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Stack Emissions Testing Report Commissioned by
Duynie Ingredients

Installation Name & Address

Duynie Ingredients
Coed Abden Road
Wrexham Industrial Estate
Wrexham
LL13 9UH

Stack Reference

Dryer Stack

Dates of the Monitoring Campaign

25th - 26th September 2025

Job Reference Number

EMT14377

Report Written by

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8th October 2025

Version

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Signature of Report Approver



TITLE PAGE

CONTENTS

EXECUTIVE SUMMARY

Monitoring Objectives	3
Monitoring Results	4
Monitoring Dates & Times	5
Process Details	6
Monitoring & Analytical Methods	7
Summary of Sampling Deviations	7
Sampling Location	8
Plant Photos / Sample Points	9

APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

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Executive Summary

(Page 1 of 7)

MONITORING OBJECTIVES

Duynie Ingredients , Wrexham
Dryer Stack
25th - 26th September 2025

Overall Aim of the Monitoring Campaign

Element were commissioned by Duynie Ingredients to carry out stack emissions testing on the Dryer Stack 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

Total Particulate Matter, Hydrogen Chloride

Executive Summary
(Page 2 of 7)

MONITORING RESULTS

Duynie Ingredients , Wrexham
Dryer Stack
25th - 26th September 2025

where MU = Measurement Uncertainty associated with the Result

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter ¹	mg/m ³	14.5	0.85	-	g/hr	230	17.6	-
Hydrogen Chloride ¹	mg/m ³	0.04	0.0019	-	g/hr	0.57	0.04	-
Water Vapour	% v/v	4.6	0.24					
Stack Gas Temperature	°C	33.3						
Stack Gas Velocity	m/s	11.4	0.22					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	17601	865					
Volumetric Flow Rate (REF) ¹	m ³ /hr	15924	782					

NOTE: VOLUMETRIC FLOW RATE & VELOCITY DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

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

Executive Summary

(Page 3 of 7)

MONITORING DATE(S) & TIMES

Duynie Ingredients , Wrexham

Dryer Stack

25th - 26th September 2025

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m ³	14.5	g/hr	230	25/09/2025	12:59 - 13:29, 13:31 - 14:01	60
Hydrogen Chloride	R1	mg/m ³	0.04	g/hr	0.57	25/09/2025	12:59 - 13:29, 13:31 - 14:01	60
Velocity Traverse	R1					25/09/2025	12:15 - 12:25	

All results are expressed at the respective reference conditions.

Executive Summary
(Page 4 of 7)

PROCESS DETAILS

Duynie Ingredients , Wrexham
Dryer Stack
25th - 26th September 2025

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operating Conditions
Capacity (of 100%) and Tonnes / Hour	Normal Operation
Continuous or Batch Process	Conitnuous
Feedstock (if applicable)	N/A
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	Steam
Plume Appearance	Steam Plume off process visable

Executive Summary

(Page 5 of 7)

MONITORING & ANALYTICAL METHODS

Duynie Ingredients , Wrexham

Dryer Stack

25th - 26th September 2025

Parameter	Monitoring				Analysis				Overall Status	LOD (Average)
	Standard	Technical Procedure	Sampling Status	Testing Lab	Analytical Procedure	Analytical Technique	Analysis Status	Analysis Lab		
Total Particulate Matter	EN 13284-1	MD 001	MCERTS	EET	MD 103	Gravimetric	MCERTS	EET	MCERTS	0.22 mg/m ³
Hydrogen Chloride	EN 1911	MD 011	MCERTS	EET	MD 101	IC	MCERTS	EET	MCERTS	0.023 mg/m ³
Water Vapour	EN 14790	MD 005	MCERTS	EET	MD 005	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
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
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SUMMARY OF SAMPLING DEVIATIONS

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

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.74
Width	m	-
Area	m ²	0.43
Port Depth	cm	9
Orientation of Duct	-	Vertical
Number of Ports	-	2
Sample Port Size	-	4" BSP

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	MEWP
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	No
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.

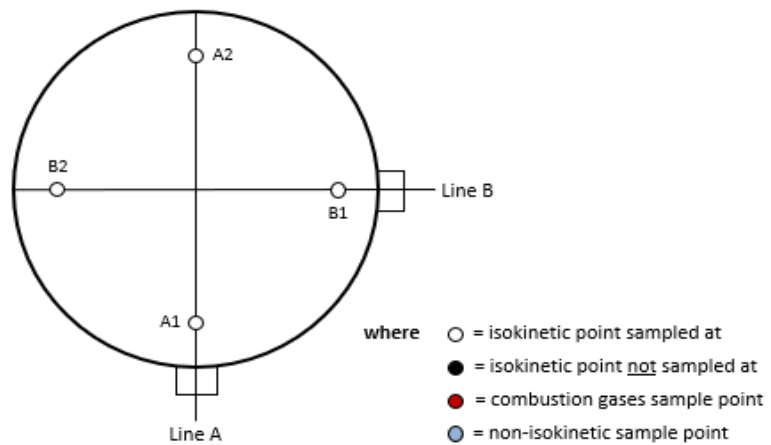
Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	26.0	> 5 Pa	Yes
Mean Velocity	m/s	10.38	-	-
Lowest Gas Velocity	m/s	5.61	-	-
Highest Gas Velocity	m/s	12.25	-	-
Ratio of Above	: 1	2.18	< 3 : 1	Yes
Maximum Angle of Swirl	°	7.00	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

PLANT PHOTOS



SAMPLE POINTS





APPENDICES

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	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		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM (1)	CAT 7.95	Horiba PG-250	-	Digital Manometer 500	CAT 3.265
Control Box DGM (2)	-	Horiba PG-250	-	Digital Manometer 10000	-
Box Thermocouples (1)	CAT 3.31	Servomex 4900	-	Digital Temperature Meter	-
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	CAT 14.98
Umbilical (1)	CAT 3.31	ABB AO2020-URAS26	-	Barometer	CAT 13.62
Umbilical (2)	-	Testo 350 XL	-	Stack Thermocouple 0.5m	-
Oven Box (1)	CAT 12.36	JCT JCC P1 Cooler	-	Stack Thermocouple 1.0m	CAT A009182
Oven Box (2)	-	Gasmet DX4000	-	Stack Thermocouple 1.5m	-
Heated Probe 0.5m	-	Gasmet Sampling System	-	1m Heated Line (1)	-
Heated Probe 1.0m	CAT 5.64	Sick 3006	-	1m Heated Line (2)	-
Heated Probe 1.5m	-	M&C PSS	-	1m Heated Line (3)	-
S-Pitot (1) -	CAT 21P.134	Mass Flow Controller (1)	-	5m Heated Line (1)	-
S-Pitot (2) -	CAT 21S.71	Mass Flow Controller (2)	-	15m Heated Line (1)	-
L-Pitot - Coef. 993 (4.1931)	-	Mass View (1)	-	20m Heated Line (1)	-
Site Balance	CAT 17.108	Mass View (2)	-	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.108	Hioki 5043 (V)	-	Dual Channel Heater Controller	-
Last Impinger Arm	-	Easylogger EN-EL-12 Bit	-	Single Channel Heater Controller	-
Callipers	CAT 23.53	Bioaerosols Temperature Logger	-	Laboratory Balance	CAT 1.18, 1.18a, 1.18b
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.58

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	EN 13284-1	MD 001
Hydrogen Chloride	EN 1911	MD 011
Water Vapour	EN 14790	MD 005
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	0.74
Stack Width, W	m	-
Stack Area, A	m ²	0.43
Average Stack Gas Temperature, T _a	°C	31.0
Average Stack Gas Pressure	Pa	95.3
Average Stack Static Pressure, P _{static}	kPa	-0.064
Average Barometric Pressure, P _b	kPa	102.9
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)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	19.84	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	75.48	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	4.62	0.0462	18.02	0.8037	0.03713

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	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.265
Dry Density (Actual), P _{Actual}	kg/m ³	1.174
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.153

Where: P_{STD} = sum of component concentrations, kg/m³ (not including water vapour)
 P_{STW} = sum of all wet concentrations / 100 x density, kg/m³ (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) = $P_{STW} \times (T_c / P_s) \times (P_a / T_a)$

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	31.0	0.0
Total Pressure	kPa	102.8	101.3
Moisture	%	4.62	4.62

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	16065
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	14646
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	13969
Gas Volumetric Flowrate REF ¹	m ³ /hr	14646

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

(1 of 1)

Parameter	Units	Value
Date of Survey	-	25/09/2025
Time of Survey	-	12:15 - 12:25
Atmospheric Pressure	kPa	102.9
Average Stack Static Pressure	Pa	-64
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	-	2
Number of Lines Used	-	2

Traverse Point	Depth m	ΔP Pa	Sampling Line A				Sampling Line B				
			Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °
<i>STATIC (Units: Pa)</i>		-63.0					-65.0				
Mean		115.5	31.0	1.153	11.82		75.0	31.0	1.153	8.93	
1	0.11	117.0	31.0	1.153	11.90	6.0	124.0	31.0	1.153	12.25	6.0
2	0.63	114.0	31.0	1.153	11.75	7.0	26.0	31.0	1.153	5.61	7.0

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	$u(\Delta p_i)$	1.891	Pa
- Resolution	$u(\text{res})$	0.00087	
- Calibration	$u(\text{cal})$	0.945	
- Drift	$u(\text{drift})$	0.083	
- Lack of Fit	$u(\text{fit})$	1.547	
- Overall corrections to dynamic measurements	$u(C_f)$	2.576	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00003	-
- $\varphi_{O_2,w}$	-	19.839	
- $\varphi_{CO_2,w}$	-	0.057	
- Oxygen, dry	$u(\phi_{O_2,d})$	0.637	
- Carbon Dioxide, dry	$u(\phi_{CO_2,d})$	0.002	
- Water Vapour	$u(\phi_{H_2O})$	0.236	
- Oxygen, wet	$u(\phi_{O_2,w})$	0.609	
- Carbon Dioxide, wet	$u(\phi_{CO_2,w})$	0.002	
Standard uncertainty associated with the stack temperature	$u(T_c)$	1.551	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.697	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	1.337	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00636	-
Standard uncertainty associated with the local velocities	$u(v_i)$	0.150	Pa
Standard uncertainty associated with the mean velocity	$u(\bar{v})$	0.101	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	0.198	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	1.91	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV,w)$	789.4	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00063	
- $u^2(qV,w)$	-	162229	
- $u(qV,w)$	-	402.8	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV,w)$	4.91	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

Duynie Ingredients , Wrexham
Dryer Stack

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	14.5	14.5
Uncertainty	±mg/m ³	0.85	0.85
Mass Emission	g/hr	230	230
Uncertainty	±g/hr	17.6	17.6

Parameter	Units	Run 1	Mean
Water Vapour	% v/v	4.6	4.6
Uncertainty	±% v/v	0.24	0.24

Blank Runs

Parameter	Units	Blank 1	Maximum
Concentration	mg/m ³	0.22	0.22

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value	
Standard	EN 13284-1	
Technical Procedure	MD 001	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	Out Stack	
Filter Size and Material	47mm Quartz Fibre	
Number of Sampling Lines Used	2 / 2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	4 / 4	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1, A2, B1, B2	

Reference Conditions

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

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P _b	mmHg	771.8	
Stack static pressure, P _{static}	mmH ₂ O	-6.4	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	771.3	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	29.6	
Total mass collected in impingers (silica trap)	g	9.2	
Total mass of liquid collected, V _{lc}	g	38.8	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0483	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V _m	m ³	1.0171	
Gas meter correction factor, Y _d	-	1.0500	
Average dry gas meter temperature, T _m	°C	24.6	
Average pressure drop across orifice, ΔH	mmH ₂ O	32.9	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.9981	
Moisture content, B_{w0} & R_{wv}			
$B_{w0} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0462	
B _{w0} as a percentage	% v/v	4.62	
Reported Water Vapour, checked with Tables in EN 14790, R _{wv}	% v/v	4.62	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.0464	
Volume of gas metered at Oxygen Reference Conditions, V_{mstd@X%O₂} & V_{mstw@X%O₂}			
IED & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet (O _{2REFw}) = (21 - REF%O ₂) / (21 - ACT%O _{2w})	-	N/A	
O ₂ Reference Factor dry (O _{2REFd}) = (21 - REF%O ₂) / (21 - ACT%O _{2d})	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.34	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K _p	-	34.97	
Velocity pressure coefficient, C _p	-	0.85	
Average of velocity heads, ΔP _{avg}	mmH ₂ O	10.39	
Average square root of velocity heads, √ΔP	√mmH ₂ O	3.22	
Average stack gas temperature, T _s	°C	33.3	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (V(M_s)(P_s))$	m/s	11.37	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO₂}), Dry@O_{2REF} (Q_{stdO₂})			
Area of stack, A _s	m ²	0.43	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	293.4	
Conversion factor (K/mm.Hg), C _f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	265.4	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	253.1	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273) / (O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D _n	mm	6.01	
Nozzle area, A _n	mm ²	28.40	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	99.5	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	12:59 - 13:29, 13:31 - 14:01
Sampling Dates	-	25/09/2025
Sampling Device	-	ISO
Volume Sampled (REF)	m ³	1.0464
Filter I.D. Number	-	47-109437
Start Filter Mass	g	0.14738
End Filter Mass	g	0.14715
Total Mass on Filter	g	-0.00023
Probe Rinse I.D. Number	-	PR-47-109437
Start Probe Rinse Mass	g	2.88008
End Probe Rinse Mass	g	2.89544
Total Mass in Probe Rinse	g	0.01536
Total Mass Collected	mg	15.12
Calculated Concentration	mg/m ³	14.45
Balance Uncertainty / LOD	mg/m ³	0.22

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	25/09/2025
Average Volume Sampled (REF)	m ³	1.0464
Filter I.D. Number	-	47-109685
Start Filter Mass	g	0.14663
End Filter Mass	g	0.14655
Total Mass on Filter	g	-0.00008
Probe Rinse I.D. Number	-	PR-47-109685
Start Probe Rinse Mass	g	2.91771
End Probe Rinse Mass	g	2.91768
Total Mass in Probe Rinse	g	-0.00003
Total Mass Collected	mg	-0.11
Calculated Concentration	mg/m ³	-0.11
Balance Uncertainty / LOD	mg/m ³	0.22

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	17.8
Pre-Sampling Leak Rate	l/min	0.25
Post-Sampling Leak Rate	l/min	
Allowable Leak Rate	l/min	0.40
Leak Test Acceptable	-	Yes

Water Droplets	Units	Run 1
Are Water Droplets Present	-	No

MU (Concurrent Water Vapour)	Units	Run 1
Measurement Uncertainty (MU)	%	5.1
Allowable MU	%	20.0
MU Acceptable	%	Yes

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

Isokinetic Criterion Compliance	Units	Run 1
Isokinetic Variation	%	99.5
Allowable Isokinetic Range	%	95 - 115
Isokineticity Acceptable	-	Yes

Weighing Uncertainty Criteria	Units	Run 1
Overall Weighing Uncertainty	± mg	0.33
Overall Weighing Uncertainty	± mg/m ³	0.31
ELV [Daily ELV for IED]	mg/m ³	N/A
Allowable Weighing Uncertainty	mg/m ³	N/A
Weighing Uncertainty Acceptable	-	N/A

Filter Temperatures	Units	Run 1
Pre-Conditioning Temperature	°C	180
Post-Conditioning Temperature	°C	160
Maximum Filter Temperature	°C	120

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	20.0
Pre-Sampling Leak Rate	l/min	0.24
Post-Sampling Leak Rate	l/min	
Allowable Leak Rate	l/min	0.40
Leak Test Acceptable	-	Yes

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

Acetone / Water Rinse Blank	Units	Blank
Acetone / Water Rinse Value	mg/l	2.7
Allowable Blank	mg/l	10
Blank Acceptable	-	Yes

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

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value		Standard uncertainty		
	Symbol	Run 1	Symbol	Units	Run 1
Sampled Volume (Actual)	V _m	1.0171	uV _m	m ³	0.0203
Sampled Gas Temperature	T _m	297.6	uT _m	K	2.00
Sampled Gas Pressure	p _m	102.8	up _m	kPa	0.50
Sampled Gas Humidity	H _m	0.00	uH _m	% v/v	1.00
Leak	L	1.40	uL	%	-
Mass of Particulate	m	15.12	um	mg	0.23
Uncollected Mass	UCM	-0.11	uUCM	mg	-

Measured Quantities	Uncertainty as a Percentage		Requirement of Standard
	Units	Run 1	
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.67	≤1%
Sampled Gas Pressure	%	0.49	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	1.40	≤2%
Mass of Particulate	%	-	-
Uncollected Mass	%	-	-

Measured Quantities	Uncertainty in Measurement Units			Sensitivity Coefficient	
	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	0.9981	14.48	
Leak	L	mg/m ³	0.117	1.00	
Mass of Particulate	L _r	mg	15.123	0.96	
Uncollected Mass	UCM	mg	-0.06	0.96	

Measured Quantities	Uncertainty in Result	
	Units	Run 1
Sampled Volume (STP)	mg/m ³	0.349
Leak	mg/m ³	0.1172
Mass of Particulate	mg/m ³	0.2198
Uncollected Mass	mg/m ³	-0.0607

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	0.43
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.85
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.85
Reported Uncertainty	mg/m ³	0.85
Expanded uncertainty (95% confidence), without Oxygen Correction	%	5.9
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	5.9
Reported Uncertainty	%	5.9
Reported Uncertainty as % of ELV	%	N/A

HYDROGEN CHLORIDE: RESULTS SUMMARY

Duynie Ingredients , Wrexham
Dryer Stack

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	0.04	0.04
Uncertainty	±mg/m ³	0.0019	0.0019
Mass Emission	g/hr	0.57	0.57
Uncertainty	±g/hr	0.04	0.04

Parameter	Units	Run 1	Mean
Water Vapour	% v/v	4.6	4.6
Uncertainty	±% v/v	0.24	0.24

Blank Runs

Parameter	Units	Blank 1	Maximum
Concentration	mg/m ³	< 0.01	< 0.01

General Sampling Information

Parameter	Value
Standard	EN 1911
Technical Procedure	MD 011
Name of Analytical Laboratory	EET
Analytical Laboratory's Procedure	MD 101
ISO 17025 Accredited Analysis?	MCERTS
Date of Sample Analysis	01/10/2025
Probe Material	Titanium
Filter Housing Material	Titanium
Impinger Material	Polyethylene
Absorption Solution	HPLC Grade Water
Positioning of Filter	Out Stack
Filter Size and Material	47mm Quartz Fibre
Number of Sampling Lines Used	2 / 2
Number of Sampling Points Used	4 / 4
Sample Point I.D.'s	A1, A2, B1, B2

FORMAT: Number Used / Number Required

Reference Conditions

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

HYDROGEN CHLORIDE: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P _b	mmHg	771.8	
Stack static pressure, P _{static}	mmH ₂ O	-6.4	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	771.3	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	29.6	
Total mass collected in impingers (silica trap)	g	9.2	
Total mass of liquid collected, V _{lc}	g	38.8	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0483	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V _m	m ³	1.0171	
Gas meter correction factor, Y _d	-	1.0500	
Average dry gas meter temperature, T _m	°C	24.6	
Average pressure drop across orifice, ΔH	mmH ₂ O	32.9	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.9981	
Moisture content, B_{w0} & R_{wv}			
$B_{w0} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0462	
B _{w0} as a percentage	% v/v	4.62	
Reported Water Vapour, checked with Tables in EN 14790, R _{wv}	% v/v	4.62	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.0464	
Volume of gas metered at Oxygen Reference Conditions, V_{mstd@X%O₂} & V_{mstw@X%O₂}			
IED & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet (O _{2REFw}) = (21 - REF%O ₂) / (21 - ACT%O _{2w})	-	N/A	
O ₂ Reference Factor dry (O _{2REFd}) = (21 - REF%O ₂) / (21 - ACT%O _{2d})	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.34	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K _p	-	34.97	
Velocity pressure coefficient, C _p	-	0.85	
Average of velocity heads, ΔP _{avg}	mmH ₂ O	10.39	
Average square root of velocity heads, √ΔP	√mmH ₂ O	3.22	
Average stack gas temperature, T _s	°C	33.3	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (V(M_s)(P_s))$	m/s	11.37	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO₂}), Dry@O_{2REF} (Q_{stdO₂})			
Area of stack, A _s	m ²	0.43	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	293.4	
Conversion factor (K/mm.Hg), C _f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	265.4	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	253.1	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273) / (O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D _n	mm	6.01	
Nozzle area, A _n	mm ²	28.40	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	99.5	

HYDROGEN CHLORIDE: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	12:59 - 13:29, 13:31 - 14:01
Sampling Dates	-	25/09/2025
Sampling Device	-	ISO
Volume Sampled (REF)	m ³	1.0464
Laboratory Result for Front Impingers	µg/ml	0.09
Laboratory Result for Back Impinger	µg/ml	< 0.05
Volume in Front Impingers	ml	338.4
Volume in Back Impinger	ml	143.3
Mass in Front Impingers	µg	30.5
Mass in Back Impinger	µg	< 7.2
Total Mass Collected	µg	37.6
Calculated Concentration	mg/m ³	0.04

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	25/09/2025
Average Volume Sampled (REF)	m ³	1.0464
Laboratory Result for Impingers	µg/ml	< 0.05
Volume in Impingers	ml	306.0
Total Mass Collected	µg	< 15.3
Calculated Concentration	mg/m ³	< 0.01

HYDROGEN CHLORIDE: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	17.8
Pre-Sampling Leak Rate	l/min	0.25
Post-Sampling Leak Rate	l/min	N/A
Allowable Leak Rate	l/min	0.40
Leak Test Acceptable	-	Yes

Absorption Efficiency	Units	Run 1
Absorption Efficiency	%	100.0
Allowable Absorption Efficiency	%	N/A ¹
Absorption Efficiency Acceptable	-	Yes ¹

¹ The concentration in the last absorber was less than 5 times the analytical detection limit.

Water Droplets	Units	Run 1
Are Water Droplets Present	-	No

MU (Concurrent Water Vapour)	Units	Run 1
Measurement Uncertainty (MU)	%	5.1
Allowable MU	%	20.0
MU Acceptable	%	Yes

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

Isokinetic Criterion Compliance	Units	Run 1
Isokinetic Variation	%	99.5
Allowable Isokinetic Range	%	95 - 115
Isokineticity Acceptable	-	Yes

Filter Temperatures	Units	Run 1
Maximum Filter Temperature	°C	120

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

HYDROGEN CHLORIDE: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	20.0
Pre-Sampling Leak Rate	l/min	0.24
Post-Sampling Leak Rate	l/min	
Allowable Leak Rate	l/min	0.40
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 CHLORIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value		Standard uncertainty		
	Symbol	Run 1	Symbol	Units	Run 1
Sampled Volume (Actual)	V _m	1.0171	uV _m	m ³	0.0203
Sampled Gas Temperature	T _m	297.6	uT _m	K	2.00
Sampled Gas Pressure	p _m	102.8	up _m	kPa	0.50
Sampled Gas Humidity	H _m	0.00	uH _m	% v/v	1.00
Leak	L	1.40	uL	%	-
Laboratory Result	L _r	1.05	uL _r	%	-

Measured Quantities	Uncertainty as a Percentage		Requirement of Standard
	Units	Run 1	
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.67	≤1%
Sampled Gas Pressure	%	0.49	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	1.40	≤2%
Laboratory Result	%	1.05	No Requirement

Measured Quantities	Uncertainty in Measurement Units			Sensitivity Coefficient	
	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	0.9981	0.04	
Leak	L	mg/m ³	0.0003	1.00	
Laboratory Result	L _r	mg/m ³	0.0004	1.00	

Measured Quantities	Uncertainty in Result	
	Units	Run 1
Sampled Volume (STP)	mg/m ³	0.001
Leak	mg/m ³	0.0003
Laboratory Result	mg/m ³	0.0004

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	0.001
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.002
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.002
Reported Uncertainty	mg/m ³	0.002
Expanded uncertainty (95% confidence), without Oxygen Correction	%	5.4
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	5.4
Reported Uncertainty	%	5.4
Reported Uncertainty as % of ELV	%	N/A

VERSION HISTORY

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