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Stack Emissions Testing Report Commissioned by
Blazers Fuels Ltd

Installation Name & Address

North West Biomass
Kinmel Bay
Tir Llwyd Industrial Estate
Rhyl
North Wales
LL18 5JA

Stack Reference

Biomass CHP Plant Exhaust

Dates of the Monitoring Campaign

23rd April 2021

Job Reference Number

EMT-00712

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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

North West Biomass, Kinnel Bay

Biomass CHP Plant Exhaust

23rd April 2021

Overall Aim of the Monitoring Campaign

Element were commissioned by Blazers Fuels Ltd to carry out stack emissions testing for North West Biomass on the Biomass CHP Plant Exhaust at Kinnel Bay.

The aim of the monitoring campaign was to perform testing, as requested by the customer, for a number of prescribed pollutants..

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon), Oxides of Nitrogen (as NO₂), Carbon Monoxide

MONITORING RESULTS

North West Biomass, Kinnel Bay
Biomass CHP Plant Exhaust
23rd April 2021

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	1.3	0.24	50.0	g/hr	19.4	3.8	-
Total VOCs (as Carbon) ¹	mg/m ³	5.4	0.46	30.0	g/hr	83.0	8.1	-
Oxides of Nitrogen (as NO ₂) ¹	mg/m ³	107	4.7	475	g/hr	1636	107	-
Carbon Monoxide ¹	mg/m ³	0.23	1.07	225	g/hr	3.6	16.4	-
Oxygen	% v/v	Dry 9.8	0.32					
Water Vapour	% v/v	13.1	0.7					
Stack Gas Temperature	°C	164						
Stack Gas Velocity	m/s	11.6	0.20					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	25409	1231					
Volumetric Flow Rate (REF)	m ³ /hr	15323	742					

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

¹ Reference Conditions (REF) are: 273K, 101.3kPa, dry gas, 11% oxygen.

Executive Summary

(Page 3 of 7)

MONITORING DATE(S) & TIMES

North West Biomass, Kinnel Bay

Biomass CHP Plant Exhaust

23rd April 2021

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m ³	1.3	g/hr	19.4	23/04/21	13:44 - 14:14, 14:15 - 14:45	60
Total VOCs (as Carbon)	R1	mg/m ³	5.4	g/hr	83.0	23/04/2021	13:44 - 14:44	60
Oxides of Nitrogen (as NO ₂)	R1	mg/m ³	107	g/hr	1636	23/04/2021	13:44 - 14:44	60
Carbon Monoxide	R1	mg/m ³	0.2	g/hr	3.6	23/04/2021	13:44 - 14:44	60
Oxygen	R1	% v/v	9.8			23/04/2021	13:44 - 14:44	60
Velocity Traverse	R1					23/04/2021	13:10 - 13:25	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

North West Biomass, Kinmel Bay
Biomass CHP Plant Exhaust
23rd April 2021

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operation
Capacity (of 100%) and Tonnes / Hour	Standard Operating Capacity
Continuous or Batch Process	Continuous
Feedstock (if applicable)	N/A
Abatement System	Bag Filter & Cyclone
Abatement System Running Status	On
Fuel	Virgin wood-chip and Untreated waste wood
Plume Appearance	Not visible from the sampling location

MONITORING & ANALYTICAL METHODS

North West Biomass, Kinnel Bay
Biomass CHP Plant Exhaust
23rd April 2021

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	CAT-TP-01	MCERTS	EET	CAT-TP-03	Gravimetric	MCERTS	EET	MCERTS	0.1 mg/m ³
Water Vapour	EN 14790	CAT-TP-05	MCERTS	EET	CAT-TP-05	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	MCERTS	EET	Flame Ionisation Detection by Sick 3006 FID				MCERTS	0.32 mg/m ³
Oxides of Nitrogen (as NO ₂)	EN 14792	CAT-TP-21	MCERTS	EET	Chemiluminescence by Horiba PG-250				MCERTS	0.41 mg/m ³
Carbon Monoxide	EN 15058	CAT-TP-21	MCERTS	EET	NDIR by Horiba PG-250				MCERTS	0.25 mg/m ³
Oxygen	EN 14789	CAT-TP-21	MCERTS	EET	Dry Zirconia Cell by Horiba PG-250				MCERTS	0.1 %
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	MCERTS	EET	Pitot Tube and Thermocouple				MCERTS	1.2 m/s

ANALYSIS LABORATORIES

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

Element Materials Technology (EET)	ISO 17025 Accreditation Number: 4279
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SUMMARY OF SAMPLING DEVIATIONS

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

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.88
Width	m	-
Area	m ²	0.61
Port Depth	cm	34
Orientation of Duct	-	Vertical
Number of Ports	-	2
Sample Port Size	-	5" Flange

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	Permanent
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)	Yes
Platform has vertical base boards (approx. 0.25m high)	Yes
Platform has chains / self closing gates at top of ladders	Yes
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.

Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	56.0	> 5 Pa	Yes
Mean Velocity	m/s	10.21	-	-
Lowest Gas Velocity	m/s	9.90	-	-
Highest Gas Velocity	m/s	10.59	-	-
Ratio of Above	: 1	1.07	< 3 : 1	Yes
Maximum Angle of Swirl	°	6.00	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

PLANT PHOTOS

Photo 1

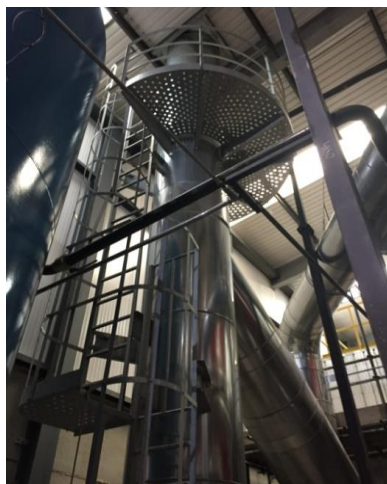
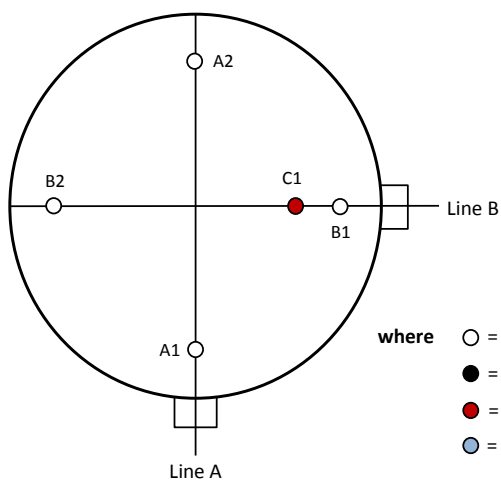


Photo 2



SAMPLE POINTS



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	Danny Pryke	MCERTS Level 2	MM 03 163	TE1 TE2 TE3 TE4
Trainee	Afraz Rajah	MCERTS Trainee	MM 21 1620	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)	CAT 7.62	Horiba PG-350E	CAT 39.3	Digital Manometer (1)	CAT 3.119
Control Box DGM (2)	-	Horiba PG-250	-	Digital Manometer (2)	-
Box Thermocouples (1)	CAT 3.132	Servomex 4900	-	Digital Temperature Meter	CAT 3.119
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	CAT 14.53
Umbilical (1)	CAT 3.132	ABB AO2020-URAS26	-	Barometer	CAT 13.38
Umbilical (2)	-	Testo 350 XL	-	Stack Thermocouple (1)	CAT 4.1043
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)	-
Heated Probe (2)	CAT 5.123	Bernath 3006 FID	-	1m Heated Line (2)	-
Heated Probe (3)	-	M&C PSS	CAT 11.87	1m Heated Line (3)	-
S-Pitot (1)	CAT 21P.134	Mass Flow Controller (1)	CAT 6.48	5m Heated Line (1)	-
S-Pitot (2)	-	Mass Flow Controller (2)	CAT 6.49	15m Heated Line (1)	-
L-Pitot	-	Mass View (1)	-	20m Heated Line (1)	CAT 20.180
Site Balance	CAT 17.26	Mass View (2)	-	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.26	Hioki 5043 (V)	-	Dual Channel Heater Controller	-
Last Impinger Arm	-	Hioki 5043 (V)	-	Single Channel Heater Controller	-
Callipers	CAT 23.27	Bioaerosols Temperature Logger	-	Laboratory Balance	CAT 1.18, 1.18a, 1.18b
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.34

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	EN 13284-1	CAT-TP-01
Water Vapour	EN 14790	CAT-TP-05
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20
Oxides of Nitrogen (as NO ₂)	EN 14792	CAT-TP-21
Carbon Monoxide	EN 15058	CAT-TP-21
Oxygen	EN 14789	CAT-TP-21
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.88
Stack Width, W	m	-
Stack Area, A	m ²	0.61
Average Stack Gas Temperature, T _a	°C	145.9
Average Stack Gas Pressure	Pa	59.5
Average Stack Static Pressure, P _{static}	kPa	0.043
Average Barometric Pressure, P _b	kPa	100.3
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

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)	-	3.00	2.61	0.0300	44.01	1.9635	0.05891
O ₂	-	9.77	8.49	0.0977	32.00	1.4277	0.13949
N ₂	-	87.23	75.81	0.8723	28.01	1.2498	1.09023
Moisture (H ₂ O)	-	-	13.09	0.1309	18.02	0.8037	0.10525

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	1.289
Wet Density (STP), P _{STW}	kg/m ³	1.225
Dry Density (Actual), P _{Actual}	kg/m ³	0.832
Average Wet Density (Actual), P _{ActualW}	kg/m ³	0.791

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) = $P_{STW} \times (T_s / P_s) \times (P_a / T_a)$

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	145.9	0.0
Total Pressure	kPa	100.3	101.3
Moisture	%	13.09	0.00
Oxygen (Dry)	%	9.8	11.0

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	22349
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	14428
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	12539
Gas Volumetric Flowrate REF ¹	m ³ /hr	14081

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

(1 of 1)

Parameter	Units	Value
Date of Survey	-	23/04/2021
Time of Survey	-	13:10 - 13:25
Atmospheric Pressure	kPa	100.3
Average Stack Static Pressure	Pa	43
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	Yes
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	-	0.83
Number of Lines Available	-	2
Number of Lines Used	-	2

Sampling Line A							Sampling Line B				
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °
STATIC (Units: Pa)		43.0									
Mean		60.5	146.2	0.790	10.29		58.5	145.6	0.792	10.12	
1	0.13	64.0	146.1	0.791	10.59	4.0	56.0	145.3	0.792	9.90	3.0
2	0.75	57.0	146.3	0.790	10.00	6.0	61.0	145.8	0.791	10.34	4.0

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	$u(\Delta p_i)$	1.434	Pa
- Resolution	$u(res)$	0.00087	
- Calibration	$u(cal)$	0.369	
- Drift	$u(drift)$	0.083	
- Lack of Fit	$u(fit)$	0.604	
- Overall corrections to dynamic measurements	$u(C_f)$	1.057	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00007	-
- $\varphi_{O_2,w}$	-	8.491	
- $\varphi_{CO_2,w}$	-	2.607	
- Oxygen, dry	$u(\phi_{O_2,d})$	0.299	
- Carbon Dioxide, dry	$u(\phi_{CO_2,d})$	0.092	
- Water Vapour	$u(\phi_{H_2O})$	0.668	
- Oxygen, wet	$u(\phi_{O_2,w})$	0.268	
- Carbon Dioxide, wet	$u(\phi_{CO_2,w})$	0.082	
Standard uncertainty associated with the stack temperature	$u(T_c)$	2.137	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.695	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	1.014	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00427	-
Standard uncertainty associated with the local velocities	$u(v_i)$	0.139	Pa
Standard uncertainty associated with the mean velocity	$u(\bar{v})$	0.090	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	0.176	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	1.72	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV,w)$	1082.5	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00061	
- $u^2(qV,w)$	-	305013	
- $u(qV,w)$	-	552.3	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV,w)$	4.84	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

North West Biomass, Kinmel Bay
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.3		1.3
Uncertainty	±mg/m ³	0.24		0.24
Mass Emission	g/hr	19.4		19.4
Uncertainty	±g/hr	3.8		3.8

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	13.1		13.1
Uncertainty	±% v/v	0.66		0.66

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.10		0.10

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	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Glass 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, dry gas, 11% oxygen.

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	752.3	
Stack static pressure, P_{static}	mmH ₂ O	4.3	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	752.6	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	140.3	
Total mass collected in impingers (silica trap)	g	44.6	
Total mass of liquid collected, V_{lc}	g	184.9	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.2304	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.6220	
Gas meter correction factor, V_d	-	1.0120	
Average dry gas meter temperature, T_m	°C	19.4	
Average pressure drop across orifice, ΔH	mmH ₂ O	81.6	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(V_d)) / (T_m + 273)$	m ³	1.5290	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.1309	
B_{wo} as a percentage	% v/v	13.09	
Reported Water Vapour, checked with Tables in EN 14790, R_{wv}	% v/v	13.09	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.7594	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
IED & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	8.49	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	9.77	
% oxygen reference condition, REF%O ₂	% v/v	11.00	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	0.80	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	0.89	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	2.2006	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	1.7168	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	3.00	
O ₂	% v/v	9.77	
Total	% v/v	12.77	
N ₂	% v/v	87.23	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.87	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	27.45	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K_p	-	34.97	
Velocity pressure coefficient, C_p	-	0.83	
Average of velocity heads, ΔP_{avg}	mmH ₂ O	7.48	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	2.73	
Average stack gas temperature, T_s	°C	164.4	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (\sqrt{M_s}(P_s))$	m/s	11.60	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})			
Area of stack, A_s	m ²	0.61	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	423.5	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	261.7	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	227.5	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m ³ /min	327.4	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273) / (O_{2REFd})$	m ³ /min	255.4	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	8.95	
Nozzle area, A_n	mm ²	62.97	
Total sampling time, q	min	60	
$\%I = (4.6398E^9)(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	108.2	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	13:44 - 14:14, 14:15 - 14:45
Sampling Dates	-	23/04/21
Sampling Device	-	ISO
Volume Sampled (REF)	m ³	1.7168
Filter I.D. Number	-	47-79812
Start Filter Mass	g	0.14802
End Filter Mass	g	0.14600
Total Mass on Filter	g	-0.00202
Probe Rinse I.D. Number	-	PR-47-79812
Start Probe Rinse Mass	g	3.07350
End Probe Rinse Mass	g	3.07769
Total Mass in Probe Rinse	g	0.00420
Total Mass Collected	mg	2.18
Calculated Concentration	mg/m ³	1.27
Balance Uncertainty / LOD	mg/m ³	0.10

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	23/04/21
Average Volume Sampled (REF)	m ³	1.7168
Filter I.D. Number	-	47-79805
Start Filter Mass	g	0.14991
End Filter Mass	g	0.14983
Total Mass on Filter	g	-0.00008
Probe Rinse I.D. Number	-	PR-47-79805
Start Probe Rinse Mass	g	2.95565
End Probe Rinse Mass	g	2.95559
Total Mass in Probe Rinse	g	-0.00006
Total Mass Collected	mg	-0.14
Calculated Concentration	mg/m ³	-0.08
Balance Uncertainty / LOD	mg/m ³	0.10

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	27.4	
Pre-Sampling Leak Rate	l/min	0.13	
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)	%	5.0	
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	%	108.2	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.36	
Overall Weighing Uncertainty	± mg/m ³	0.21	
ELV [Daily ELV for IED]	mg/m ³	50.00	
Allowable Weighing Uncertainty	mg/m ³	2.50	
Weighing Uncertainty Acceptable	-	Yes	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	178	
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	0.14	
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	5.0	
Blank Acceptable	-	Yes	

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.	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value		Standard uncertainty		
	Symbol	Run 1	Symbol	Units	Run 1
Sampled Volume (Actual)	V _m	1.6220	uV _m	m ³	0.0324
Sampled Gas Temperature	T _m	292.4	uT _m	K	2.00
Sampled Gas Pressure	p _m	100.4	up _m	kPa	0.50
Sampled Gas Humidity	H _m	0.00	uH _m	% v/v	1.00
Leak	L	0.48	uL	%	-
Mass of Particulate	m	2.18	um	mg	0.18
Uncollected Mass	UCM	-0.14	uUCM	mg	-

Measured Quantities	Uncertainty as a Percentage		Requirement of Standard
	Units	Run 1	
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.68	≤1%
Sampled Gas Pressure	%	0.50	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	0.48	≤2%
Mass of Particulate	%	0.21	<5% of ELV
Uncollected Mass	%	-	-

Measured Quantities	Uncertainty in Measurement Units			Sensitivity Coefficient	
	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	1.5290	0.83	
Leak	L	mg/m ³	0.003	1.00	
Mass of Particulate	L _r	mg	2.177	0.58	
Uncollected Mass	UCM	mg	-0.08	0.58	

Measured Quantities	Uncertainty in Result	
	Units	Run 1
Sampled Volume (STP)	mg/m ³	0.032
Leak	mg/m ³	0.0035
Mass of Particulate	mg/m ³	0.1048
Uncollected Mass	mg/m ³	-0.0482

Measured Quantities	Oxygen Correction Part of MU Budget	
	Units	Run 1
O ₂ Correction Factor	-	0.89
Stack Gas O ₂ Content	% v/v	9.77
MU for O ₂ Correction	-	0.04
Overall MU For O ₂ Measurement	%	4.45

Parameter	Units	Run 1
Combined uncertainty	mg/m ³	0.12
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.23
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	0.24
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.24
Reported Uncertainty	mg/m ³	0.24
Expanded uncertainty (95% confidence), without Oxygen Correction	%	18.5
Expanded uncertainty (95% confidence), with Oxygen Correction	%	19.0
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	19.0
Reported Uncertainty	%	19.0

TOTAL VOCs (as CARBON): RESULTS SUMMARY

North West Biomass, Kinnel Bay
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	5.4	5.4
Uncertainty	±mg/m ³	0.46	0.46
Mass Emission	g/hr	83.0	83.0
Uncertainty	±g/hr	8.1	8.1

General Sampling Information

Parameter	Value
Standard	EN 12619:2013
Technical Procedure	CAT-TP-20
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Type	Propane in 15% O ₂ in N ₂ (5 Grade)
Span Gas Reference Number	CYL 12.0313 in N ₂ CYL 1.0422a in AIR
Span Gas Expiry Date	18/08/2022 27/11/2025
Span Gas Start Pressure (bar)	100 200
Gas Cylinder Concentration (ppm)	85.75 79.82
Span Gas Set Point (ppm)	81.51
Span Gas Uncertainty (%)	2 2
Zero Gas Type	15% O ₂ in N ₂ (5 Grade)
Number of Sampling Lines Used	1 / 2
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	C1

This is the blended concentration of both propane cylinders

FORMAT: Number Used / Number Required

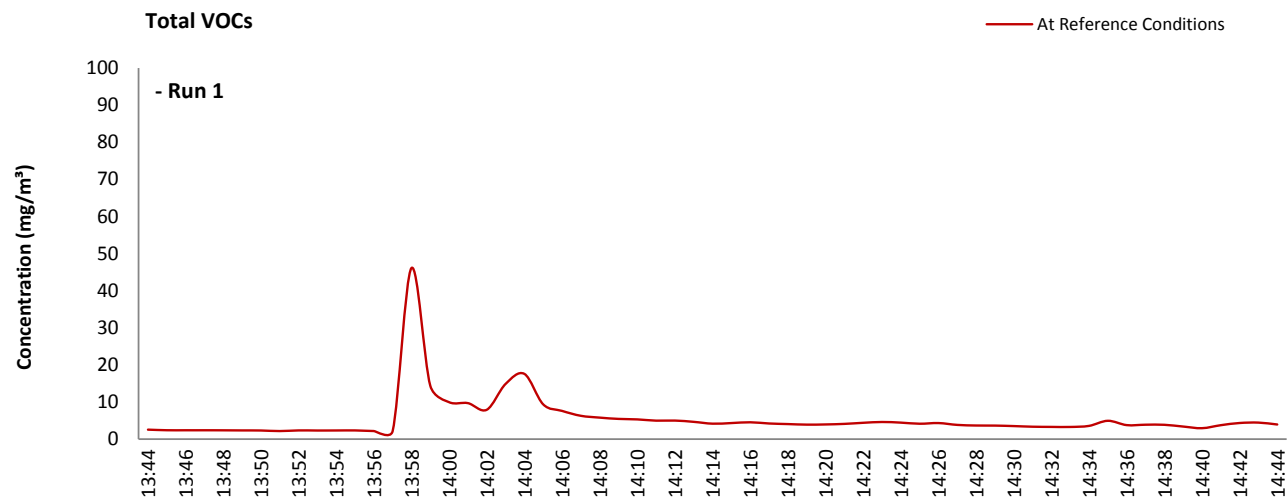
FORMAT: Number Used / Number Required

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 11% oxygen.

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



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

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	13:44 - 14:44
Sampling Dates	-	23/04/2021
Instrument Range	ppm	100
Span Gas Value	ppm	81.5

Quality Assurance

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.10
	Zero Down Sampling Line (Post)	ppm	0.10
	Zero Drift	ppm	0.00
	Allowable Zero Drift	± ppm	4.08
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	81.40
	Span Down Sampling Line (Post)	ppm	81.40
	Span Drift	ppm	0.00
	Allowable Span Drift	± ppm	4.08
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	16 - 20

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	30.0	mg/m ³ (REF)
Allowable MU	15.0	%
Measured concentration	6.08	mg/m ³ (STP, dry)
Range Used	100.0	ppm
Range Used [A]	160.6	mg/m ³
Cal gas conc.	81.5	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.	130.9	mg/m ³

Performance characteristics	RUN 1	Units
Response time	45	seconds
Number of readings in measurement	60	-
Repeatability at zero	2.00	% full scale
Repeatability at span level	0.00	% full scale
Deviation from linearity	0.53	% 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)	0.12	% of value
Uncertainty of calibration gas	2.83	% 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	0.05	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	0.10	mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		6.08	mg/m ³
Expanded uncertainty	k =	0.24	mg/m ³
Expanded uncertainty	1.96	0.48	mg/m ³
Uncertainty corrected to std conds. (O ₂)		0.43	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	7.86	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	1.59	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	15.0	% at ELV
Result of Compliance with Uncertainty Requirement	N/A	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	8.51	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	3.57	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	15.4	% at ELV
Result of Compliance with Uncertainty Requirement	COMPLIANT	-

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

OXIDES OF NITROGEN (as NO₂): RESULTS SUMMARY

North West Biomass, Kinnel Bay
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	107	107
Uncertainty	±mg/m ³	4.7	4.7
Mass Emission	g/hr	1636	1636
Uncertainty	±g/hr	107	107

General Sampling Information

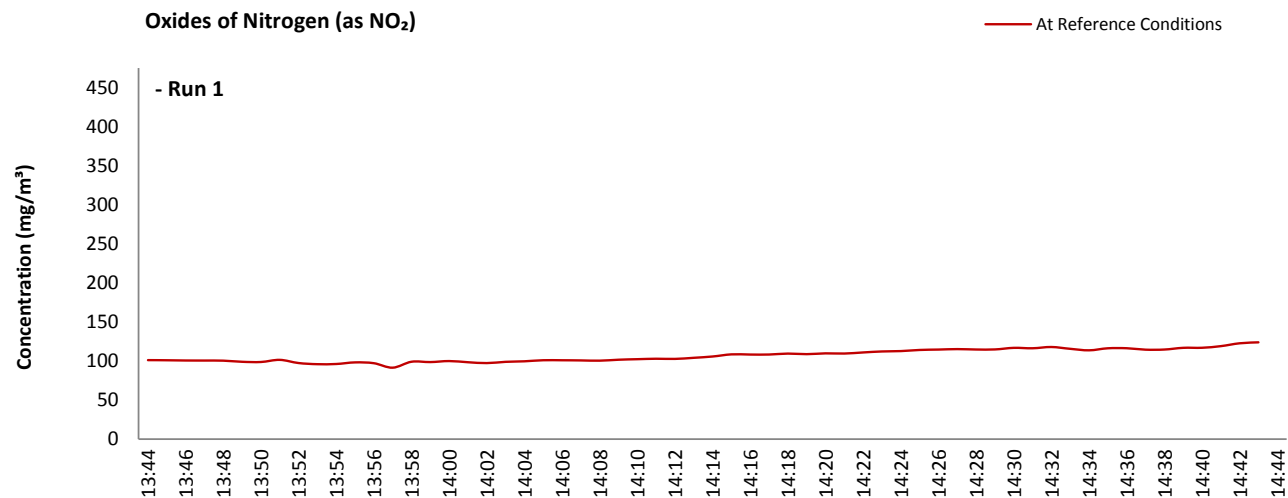
Parameter	Value	
Standard	EN 14792	
Technical Procedure	CAT-TP-21	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Date & Result of Last Converter Check	7/7/21 - 96.3%	
Span Gas Type	Nitrogen Monoxide	
Span Gas Reference Number	CYL12.0314	
Span Gas Expiry Date	18/08/22	
Span Gas Start Pressure (bar)	85	
Gas Cylinder Concentration (ppm)	404.4	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1 / 2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 11% oxygen.

OXIDES OF NITROGEN (as NO₂): DATA TREND

Graphical Trend of Data



OXIDES OF NITROGEN (as NO₂): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	13:44 - 14:44
Sampling Dates	-	23/04/2021
Instrument Range	ppm	500
Span Gas Value	ppm	400.0

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

Zero Drift	Units	Run 1
Zero at Analyser (Pre)	ppm	0.10
Zero at Analyser (Post)	ppm	0.20
Zero Drift	ppm	0.10
Zero Drift	%	0.02
Drift Correction Applied	2-5%	No
Allowable Zero Drift	± %	5.00
Zero Drift Acceptable	-	Yes

Span Drift	Units	Run 1
Span at Analyser (Pre)	ppm	400.40
Span at Analyser (Post)	ppm	399.90
Span Drift	ppm	-0.50
Zero Adj. Span Drift	%	0.15
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	16 - 20

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

OXIDES OF NITROGEN (as NO₂): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1	Units
Limit value	475.0	mg/m ³ (REF)
Allowable MU	10.0	%
Measured concentration	119.96	mg/m ³ (STP, dry)
Ratio NO / NO ₂	5	%
Range Used	500.0	ppm
Range Used [A]	1026.1	mg/m ³
Cal gas conc.	400.0	ppm
Conversion	2.05	ppm to mg/m ³
MCERTS Range [B]	125.0	mg/m ³
Lower of [A] or [B]	125.0	mg/m ³
Cal gas conc.	820.9	mg/m ³

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	0.28	% of value
Zero drift	0.02	% full scale
Span drift	-0.15	% full scale
Volume or pressure flow dependence	0.40	% of full scale
Atmospheric pressure dependence	0.30	% of value/kPa
Ambient temperature dependence	0.18	% full scale/10K
Combined interference	0.60	% range
Dependence on voltage	0.40	% full scale/10V
Converter efficiency	96.3	%
Losses in the line (leak)	0.07	% 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/m ³
Standard deviation of repeatability at span level	0.05	mg/m ³
Lack of fit	0.20	mg/m ³
Drift	0.00	mg/m ³
Volume or pressure flow dependence	0.00	mg/m ³
Atmospheric pressure dependence	0.11	mg/m ³
Ambient temperature dependence	0.03	mg/m ³
Combined interference (from MCERTS Certificate)	0.43	mg/m ³
Dependence on voltage	0.05	mg/m ³
Converter efficiency	0.13	mg/m ³
Losses in the line (leak)	0.05	mg/m ³
Uncertainty of calibration gas blending	0.97	mg/m ³
Uncertainty of calibration gas	1.39	mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		119.96	mg/m ³
Expanded uncertainty		1.82	mg/m ³
Expanded uncertainty	k = 1.96	3.57	mg/m ³
Uncertainty corrected to std conds. (O ₂)		3.17	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	2.97	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	0.75	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	10.0	% at ELV
Result of Compliance with Uncertainty Requirement	N/A	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	4.42	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	3.34	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	10.5	% at ELV
Result of Compliance with Uncertainty Requirement	COMPLIANT	-

Requirement for SRM is that Uncertainty should be <10% of the value at the ELV, on a dry gas basis, or if O₂ correction is applied less than 10% + the uncertainty associated with the O₂ correction (using sqrt of sum squares to add uncertainty components).

CARBON MONOXIDE: RESULTS SUMMARY

North West Biomass, Kinnel Bay
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	0.23	0.23
Uncertainty	±mg/m ³	1.1	1.1
Mass Emission	g/hr	3.6	3.6
Uncertainty	±g/hr	16.4	16.4

General Sampling Information

Parameter	Value
Standard	EN 15058
Technical Procedure	CAT-TP-21
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Type	Carbon Monoxide
Span Gas Reference Number	CYL12.0314
Span Gas Expiry Date	18/08/22
Span Gas Start Pressure (bar)	85
Gas Cylinder Concentration (ppm)	393.8
Span Gas Uncertainty (%)	2
Zero Gas Type	Nitrogen (5 Grade)
Number of Sampling Lines Used	1 / 2
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A1

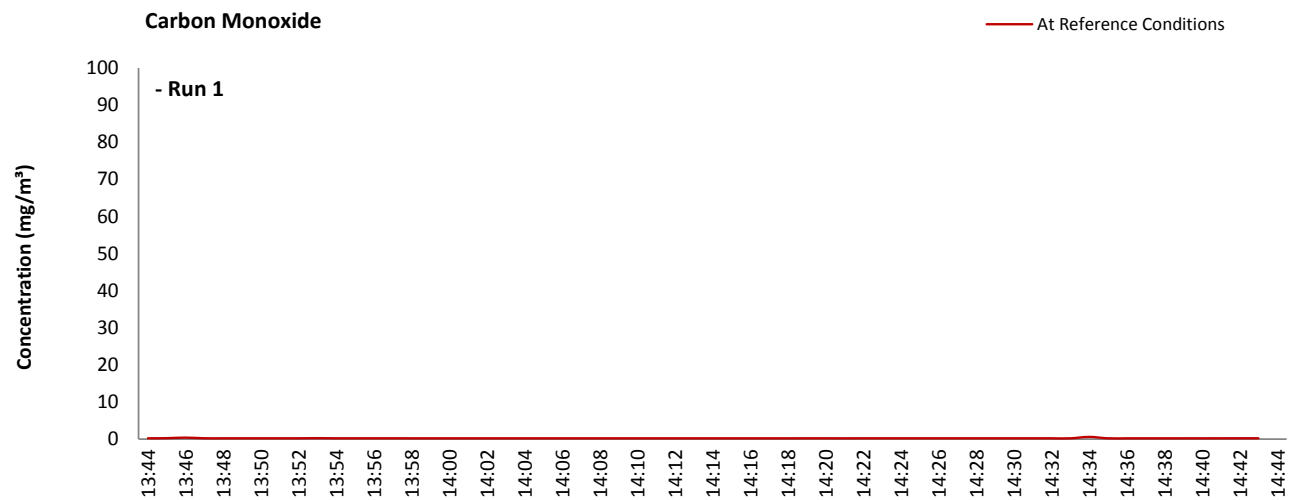
FORMAT: Number Used / Number Required
FORMAT: Number Used / Number Required

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 11% oxygen.

CARBON MONOXIDE: DATA TREND

Graphical Trend of Data



CARBON MONOXIDE: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	13:44 - 14:44
Sampling Dates	-	23/04/2021
Instrument Range	ppm	500
Span Gas Value	ppm	393.8

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

Zero Drift	Units	Run 1
Zero at Analyser (Pre)	ppm	-1.00
Zero at Analyser (Post)	ppm	0.20
Zero Drift	ppm	1.20
Zero Drift	%	0.30
Drift Correction Applied	2-5%	No
Allowable Zero Drift	± %	5.00
Zero Drift Acceptable	-	Yes

Span Drift	Units	Run 1
Span at Analyser (Pre)	ppm	393.80
Span at Analyser (Post)	ppm	393.70
Span Drift	ppm	-0.10
Zero Adj. Span Drift	%	0.33
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	16 - 20

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

CARBON MONOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1	Units
Limit value	225.0	mg/m ³ (REF)
Allowable MU	6.0	%
Measured concentration	0.26	mg/m ³ (STP, dry)
Range Used	500.0	ppm
Range Used [A]	624.6	mg/m ³
Cal gas conc.	393.8	ppm
Conversion	1.25	ppm to mg/m ³
MCERTS Range [B]	95.0	mg/m ³
Lower of [A] or [B]	95.0	mg/m ³
Cal gas conc.	491.9	mg/m ³

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	0.40	% of value
Zero drift	0.30	% full scale
Span drift	-0.33	% 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)	0.10	% 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/m ³
Standard deviation of repeatability at span level	0.05	mg/m ³
Lack of fit	0.22	mg/m ³
Drift	0.00	mg/m ³
Volume or pressure flow dependence	0.00	mg/m ³
Atmospheric pressure dependence	0.08	mg/m ³
Ambient temperature dependence	0.01	mg/m ³
Combined interference (from MCERTS Certificate)	0.40	mg/m ³
Dependence on voltage	0.05	mg/m ³
Losses in the line (leak)	0.00	mg/m ³
Uncertainty of calibration gas blending	0.00	mg/m ³
Uncertainty of calibration gas	0.00	mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		0.26	mg/m ³
Expanded uncertainty	k = 1.96	0.61	mg/m ³
Expanded uncertainty		1.20	mg/m ³
Uncertainty corrected to std conds. (O ₂)		1.07	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	461.06	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	0.53	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	6.0	% at ELV
Result of Compliance with Uncertainty Requirement	N/A	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	461.07	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	3.31	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	6.8	% at ELV
Result of Compliance with Uncertainty Requirement	COMPLIANT	-

Requirement for SRM is that Uncertainty should be <6% of the value at the ELV, on a dry gas basis, or if O₂ correction is applied less than 6% + the uncertainty associated with the O₂ correction (using sqrt of sum squares to add uncertainty components).

OXYGEN: RESULTS SUMMARY

North West Biomass, Kinnel Bay
Biomass CHP Plant Exhaust

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	% v/v	9.8	9.8
Uncertainty	±% v/v	0.32	0.32

General Sampling Information

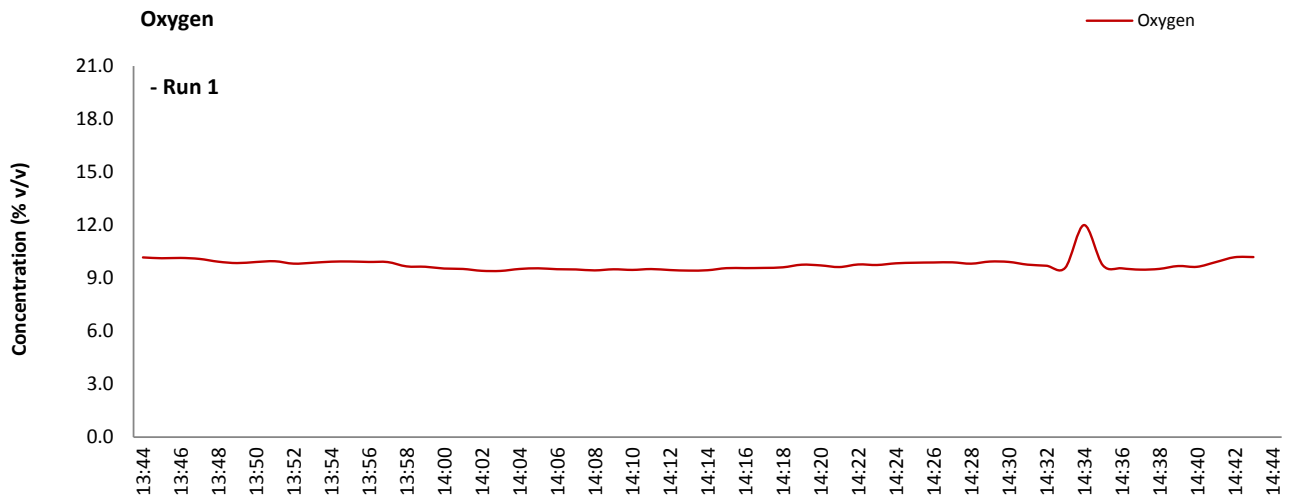
Parameter	Value
Standard	EN 14789
Technical Procedure	CAT-TP-21
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Type	Synthetic Air (5 Grade)
Span Gas Reference Number	CYL11.0414
Span Gas Expiry Date	01/03/2025
Span Gas Start Pressure (bar)	45
Gas Cylinder Concentration (% v/v)	21.34
Span Gas Uncertainty (%)	2
Zero Gas Type	Nitrogen (5 Grade)
Number of Sampling Lines Used	1 / 2
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A1

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

OXYGEN: DATA TREND

Graphical Trend of Data



OXYGEN: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	13:44 - 14:44
Sampling Dates	-	23/04/2021
Instrument Range	% v/v	25.0
Span Gas Value	% v/v	15.0

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.0
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

Zero Drift	Units	Run 1
Zero at Analyser (Pre)	% v/v	-0.01
Zero at Analyser (Post)	% v/v	0.02
Zero Drift	% v/v	0.03
Zero Drift	%	0.20
Drift Correction Applied	2-5%	No
Allowable Zero Drift	± %	5.00
Zero Drift Acceptable	-	Yes

Span Drift	Units	Run 1
Span at Analyser (Pre)	% v/v	15.00
Span at Analyser (Post)	% v/v	14.97
Span Drift	% v/v	-0.03
Zero Adj. Span Drift	%	0.40
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	16 - 20

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

OXYGEN: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1	Units
Limit value	N/A	%vol
Allowable MU	6.0	%
Measured concentration	9.77	%vol
Range Used	25.0	%vol
Cal gas conc.	21.3	%vol

Performance characteristics	RUN 1	Units
Response time	60	seconds
Number of readings in measurement	60	-
Repeatability at zero	0.04	% full scale
Repeatability at span level	0.04	% full scale
Deviation from linearity	0.07	% of value
Zero drift	0.20	% full scale
Span drift	-0.40	% full scale
Volume or pressure flow dependence	0.20	% of full scale
Atmospheric pressure dependence	0.30	% of value/kPa
Ambient temperature dependence	-0.07	% full scale/10K
Combined interference	0.56	% range
Dependence on voltage	0.02	% full scale/10V
Losses in the line (leak)	0.20	% of value
Uncertainty of calibration gas	2.00	% of value

Performance characteristic	RUN 1	Units
Standard deviation of repeatability at zero	use rep at span	%vol
Standard deviation of repeatability at span level	0.01	%vol
Lack of fit	0.01	%vol
Drift	0.00	%vol
Volume or pressure flow dependence	0.00	%vol
Atmospheric pressure dependence	0.02	%vol
Ambient temperature dependence	-0.01	%vol
Combined interference (from MCERTS Certificate)	0.08	%vol
Dependence on voltage	0.00	%vol
Losses in the line (leak)	0.01	%vol
Uncertainty of calibration gas	0.11	%vol

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		9.77	%vol
Expanded uncertainty		0.16	%vol
	k = 1.96	0.32	%vol

Expanded uncertainty (no O ₂) - at 95% Confidence	RUN 1	Units
	3.27	% 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.

4279

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