

Air Quality Assessment

Teesside Anaerobic Digestion Power Plant, Middlesbrough

Client: Duranta Teesside Ltd

Reference: 2665-1r2

Date: 9th December 2025



Report Issue

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Middlesbrough

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Authored by	Liam Shelmerdine	Liam Shelmerdine		
Position	Principal Air Quality Consultant	Principal Air Quality Consultant		
Reviewed by	Ger Parry	Ger Parry		
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Serendipity Labs, Building 7, Exchange Quay, Salford, M5 3EP

info@red-env.co.uk | 0161 706 0075 | www.red-env.co.uk

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Executive Summary

Redmore Environmental Ltd was commissioned by Duranta Teesside Ltd to undertake an Air Quality Assessment in support of an Environmental Permit Variation Application for Teesside Anaerobic Digestion Power Plant, Forty Foot Road, Middlesbrough.

The Environmental Permit Variation Application seeks to authorise a number of proposed changes to the site. These include the development of a new area which will accommodate an additional emergency flare unit, a digester tank and a biogas upgrading facility with grid entry unit.

The proposed changes have the potential to result in additional atmospheric emissions and associated air quality impacts at sensitive locations in the vicinity of the site. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and consider potential effects.

An assessment using a standard screening tool was undertaken in order to predict pollution levels as a result of emissions from relevant new plant at the facility. The findings indicated that the operation of the plant is not predicted to result in significant impacts at any sensitive location within the vicinity of the site.

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1.0 INTRODUCTION

- 1.1.1 Redmore Environmental Ltd was commissioned by Duranta Teesside Ltd to undertake an Air Quality Assessment in support of an Environmental Permit Variation Application for Teesside Anaerobic Digestion (AD) Power Plant, Forty Foot Road, Middlesbrough.
- 1.1.2 Atmospheric emissions associated with new plant which is proposed for installation at facility have the potential to cause air quality impacts at sensitive locations in the vicinity of the site. As such, an Air Quality Assessment was undertaken in order to define baseline conditions and consider potential effects.

1.2 Site Location and Context

- 1.2.1 Teesside AD Power Plant is located on land off Forty Foot Road, Middlesbrough, at National Grid Reference (NGR): 448850, 521070. Reference should be made to Figure 1 for a map of the site and surrounding area.
- 1.2.2 Existing activities at the facility are controlled under an Environmental Permit (ref: EPR/YP3236RW) issued by the Environment Agency (EA). An Environmental Permit Variation Application is being made to the EA in order to authorise a number of proposed changes to the site. These include the development of a new area which will accommodate an additional emergency flare unit, a digester tank and a biogas upgrading facility with grid entry unit.
- 1.2.3 The proposed changes have the potential to result in additional atmospheric emissions and associated air quality impacts at sensitive locations in the vicinity of the site. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and consider potential effects. This is detailed within the following report.

2.0 METHODOLOGY

2.1 Introduction

2.1.1 The site changes include the development of a new area adjacent to the existing plant which will accommodate an additional emergency flare unit, a digester tank and biogas upgrading facility and grid entry unit. Reference should be made to Figure 2 for a site layout plan.

2.2 Potential Emission Sources

2.2.1 The proposed changes will not introduce any new combustion emission sources to the site, other than the additional flare unit. In addition, the Operator has confirmed that the changes will not affect the emission potential of existing combustion plant installed at the facility.

2.2.2 The new flare will only be utilised in emergency situations and will not function as part of normal operations at the site. As such, potential impacts as a result of emissions from the new flare are not considered to be significant and have not been evaluated further as part of the assessment.

2.2.3 The new digester will be completely sealed, and the only potential atmospheric emission source will be the Pressure Release Valves (PRVs) installed on the tank. These are a necessary safety feature to avoid overpressure and will only operate during emergency scenarios. As such, potential emissions from the PRVs are not considered to be significant and have not been evaluated further as part of the assessment.

2.2.4 The new upgrading facility will be used to convert biogas produced by the AD process to biomethane for injection into the gas grid. This involves stripping out impurities, mainly carbon dioxide (CO₂), Volatile Organic Compounds (VOCs) and hydrogen sulphide (H₂S), before treatment with an odorant and transfer off-site.

2.2.5 The majority of VOCs and H₂S will be absorbed onto the activated carbon filter and not released to atmosphere. However, there is the potential for trace amounts of residual impurities within the emissions from the CO₂ vent serving the upgrading unit (emission point A13). These have therefore been considered further through a H1 Assessment.

2.2.6 Although minor residual impurities may remain in the CO₂ vent stream, releases from the upgrading process are not expected to constitute a significant odour emission source. The vent is a controlled process discharge from an enclosed upgrading system and does not involve any of the activities typically associated with odour generation at AD facilities, such as handling or agitation of raw or partially treated organic materials. As the upgrading unit does not introduce new odorous operations and the CO₂ vent is not regarded as a material source of emissions, a separate Odour Assessment is not considered necessary in support of the Environmental Permit Variation Application.

2.3 H1 Assessment Tool

2.3.1 The H1 Assessment tool is a Microsoft Excel based assessment methodology produced to support the EA risk assessment process¹. The tool allows the user to calculate the contribution of defined emission sources to ground level pollution concentrations based on various input values. These can then be compared with the relevant air quality standards or Environmental Assessment Levels (EALs) to determine the acceptability of the facility in terms of air quality.

2.4 Assessment Inputs

2.4.1 The facility includes an existing biogas upgrading unit. The proposed additional upgrading facility will be similar in design to the existing unit. As such, the inputs used in the assessment were derived from the results of Emissions Monitoring undertaken at the site by Element in December 2024, which included quantification of pollutant concentrations from the CO₂ exhaust vent. A summary of the results is provided in Table 1. Reference should be made to Appendix 1 for the full monitoring report.

Table 1 Emissions Concentrations

Monitoring Date	Monitoring Company	Pollutant	Measured Concentration (mg/m ³)
19/12/2024	Element	Total VOC (TVOC)	20,293
		H ₂ S	6.8

¹ <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>.

2.4.2 It should be noted that for the purpose of the assessment, it was assumed that the entire VOC emission consisted of methane (CH₄), as it is not anticipated that there are significant releases of any other species such as benzene (C₆H₆) from the proposed biogas upgrading unit. This is supported by the following considerations:

- Upgrade of biogas at the site does not currently and will not in the future involve combustion of gas at any stage. As such, C₆H₆ is not generated by the process;
- The plant does not process waste materials which are likely to contain C₆H₆. As such, it is unlikely that biogas generated by the AD process will contain the compound; and,
- Raw biogas is subject to carbon filtration prior to low pressure conditioning which is likely to remove any residual C₆H₆ which is present as a result of the AD process.

2.4.3 A summary of the input data is provided in Table 2. This was derived from the technical specification for the proposed upgrading unit and information provided by the Operator.

Table 2 Input Data

Parameter	Value	Unit
Effective Stack height	0 ^(a)	m
Stack diameter	0.10	m
Exhaust gas temperature	21	°C
Exhaust gas flow rate	390	m ³ /hr
Exhaust gas flow rate	362 ^(b)	Nm ³ /hr
Exhaust gas efflux velocity	13.79	m/s
CH ₄ emission concentration	20,293	mg/m ³
H ₂ S emission concentration	6.8	mg/m ³
CH ₄ emission rate	2.0414	g/s
H ₂ S emission rate	0.0007	g/s

Note: (a) There are a number of buildings in the vicinity of the upgrade unit that may affect emission dispersion. The effective stack height was therefore entered into the H1 Assessment Tool as 0m in accordance with EA guidance².

² <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>.

(b) At 273°K with no correction for moisture or oxygen.

2.5 Background Pollutant Concentrations

2.5.1 There is currently no UK baseline monitoring data available for H₂S nor CH₄. As such, in the absence of such information, background levels have not been considered as part of the assessment.

2.6 Environmental Assessment Levels

2.6.1 An EAL is the concentration of a substance, which, in a particular environmental medium, the regulators regard as an appropriate comparator value. This enables comparison between the environmental effects of different substances in that medium and between environmental effects in different media, enabling the summation of those effects.

2.6.2 Ideally EALs to fulfil this objective would be defined for each pollutant:

- Based on the particular habitats or receptors (in particular three main types of receptor should be considered, protection of human health, protection of natural ecosystems and protection of specific sensitive receptors, e.g. materials, commercial activities requiring a particular environmental quality);
- Be produced according to a standardised protocol to ensure that they are consistent, reproducible and readily understood;
- Provide similar measure of protection for different receptors both within and between media; and,
- Take account of habitat specific environmental factors such as pH, nutrient status, bioaccumulation, transfer and transformation processes where necessary.

2.6.3 EALs used in this assessment were obtained from EA guidance 'Air emissions risk assessment for your environmental permit'³ and are summarised in Table 3.

³ <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>.

Table 3 Environmental Assessment Levels

Pollutant	Environmental Assessment Level ($\mu\text{g}/\text{m}^3$)	
	Concentration	Averaging Period
H ₂ S	140	Annual mean
	150	24-hour mean

2.6.4 It should be noted that EALs have not been defined by the EA for CH₄. As such, potential impacts as a result of emissions of the pollutant have not been considered further as part of the assessment.

2.7 Assessment Criteria

2.7.1 Predicted pollutant concentrations were summarised in the following formats:

- Process contribution (PC) - Predicted pollutant level as a result of emissions from the proposed upgrade unit CO₂ vent only; and,
- Predicted environmental concentration (PEC) - Total predicted pollutant level as a result of emissions from the proposed upgrade unit CO₂ vent and existing baseline conditions.

2.7.2 EA guidance 'Air emissions risk assessment for your environmental permit'⁴ states that PCs can be screened as insignificant if they meet the following criteria:

- The short-term PC is less than 10% of the short-term environmental standard; and,
- The long-term PC is less than 1% of the long-term environmental standard.

2.7.3 The PCs predicted from the H1 Assessment Tool were compared with the relevant EALs in order to determine potential for significant air quality effects.

⁴ <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>.

3.0 **ASSESSMENT**

- 3.1.1 The contribution of exhaust gases from the proposed upgrading plant to ground level pollutant concentrations was calculated using the H1 assessment method as described previously. The results are summarised in Table 4.

Table 4 H1 Assessment Results

Pollutant	Averaging Period	PC (µg/m ³)	PC Proportion of EQS (%)	PEC (µg/m ³)	PEC Proportion of EQS (%)
H ₂ S	Annual mean	0.1011	0.07	0.1011	0.07
	24-hour mean	1.5733	1.05	1.5733	1.05

- 3.1.2 As shown in Table 4, annual mean and 24-hour mean H₂S PCs were less than 1% and 10% of the relevant EQSs, respectively. As such, impacts associated with emissions from the proposed upgrading unit were screened as insignificant within the H1 Assessment tool.

4.0 CONCLUSION

- 4.1.1 Redmore Environmental Ltd was commissioned by Duranta Teesside Ltd to undertake an Air Quality Assessment in support of an Environmental Permit Variation Application for Teesside AD Power Plant, Forty Foot Road, Middlesbrough.
- 4.1.2 The Environmental Permit Variation Application seeks to authorise a number of proposed changes to the site. These include the development of a new area which will accommodate an additional emergency flare unit, a digester tank and a biogas upgrading facility with grid entry unit.
- 4.1.3 The proposed changes have the potential to result in additional atmospheric emissions from the plant and associated air quality impacts at sensitive locations in the vicinity of the site. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and consider potential effects.
- 4.1.4 An assessment using the EA H1 Assessment Tool was undertaken in order to predict pollution levels as a result of emissions from the proposed gas upgrading unit. The findings indicated that the operation of the plant is not predicted to result in significant impacts at any location within the vicinity of the site.

5.0 **ABBREVIATIONS**

AD	Anaerobic Digestion
CH ₄	Methane
C ₆ H ₆	Benzene
CO ₂	Carbon Dioxide
EA	Environment Agency
EAL	Environmental Assessment Levels
H ₂ S	Hydrogen Sulphide
NGR	National Grid Reference
PC	Process Contribution
PEC	Predicted Environmental Concentration
PRV	Pressure Release Valves
VOC	Volatile Organic Compound

Figures



Legend

Title
Figure 2 - Site Layout Plan

Project
Air Quality Assessment
Teesside Anaerobic Digestion Power
Plant, Middlesbrough

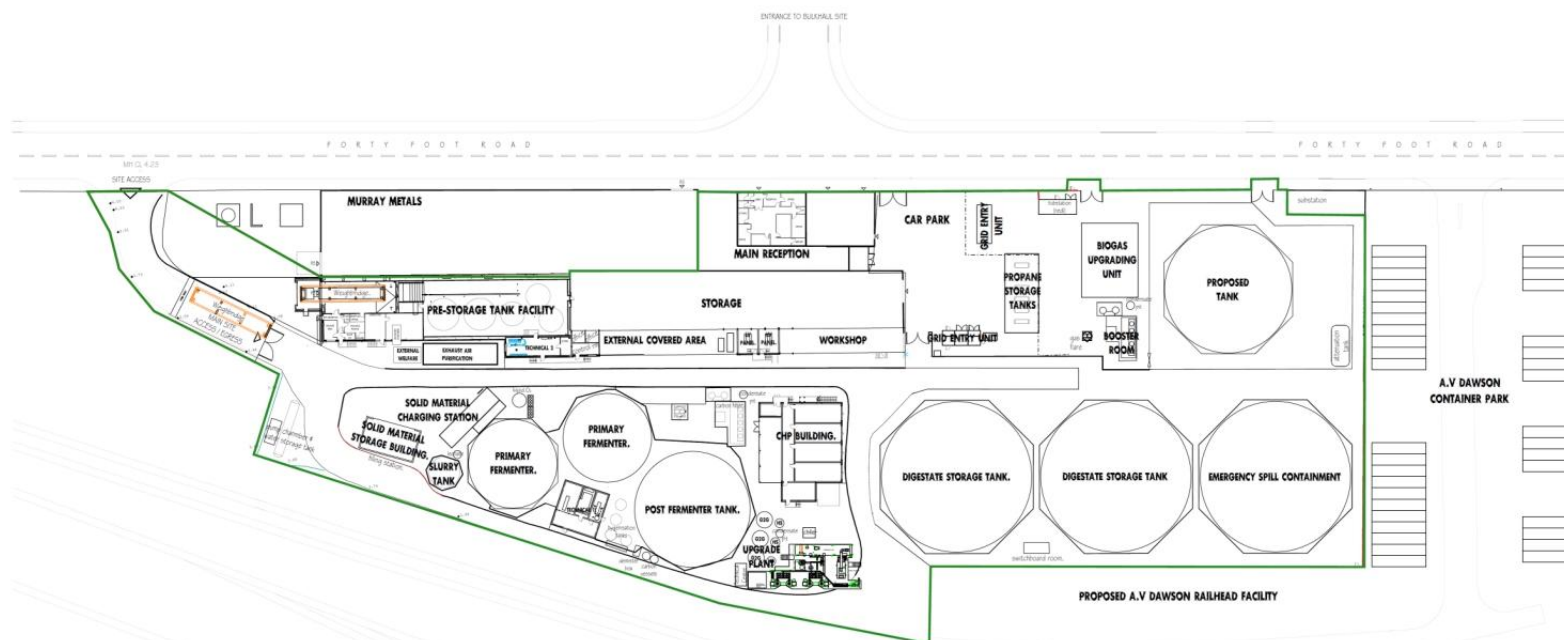
Project Reference
2665-1

Client
Duranta Teesside Ltd

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Appendix 1: Emissions Monitoring Reports



Element, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL
Your Element Contact: Scott Pilkington (07825 991 537)
E: scott.pilkington@element.com

Stack Emissions Testing Report Commissioned by
Air Liquide Biogas Solutions Europe Ltd

Installation Name & Address
Air Liquide Biogas Solutions Europe Ltd
Duranta Energy Ltd
Forty Foot Road
Middlesbrough
Cleveland
TS2 1HG

EPR Permit: EPR/YP3433VP

Stack Reference
A8 Biogas Upgrade Plant

Dates of the Monitoring Campaign
19th December 2024

Job Reference Number
EMT11454

Report Written by
Kelvin Moore Team Leader MCERTS Level 2 MM02 057 TE1 TE2 TE3 TE4

Report Approved by
Donal O Faogain Technical Report Writer MCERTS Level 2 MM13 1259 TE1 TE2 TE3 TE4

Report Date
17th January 2025

Version
Version 1

Signature of Report Approver


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APPENDIX 2 - Raw Data, Sampling Equations & Charts

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Executive Summary

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MONITORING OBJECTIVES

Air Liquide Biogas Solutions Europe Ltd, Middlesbrough
A8 Biogas Upgrade Plant
19th December 2024

Overall Aim of the Monitoring Campaign

Element were commissioned by Air Liquide Biogas Solutions Europe Ltd to carry out stack emissions testing on the A8 Biogas Upgrade Plant at Middlesbrough.

The aim of the monitoring campaign was to perform testing, as requested by the customer, for a number of prescribed pollutants. There are no emission limits set for any of the pollutants at this time.

Special Requirements

There were no special requirements.

Target Parameters

Hydrogen Sulphide, Total VOCs (as Carbon)

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MONITORING RESULTS

Air Liquide Biogas Solutions Europe Ltd, Middlesbrough
A8 Biogas Upgrade Plant
19th December 2024

where MU = Measurement Uncertainty associated with the Result

Concentration				
Parameter	Units	Result	MU +/-	Limit
Hydrogen Sulphide	¹ mg/m ³	6.8	0.62	-
Total VOCs (as Carbon)	¹ mg/m ³	20293	459	-
Water Vapour	% v/v	13.3	0.92	

¹ Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

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MONITORING DATE(S) & TIMES

Air Liquide Biogas Solutions Europe Ltd, Middlesbrough
A8 Biogas Upgrade Plant
19th December 2024

Parameter	Units	Concentration		Sampling Date(s)	Sampling Times	Duration mins
Hydrogen Sulphide	R1	mg/m ³	6.8	19/12/2024	10:00 - 10:30	30
Total VOCs (as Carbon)	R1	mg/m ³	20293	19/12/2024	10:00 - 10:30	30

All results are expressed at the respective reference conditions.

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PROCESS DETAILS

Air Liquide Biogas Solutions Europe Ltd, Middlesbrough
A8 Biogas Upgrade Plant
19th December 2024

Standard Operating Conditions

Parameter	Value
Process Status	N/A
Capacity (of 100%) and Tonnes / Hour	N/A
Continuous or Batch Process	Continuous
Feedstock (if applicable)	N/A
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	Off gas from Biogas process
Plume Appearance	N/A

Executive Summary

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MONITORING & ANALYTICAL METHODS

Air Liquide Biogas Solutions Europe Ltd, Middlesbrough
A8 Biogas Upgrade Plant
19th December 2024

Parameter	Monitoring				Analysis				Overall Status	LOD (Average)
	Standard	Technical Procedure	Sampling Status	Testing Lab	Analytical Procedure	Analytical Technique	Analysis Status	Analysis Lab		
Hydrogen Sulphide	US EPA M11	MD 015	None	EET	M120	IC	MCERTS	RPS	None	2.223 mg/m ³
Water Vapour	EN 14790	MD 005	None	EET	MD 005	Gravimetric	MCERTS	EET	None	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	MD 020	None	EET	Flame Ionisation Detection by Sick 3006				None	0.32 mg/m ³

ANALYSIS LABORATORIES

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

Element (Stockport Lab - EET)	ISO 17025 Accreditation Number: UKAS 4279
RPS Laboratories Ltd (RPS)	ISO 17025 Accreditation Number: UKAS 0605

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total VOCs (as Carbon)	All	Due to the intrinsically safe nature of the site and the location of the sample point an unheated line was used.

Executive Summary

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SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.05
Width	m	-
Area	m ²	0.002
Port Depth	cm	5
Orientation of Duct	-	Vertical
Number of Ports	-	1
Sample Port Size	-	1" BSP

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

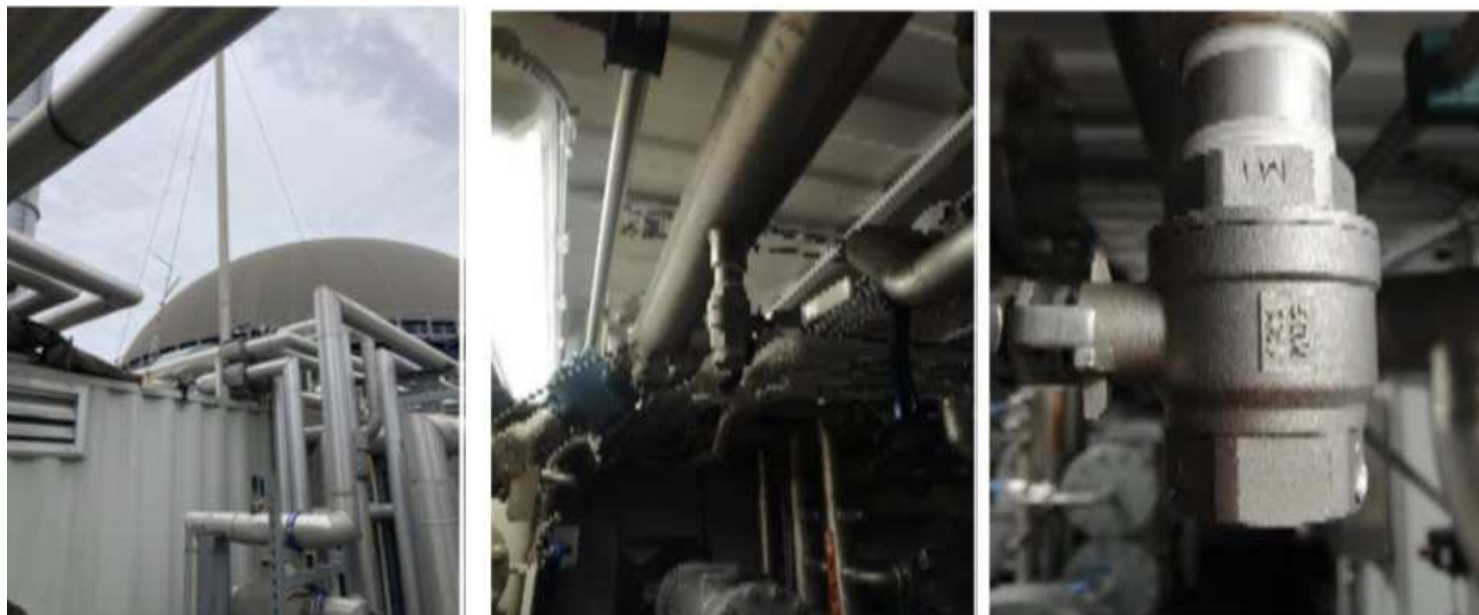
EN 15259 Homogeneity Test Requirements

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

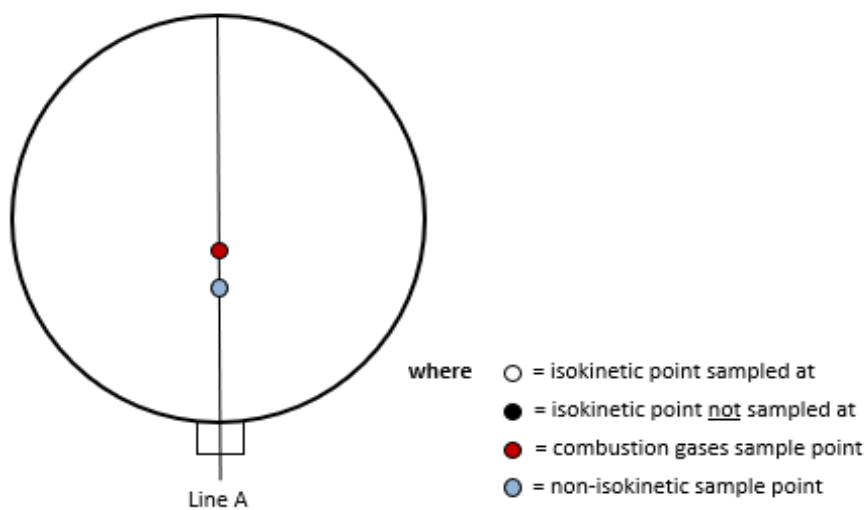
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PLANT PHOTOS



SAMPLE POINTS



APPENDICES

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Kelvin Moore	MCERTS Level 2	MM 02 057	TE1 TE2 TE3 TE4
Trainee	Daniel Bough	MCERTS Level 1	MM24 1246	None

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM (1)	-	Horiba PG-350E	-	Digital Manometer (1)	-
Control Box DGM (2)	-	Horiba PG-250 SRM	-	Digital Manometer (2)	-
Box Thermocouples (1)	-	Servomex 4900	-	Digital Temperature Meter	-
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	CAT 14.104
Umbilical (1)	-	ABB AO2020-URAS26	-	Barometer	CAT 13.48
Umbilical (2)	-	Testo 350 XL	-	Stack Thermocouple (1)	CAT 4.1898
Oven Box (1)	-	JCT JCC P1 Cooler	-	Stack Thermocouple (2)	-
Oven Box (2)	-	Gasmet DX4000	-	Stack Thermocouple (3)	-
Heated Probe (1)	-	Gasmet Sampling System	-	1m Heated Line (1)	CAT 20.2
Heated Probe (2)	-	Sick 3006	CAT 8.47	1m Heated Line (2)	-
Heated Probe (3)	-	M&C PSS	CAT 12.121	1m Heated Line (3)	-
S-Pitot (1)	-	Mass Flow Controller (1)	CAT 6.75	5m Heated Line (1)	-
S-Pitot (2)	-	Mass Flow Controller (2)	CAT 6.76	15m Heated Line (1)	-
L-Pitot	-	Mass View (1)	CAT 25.75	20m Heated Line (1)	CAT 20.255
Site Balance	CAT 17.50	Mass View (2)	CAT 25.76	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.50	Hioki 5043 (V)	-	Dual Channel Heater Controller	-
Last Impinger Arm	CAT 4.1188	Easylogger EN-EL-12 Bit	-	Single Channel Heater Controller	-
Callipers	-	Bioaerosols Temperature Logger	-	Laboratory Balance	-
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.100

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Hydrogen Sulphide	US EPA M11	MD 015
Water Vapour	EN 14790	MD 005
Total VOCs (as Carbon)	EN 12619:2013	MD 020

APPENDIX 2

HYDROGEN SULPHIDE: RESULTS SUMMARY

Air Liquide Biogas Solutions Europe Ltd, Middlesbrough
A8 Biogas Upgrade Plant

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	6.8	6.8
Uncertainty	±mg/m ³	0.62	0.62

Parameter	Units	Run 1	Mean
Water Vapour	% v/v	13.3	13.3
Uncertainty	±% v/v	0.92	0.92

Blank Runs

Parameter	Units	Blank 1	Maximum
Concentration	mg/m ³	< 2.1	< 2.1

General Sampling Information

Parameter	Value
Standard	US EPA M11
Technical Procedure	MD 015
Name of Analytical Laboratory	RPS
Analytical Laboratory's Procedure	M120
ISO 17025 Accredited Analysis?	MCERTS
Date of Sample Analysis	07/01/2025
Probe Material	Stainless Steel
Filter Housing Material	N/A
Impinger Material	Polyethylene
Absorption Solution	Zinc Acetate Solution
Positioning of Filter	Out Stack Heated Head
Filter Size and Material	0.1µm Glass Fibre
Number of Sampling Lines Used	1/1
Number of Sampling Points Used	1/1
Sample Point I.D.'s	A1

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, without correction for water vapour content.

HYDROGEN SULPHIDE: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	10:00 - 10:30
Sampling Dates	-	19/12/2024
Sampling Device	-	MFC / MV
Duration	mins	30
Volume Sampled (STP, Dry)	m ³	0.0705
Volume Sampled (STP, Wet)	m ³	0.0813
Volume Sampled (REF)	m ³	0.0813
Sample Flow Rate	l/min	2.35
Laboratory Result for Front Impingers	µg/ml	1.89
Laboratory Result for Back Impinger	µg/ml	0.76
Volume in Front Impingers	ml	245.0
Volume in Back Impinger	ml	116.5
Mass in Front Impingers	µg	463.1
Mass in Back Impinger	µg	88.5
Total Mass Collected	µg	551.6
Calculated Concentration	mg/m ³	6.78
Liquid Trap Start Mass	g	1714.9
Liquid Trap End Mass	g	1719.3
Silica Trap Start Mass	g	426.7
Silica Trap End Mass	g	431.0
Total Mass Of Water Vapour	g	8.7
Calculated Water Vapour	% v/v	13.33

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

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	19/12/24
Average Volume Sampled (REF)	m ³	0.0813
Laboratory Result for Impingers	µg/ml	< 0.50
Volume in Impingers	ml	334.2
Total Mass Collected	µg	< 167.1
Calculated Concentration	mg/m ³	< 2.05

HYDROGEN SULPHIDE: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	2.3	
Pre-Sampling Leak Rate	l/min	0.00	
Post-Sampling Leak Rate	l/min	0.00	
Allowable Leak Rate	l/min	0.05	
Leak Test Acceptable	-	Yes	
Absorption Efficiency	Units	Run 1	
Absorption Efficiency	%	83.9	
Allowable Absorption Efficiency	%	N/A	
Absorption Efficiency Acceptable	-	N/A	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	6.9	
Allowable MU	%	20.0	
MU Acceptable	%	Yes	
Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	
Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	2.0	
Pre-Sampling Leak Rate	l/min	0.00	
Post-Sampling Leak Rate	l/min	0.00	
Allowable Leak Rate	l/min	0.04	
Leak Test Acceptable	-	Yes	
Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m ³	N/A	
Blank Acceptable	-	N/A	

Method Deviations

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

HYDROGEN SULPHIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value		Standard uncertainty		
	Symbol	Run 1	Symbol	Units	Run 1
Sampled Volume (STP)	V_m	0.0705	uV_m	m^3	0.0014
Leak	L	0.00	uL	%	-
Laboratory Result	L_r	4.20	uL_r	%	-

Measured Quantities	Uncertainty as a Percentage		Requirement of Standard
	Units	Run 1	
Sampled Volume (STP)	%	2.00	$\leq 2\%$
Leak	%	0.00	$\leq 2\%$
Laboratory Result	%	4.20	No Requirement

Measured Quantities	Uncertainty in Measurement Units			Sensitivity Coefficient
	Symbol	Units	Run 1	
Sampled Volume (STP)	V_m	m^3	0.0705	96.25
Leak	L	mg/m^3	0.000	1.00
Laboratory Result	L_r	mg/m^3	0.285	1.00

Measured Quantities	Uncertainty in Result	
	Units	Run 1
Sampled Volume (STP)	mg/m^3	0.136
Leak	mg/m^3	0.0000
Laboratory Result	mg/m^3	0.2849

Measured Quantities	Oxygen Correction Part of MU Budget	
	Units	Run 1
O ₂ Correction Factor	-	N/A
Stack Gas O ₂ Content	% v/v	N/A
MU for O ₂ Correction	-	N/A
Overall MU For O ₂ Measurement	%	N/A

Parameter	Units	Run 1
Combined uncertainty	mg/m^3	0.32
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m^3	0.62
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m^3	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m^3	0.62
Reported Uncertainty	mg/m^3	0.62
Expanded uncertainty (95% confidence), without Oxygen Correction	%	9.1
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	9.1
Reported Uncertainty	%	9.1
Reported Uncertainty as % of ELV	%	N/A

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Air Liquide Biogas Solutions Europe Ltd, Middlesbrough
A8 Biogas Upgrade Plant

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	20293	20293
Uncertainty	±mg/m ³	459	459

General Sampling Information

Parameter	Value
Standard	EN 12619:2013
Technical Procedure	MD 020
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Type	Propane In Synthetic Air (5 Grade)
Span Gas Reference Number	1.0402a
Span Gas Expiry Date	8/2/25
Span Gas Start Pressure (bar)	70
Gas Cylinder Concentration (ppm)	8000.31
Span Gas Set Point (ppm)	8000.31
Span Gas Uncertainty (%)	2
Zero Gas Type	Synthetic Air (5 Grade)
Number of Sampling Lines Used	1/1
Number of Sampling Points Used	1/1
Sample Point I.D.'s	A1

FORMAT: Number Used / Number Required

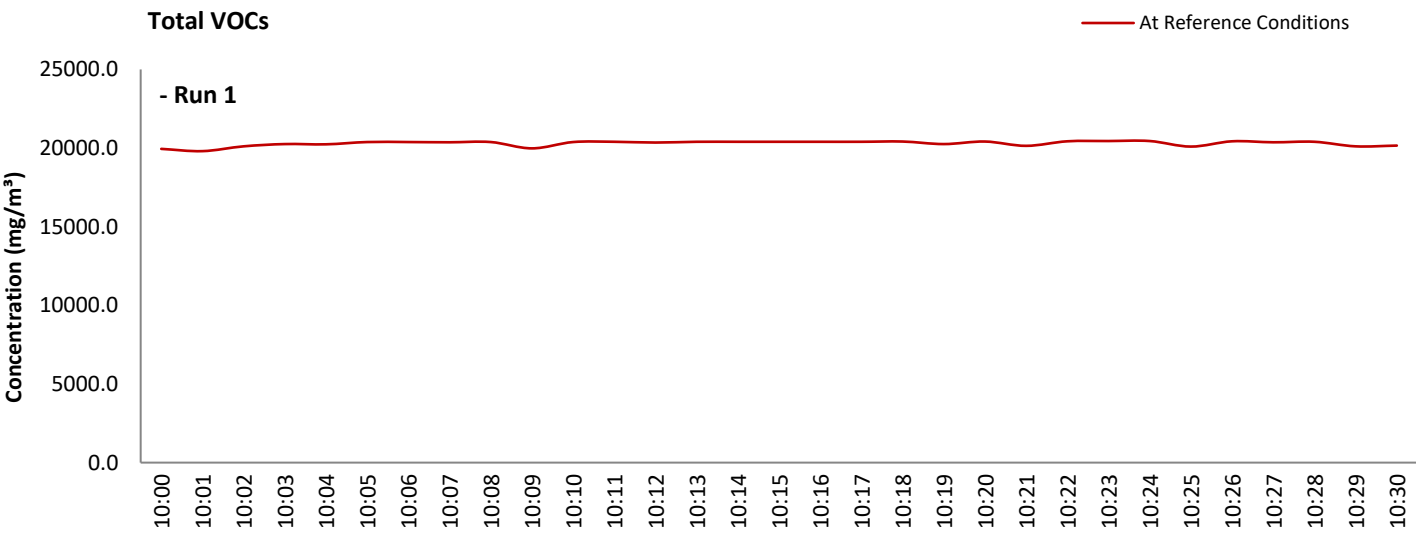
FORMAT: Number Used / Number Required

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, without correction for water vapour content.

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	10:00 - 10:30
Sampling Dates	-	19/12/2024
Instrument Range	ppm	10000
Span Gas Value	ppm	8000.3

Quality Assurance

Zero Drift	Units	Run 1
CAL 1 Zero Down Sampling Line (Pre)	ppm	0.00
Zero Down Sampling Line (Post)	ppm	0.00
Zero Drift	ppm	0.00
Zero Drift	%	0.00
Drift Correction Applied	2-5%	No
Allowable Zero Drift	± ppm	400.02
Zero Drift Acceptable	-	Yes

Span Drift	Units	Run 1
CAL 1 Span Down Sampling Line (Pre)	ppm	8000.00
Span Down Sampling Line (Post)	ppm	8000.00
Span Drift	ppm	0.00
Span Drift	%	0.00
Drift Correction Applied	2-5%	No
Allowable Span Drift	± ppm	400.02
Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	11 - 13

Method Deviations

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

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1	Units
Limit value	-	mg/m ³ (REF)
Allowable MU	15.0	%
Measured concentration	23414.35	mg/m ³ (STP, dry)
Range Used	10000.0	ppm
Range Used [A]	16061.4	mg/m ³
Cal gas conc.	8000.3	ppm
Conversion	1.61	ppm to mg/m ³
MCERTS Range [B]	15.0	mg/m ³
Lower of [A] or [B]	15.0	mg/m ³
Cal gas conc.	12849.6	mg/m ³

Performance characteristics	RUN 1	Units
Response time	45	seconds
Number of readings in measurement	30	-
Repeatability at zero	2.00	% full scale
Repeatability at span level	0.00	% full scale
Deviation from linearity	0.64	% of value
Zero drift	0.00	% full scale
Span drift	0.00	% full scale
Volume or pressure flow dependence	1.60	% of full scale
Atmospheric pressure dependence	0.30	% of value/kPa
Ambient temperature dependence	1.40	% full scale/10K
Combined interference	0.45	% range
Dependence on voltage	0.50	% full scale/10V
Losses in the line (leak)	0.00	% of value
Uncertainty of calibration gas	2.00	% of value

Performance characteristic	RUN 1	Units
Standard deviation of repeatability at zero	use rep at span	mg/m ³
Standard deviation of repeatability at span level	0.00	mg/m ³
Lack of fit	0.06	mg/m ³
Drift	0.00	mg/m ³
Volume or pressure flow dependence	0.00	mg/m ³
Atmospheric pressure dependence	0.01	mg/m ³
Ambient temperature dependence	0.20	mg/m ³
Combined interference (from MCERTS Certificate)	0.04	mg/m ³
Dependence on voltage	0.06	mg/m ³
Losses in the line (leak)	0.00	mg/m ³
Uncertainty of calibration gas	270.37	mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		23414.35	mg/m ³
Expanded uncertainty	k = 1.96	270.37	mg/m ³
Expanded uncertainty		529.92	mg/m ³
Uncertainty corrected to std conds. (O ₂)		529.92	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	2.26	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	N/A	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	N/A	% at ELV
Result of Compliance with Uncertainty Requirement	N/A	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	N/A	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	N/A	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	N/A	% at ELV
Result of Compliance with Uncertainty Requirement	N/A	-

Requirement for SRM is that Uncertainty should be <15% of the value at the ELV, on a dry gas basis, or if O₂ correction is applied less than 15% + the uncertainty associated with the O₂ correction (using sqrt of sum squares to add uncertainty components).

VERSION HISTORY

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