Element, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL
Your Element Contact: Richard Carter (+44(0)7585 894 426)
E: richard.carter@element.com

Stack Emissions Testing Report Commissioned by
Duynie Ingredients

Installation Name & Address
Duynie Ingredients
Coed Abden Road
Wrexham Industrial Estate
Wrexham
LL13 9UH

Stack Reference
Boiler 1

Dates of the Monitoring Campaign
25th - 26th September 2025

Job Reference Number
EMT14377

Report Written by
Stephen Taylor Team Leader MCERTS Level 2 MM 23 1803 TE1 TE3 & TE4

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

Report Date
8th October 2025

Version
Version 1

Signature of Report Approver


CONTENTS

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

MONITORING OBJECTIVES

Duynie Ingredients , Wrexham
Boiler 1
25th - 26th September 2025

Overall Aim of the Monitoring Campaign

Element were commissioned by Duynie Ingredients to carry out stack emissions testing on the Boiler 1 at Wrexham.

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

Oxides of Nitrogen (as NO_2), Carbon Monoxide

MONITORING RESULTS

Duynie Ingredients , Wrexham
Boiler 1
25th - 26th September 2025

where MU = Measurement Uncertainty associated with the Result

					Concentration					Mass Emission		
Parameter					**Units**	**Result**	**MU +/-**	**Limit**	**Units**	**Result**	**MU +/-**	**Limit**
Oxides of Nitrogen (as NO_2)	[1]				mg/m³	75.2	4.8	-	g/hr	246	24.1	-
Carbon Monoxide	[1]				mg/m³	1.9	1.4	-	g/hr	6.1	4.5	-
Oxygen	% v/v	**Wet**	4.80		% v/v	**Dry** 5.6	0.30					
Water Vapour					% v/v	13.8	0.59					
Stack Gas Temperature					°C	123						
Stack Gas Velocity					m/s	3.8	0.22					
Volumetric Flow Rate (ACTUAL)					m³/hr	5224	391					
Volumetric Flow Rate (REF)	[1]				m³/hr	3270	245					

NOTE: VOLUMETRIC FLOW RATE & VELOCITY DATA TAKEN FROM THE PRELIMINARY VELOCITY TRAVERSE.

[1] Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content, 3% oxygen.

MONITORING DATE(S) & TIMES

Duynie Ingredients , Wrexham
Boiler 1
25th - 26th September 2025

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Oxides of Nitrogen (as NO_2)	R1	mg/m^3	75.2	g/hr	246	26/09/2025	12:12 - 13:12	60
Carbon Monoxide	R1	mg/m^3	1.9	g/hr	6.1	26/09/2025	12:12 - 13:12	60
Oxygen	R1	% v/v	4.8			26/09/2025	12:12 - 13:12	60
Water Vapour	R1	% v/v	13.8			26/09/2025	12:12 - 13:12	60
Velocity Traverse	R1					26/09/2025	11:58 - 12:08	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

Duynie Ingredients , Wrexham
Boiler 1
25th - 26th September 2025

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operating Capacity
Capacity (of 100%) and Tonnes / Hour	Variable On Demand
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Natural Gas
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	Natural Gas
Plume Appearance	None Visable

MONITORING & ANALYTICAL METHODS

Duynie Ingredients , Wrexham
Boiler 1
25th - 26th September 2025

	Monitoring				Analysis					
Parameter	**Standard**	**Technical Procedure**	**Sampling Status**	**Testing Lab**	**Analytical Procedure**	**Analytical Technique**	**Analysis Status**	**Analysis Lab**	**Overall Status**	**LOD (Average)**
Water Vapour	EN 14790	MD 005	MCERTS	EET	MD 005	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Oxides of Nitrogen (as NO_2)	EN 14792	MD 021	MCERTS	EET	Chemiluminescence by Horiba PG-250				MCERTS	0.41 mg/m³
Carbon Monoxide	EN 15058	MD 021	MCERTS	EET	NDIR by Horiba PG-250				MCERTS	1.96 mg/m³
Oxygen	EN 14789	MD 021	MCERTS	EET	Dry Zirconia Cell by Horiba PG-250				MCERTS	0.1 %
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	MD 041	MCERTS	EET	Pitot Tube and Thermocouple				MCERTS	1.2 m/s

ANALYSIS LABORATORIES

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

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

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Velocity & Vol. Flow Rate	All	Only one out of two required sampling lines was available, however the number of sample points used on the available line were increased to the minimum required by the Standard

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.70
Width	m	-
Area	m²	0.38
Port Depth	cm	8
Orientation of Duct	-	Vertical
Number of Ports	-	1
Sample Port Size	-	5" BSP

Location of Sampling Platform

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

Platform Details

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

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.

Sampling Plane Validation Criteria (from EN 15259)

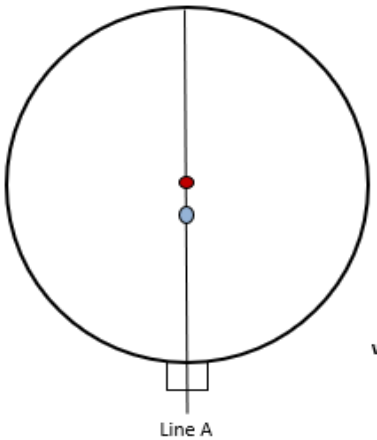
Criteria in EN 15259	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	8.6	> 5 Pa	Yes
Mean Velocity	m/s	3.77	-	-
Lowest Gas Velocity	m/s	3.70	-	-
Highest Gas Velocity	m/s	3.93	-	-
Ratio of Above	: 1	1.06	< 3 : 1	Yes
Maximum Angle of Swirl	°	7.00	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

PLANT PHOTOS

Photo 1

Photo 2

SAMPLE POINTS



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

APPENDIX CONTENTS

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Stephen Taylor	MCERTS Level 2	MM 23 1803	TE1 TE3 & TE4
Technician	Tom Dixon	MCERTS Level 1	MM 23 1802	TE1

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	**Equipment I.D.**
Control Box DGM (1)	-
Control Box DGM (2)	-
Box Thermocouples (1)	-
Box Thermocouples (2)	-
Umbilical (1)	-
Umbilical (2)	-
Oven Box (1)	-
Oven Box (2)	-
Heated Probe (1)	-
Heated Probe (2)	-
Heated Probe (3)	-
S-Pitot (1)	CAT 21S.71
S-Pitot (2)	-
L-Pitot	-
Site Balance	CAT 17.108
500g / 1Kg Check Weights	CAT 17.108
Last Impinger Arm	-
Callipers	-
Tubes Kit Thermocouple	-

Instrumental Analysers	
Equipment Type	**Equipment I.D.**
Horiba PG-250	CAT 9.29
Horiba PG-250	-
Servomex 4900	-
Eco Physics CLD 822Mh	-
ABB AO2020-URAS26	-
Testo 350 XL	-
JCT JCC P1 Cooler	CAT 4.0030
Gasmet DX4000	-
Gasmet Sampling System	-
Sick 3006	-
M&C PSS	CAT 12.174
Mass Flow Controller (1)	CAT 6.23
Mass Flow Controller (2)	CAT 6.24
Mass View (1)	CAT 25.94
Mass View (2)	CAT 25.121
Hioki 5043 (V)	-
Easylogger EN-EL-12 Bit	-
Bioaerosols Temperature Logger	-
Electronic Refrigerator	-

Miscellaneous Items	
Equipment Type	**Equipment I.D.**
Digital Manometer 500	CAT 3.265
Digital Manometer 10000	-
Digital Temperature Meter	-
Stopwatch	CAT 14.98
Barometer	CAT 13.62
Stack Thermocouple 0.5m	-
Stack Thermocouple 1.0m	-
Stack Thermocouple 1.5m	-
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	-
15m Heated Line (1)	-
20m Heated Line (1)	CAT 20.277
20m Heated Line (2)	-
Dual Channel Heater Controller	-
Single Channel Heater Controller	-
Laboratory Balance	
Tape Measure	CAT 16.58

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Water Vapour	EN 14790	MD 005
Oxides of Nitrogen (as NO_2)	EN 14792	MD 021
Carbon Monoxide	EN 15058	MD 021
Oxygen	EN 14789	MD 021
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	MD 041

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.70
Stack Width, W	m	-
Stack Area, A	m^2	0.38
Average Stack Gas Temperature, T_a	°C	123.2
Average Stack Gas Pressure	Pa	8.9
Average Stack Static Pressure, P_{static}	kPa	-0.033
Average Barometric Pressure, P_b	kPa	102.3
Average Pitot Tube Calibration Coefficient, C_p	-	0.84

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m^3 p	Conc kg/m^3 p_i
CO_2 (Estimated)	-	10.00	8.62	0.1000	44.01	1.9635	0.19635
O_2	-	5.57	4.80	0.0557	32.00	1.4277	0.07955
N_2	-	84.43	72.79	0.8443	28.01	1.2498	1.05522
Moisture (H_2O)	-	-	13.79	0.1379	18.02	0.8037	0.11082

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P_{STD}	kg/m^3	1.331
Wet Density (STP), P_{STW}	kg/m^3	1.258
Dry Density (Actual), P_{Actual}	kg/m^3	0.926
Average Wet Density (Actual), $P_{ActualW}$	kg/m^3	0.875

Where: P_{STD} = sum of component concentrations, kg/m^3 (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m^3 (including water vapour)

$P_{Actual} = P_{STD} \times (T_{STP} / (P_{STP})) \times ((P_{static} + P_b) / T_a)$

$P_{ActualW}$ (at each sampling point) $= P_{STW} \times (T_s / P_s) \times (P_a / T_a)$

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF [1]
Temperature	°C	123.2	0.0
Total Pressure	kPa	102.3	101.3
Moisture	%	13.79	13.79
Oxygen (Dry)	%	5.6	N/A
Oxygen (Wet)	%	4.8	3.0

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m^3/hr	5224
Gas Volumetric Flowrate (STP, Wet)	m^3/hr	3634
Gas Volumetric Flowrate (STP, Dry)	m^3/hr	3133
Gas Volumetric Flowrate REF [1]	m^3/hr	3270

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE TO EN 16911-1 (MID)

(1 of 1)

Parameter	Units	Value
Date of Survey	-	26/09/2025
Time of Survey	-	11:58 - 12:08
Atmospheric Pressure	kPa	102.3
Average Stack Static Pressure	Pa	-33
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with KIMO MP 210 (500Pa)	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C_p	-	0.84
Number of Lines Available	-	1
Number of Lines Used	-	1

Sampling Line A

Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m³	Velocity m/s	Swirl °
STATIC (Units: Pa)		*-32.7*				
Mean		**8.9**	**123.2**	**0.875**	**3.77**	
1	0.05	8.8	123.2	0.875	3.75	6.0
2	0.18	8.6	123.2	0.875	3.70	7.0
3	0.53	8.6	123.3	0.875	3.70	7.0
4	0.65	9.7	123.2	0.875	3.93	6.0

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE TO EN 16911-1 (MID) - MEASUREMENT UNCERTAINTY

(1 of 1)

Performance characteristics (Uncertainty Components)	Uncertainty	Value	Units
Standard Uncertainty on the coefficient of the Pitot Tube	u(k)	0.005	-
Standard Uncertainty associated with the mean local dynamic pressures	u(Δpi)	1.046	Pa
- Resolution	u(res)	0.00087	
- Calibration	u(cal)	0.008	
- Drift	u(drift)	0.083	
- Lack of Fit	u(fit)	0.002	
- Overall corrections to dynamic measurements	u(Cf)	0.094	
Standard uncertainty associated with the molar mass of the gas	u(M)	0.00008	-
- $\varphi O_2,w$	-	4.804	
- $\varphi CO_2,w$	-	8.621	
- Oxygen, dry	u(ϕO_2,d)	0.171	
- Carbon Dioxide, dry	u(ϕCO_2,d)	0.306	
- Water Vapour	u(ϕH_2O)	0.703	
- Oxygen, wet	u(ϕO_2,w)	0.152	
- Carbon Dioxide, wet	u(ϕCO_2,w)	0.273	
Standard uncertainty associated with the stack temperature	u(Tc)	2.022	K
Standard uncertainty associated with the absolute pressure in the duct	u(pc)	175.695	Pa
- Atmospheric Pressure	u(patm)	175.692	
- Static Pressure	u(pstat)	1.046	
Standard uncertainty associated with the density in the duct	u(ρ)	0.00537	-
Standard uncertainty associated with the local velocities	u(vi)	0.223	Pa
Standard uncertainty associated with the mean velocity	u(v)	0.115	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	Uc(v)	0.225	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	Uc,rel(v)	5.96	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	Uc(qV,w)	390.9	m^3/hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00146	
- $u^2(qV,w)$	-	39774	
- $u(qV,w)$	-	199.4	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	Uc,rel(qV,w)	7.48	%

WATER VAPOUR: RESULTS SUMMARY

Duynie Ingredients , Wrexham

Boiler 1

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	% v/v	13.8		13.8
Uncertainty	±% v/v	0.59		0.59

General Sampling Information

Parameter	Value
Standard	EN 14790
Technical Procedure	MD 005

WATER VAPOUR: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	12:12 - 13:12
Sampling Dates	-	26/09/2025
Sampling Device	-	MFC / MV
Duration	mins	60
Volume Sampled (STP, Dry)	m^3	0.1846
Volume Sampled (STP, Wet)	m^3	0.2142
Sample Flow Rate	l/min	2.98
Liquid Trap Start Mass	g	4042.5
Liquid Trap End Mass	g	4063.1
Silica Trap Start Mass	g	1451.4
Silica Trap End Mass	g	1454.5
Total Mass Of Water Vapour	g	23.7
Calculated Water Vapour	% v/v	13.79

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

WATER VAPOUR: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	3.0
Pre-Sampling Leak Rate	l/min	0.02
Post-Sampling Leak Rate	l/min	0.02
Allowable Leak Rate	l/min	0.06
Leak Test Acceptable	-	Yes

Water Droplets	Units	Run 1
Are Water Droplets Present	-	No

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

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

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

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

WATER VAPOUR: MEASUREMENT UNCERTAINTY CALCULATIONS

	Value			Standard uncertainty			
Measured Quantities	**Symbol**	**Run 1**		**Symbol**	**Units**	**Run 1**	
Sampled Volume (STP)	V_m	0.1846		uV_m	m^3	0.0037	
Repeatability of Weighing	R_w	23.70		uR_w	g	0.15	
Reading of Balance	R_b	23.70		uR_b	g	0.12	
Leak	L	0.67			%	-	

	Uncertainty as a Percentage			
Measured Quantities	**Units**	**Run 1**		**Requirement of Standard**
Sampled Volume (STP)	%	2.00		≤2%
Repeatability of Weighing	%	0.63		No Requirement
Reading of Balance	%	0.50		No Requirement
Leak	%	0.67		≤2%

	Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	**Symbol**	**Units**	**Run 1**		**Run 1**	
Sampled Volume (STP)	V_m	m^3	0.1846		74.67	
Repeatability of Weighing	R_w	g	23.70		0.58	
Reading of Balance	R_b	g	23.70		0.58	
Leak	L	% v/v	0.05		1.00	

	Uncertainty in Result		
Measured Quantities	**Units**	**Run 1**	
Sampled Volume (STP)	% v/v	0.276	
Repeatability of Weighing	% v/v	0.087	
Reading of Balance	% v/v	0.069	
Leak	% v/v	0.053	

Parameter	**Units**	**Run 1**
Combined uncertainty	% v/v	0.30
Expanded uncertainty (95% confidence)	% v/v	0.59
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.59
Uncertainty if Water Droplets are present	% v/v	N/A
Reported Uncertainty	% v/v	0.59
Expanded uncertainty (95% confidence)	%	4.3
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	4.3
Uncertainty if Water Droplets are present	%	N/A
Reported Uncertainty	%	4.3

OXIDES OF NITROGEN (as NO_2): RESULTS SUMMARY

Duynie Ingredients , Wrexham
Boiler 1

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	75.2		75.2
Uncertainty	±mg/m³	4.8		4.8
Mass Emission	g/hr	246		246
Uncertainty	±g/hr	24.1		24.1

General Sampling Information

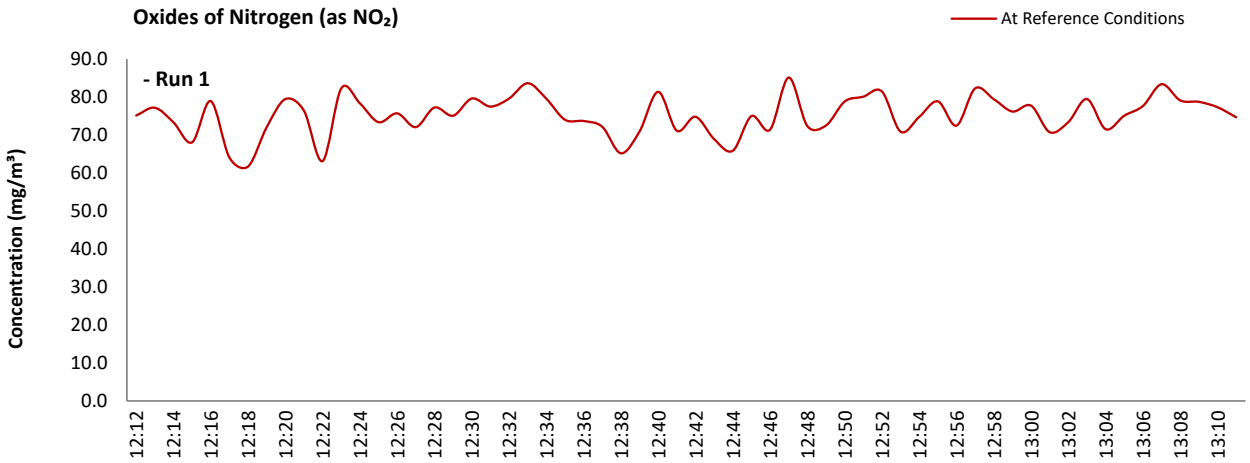
Parameter	Value	
Standard	EN 14792	
Technical Procedure	MD 021	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Date & Result of Last Converter Check	10/03/2025 - 95.8%	
Span Gas Type	Nitrogen Monoxide	
Span Gas Reference Number	12.0734	
Span Gas Expiry Date	07/04/2027	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (ppm)	401	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, without correction for water vapour content, 3% oxygen.

OXIDES OF NITROGEN (as NO_2): DATA TREND

Graphical Trend of Data



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

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:12 - 13:12
Sampling Dates	-	26/09/2025
Instrument Range	ppm	500
Span Gas Value	ppm	401.0

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.8
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	ppm	0.00
CAL 1	Zero at Analyser (Post)	ppm	-0.40
CAL 1	Zero Drift	ppm	-0.40
CAL 1	Zero Drift	%	0.10
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	ppm	401.00
CAL 1	Span at Analyser (Post)	ppm	401.40
CAL 1	Span Drift	ppm	0.40
CAL 1	Zero Adj. Span Drift	%	0.20
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	18 - 20

Method Deviations

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

OXIDES OF NITROGEN (as NO_2): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	-		mg/m³ (REF)
Allowable MU	10.0		%
Measured concentration	78.49		mg/m³ (STP, dry)
Ratio NO / NO_2	5		%
Range Used	500.0		ppm
Range Used [A]	1026.1		mg/m³
Cal gas conc.	401.0		ppm
Conversion	2.05		ppm to mg/m³
MCERTS Range [B]	125.0		mg/m³
Lower of [A] or [B]	125.0		mg/m³
Cal gas conc.	823.0		mg/m³

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.40		% full scale
Repeatability at span level	0.40		% full scale
Deviation from linearity	0.56		% of value
Zero drift	-0.10		% full scale
Span drift	0.20		% full scale
Volume or pressure flow dependence	0.40		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	0.18		% full scale/10K
Combined interference	0.60		% range
Dependence on voltage	0.40		% full scale/10V
Converter efficiency	95.8		%
Losses in the line (leak)	1.00		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.05		mg/m³
Lack of fit	0.40		mg/m³
Drift	-0.38		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.11		mg/m³
Ambient temperature dependence	0.03		mg/m³
Combined interference (from MCERTS Certificate)	0.43		mg/m³
Dependence on voltage	0.05		mg/m³
Converter efficiency	0.10		mg/m³
Losses in the line (leak)	0.45		mg/m³
Uncertainty of calibration gas blending	0.63		mg/m³
Uncertainty of calibration gas	0.91		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	78.49		mg/m³
Combined uncertainty			1.40		mg/m³
Expanded uncertainty	k =	1.96	2.74		mg/m³
Uncertainty corrected to std conds. (O_2)			3.20		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	3.49		% 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	6.36		% 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 <10% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 10% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

CARBON MONOXIDE: RESULTS SUMMARY

Duynie Ingredients , Wrexham
Boiler 1

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	1.9		1.9
Uncertainty	±mg/m³	1.4		1.4
Mass Emission	g/hr	6.1		6.1
Uncertainty	±g/hr	4.5		4.5

General Sampling Information

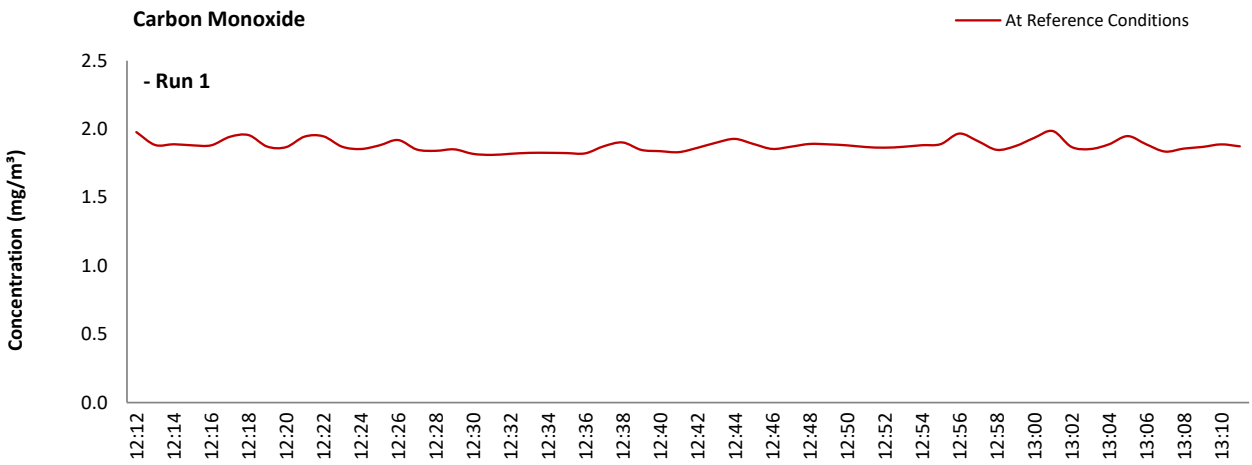
Parameter	Value	
Standard	EN 15058	
Technical Procedure	MD 021	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Carbon Monoxide	
Span Gas Reference Number	12.0734	
Span Gas Expiry Date	07/04/2027	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (ppm)	395.1	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, without correction for water vapour content, 3% oxygen.

CARBON MONOXIDE: DATA TREND

Graphical Trend of Data



CARBON MONOXIDE: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:12 - 13:12
Sampling Dates	-	26/09/2025
Instrument Range	ppm	500
Span Gas Value	ppm	395.1

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.8
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	ppm	0.00
CAL 1	Zero at Analyser (Post)	ppm	0.70
CAL 1	Zero Drift	ppm	0.70
CAL 1	Zero Drift	%	0.18
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	ppm	395.10
CAL 1	Span at Analyser (Post)	ppm	394.00
CAL 1	Span Drift	ppm	-1.10
CAL 1	Zero Adj. Span Drift	%	0.46
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	18 - 20

Method Deviations

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

CARBON MONOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	-		mg/m³ (REF)
Allowable MU	6.0		%
Measured concentration	1.96		mg/m³ (STP, dry)
Range Used	500.0		ppm
Range Used [A]	624.6		mg/m³
Cal gas conc.	395.1		ppm
Conversion	1.25		ppm to mg/m³
MCERTS Range [B]	95.0		mg/m³
Lower of [A] or [B]	95.0		mg/m³
Cal gas conc.	493.6		mg/m³

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.40		% full scale
Repeatability at span level	0.40		% full scale
Deviation from linearity	0.63		% of value
Zero drift	0.18		% full scale
Span drift	-0.46		% full scale
Volume or pressure flow dependence	0.40		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	0.05		% full scale/10K
Combined interference	0.73		% range
Dependence on voltage	0.40		% full scale/10V
Losses in the line (leak)	1.49		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.05		mg/m³
Lack of fit	0.35		mg/m³
Drift	0.50		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.08		mg/m³
Ambient temperature dependence	0.01		mg/m³
Combined interference (from MCERTS Certificate)	0.40		mg/m³
Dependence on voltage	0.05		mg/m³
Losses in the line (leak)	0.02		mg/m³
Uncertainty of calibration gas blending	0.02		mg/m³
Uncertainty of calibration gas	0.02		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	1.96		mg/m³
Combined uncertainty			0.73		mg/m³
Expanded uncertainty	k =	1.96	1.44		mg/m³
Uncertainty corrected to std conds. (O_2)			1.68		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	73.40		% 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	73.59		% 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 <6% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 6% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXYGEN: RESULTS SUMMARY

Duynie Ingredients , Wrexham
Boiler 1

Sample Runs

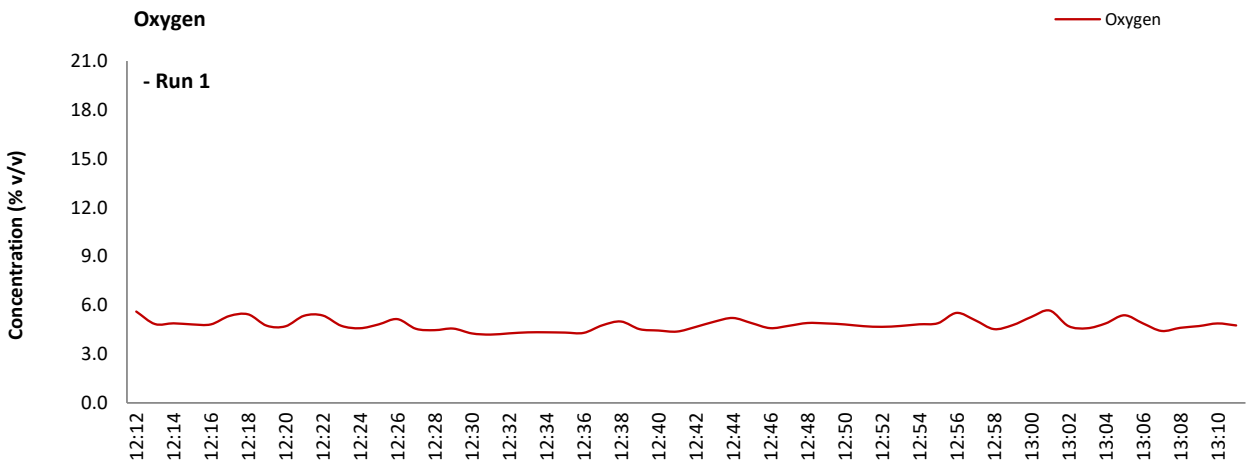
Parameter	Units	Run 1		Mean
Concentration	% v/v	4.8		4.8
Uncertainty	±% v/v	0.26		0.26

General Sampling Information

Parameter	Value	
Standard	EN 14789	
Technical Procedure	MD 021	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Synthetic Air (5 Grade)	
Span Gas Reference Number	11.0688	
Span Gas Expiry Date	31/01/2030	
Span Gas Start Pressure (bar)	180	
Gas Cylinder Concentration (% v/v)	21.53	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

OXYGEN: DATA TREND

Graphical Trend of Data



OXYGEN: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:12 - 13:12
Sampling Dates	-	26/09/2025
Instrument Range	% v/v	25.0
Span Gas Value	% v/v	5.0

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.8
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	% v/v	0.00
	Zero at Analyser (Post)	% v/v	0.03
	Zero Drift	% v/v	0.03
	Zero Drift	%	0.55
	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	% v/v	5.42
	Span at Analyser (Post)	% v/v	5.27
	Span Drift	% v/v	-0.15
	Zero Adj. Span Drift	%	3.60
	Drift Correction Applied	2-5%	Yes
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	18 - 20

Method Deviations

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

OXYGEN: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	N/A		%vol
Allowable MU	6.0		%
Measured concentration	4.80		%vol
Range Used	25.0		%vol
Cal gas conc.	21.5		%vol

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.04		% full scale
Repeatability at span level	0.04		% full scale
Deviation from linearity	0.05		% of value
Zero drift	0.55		% full scale
Span drift	0.00		% full scale
Volume or pressure flow dependence	0.20		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	-0.07		% full scale/10K
Combined interference	0.56		% range
Dependence on voltage	0.02		% full scale/10V
Losses in the line (leak)	1.60		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		%vol
Standard deviation of repeatability at span level	0.01		%vol
Lack of fit	0.01		%vol
Drift	0.07		%vol
Volume or pressure flow dependence	0.00		%vol
Atmospheric pressure dependence	0.02		%vol
Ambient temperature dependence	-0.01		%vol
Combined interference (from MCERTS Certificate)	0.08		%vol
Dependence on voltage	0.00		%vol
Losses in the line (leak)	0.04		%vol
Uncertainty of calibration gas	0.06		%vol

			RUN 1		Units
Measurement uncertainty		**Result**	4.80		%vol
Combined uncertainty			0.13		%vol
Expanded uncertainty	k =	1.96	0.26		%vol

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	5.31		% of Value
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

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

VERSION HISTORY

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