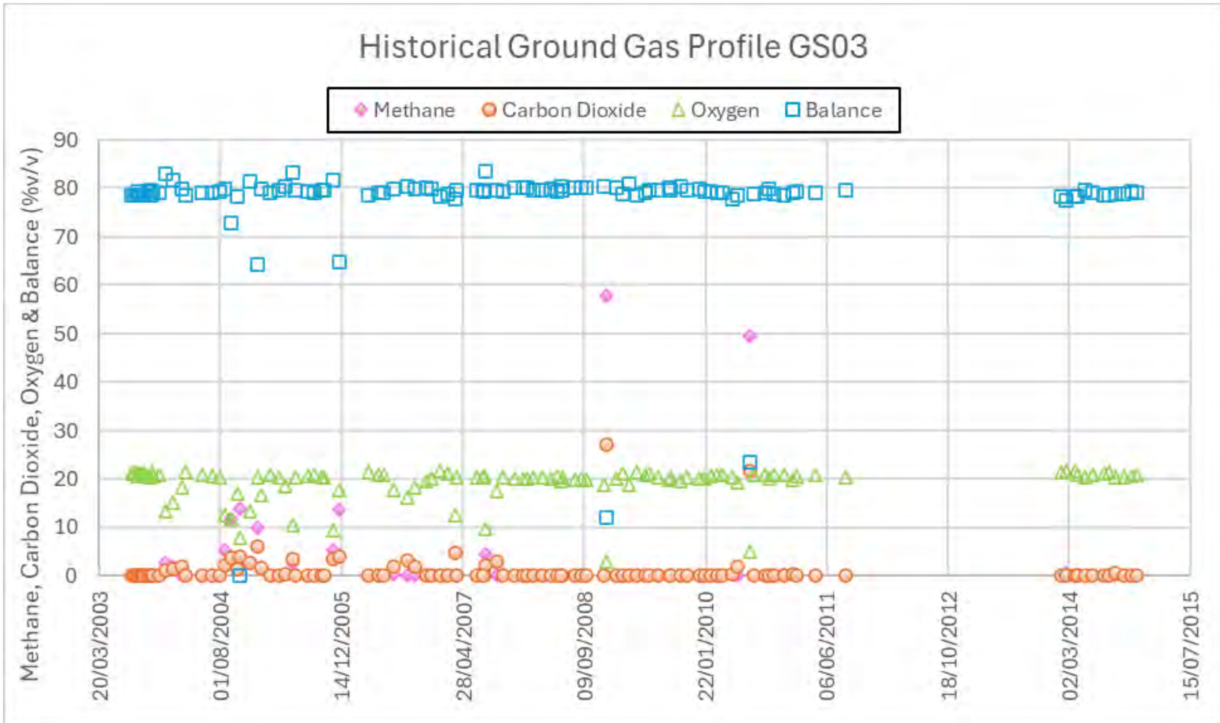


Figure 16: Historical Ground Gas Profile GS03

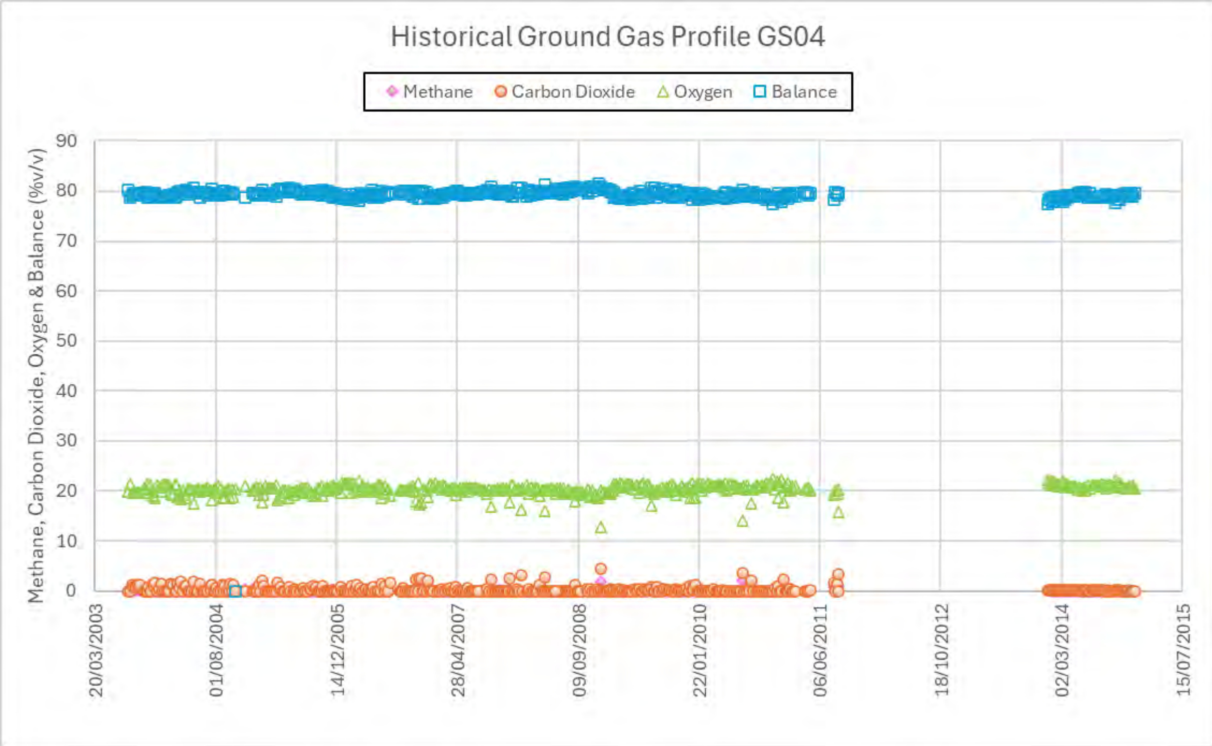


Figure 17: Historical Ground Gas Profile GS04

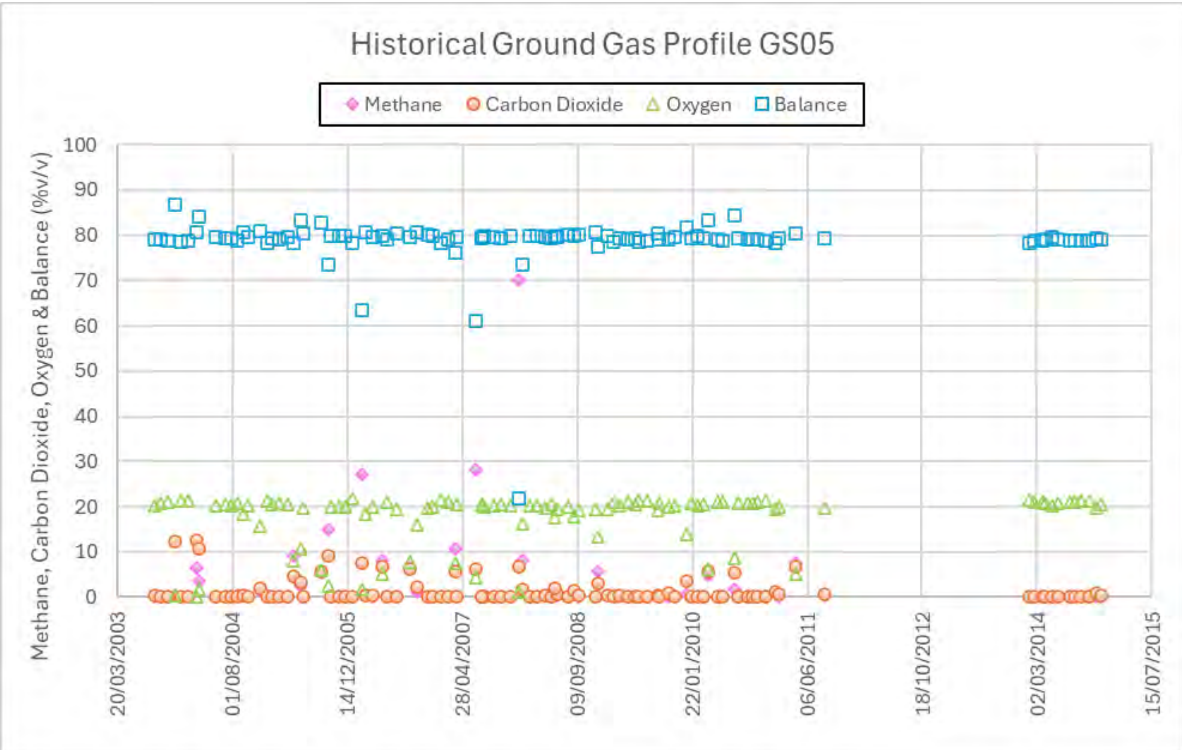


Figure 18: Historical Ground Gas Profile GS05

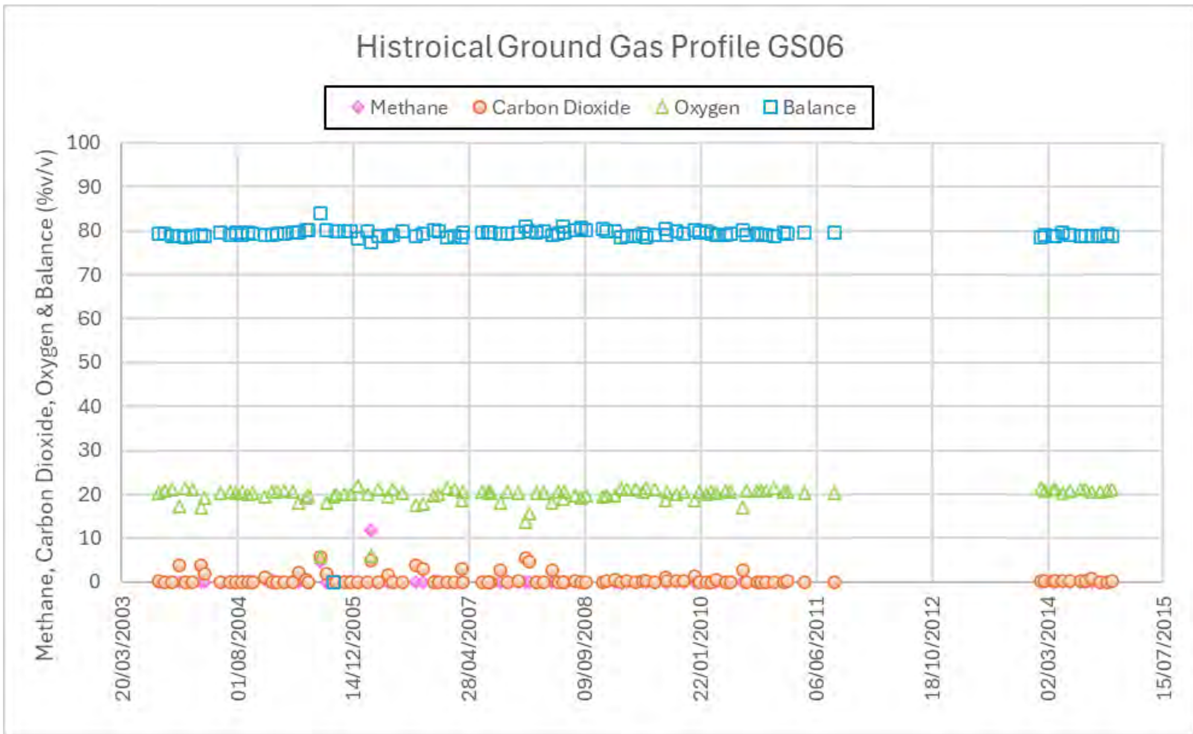


Figure 19: Historical Ground Gas Profile GS06

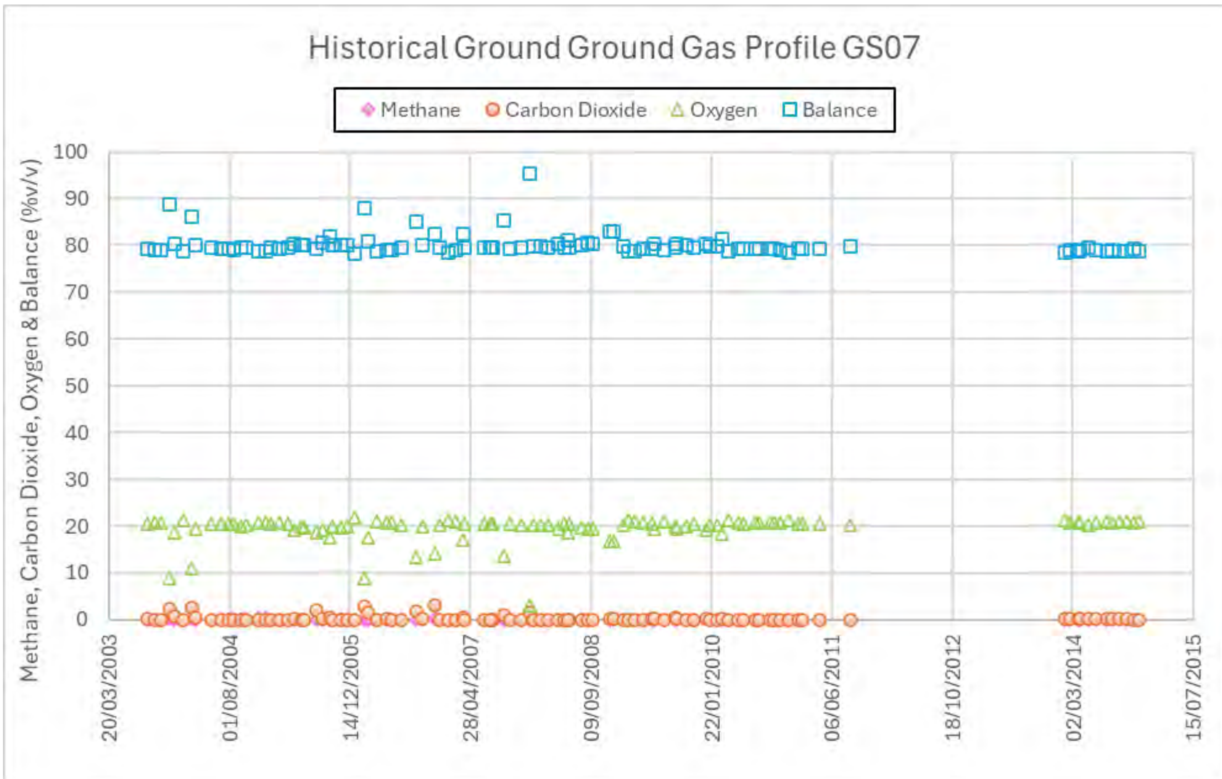


Figure 20: Historical Ground Gas Profile GS07

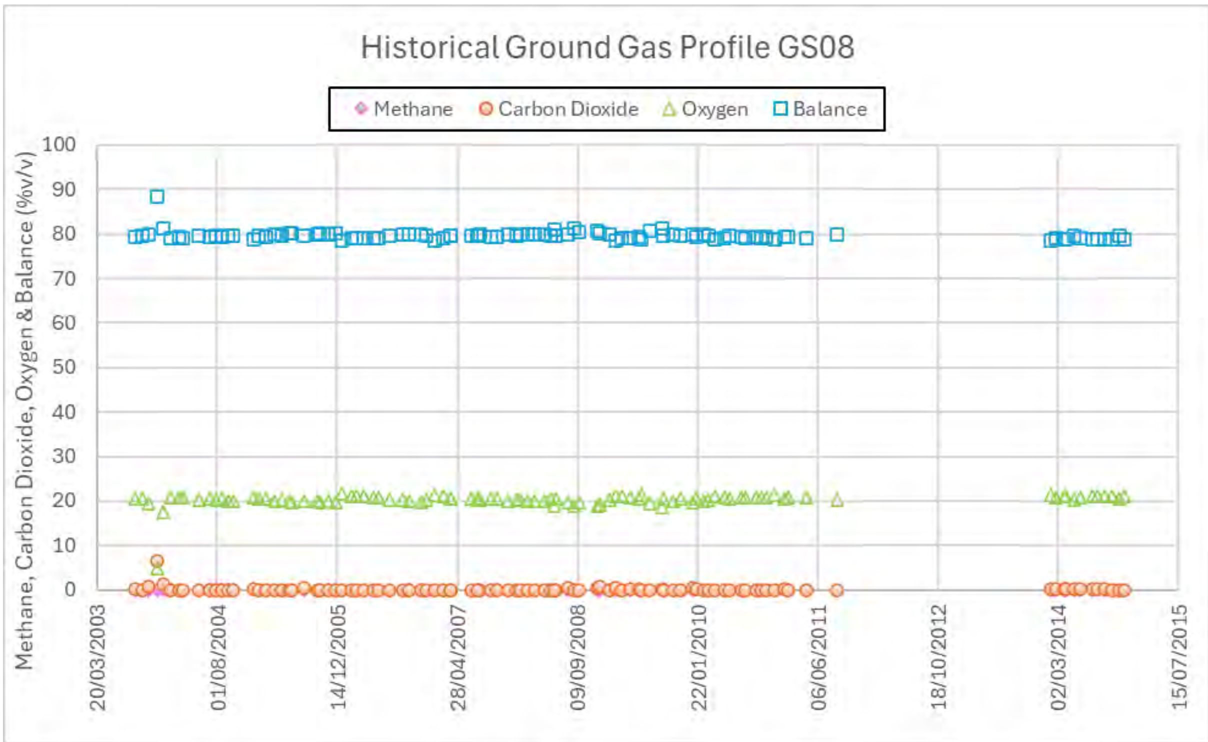


Figure 21: Historical Ground Gas Profile GS08

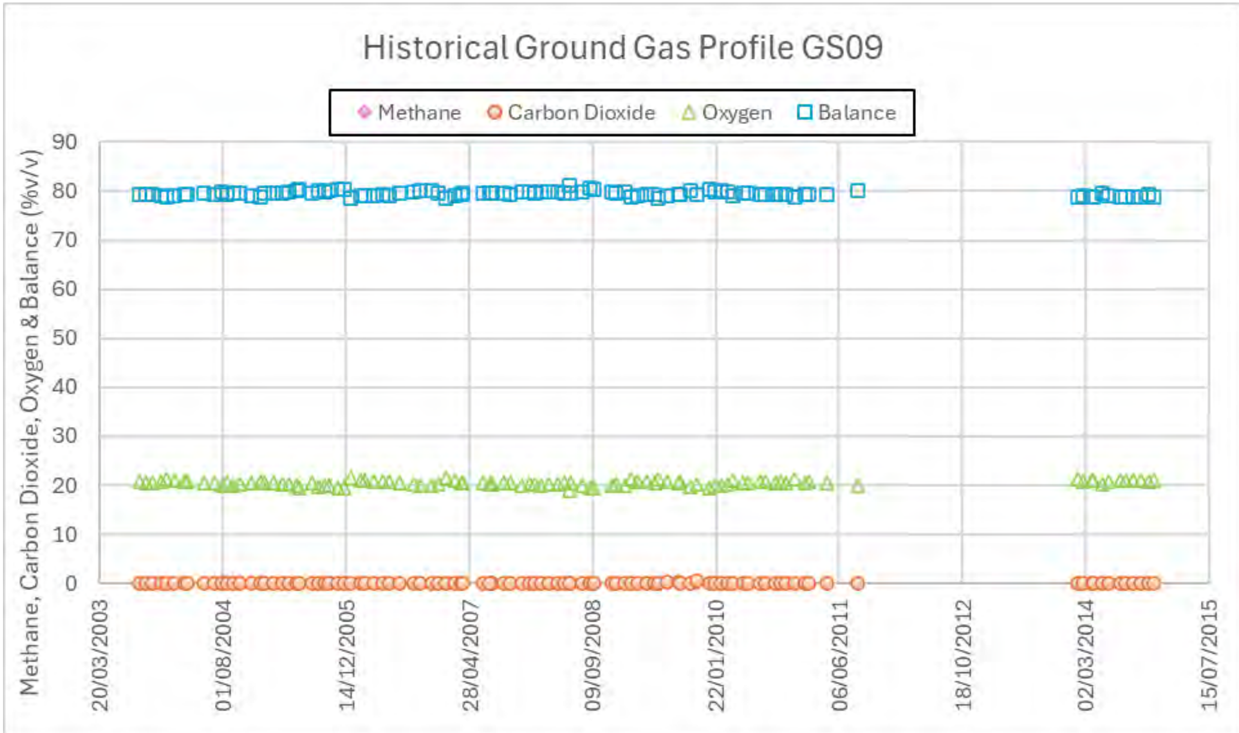


Figure 22: Historical Ground Gas Profile GS09

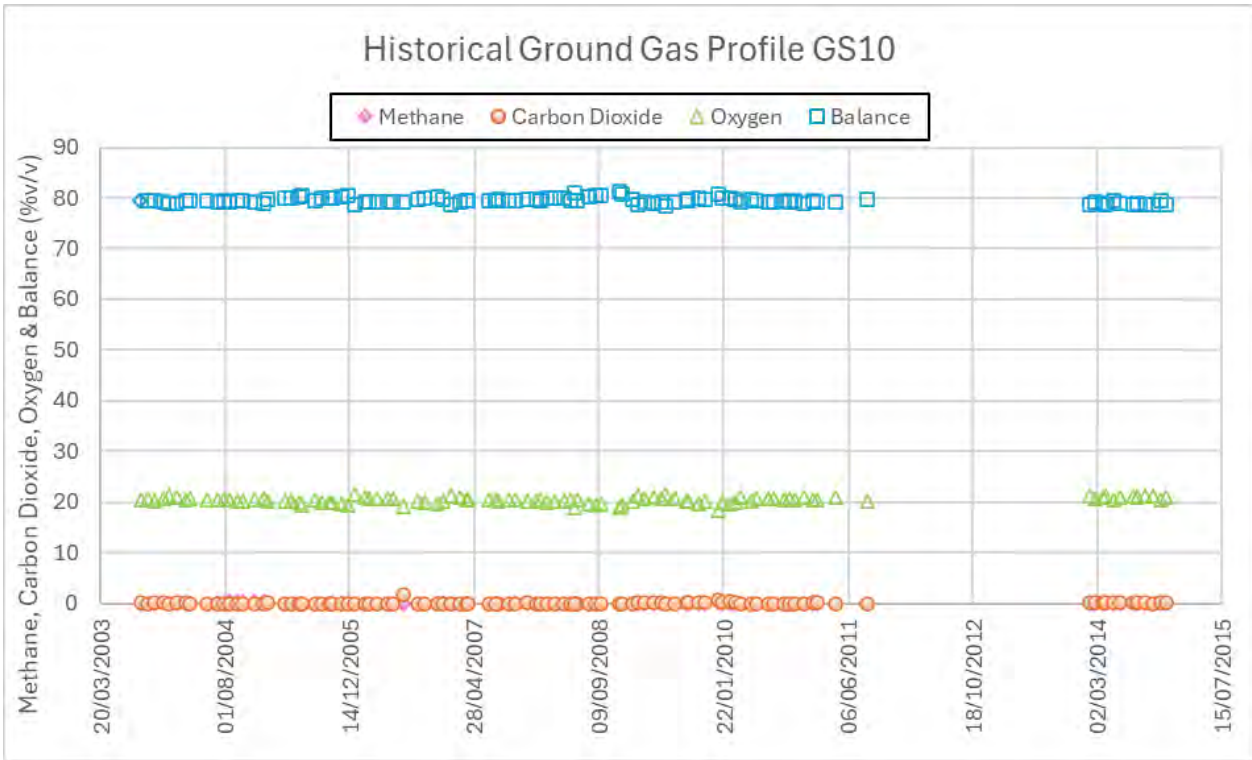


Figure 23: Historical Ground Gas Profile GS10

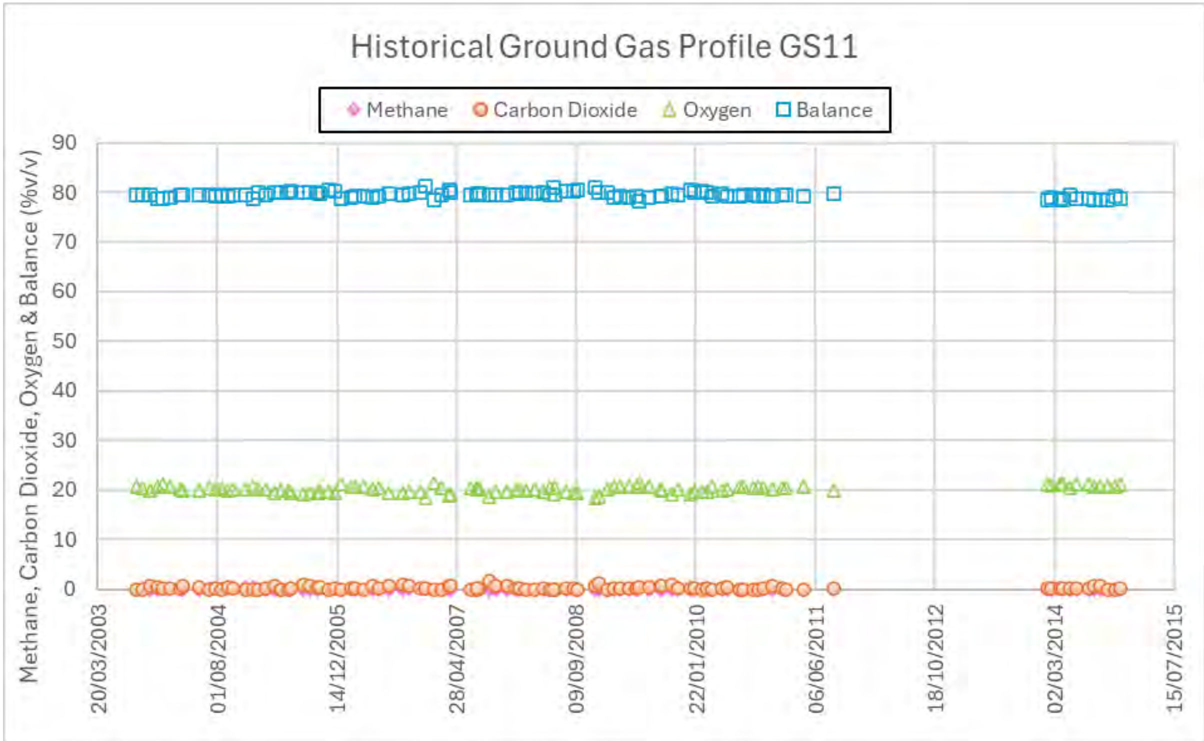


Figure 24: Historical Ground Gas Profile GS11

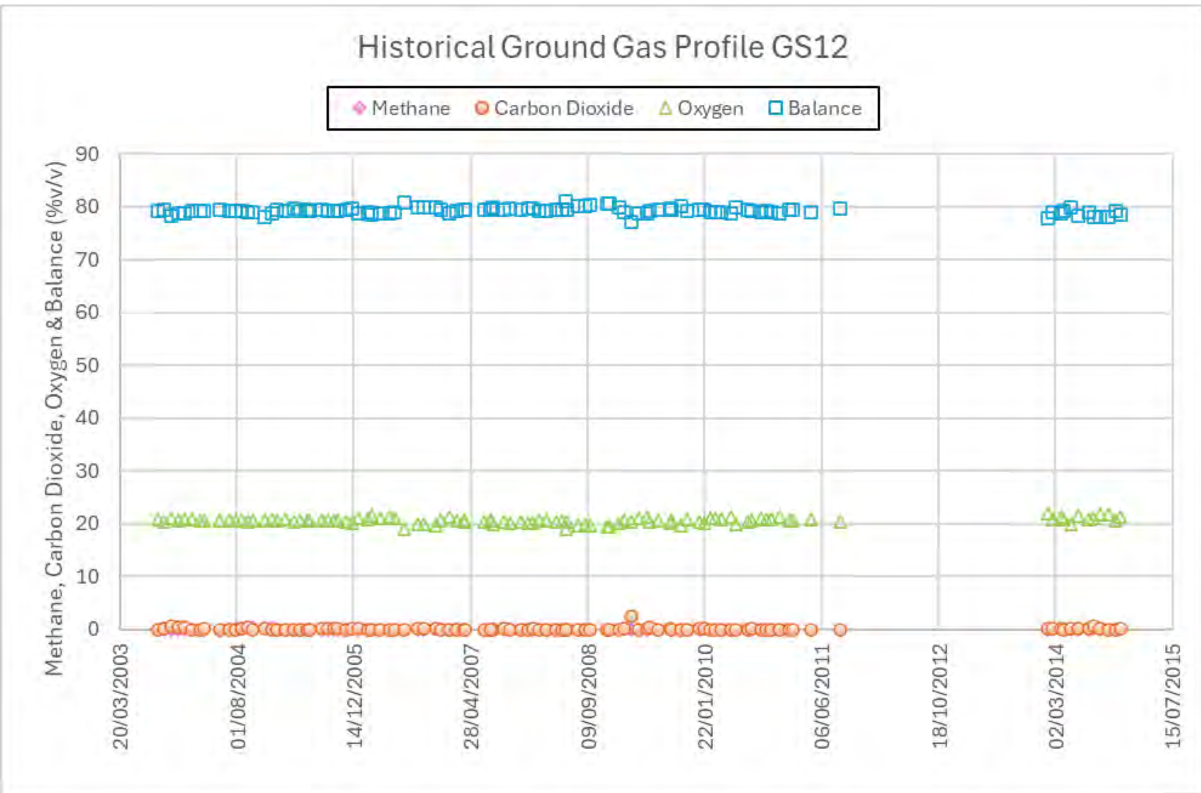


Figure 25: Historical Ground Gas Profile GS12

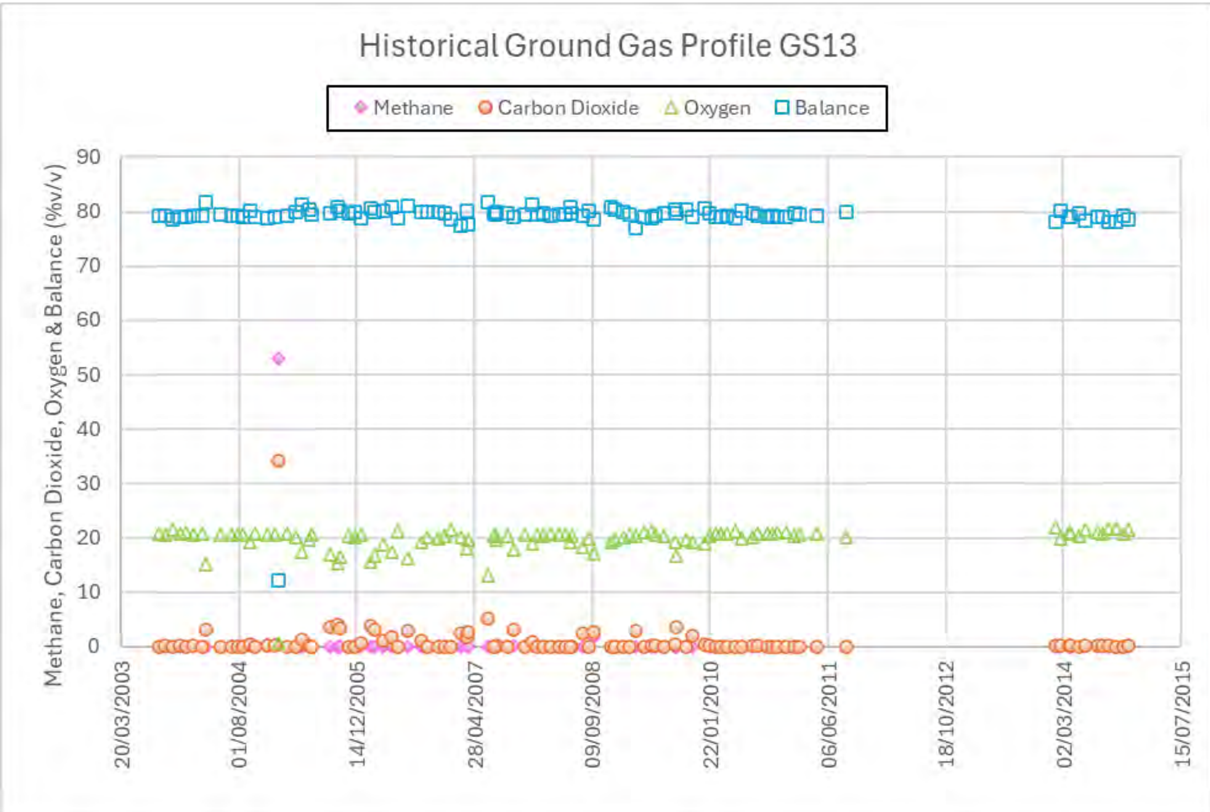


Figure 26: Historical Ground Gas Profile GS13

APPENDIX 2

GasSim Tier 1 Assessment Results Print Out

Year of Interest: All
Distance from Flare to Nearest Boundary: 131
Distance from Flare to Nearest Receptor: 131
Distance from Gas Engine to Nearest Boundary: 131
Distance from Gas Engine to Nearest Receptor: 131
Distance from Operational Area to Nearest Boundary: 18
Distance from Operational Area to Nearest Receptor: 18

		Short Term EQS or EAL µg/m3	Long Term EQS or EAL µg/m3	Background Concentration µg/m3
Acrylonitrile - surface	1999	264	8.8	0
Acrylonitrile - surface	2005	264	8.8	0
Acrylonitrile - surface	2006	264	8.8	0
Acrylonitrile - surface	2007	264	8.8	0
Acrylonitrile - surface	2008	264	8.8	0
Acrylonitrile - surface	2009	264	8.8	0
Acrylonitrile - surface	2010	264	8.8	0
Acrylonitrile - surface	2011	264	8.8	0
Acrylonitrile - surface	2012	264	8.8	0
Acrylonitrile - surface	2013	264	8.8	0
Acrylonitrile - surface	2014	264	8.8	0
Acrylonitrile - surface	2015	264	8.8	0
Acrylonitrile - surface	2016	264	8.8	0
Arsenic - surface	1994	0.003	0	0
Arsenic - surface	1995	0.003	0	0
Arsenic - surface	1996	0.003	0	0
Arsenic - surface	1997	0.003	0	0
Arsenic - surface	1998	0.003	0	0
Arsenic - surface	1999	0.003	0	0
Arsenic - surface	2000	0.003	0	0
Arsenic - surface	2001	0.003	0	0
Arsenic - surface	2002	0.003	0	0
Arsenic - surface	2003	0.003	0	0
Arsenic - surface	2004	0.003	0	0
Arsenic - surface	2005	0.003	0	0
Arsenic - surface	2006	0.003	0	0
Arsenic - surface	2007	0.003	0	0
Arsenic - surface	2008	0.003	0	0

		Short Term EQS or EAL µg/m3	Long Term EQS or EAL µg/m3	Background Concentration µg/m3
Arsenic - surface	2009	0.003	0	0
Arsenic - surface	2010	0.003	0	0
Arsenic - surface	2011	0.003	0	0
Arsenic - surface	2012	0.003	0	0
Arsenic - surface	2013	0.003	0	0
Arsenic - surface	2014	0.003	0	0
Arsenic - surface	2015	0.003	0	0
Arsenic - surface	2016	0.003	0	0
Arsenic - surface	2017	0.003	0	0
Arsenic - surface	2018	0.003	0	0
Arsenic - surface	2019	0.003	0	0
Arsenic - surface	2020	0.003	0	0
Arsenic - surface	2021	0.003	0	0
Arsenic - surface	2022	0.003	0	0
Arsenic - surface	2023	0.003	0	0
Arsenic - surface	2024	0.003	0	0
Arsenic - surface	2025	0.003	0	0
Arsenic - surface	2026	0.003	0	0
Arsenic - surface	2027	0.003	0	0
Arsenic - surface	2028	0.003	0	0
Arsenic - surface	2029	0.003	0	0
Arsenic - surface	2030	0.003	0	0
Arsenic - surface	2031	0.003	0	0
Arsenic - surface	2032	0.003	0	0
Arsenic - surface	2033	0.003	0	0
Arsenic - surface	2034	0.003	0	0
Arsenic - surface	2037	0.003	0	0
Arsenic - surface	2038	0.003	0	0
Arsenic - surface	2039	0.003	0	0
Arsenic - surface	2040	0.003	0	0
Arsenic - surface	2041	0.003	0	0
Arsenic - surface	2042	0.003	0	0
Arsenic - surface	2043	0.003	0	0
Arsenic - surface	2044	0.003	0	0
Arsenic - surface	2045	0.003	0	0
Benzene - surface	1995	0	5	0.2

		Short Term EQS or EAL µg/m3	Long Term EQS or EAL µg/m3	Background Concentration µg/m3
Benzene - surface	1996	0	5	0.2
Benzene - surface	1997	0	5	0.2
Benzene - surface	1998	0	5	0.2
Benzene - surface	1999	0	5	0.2
Benzene - surface	2000	0	5	0.2
Benzene - surface	2001	0	5	0.2
Benzene - surface	2002	0	5	0.2
Benzene - surface	2003	0	5	0.2
Benzene - surface	2004	0	5	0.2
Benzene - surface	2005	0	5	0.2
Benzene - surface	2006	0	5	0.2
Benzene - surface	2007	0	5	0.2
Benzene - surface	2008	0	5	0.2
Benzene - surface	2009	0	5	0.2
Benzene - surface	2010	0	5	0.2
Benzene - surface	2011	0	5	0.2
Benzene - surface	2012	0	5	0.2
Benzene - surface	2013	0	5	0.2
Benzene - surface	2014	0	5	0.2
Benzene - surface	2015	0	5	0.2
Benzene - surface	2016	0	5	0.2
Benzene - surface	2017	0	5	0.2
Benzene - surface	2018	0	5	0.2
Benzene - surface	2019	0	5	0.2
Benzene - surface	2020	0	5	0.2
Benzene - surface	2021	0	5	0.2
Benzene - surface	2022	0	5	0.2
Benzene - surface	2023	0	5	0.2
Benzene - surface	2024	0	5	0.2
Benzene - surface	2025	0	5	0.2
Carbon disulphide - surface	2006	100	64	0
Carbon disulphide - surface	2007	100	64	0
Carbon disulphide - surface	2008	100	64	0
Carbon disulphide - surface	2009	100	64	0
Carbon disulphide - surface	2010	100	64	0
Carbon disulphide - surface	2011	100	64	0

		Short Term EQS or EAL µg/m3	Long Term EQS or EAL µg/m3	Background Concentration µg/m3
Carbon disulphide - surface	2012	100	64	0
Carbon disulphide - surface	2013	100	64	0
Carbon disulphide - surface	2014	100	64	0
Carbon disulphide - surface	2015	100	64	0
Ethylene dichloride - surface	1996	700	42	0
Ethylene dichloride - surface	1997	700	42	0
Ethylene dichloride - surface	1998	700	42	0
Ethylene dichloride - surface	1999	700	42	0
Ethylene dichloride - surface	2000	700	42	0
Ethylene dichloride - surface	2001	700	42	0
Ethylene dichloride - surface	2002	700	42	0
Ethylene dichloride - surface	2003	700	42	0
Ethylene dichloride - surface	2004	700	42	0
Ethylene dichloride - surface	2005	700	42	0
Ethylene dichloride - surface	2006	700	42	0
Ethylene dichloride - surface	2007	700	42	0
Ethylene dichloride - surface	2008	700	42	0
Ethylene dichloride - surface	2009	700	42	0
Ethylene dichloride - surface	2010	700	42	0
Ethylene dichloride - surface	2011	700	42	0
Ethylene dichloride - surface	2012	700	42	0
Ethylene dichloride - surface	2013	700	42	0
Ethylene dichloride - surface	2014	700	42	0
Ethylene dichloride - surface	2015	700	42	0
Ethylene dichloride - surface	2016	700	42	0
Ethylene dichloride - surface	2017	700	42	0
Ethylene dichloride - surface	2018	700	42	0
Ethylene dichloride - surface	2019	700	42	0
Ethylene dichloride - surface	2020	700	42	0
Ethylene dichloride - surface	2021	700	42	0
Ethylene dichloride - surface	2022	700	42	0
Ethylene dichloride - surface	2023	700	42	0
Ethylene dichloride - surface	2024	700	42	0
Hydrogen sulphide - surface	1995	150	140	0
Hydrogen sulphide - surface	1996	150	140	0
Hydrogen sulphide - surface	1997	150	140	0

		Short Term EQS or EAL µg/m3	Long Term EQS or EAL µg/m3	Background Concentration µg/m3
Hydrogen sulphide - surface	1998	150	140	0
Hydrogen sulphide - surface	1999	150	140	0
Hydrogen sulphide - surface	2000	150	140	0
Hydrogen sulphide - surface	2001	150	140	0
Hydrogen sulphide - surface	2002	150	140	0
Hydrogen sulphide - surface	2003	150	140	0
Hydrogen sulphide - surface	2004	150	140	0
Hydrogen sulphide - surface	2005	150	140	0
Hydrogen sulphide - surface	2006	150	140	0
Hydrogen sulphide - surface	2007	150	140	0
Hydrogen sulphide - surface	2008	150	140	0
Hydrogen sulphide - surface	2009	150	140	0
Hydrogen sulphide - surface	2010	150	140	0
Hydrogen sulphide - surface	2011	150	140	0
Hydrogen sulphide - surface	2012	150	140	0
Hydrogen sulphide - surface	2013	150	140	0
Hydrogen sulphide - surface	2014	150	140	0
Hydrogen sulphide - surface	2015	150	140	0
Hydrogen sulphide - surface	2016	150	140	0
Hydrogen sulphide - surface	2017	150	140	0
Hydrogen sulphide - surface	2018	150	140	0
Hydrogen sulphide - surface	2019	150	140	0
Hydrogen sulphide - surface	2020	150	140	0
Hydrogen sulphide - surface	2021	150	140	0
Hydrogen sulphide - surface	2022	150	140	0
Hydrogen sulphide - surface	2023	150	140	0
Hydrogen sulphide - surface	2024	150	140	0
Hydrogen sulphide - surface	2025	150	140	0
Hydrogen sulphide - surface	2026	150	140	0
Hydrogen sulphide - surface	2027	150	140	0
Nitrogen oxides (NOx) - engine	2012	200	40	11.1
Nitrogen oxides (NOx) - engine	2014	200	40	11.1
Nitrogen oxides (NOx) - engine	2015	200	40	11.1
Nitrogen oxides (NOx) - engine	2019	200	40	11.1
Nitrogen oxides (NOx) - engine	2020	200	40	11.1
Nitrogen oxides (NOx) - engine	2021	200	40	11.1

		Short Term EQS or EAL µg/m3	Long Term EQS or EAL µg/m3	Background Concentration µg/m3
Nitrogen oxides (NOx) - engine	2022	200	40	11.1
Nitrogen oxides (NOx) - engine	2023	200	40	11.1
Nitrogen oxides (NOx) - engine	2024	200	40	11.1
Nitrogen oxides (NOx) - engine	2025	200	40	11.1
Nitrogen oxides (NOx) - engine	2026	200	40	11.1
Nitrogen oxides (NOx) - engine	2027	200	40	11.1
Nitrogen oxides (NOx) - engine	2028	200	40	11.1
Nitrogen oxides (NOx) - engine	2029	200	40	11.1
Nitrogen oxides (NOx) - engine	2030	200	40	11.1
Nitrogen oxides (NOx) - engine	2031	200	40	11.1
Nitrogen oxides (NOx) - engine	2032	200	40	11.1
Nitrogen oxides (NOx) - engine	2033	200	40	11.1
Nitrogen oxides (NOx) - engine	2034	200	40	11.1
Sulphur dioxide - flare	2013	350	0	3.8
Sulphur dioxide 15 min - flare	2013	266		3.8
Sulphur dioxide 24 hour - flare	2013	125		3.8
Sulphur dioxide - engine	2014	350	0	3.8
Sulphur dioxide 15 min - engine	2014	266		3.8
Sulphur dioxide 24 hour - engine	2014	125		3.8
Sulphur dioxide - flare	2014	350	0	3.8
Sulphur dioxide 15 min - flare	2014	266		3.8
Sulphur dioxide 24 hour - flare	2014	125		3.8
Sulphur dioxide - engine	2015	350	0	3.8
Sulphur dioxide 15 min - engine	2015	266		3.8
Sulphur dioxide 24 hour - engine	2015	125		3.8
Sulphur dioxide - flare	2015	350	0	3.8
Sulphur dioxide 15 min - flare	2015	266		3.8
Sulphur dioxide 24 hour - flare	2015	125		3.8
Sulphur dioxide - flare	2016	350	0	3.8
Sulphur dioxide 15 min - flare	2016	266		3.8
Sulphur dioxide 24 hour - flare	2016	125		3.8
Sulphur dioxide - flare	2017	350	0	3.8
Sulphur dioxide 15 min - flare	2017	266		3.8
Sulphur dioxide 24 hour - flare	2017	125		3.8
Sulphur dioxide - flare	2018	350	0	3.8
Sulphur dioxide 15 min - flare	2018	266		3.8

		Short Term EQS or EAL µg/m3	Long Term EQS or EAL µg/m3	Background Concentration µg/m3
Sulphur dioxide 24 hour - flare	2018	125		3.8
Sulphur dioxide - engine	2019	350	0	3.8
Sulphur dioxide 15 min - engine	2019	266		3.8
Sulphur dioxide 24 hour - engine	2019	125		3.8
Sulphur dioxide 15 min - flare	2019	266		3.8
Sulphur dioxide 24 hour - flare	2019	125		3.8
Sulphur dioxide - engine	2020	350	0	3.8
Sulphur dioxide 15 min - engine	2020	266		3.8
Sulphur dioxide 24 hour - engine	2020	125		3.8
Sulphur dioxide - engine	2021	350	0	3.8
Sulphur dioxide 15 min - engine	2021	266		3.8
Sulphur dioxide 24 hour - engine	2021	125		3.8
Sulphur dioxide - engine	2022	350	0	3.8
Sulphur dioxide 15 min - engine	2022	266		3.8
Sulphur dioxide 24 hour - engine	2022	125		3.8
Sulphur dioxide - engine	2023	350	0	3.8
Sulphur dioxide 15 min - engine	2023	266		3.8
Sulphur dioxide 24 hour - engine	2023	125		3.8
Sulphur dioxide - engine	2024	350	0	3.8
Sulphur dioxide 15 min - engine	2024	266		3.8
Sulphur dioxide 24 hour - engine	2024	125		3.8
Sulphur dioxide - engine	2025	350	0	3.8
Sulphur dioxide 15 min - engine	2025	266		3.8
Sulphur dioxide 24 hour - engine	2025	125		3.8
Sulphur dioxide - engine	2026	350	0	3.8
Sulphur dioxide 15 min - engine	2026	266		3.8
Sulphur dioxide 24 hour - engine	2026	125		3.8
Sulphur dioxide - engine	2027	350	0	3.8
Sulphur dioxide 15 min - engine	2027	266		3.8
Sulphur dioxide 24 hour - engine	2027	125		3.8
Sulphur dioxide - engine	2028	350	0	3.8
Sulphur dioxide 15 min - engine	2028	266		3.8
Sulphur dioxide 24 hour - engine	2028	125		3.8
Sulphur dioxide - engine	2029	350	0	3.8
Sulphur dioxide 15 min - engine	2029	266		3.8
Sulphur dioxide 24 hour - engine	2029	125		3.8

		Short Term EQS or EAL µg/m3	Long Term EQS or EAL µg/m3	Background Concentration µg/m3
Sulphur dioxide - engine	2030	350	0	3.8
Sulphur dioxide 15 min - engine	2030	266		3.8
Sulphur dioxide 24 hour - engine	2030	125		3.8
Sulphur dioxide - engine	2031	350	0	3.8
Sulphur dioxide 15 min - engine	2031	266		3.8
Sulphur dioxide 24 hour - engine	2031	125		3.8
Sulphur dioxide - engine	2032	350	0	3.8
Sulphur dioxide 15 min - engine	2032	266		3.8
Sulphur dioxide 24 hour - engine	2032	125		3.8
Sulphur dioxide - engine	2033	350	0	3.8
Sulphur dioxide 15 min - engine	2033	266		3.8
Sulphur dioxide 24 hour - engine	2033	125		3.8
Sulphur dioxide - engine	2034	350	0	3.8
Sulphur dioxide 15 min - engine	2034	266		3.8
Sulphur dioxide 24 hour - engine	2034	125		3.8
Sulphur dioxide - flare	2034	350	0	3.8
Sulphur dioxide 15 min - flare	2034	266		3.8
Sulphur dioxide 24 hour - flare	2034	125		3.8
Sulphur dioxide - flare	2035	350	0	3.8
Sulphur dioxide 15 min - flare	2035	266		3.8
Sulphur dioxide 24 hour - flare	2035	125		3.8
Sulphur dioxide - flare	2036	350	0	3.8
Sulphur dioxide 15 min - flare	2036	266		3.8
Sulphur dioxide 24 hour - flare	2036	125		3.8
Sulphur dioxide - flare	2037	350	0	3.8
Sulphur dioxide 15 min - flare	2037	266		3.8
Sulphur dioxide 24 hour - flare	2037	125		3.8
Vinyl chloride (chloroethene, chloroethylene) - surface	1999	1851	159	0
Vinyl chloride (chloroethene, chloroethylene) - surface	2000	1851	159	0
Vinyl chloride (chloroethene, chloroethylene) - surface	2005	1851	159	0
Vinyl chloride (chloroethene, chloroethylene) - surface	2006	1851	159	0
Vinyl chloride (chloroethene, chloroethylene) - surface	2007	1851	159	0
Vinyl chloride (chloroethene, chloroethylene) - surface	2008	1851	159	0
Vinyl chloride (chloroethene, chloroethylene) - surface	2009	1851	159	0
Vinyl chloride (chloroethene, chloroethylene) - surface	2010	1851	159	0
Vinyl chloride (chloroethene, chloroethylene) - surface	2011	1851	159	0

		Short Term EQS or EAL µg/m3	Long Term EQS or EAL µg/m3	Background Concentration µg/m3
Vinyl chloride (chloroethene, chloroethylene) - surface	2012	1851	159	0
Vinyl chloride (chloroethene, chloroethylene) - surface	2013	1851	159	0
Vinyl chloride (chloroethene, chloroethylene) - surface	2014	1851	159	0
Vinyl chloride (chloroethene, chloroethylene) - surface	2015	1851	159	0
Vinyl chloride (chloroethene, chloroethylene) - surface	2016	1851	159	0
Xylene (all isomers) - surface	1999	66200	4410	0
Xylene (all isomers) - surface	2000	66200	4410	0
Xylene (all isomers) - surface	2006	66200	4410	0
Xylene (all isomers) - surface	2007	66200	4410	0
Xylene (all isomers) - surface	2009	66200	4410	0
Xylene (all isomers) - surface	2010	66200	4410	0
Xylene (all isomers) - surface	2011	66200	4410	0
Xylene (all isomers) - surface	2012	66200	4410	0
Xylene (all isomers) - surface	2013	66200	4410	0
Xylene (all isomers) - surface	2014	66200	4410	0
Xylene (all isomers) - surface	2015	66200	4410	0
Xylene (all isomers) - surface	2016	66200	4410	0

	Short Term				Long term			
	Predicted Boundary Concentration µg/m3	Predicted Nearest Receptor Concentration µg/m3	Is the emission rate Insignificant?	Is detailed modelling required?	Predicted Boundary Concentration µg/m3	Predicted Nearest Receptor Concentration µg/m3	Is the emission rate Insignificant?	Is detailed modelling required?
Acrylonitrile - surface - 1999	4.48965(18m)	4.48965(18m)	Yes	No	0.0925991(18m)	0.0925991(18m)	No	No
Acrylonitrile - surface - 2005	4.98631(18m)	4.98631(18m)	Yes	No	0.102843(18m)	0.102843(18m)	No	No
Acrylonitrile - surface - 2006	5.56107(18m)	5.56107(18m)	Yes	No	0.114697(18m)	0.114697(18m)	No	No
Acrylonitrile - surface - 2007	6.18398(18m)	6.18398(18m)	Yes	No	0.127545(18m)	0.127545(18m)	No	No
Acrylonitrile - surface - 2008	6.55601(18m)	6.55601(18m)	Yes	No	0.135218(18m)	0.135218(18m)	No	No
Acrylonitrile - surface - 2009	7.672(18m)	7.672(18m)	Yes	No	0.158235(18m)	0.158235(18m)	No	No
Acrylonitrile - surface - 2010	8.99615(18m)	8.99615(18m)	Yes	No	0.185546(18m)	0.185546(18m)	No	No
Acrylonitrile - surface - 2011	10.6073(18m)	10.6073(18m)	Yes	No	0.218776(18m)	0.218776(18m)	No	No
Acrylonitrile - surface - 2012	8.60155(18m)	8.60155(18m)	Yes	No	0.177407(18m)	0.177407(18m)	No	No
Acrylonitrile - surface - 2013	7.47889(18m)	7.47889(18m)	Yes	No	0.154252(18m)	0.154252(18m)	No	No
Acrylonitrile - surface - 2014	6.88486(18m)	6.88486(18m)	Yes	No	0.142(18m)	0.142(18m)	No	No
Acrylonitrile - surface - 2015	5.91102(18m)	5.91102(18m)	Yes	No	0.121915(18m)	0.121915(18m)	No	No
Acrylonitrile - surface - 2016	4.37948(18m)	4.37948(18m)	Yes	No	0.0903269(18m)	0.0903269(18m)	No	No
Arsenic - surface - 1994	0.00224851(18m)	0.00224851(18m)	No	Yes	4.63755e-005(18m)	4.63755e-005(18m)	No EAL	No EAL
Arsenic - surface - 1995	0.0206855(18m)	0.0206855(18m)	No	Yes	0.000426639(18m)	0.000426639(18m)	No EAL	No EAL
Arsenic - surface - 1996	0.0515289(18m)	0.0515289(18m)	No	Yes	0.00106278(18m)	0.00106278(18m)	No EAL	No EAL
Arsenic - surface - 1997	0.0402442(18m)	0.0402442(18m)	No	Yes	0.000830038(18m)	0.000830038(18m)	No EAL	No EAL
Arsenic - surface - 1998	0.0519098(18m)	0.0519098(18m)	No	Yes	0.00107064(18m)	0.00107064(18m)	No EAL	No EAL
Arsenic - surface - 1999	0.0551838(18m)	0.0551838(18m)	No	Yes	0.00113817(18m)	0.00113817(18m)	No EAL	No EAL
Arsenic - surface - 2000	0.0593559(18m)	0.0593559(18m)	No	Yes	0.00122422(18m)	0.00122422(18m)	No EAL	No EAL
Arsenic - surface - 2001	0.0460775(18m)	0.0460775(18m)	No	Yes	0.000950348(18m)	0.000950348(18m)	No EAL	No EAL
Arsenic - surface - 2002	0.0401348(18m)	0.0401348(18m)	No	Yes	0.00082778(18m)	0.00082778(18m)	No EAL	No EAL
Arsenic - surface - 2003	0.0421648(18m)	0.0421648(18m)	No	Yes	0.00086965(18m)	0.00086965(18m)	No EAL	No EAL
Arsenic - surface - 2004	0.0458519(18m)	0.0458519(18m)	No	Yes	0.000945695(18m)	0.000945695(18m)	No EAL	No EAL
Arsenic - surface - 2005	0.0704038(18m)	0.0704038(18m)	No	Yes	0.00145208(18m)	0.00145208(18m)	No EAL	No EAL
Arsenic - surface - 2006	0.08921(18m)	0.08921(18m)	No	Yes	0.00183996(18m)	0.00183996(18m)	No EAL	No EAL
Arsenic - surface - 2007	0.0980863(18m)	0.0980863(18m)	No	Yes	0.00202303(18m)	0.00202303(18m)	No EAL	No EAL
Arsenic - surface - 2008	0.0943695(18m)	0.0943695(18m)	No	Yes	0.00194637(18m)	0.00194637(18m)	No EAL	No EAL
Arsenic - surface - 2009	0.112035(18m)	0.112035(18m)	No	Yes	0.00231073(18m)	0.00231073(18m)	No EAL	No EAL
Arsenic - surface - 2010	0.126559(18m)	0.126559(18m)	No	Yes	0.00261027(18m)	0.00261027(18m)	No EAL	No EAL
Arsenic - surface - 2011	0.143038(18m)	0.143038(18m)	No	Yes	0.00295017(18m)	0.00295017(18m)	No EAL	No EAL
Arsenic - surface - 2012	0.126894(18m)	0.126894(18m)	No	Yes	0.0026172(18m)	0.0026172(18m)	No EAL	No EAL
Arsenic - surface - 2013	0.120567(18m)	0.120567(18m)	No	Yes	0.00248669(18m)	0.00248669(18m)	No EAL	No EAL
Arsenic - surface - 2014	0.112216(18m)	0.112216(18m)	No	Yes	0.00231447(18m)	0.00231447(18m)	No EAL	No EAL

	Short Term				Long term			
	Predicted Boundary Concentration µg/m3	Predicted Nearest Receptor Concentration µg/m3	Is the emission rate Insignificant?	Is detailed modelling required?	Predicted Boundary Concentration µg/m3	Predicted Nearest Receptor Concentration µg/m3	Is the emission rate Insignificant?	Is detailed modelling required?
Arsenic - surface - 2015	0.094818(18m)	0.094818(18m)	No	Yes	0.00195562(18m)	0.00195562(18m)	No EAL	No EAL
Arsenic - surface - 2016	0.0711384(18m)	0.0711384(18m)	No	Yes	0.00146723(18m)	0.00146723(18m)	No EAL	No EAL
Arsenic - surface - 2017	0.0488965(18m)	0.0488965(18m)	No	Yes	0.00100849(18m)	0.00100849(18m)	No EAL	No EAL
Arsenic - surface - 2018	0.0475071(18m)	0.0475071(18m)	No	Yes	0.000979833(18m)	0.000979833(18m)	No EAL	No EAL
Arsenic - surface - 2019	0.0396414(18m)	0.0396414(18m)	No	Yes	0.000817603(18m)	0.000817603(18m)	No EAL	No EAL
Arsenic - surface - 2020	0.0319196(18m)	0.0319196(18m)	No	Yes	0.000658341(18m)	0.000658341(18m)	No EAL	No EAL
Arsenic - surface - 2021	0.0378958(18m)	0.0378958(18m)	No	Yes	0.000781601(18m)	0.000781601(18m)	No EAL	No EAL
Arsenic - surface - 2022	0.0395805(18m)	0.0395805(18m)	No	Yes	0.000816347(18m)	0.000816347(18m)	No EAL	No EAL
Arsenic - surface - 2023	0.0284287(18m)	0.0284287(18m)	No	Yes	0.000586342(18m)	0.000586342(18m)	No EAL	No EAL
Arsenic - surface - 2024	0.0167494(18m)	0.0167494(18m)	No	Yes	0.000345457(18m)	0.000345457(18m)	No EAL	No EAL
Arsenic - surface - 2025	0.0123835(18m)	0.0123835(18m)	No	Yes	0.00025541(18m)	0.00025541(18m)	No EAL	No EAL
Arsenic - surface - 2026	0.00645555(18m)	0.00645555(18m)	No	Yes	0.000133146(18m)	0.000133146(18m)	No EAL	No EAL
Arsenic - surface - 2027	0.00837499(18m)	0.00837499(18m)	No	Yes	0.000172734(18m)	0.000172734(18m)	No EAL	No EAL
Arsenic - surface - 2028	0.00292077(18m)	0.00292077(18m)	No	Yes	6.0241e-005(18m)	6.0241e-005(18m)	No EAL	No EAL
Arsenic - surface - 2029	0.00203848(18m)	0.00203848(18m)	No	Yes	4.20437e-005(18m)	4.20437e-005(18m)	No EAL	No EAL
Arsenic - surface - 2030	0.0015988(18m)	0.0015988(18m)	No	Yes	3.29752e-005(18m)	3.29752e-005(18m)	No EAL	No EAL
Arsenic - surface - 2031	0.00127854(18m)	0.00127854(18m)	No	Yes	2.63699e-005(18m)	2.63699e-005(18m)	No EAL	No EAL
Arsenic - surface - 2032	0.000956998(18m)	0.000956998(18m)	No	Yes	1.97381e-005(18m)	1.97381e-005(18m)	No EAL	No EAL
Arsenic - surface - 2033	0.000726501(18m)	0.000726501(18m)	No	Yes	1.49841e-005(18m)	1.49841e-005(18m)	No EAL	No EAL
Arsenic - surface - 2034	0.000517299(18m)	0.000517299(18m)	No	No	1.06693e-005(18m)	1.06693e-005(18m)	No EAL	No EAL
Arsenic - surface - 2037	0.00103928(18m)	0.00103928(18m)	No	Yes	2.14351e-005(18m)	2.14351e-005(18m)	No EAL	No EAL
Arsenic - surface - 2038	0.00162278(18m)	0.00162278(18m)	No	Yes	3.34698e-005(18m)	3.34698e-005(18m)	No EAL	No EAL
Arsenic - surface - 2039	0.00128797(18m)	0.00128797(18m)	No	Yes	2.65643e-005(18m)	2.65643e-005(18m)	No EAL	No EAL
Arsenic - surface - 2040	0.00102298(18m)	0.00102298(18m)	No	Yes	2.1099e-005(18m)	2.1099e-005(18m)	No EAL	No EAL
Arsenic - surface - 2041	0.000813086(18m)	0.000813086(18m)	No	Yes	1.67699e-005(18m)	1.67699e-005(18m)	No EAL	No EAL
Arsenic - surface - 2042	0.000646695(18m)	0.000646695(18m)	No	Yes	1.33381e-005(18m)	1.33381e-005(18m)	No EAL	No EAL
Arsenic - surface - 2043	0.000514693(18m)	0.000514693(18m)	No	No	1.06155e-005(18m)	1.06155e-005(18m)	No EAL	No EAL
Arsenic - surface - 2044	0.000409899(18m)	0.000409899(18m)	No	No	8.45418e-006(18m)	8.45418e-006(18m)	No EAL	No EAL
Arsenic - surface - 2045	0.000326648(18m)	0.000326648(18m)	No	No	6.73711e-006(18m)	6.73711e-006(18m)	No EAL	No EAL
Benzene - surface - 1995	4.46373(18m)	4.46373(18m)	No EAL	No EAL	0.0920645(18m)	0.0920645(18m)	No	No
Benzene - surface - 1996	10.9124(18m)	10.9124(18m)	No EAL	No EAL	0.225068(18m)	0.225068(18m)	No	No
Benzene - surface - 1997	10.0252(18m)	10.0252(18m)	No EAL	No EAL	0.20677(18m)	0.20677(18m)	No	No
Benzene - surface - 1998	10.8305(18m)	10.8305(18m)	No EAL	No EAL	0.22338(18m)	0.22338(18m)	No	No
Benzene - surface - 1999	12.6185(18m)	12.6185(18m)	No EAL	No EAL	0.260257(18m)	0.260257(18m)	No	No

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Benzene - surface - 2000	13.4771(18m)	13.4771(18m)	No EAL	No EAL	0.277966(18m)	0.277966(18m)	No	No
Benzene - surface - 2001	9.63801(18m)	9.63801(18m)	No EAL	No EAL	0.198784(18m)	0.198784(18m)	No	No
Benzene - surface - 2002	8.34843(18m)	8.34843(18m)	No EAL	No EAL	0.172186(18m)	0.172186(18m)	No	No
Benzene - surface - 2003	8.88531(18m)	8.88531(18m)	No EAL	No EAL	0.183259(18m)	0.183259(18m)	No	No
Benzene - surface - 2004	10.1974(18m)	10.1974(18m)	No EAL	No EAL	0.210322(18m)	0.210322(18m)	No	No
Benzene - surface - 2005	13.816(18m)	13.816(18m)	No EAL	No EAL	0.284955(18m)	0.284955(18m)	No	No
Benzene - surface - 2006	17.093(18m)	17.093(18m)	No EAL	No EAL	0.352543(18m)	0.352543(18m)	No	No
Benzene - surface - 2007	19.7664(18m)	19.7664(18m)	No EAL	No EAL	0.407682(18m)	0.407682(18m)	No	No
Benzene - surface - 2008	18.3184(18m)	18.3184(18m)	No EAL	No EAL	0.377817(18m)	0.377817(18m)	No	No
Benzene - surface - 2009	21.8667(18m)	21.8667(18m)	No EAL	No EAL	0.451(18m)	0.451(18m)	No	No
Benzene - surface - 2010	24.3606(18m)	24.3606(18m)	No EAL	No EAL	0.502437(18m)	0.502437(18m)	No	No
Benzene - surface - 2011	27.2333(18m)	27.2333(18m)	No EAL	No EAL	0.561686(18m)	0.561686(18m)	No	No
Benzene - surface - 2012	23.9144(18m)	23.9144(18m)	No EAL	No EAL	0.493235(18m)	0.493235(18m)	No	No
Benzene - surface - 2013	24.2973(18m)	24.2973(18m)	No EAL	No EAL	0.501131(18m)	0.501131(18m)	No	No
Benzene - surface - 2014	22.0859(18m)	22.0859(18m)	No EAL	No EAL	0.455521(18m)	0.455521(18m)	No	No
Benzene - surface - 2015	19.9568(18m)	19.9568(18m)	No EAL	No EAL	0.411608(18m)	0.411608(18m)	No	No
Benzene - surface - 2016	15.8529(18m)	15.8529(18m)	No EAL	No EAL	0.326966(18m)	0.326966(18m)	No	No
Benzene - surface - 2017	10.3169(18m)	10.3169(18m)	No EAL	No EAL	0.212785(18m)	0.212785(18m)	No	No
Benzene - surface - 2018	10.6667(18m)	10.6667(18m)	No EAL	No EAL	0.220001(18m)	0.220001(18m)	No	No
Benzene - surface - 2019	7.86224(18m)	7.86224(18m)	No EAL	No EAL	0.162159(18m)	0.162159(18m)	No	No
Benzene - surface - 2020	6.7412(18m)	6.7412(18m)	No EAL	No EAL	0.139037(18m)	0.139037(18m)	No	No
Benzene - surface - 2021	8.23027(18m)	8.23027(18m)	No EAL	No EAL	0.169749(18m)	0.169749(18m)	No	No
Benzene - surface - 2022	8.45618(18m)	8.45618(18m)	No EAL	No EAL	0.174409(18m)	0.174409(18m)	No	No
Benzene - surface - 2023	5.84842(18m)	5.84842(18m)	No EAL	No EAL	0.120624(18m)	0.120624(18m)	No	No
Benzene - surface - 2024	3.42495(18m)	3.42495(18m)	No EAL	No EAL	0.0706395(18m)	0.0706395(18m)	No	No
Benzene - surface - 2025	2.46951(18m)	2.46951(18m)	No EAL	No EAL	0.0509336(18m)	0.0509336(18m)	No	No
Carbon disulphide - surface - 2006	11.4083(18m)	11.4083(18m)	No	No	0.235296(18m)	0.235296(18m)	Yes	No
Carbon disulphide - surface - 2007	12.1768(18m)	12.1768(18m)	No	No	0.251147(18m)	0.251147(18m)	Yes	No
Carbon disulphide - surface - 2008	11.6159(18m)	11.6159(18m)	No	No	0.239578(18m)	0.239578(18m)	Yes	No
Carbon disulphide - surface - 2009	13.4226(18m)	13.4226(18m)	No	No	0.276841(18m)	0.276841(18m)	Yes	No
Carbon disulphide - surface - 2010	14.8185(18m)	14.8185(18m)	No	No	0.305632(18m)	0.305632(18m)	Yes	No
Carbon disulphide - surface - 2011	16.1902(18m)	16.1902(18m)	No	No	0.333923(18m)	0.333923(18m)	Yes	No
Carbon disulphide - surface - 2012	14.0718(18m)	14.0718(18m)	No	No	0.290231(18m)	0.290231(18m)	Yes	No
Carbon disulphide - surface - 2013	13.3075(18m)	13.3075(18m)	No	No	0.274468(18m)	0.274468(18m)	Yes	No

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Carbon disulphide - surface - 2014	12.8428(18m)	12.8428(18m)	No	No	0.264884(18m)	0.264884(18m)	Yes	No
Carbon disulphide - surface - 2015	10.9376(18m)	10.9376(18m)	No	No	0.225587(18m)	0.225587(18m)	Yes	No
Ethylene dichloride - surface - 1996	30.9098(18m)	30.9098(18m)	Yes	No	0.637514(18m)	0.637514(18m)	No	No
Ethylene dichloride - surface - 1997	33.0168(18m)	33.0168(18m)	Yes	No	0.680972(18m)	0.680972(18m)	No	No
Ethylene dichloride - surface - 1998	44.3579(18m)	44.3579(18m)	Yes	No	0.914881(18m)	0.914881(18m)	No	No
Ethylene dichloride - surface - 1999	61.2589(18m)	61.2589(18m)	Yes	No	1.26346(18m)	1.26346(18m)	No	No
Ethylene dichloride - surface - 2000	58.5222(18m)	58.5222(18m)	Yes	No	1.20702(18m)	1.20702(18m)	No	No
Ethylene dichloride - surface - 2001	46.8603(18m)	46.8603(18m)	Yes	No	0.966494(18m)	0.966494(18m)	No	No
Ethylene dichloride - surface - 2002	38.5437(18m)	38.5437(18m)	Yes	No	0.794964(18m)	0.794964(18m)	No	No
Ethylene dichloride - surface - 2003	31.4975(18m)	31.4975(18m)	Yes	No	0.649637(18m)	0.649637(18m)	No	No
Ethylene dichloride - surface - 2004	33.0914(18m)	33.0914(18m)	Yes	No	0.68251(18m)	0.68251(18m)	No	No
Ethylene dichloride - surface - 2005	53.9715(18m)	53.9715(18m)	Yes	No	1.11316(18m)	1.11316(18m)	No	No
Ethylene dichloride - surface - 2006	103.39(18m)	103.39(18m)	No	No	2.13242(18m)	2.13242(18m)	No	No
Ethylene dichloride - surface - 2007	107.832(18m)	107.832(18m)	No	No	2.22403(18m)	2.22403(18m)	No	No
Ethylene dichloride - surface - 2008	102.893(18m)	102.893(18m)	No	No	2.12217(18m)	2.12217(18m)	No	No
Ethylene dichloride - surface - 2009	120.457(18m)	120.457(18m)	No	No	2.48443(18m)	2.48443(18m)	No	No
Ethylene dichloride - surface - 2010	142.129(18m)	142.129(18m)	No	Yes	2.93142(18m)	2.93142(18m)	No	No
Ethylene dichloride - surface - 2011	165.556(18m)	165.556(18m)	No	Yes	3.4146(18m)	3.4146(18m)	No	No
Ethylene dichloride - surface - 2012	152.248(18m)	152.248(18m)	No	Yes	3.14012(18m)	3.14012(18m)	No	No
Ethylene dichloride - surface - 2013	149.149(18m)	149.149(18m)	No	Yes	3.07619(18m)	3.07619(18m)	No	No
Ethylene dichloride - surface - 2014	162.234(18m)	162.234(18m)	No	Yes	3.34608(18m)	3.34608(18m)	No	No
Ethylene dichloride - surface - 2015	134.982(18m)	134.982(18m)	No	No	2.78401(18m)	2.78401(18m)	No	No
Ethylene dichloride - surface - 2016	93.1889(18m)	93.1889(18m)	No	No	1.92202(18m)	1.92202(18m)	No	No
Ethylene dichloride - surface - 2017	65.2036(18m)	65.2036(18m)	Yes	No	1.34482(18m)	1.34482(18m)	No	No
Ethylene dichloride - surface - 2018	60.8151(18m)	60.8151(18m)	Yes	No	1.25431(18m)	1.25431(18m)	No	No
Ethylene dichloride - surface - 2019	48.3827(18m)	48.3827(18m)	Yes	No	0.997894(18m)	0.997894(18m)	No	No
Ethylene dichloride - surface - 2020	49.4776(18m)	49.4776(18m)	Yes	No	1.02047(18m)	1.02047(18m)	No	No
Ethylene dichloride - surface - 2021	52.5308(18m)	52.5308(18m)	Yes	No	1.08345(18m)	1.08345(18m)	No	No
Ethylene dichloride - surface - 2022	46.489(18m)	46.489(18m)	Yes	No	0.958837(18m)	0.958837(18m)	No	No
Ethylene dichloride - surface - 2023	32.6987(18m)	32.6987(18m)	Yes	No	0.674411(18m)	0.674411(18m)	No	No
Ethylene dichloride - surface - 2024	21.896(18m)	21.896(18m)	Yes	No	0.451605(18m)	0.451605(18m)	No	No
Hydrogen sulphide - surface - 1995	131.532(18m)	131.532(18m)	No	Yes	2.71284(18m)	2.71284(18m)	No	No
Hydrogen sulphide - surface - 1996	297.441(18m)	297.441(18m)	No	Yes	6.13472(18m)	6.13472(18m)	No	No
Hydrogen sulphide - surface - 1997	308.891(18m)	308.891(18m)	No	Yes	6.37088(18m)	6.37088(18m)	No	No

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Hydrogen sulphide - surface - 1998	336.032(18m)	336.032(18m)	No	Yes	6.93065(18m)	6.93065(18m)	No	No
Hydrogen sulphide - surface - 1999	404.809(18m)	404.809(18m)	No	Yes	8.34919(18m)	8.34919(18m)	No	No
Hydrogen sulphide - surface - 2000	416.919(18m)	416.919(18m)	No	Yes	8.59895(18m)	8.59895(18m)	No	No
Hydrogen sulphide - surface - 2001	305.793(18m)	305.793(18m)	No	Yes	6.30699(18m)	6.30699(18m)	No	No
Hydrogen sulphide - surface - 2002	240.148(18m)	240.148(18m)	No	Yes	4.95304(18m)	4.95304(18m)	No	No
Hydrogen sulphide - surface - 2003	280.051(18m)	280.051(18m)	No	Yes	5.77605(18m)	5.77605(18m)	No	No
Hydrogen sulphide - surface - 2004	326.132(18m)	326.132(18m)	No	Yes	6.72647(18m)	6.72647(18m)	No	No
Hydrogen sulphide - surface - 2005	410.991(18m)	410.991(18m)	No	Yes	8.4767(18m)	8.4767(18m)	No	No
Hydrogen sulphide - surface - 2006	584.492(18m)	584.492(18m)	No	Yes	12.0551(18m)	12.0551(18m)	No	No
Hydrogen sulphide - surface - 2007	590.964(18m)	590.964(18m)	No	Yes	12.1886(18m)	12.1886(18m)	No	No
Hydrogen sulphide - surface - 2008	547.438(18m)	547.438(18m)	No	Yes	11.2909(18m)	11.2909(18m)	No	No
Hydrogen sulphide - surface - 2009	660.357(18m)	660.357(18m)	No	Yes	13.6199(18m)	13.6199(18m)	No	No
Hydrogen sulphide - surface - 2010	754.74(18m)	754.74(18m)	No	Yes	15.5665(18m)	15.5665(18m)	No	No
Hydrogen sulphide - surface - 2011	828.949(18m)	828.949(18m)	No	Yes	17.0971(18m)	17.0971(18m)	No	No
Hydrogen sulphide - surface - 2012	781.078(18m)	781.078(18m)	No	Yes	16.1097(18m)	16.1097(18m)	No	No
Hydrogen sulphide - surface - 2013	738.102(18m)	738.102(18m)	No	Yes	15.2234(18m)	15.2234(18m)	No	No
Hydrogen sulphide - surface - 2014	674.764(18m)	674.764(18m)	No	Yes	13.917(18m)	13.917(18m)	No	No
Hydrogen sulphide - surface - 2015	590.351(18m)	590.351(18m)	No	Yes	12.176(18m)	12.176(18m)	No	No
Hydrogen sulphide - surface - 2016	468.464(18m)	468.464(18m)	No	Yes	9.66207(18m)	9.66207(18m)	No	No
Hydrogen sulphide - surface - 2017	310.885(18m)	310.885(18m)	No	Yes	6.412(18m)	6.412(18m)	No	No
Hydrogen sulphide - surface - 2018	304.919(18m)	304.919(18m)	No	Yes	6.28896(18m)	6.28896(18m)	No	No
Hydrogen sulphide - surface - 2019	247.571(18m)	247.571(18m)	No	Yes	5.10616(18m)	5.10616(18m)	No	No
Hydrogen sulphide - surface - 2020	195.114(18m)	195.114(18m)	No	Yes	4.02423(18m)	4.02423(18m)	No	No
Hydrogen sulphide - surface - 2021	237.103(18m)	237.103(18m)	No	Yes	4.89025(18m)	4.89025(18m)	No	No
Hydrogen sulphide - surface - 2022	217.74(18m)	217.74(18m)	No	Yes	4.49089(18m)	4.49089(18m)	No	No
Hydrogen sulphide - surface - 2023	157.092(18m)	157.092(18m)	No	Yes	3.24001(18m)	3.24001(18m)	No	No
Hydrogen sulphide - surface - 2024	96.9301(18m)	96.9301(18m)	No	Yes	1.99918(18m)	1.99918(18m)	No	No
Hydrogen sulphide - surface - 2025	71.4697(18m)	71.4697(18m)	No	Yes	1.47406(18m)	1.47406(18m)	No	No
Hydrogen sulphide - surface - 2026	31.4852(18m)	31.4852(18m)	No	Yes	0.649383(18m)	0.649383(18m)	Yes	No
Hydrogen sulphide - surface - 2027	21.5207(18m)	21.5207(18m)	No	No	0.443864(18m)	0.443864(18m)	Yes	No
Nitrogen oxides (NOx) - engine - 2012	6.25791(131m)	6.25791(131m)	Yes	No	1.14131(131m)	1.14131(131m)	No	No
Nitrogen oxides (NOx) - engine - 2014	34.4131(131m)	34.4131(131m)	No	No	6.27622(131m)	6.27622(131m)	No	No
Nitrogen oxides (NOx) - engine - 2015	28.6793(131m)	28.6793(131m)	No	No	5.2305(131m)	5.2305(131m)	No	No
Nitrogen oxides (NOx) - engine - 2019	20.5514(131m)	20.5514(131m)	No	No	3.74814(131m)	3.74814(131m)	No	No

	Short Term				Long term			
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Nitrogen oxides (NOx) - engine - 2020	73.1051(131m)	73.1051(131m)	No	Yes	13.3328(131m)	13.3328(131m)	No	No
Nitrogen oxides (NOx) - engine - 2021	79.4534(131m)	79.4534(131m)	No	Yes	14.4906(131m)	14.4906(131m)	No	No
Nitrogen oxides (NOx) - engine - 2022	76.3828(131m)	76.3828(131m)	No	Yes	13.9306(131m)	13.9306(131m)	No	No
Nitrogen oxides (NOx) - engine - 2023	77.6962(131m)	77.6962(131m)	No	Yes	14.1701(131m)	14.1701(131m)	No	No
Nitrogen oxides (NOx) - engine - 2024	81.9991(131m)	81.9991(131m)	No	Yes	14.9549(131m)	14.9549(131m)	No	No
Nitrogen oxides (NOx) - engine - 2025	73.3874(131m)	73.3874(131m)	No	Yes	13.3843(131m)	13.3843(131m)	No	No
Nitrogen oxides (NOx) - engine - 2026	72.466(131m)	72.466(131m)	No	Yes	13.2163(131m)	13.2163(131m)	No	No
Nitrogen oxides (NOx) - engine - 2027	68.7508(131m)	68.7508(131m)	No	Yes	12.5387(131m)	12.5387(131m)	No	No
Nitrogen oxides (NOx) - engine - 2028	67.8256(131m)	67.8256(131m)	No	Yes	12.37(131m)	12.37(131m)	No	No
Nitrogen oxides (NOx) - engine - 2029	60.9219(131m)	60.9219(131m)	No	Yes	11.1109(131m)	11.1109(131m)	No	No
Nitrogen oxides (NOx) - engine - 2030	55.0616(131m)	55.0616(131m)	No	Yes	10.0421(131m)	10.0421(131m)	No	No
Nitrogen oxides (NOx) - engine - 2031	50.0375(131m)	50.0375(131m)	No	Yes	9.12579(131m)	9.12579(131m)	No	No
Nitrogen oxides (NOx) - engine - 2032	45.6172(131m)	45.6172(131m)	No	Yes	8.31961(131m)	8.31961(131m)	No	No
Nitrogen oxides (NOx) - engine - 2033	41.6669(131m)	41.6669(131m)	No	Yes	7.59916(131m)	7.59916(131m)	No	No
Nitrogen oxides (NOx) - engine - 2034	37.3337(131m)	37.3337(131m)	No	Yes	6.80888(131m)	6.80888(131m)	No	No
Sulphur dioxide - flare - 2013	44.2261(131m)	44.2261(131m)	No	No	3.17782(131m)	3.17782(131m)	No EAL	No EAL
Sulphur dioxide 15 min - flare - 2013	59.263(131m)	59.263(131m)	No	Yes				
Sulphur dioxide 24 hour - flare - 2013	26.0934(131m)	26.0934(131m)	No	Yes				
Sulphur dioxide - engine - 2014	60.8319(131m)	60.8319(131m)	No	No	5.54723(131m)	5.54723(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2014	81.5148(131m)	81.5148(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2014	35.8908(131m)	35.8908(131m)	No	Yes				
Sulphur dioxide - flare - 2014	47.676(131m)	47.676(131m)	No	No	3.42571(131m)	3.42571(131m)	No EAL	No EAL
Sulphur dioxide 15 min - flare - 2014	63.8859(131m)	63.8859(131m)	No	Yes				
Sulphur dioxide 24 hour - flare - 2014	28.1288(131m)	28.1288(131m)	No	Yes				
Sulphur dioxide - engine - 2015	50.6963(131m)	50.6963(131m)	No	No	4.62297(131m)	4.62297(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2015	67.9331(131m)	67.9331(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2015	29.9108(131m)	29.9108(131m)	No	Yes				
Sulphur dioxide - flare - 2015	47.5682(131m)	47.5682(131m)	No	No	3.41796(131m)	3.41796(131m)	No EAL	No EAL
Sulphur dioxide 15 min - flare - 2015	63.7414(131m)	63.7414(131m)	No	Yes				
Sulphur dioxide 24 hour - flare - 2015	28.0652(131m)	28.0652(131m)	No	Yes				
Sulphur dioxide - flare - 2016	44.9571(131m)	44.9571(131m)	No	No	3.23035(131m)	3.23035(131m)	No EAL	No EAL
Sulphur dioxide 15 min - flare - 2016	60.2425(131m)	60.2425(131m)	No	Yes				
Sulphur dioxide 24 hour - flare - 2016	26.5247(131m)	26.5247(131m)	No	Yes				
Sulphur dioxide - flare - 2017	46.4521(131m)	46.4521(131m)	No	No	3.33777(131m)	3.33777(131m)	No EAL	No EAL

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Sulphur dioxide 15 min - flare - 2017	62.2459(131m)	62.2459(131m)	No	Yes				
Sulphur dioxide 24 hour - flare - 2017	27.4068(131m)	27.4068(131m)	No	Yes				
Sulphur dioxide - flare - 2018	44.8547(131m)	44.8547(131m)	No	No	3.22298(131m)	3.22298(131m)	No EAL	No EAL
Sulphur dioxide 15 min - flare - 2018	60.1052(131m)	60.1052(131m)	No	Yes				
Sulphur dioxide 24 hour - flare - 2018	26.4643(131m)	26.4643(131m)	No	Yes				
Sulphur dioxide - engine - 2019	36.3286(131m)	36.3286(131m)	No	No	3.31278(131m)	3.31278(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2019	48.6803(131m)	48.6803(131m)	No	No				
Sulphur dioxide 24 hour - engine - 2019	21.4339(131m)	21.4339(131m)	No	No				
Sulphur dioxide 15 min - flare - 2019	37.1018(131m)	37.1018(131m)	No	No				
Sulphur dioxide 24 hour - flare - 2019	16.3359(131m)	16.3359(131m)	No	No				
Sulphur dioxide - engine - 2020	129.228(131m)	129.228(131m)	No	Yes	11.7842(131m)	11.7842(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2020	173.165(131m)	173.165(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2020	76.2443(131m)	76.2443(131m)	No	Yes				
Sulphur dioxide - engine - 2021	140.45(131m)	140.45(131m)	No	Yes	12.8075(131m)	12.8075(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2021	188.202(131m)	188.202(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2021	82.8652(131m)	82.8652(131m)	No	Yes				
Sulphur dioxide - engine - 2022	135.022(131m)	135.022(131m)	No	Yes	12.3125(131m)	12.3125(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2022	180.929(131m)	180.929(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2022	79.6628(131m)	79.6628(131m)	No	Yes				
Sulphur dioxide - engine - 2023	137.343(131m)	137.343(131m)	No	Yes	12.5243(131m)	12.5243(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2023	184.04(131m)	184.04(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2023	81.0326(131m)	81.0326(131m)	No	Yes				
Sulphur dioxide - engine - 2024	144.949(131m)	144.949(131m)	No	Yes	13.2179(131m)	13.2179(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2024	194.232(131m)	194.232(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2024	85.5202(131m)	85.5202(131m)	No	Yes				
Sulphur dioxide - engine - 2025	129.727(131m)	129.727(131m)	No	Yes	11.8297(131m)	11.8297(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2025	173.834(131m)	173.834(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2025	76.5387(131m)	76.5387(131m)	No	Yes				
Sulphur dioxide - engine - 2026	128.098(131m)	128.098(131m)	No	Yes	11.6812(131m)	11.6812(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2026	171.651(131m)	171.651(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2026	75.5777(131m)	75.5777(131m)	No	Yes				
Sulphur dioxide - engine - 2027	121.53(131m)	121.53(131m)	No	Yes	11.0823(131m)	11.0823(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2027	162.851(131m)	162.851(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2027	71.703(131m)	71.703(131m)	No	Yes				

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Sulphur dioxide - engine - 2028	119.895(131m)	119.895(131m)	No	Yes	10.9332(131m)	10.9332(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2028	160.659(131m)	160.659(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2028	70.7381(131m)	70.7381(131m)	No	Yes				
Sulphur dioxide - engine - 2029	107.691(131m)	107.691(131m)	No	Yes	9.82032(131m)	9.82032(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2029	144.307(131m)	144.307(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2029	63.538(131m)	63.538(131m)	No	Yes				
Sulphur dioxide - engine - 2030	97.3323(131m)	97.3323(131m)	No	Yes	8.87567(131m)	8.87567(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2030	130.425(131m)	130.425(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2030	57.426(131m)	57.426(131m)	No	Yes				
Sulphur dioxide - engine - 2031	88.4511(131m)	88.4511(131m)	No	Yes	8.06581(131m)	8.06581(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2031	118.525(131m)	118.525(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2031	52.1862(131m)	52.1862(131m)	No	Yes				
Sulphur dioxide - engine - 2032	80.6373(131m)	80.6373(131m)	No	Yes	7.35327(131m)	7.35327(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2032	108.054(131m)	108.054(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2032	47.576(131m)	47.576(131m)	No	Yes				
Sulphur dioxide - engine - 2033	73.6544(131m)	73.6544(131m)	No	Yes	6.7165(131m)	6.7165(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2033	98.6969(131m)	98.6969(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2033	43.4561(131m)	43.4561(131m)	No	Yes				
Sulphur dioxide - engine - 2034	65.9947(131m)	65.9947(131m)	No	No	6.01802(131m)	6.01802(131m)	No EAL	No EAL
Sulphur dioxide 15 min - engine - 2034	88.4328(131m)	88.4328(131m)	No	Yes				
Sulphur dioxide 24 hour - engine - 2034	38.9368(131m)	38.9368(131m)	No	Yes				
Sulphur dioxide - flare - 2034	40.6877(131m)	40.6877(131m)	No	No	2.92357(131m)	2.92357(131m)	No EAL	No EAL
Sulphur dioxide 15 min - flare - 2034	54.5215(131m)	54.5215(131m)	No	Yes				
Sulphur dioxide 24 hour - flare - 2034	24.0057(131m)	24.0057(131m)	No	Yes				
Sulphur dioxide - flare - 2035	48.467(131m)	48.467(131m)	No	No	3.48254(131m)	3.48254(131m)	No EAL	No EAL
Sulphur dioxide 15 min - flare - 2035	64.9457(131m)	64.9457(131m)	No	Yes				
Sulphur dioxide 24 hour - flare - 2035	28.5955(131m)	28.5955(131m)	No	Yes				
Sulphur dioxide - flare - 2036	44.5592(131m)	44.5592(131m)	No	No	3.20175(131m)	3.20175(131m)	No EAL	No EAL
Sulphur dioxide 15 min - flare - 2036	59.7093(131m)	59.7093(131m)	No	Yes				
Sulphur dioxide 24 hour - flare - 2036	26.2899(131m)	26.2899(131m)	No	Yes				
Sulphur dioxide - flare - 2037	37.6076(131m)	37.6076(131m)	No	No	2.70225(131m)	2.70225(131m)	No EAL	No EAL
Sulphur dioxide 15 min - flare - 2037	50.3942(131m)	50.3942(131m)	No	No				
Sulphur dioxide 24 hour - flare - 2037	22.1885(131m)	22.1885(131m)	No	No				
Vinyl chloride (chloroethene, chloroethylene) - surface - 1999	90.031(18m)	90.031(18m)	Yes	No	1.85689(18m)	1.85689(18m)	No	No

	Short Term				Long term			
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Vinyl chloride (chloroethene, chloroethylene) - surface - 2000	81.4588(18m)	81.4588(18m)	Yes	No	1.68009(18m)	1.68009(18m)	No	No
Vinyl chloride (chloroethene, chloroethylene) - surface - 2005	88.2646(18m)	88.2646(18m)	Yes	No	1.82046(18m)	1.82046(18m)	No	No
Vinyl chloride (chloroethene, chloroethylene) - surface - 2006	112.611(18m)	112.611(18m)	Yes	No	2.32261(18m)	2.32261(18m)	No	No
Vinyl chloride (chloroethene, chloroethylene) - surface - 2007	123.202(18m)	123.202(18m)	Yes	No	2.54105(18m)	2.54105(18m)	No	No
Vinyl chloride (chloroethene, chloroethylene) - surface - 2008	121.413(18m)	121.413(18m)	Yes	No	2.50414(18m)	2.50414(18m)	No	No
Vinyl chloride (chloroethene, chloroethylene) - surface - 2009	143.594(18m)	143.594(18m)	Yes	No	2.96163(18m)	2.96163(18m)	No	No
Vinyl chloride (chloroethene, chloroethylene) - surface - 2010	162.373(18m)	162.373(18m)	Yes	No	3.34894(18m)	3.34894(18m)	No	No
Vinyl chloride (chloroethene, chloroethylene) - surface - 2011	178.14(18m)	178.14(18m)	Yes	No	3.67413(18m)	3.67413(18m)	No	No
Vinyl chloride (chloroethene, chloroethylene) - surface - 2012	173.273(18m)	173.273(18m)	Yes	No	3.57376(18m)	3.57376(18m)	No	No
Vinyl chloride (chloroethene, chloroethylene) - surface - 2013	155.502(18m)	155.502(18m)	Yes	No	3.20724(18m)	3.20724(18m)	No	No
Vinyl chloride (chloroethene, chloroethylene) - surface - 2014	144.006(18m)	144.006(18m)	Yes	No	2.97012(18m)	2.97012(18m)	No	No
Vinyl chloride (chloroethene, chloroethylene) - surface - 2015	127.012(18m)	127.012(18m)	Yes	No	2.61963(18m)	2.61963(18m)	No	No
Vinyl chloride (chloroethene, chloroethylene) - surface - 2016	91.9418(18m)	91.9418(18m)	Yes	No	1.8963(18m)	1.8963(18m)	No	No
Xylene (all isomers) - surface - 1999	2142.39(18m)	2142.39(18m)	Yes	No	44.1867(18m)	44.1867(18m)	No	No
Xylene (all isomers) - surface - 2000	2154.18(18m)	2154.18(18m)	Yes	No	44.43(18m)	44.43(18m)	No	No
Xylene (all isomers) - surface - 2006	3065.51(18m)	3065.51(18m)	Yes	No	63.2261(18m)	63.2261(18m)	No	No
Xylene (all isomers) - surface - 2007	3021.59(18m)	3021.59(18m)	Yes	No	62.3203(18m)	62.3203(18m)	No	No
Xylene (all isomers) - surface - 2009	2555.38(18m)	2555.38(18m)	Yes	No	52.7047(18m)	52.7047(18m)	No	No
Xylene (all isomers) - surface - 2010	2929.11(18m)	2929.11(18m)	Yes	No	60.413(18m)	60.413(18m)	No	No
Xylene (all isomers) - surface - 2011	3355.69(18m)	3355.69(18m)	Yes	No	69.2111(18m)	69.2111(18m)	No	No
Xylene (all isomers) - surface - 2012	3146.93(18m)	3146.93(18m)	Yes	No	64.9055(18m)	64.9055(18m)	No	No
Xylene (all isomers) - surface - 2013	3705.6(18m)	3705.6(18m)	Yes	No	76.428(18m)	76.428(18m)	No	No
Xylene (all isomers) - surface - 2014	3350.47(18m)	3350.47(18m)	Yes	No	69.1035(18m)	69.1035(18m)	No	No
Xylene (all isomers) - surface - 2015	3086.66(18m)	3086.66(18m)	Yes	No	63.6624(18m)	63.6624(18m)	No	No
Xylene (all isomers) - surface - 2016	2440.82(18m)	2440.82(18m)	Yes	No	50.342(18m)	50.342(18m)	No	No

Not Modelled:

1,1,1,2-Tetrafluorochloroethane
1,1,1-Trichlorotrifluoroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethene
1,1-Dichlorotetrafluoroethane
1,2-Dichloropropane
1,2-Dichlorotetrafluoroethane
1-butanethiol
1-Chloro-1,1-difluoroethane
2-butoxy ethanol
2-Chloro-1,1,1-trifluoroethane
2-Propanol
Bromodichloromethane
Butene isomers
Butyric acid
Carbonyl sulphide
Chlorobenzene
Chlorodifluoromethane
Chloroethane
Chlorofluorocarbons (CFCs) (Total)
Chlorofluoromethane
Chlorotrifluoromethane
Dichlorodifluoromethane
Dichlorofluoromethane
Diethyl disulphide
Dimethyl disulphide
Dimethyl sulphide
Dioxins and furans (modelled as 2,3,7,8-TCDD)
Ethane
Ethanethiol (ethyl mercaptan)
Ethanol
Ethyl butyrate
Ethyl toluene (all isomers)
Ethylene
Ethylene dibromide
Fluorotrichloromethane
Freon 113
Furan
Halons
Hexachlorocyclohexane (all isomers)
Hydrochlorofluorocarbons (HCFCs) (Total)
Hydrofluorocarbons (HFCs) (Total)

Limonene

Not Modelled:

Methanethiol (methyl mercaptan)
Methyl isobutyl ketone
Nitrogen dioxide (NO2)
Nitrogen monoxide (NO)
Odour Units (Predicted)
Pentane
Pentene (all isomers)
Perfluorocarbons (PFCs) (Total)
Propane
Propanethiol
Sulphide, total simulations with H2S
Sulphide, total simulations without H2S
t-1,2-Dichloroethene
Tetrachloroethane (modelled as 1,1,2,2-Tetrachloroethane)
Total non-methane volatile organic compounds (NMVOCs)
Total volatile organic compounds (VOCs)
Trichlorofluoromethane
Trichlorotrifluoroethane
Styrene

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