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Stack Emissions Testing Report Commissioned by
Blazers Fuel

Installation Name & Address
North West Biomass
North West Biomass Ltd
Kinmel Bay
Tir Liwyd Industrial Estate
Rhyl
North Wales
LL18 5JA

Stack Reference
Stela Drying Stack 2 -A2

Dates of the Monitoring Campaign
23rd April 2021

Job Reference Number
EMT00712

Report Written by
Michael biagioni Team Leader MCERTS Level 2 MM 17 1444 TE1 TE3 TE4

Report Approved by
Tom Buller Team Leader MCERTS Level 2 MM 17 1415 TE1 TE2 TE3 TE4

Report Date
7th May 2021

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

North West Biomass, Kinmel Bay
Stela Drying Stack 2 -A2
23rd April 2021

Overall Aim of the Monitoring Campaign

Element were commissioned by Blazers Fuel to carry out stack emissions testing for North West Biomass on the Stela Drying Stack 2 -A2 at Kinmel Bay.

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

Executive Summary

MONITORING RESULTS

North West Biomass, Kinmel Bay
Stela Drying Stack 2 -A2
23rd April 2021

where MU = Measurement Uncertainty associated with the Result

	Concentration				Mass Emission			
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Units**	**Result**	**MU +/-**	**Limit**
Total Particulate Matter [1]	mg/m³	5.2	0.39	-	g/hr	536	59.7	-
Water Vapour	% v/v	0.49	0.060					
Stack Gas Temperature	°C	52.9						
Stack Gas Velocity	m/s	10.7	0.73					
Volumetric Flow Rate (ACTUAL)	m³/hr	121464	9943					
Volumetric Flow Rate (REF) [1]	m³/hr	103132	8443					

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.

MONITORING DATE(S) & TIMES

North West Biomass, Kinmel Bay
Stela Drying Stack 2 -A2
23rd April 2021

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m³	5.2	g/hr	536	23/04/2021	10:24 - 11:24	60
Velocity Traverse	R1					23/04/2021	10:00 - 10:15	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

North West Biomass, Kinmel Bay
Stela Drying Stack 2 -A2
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)	Wood Chip
Abatement System	Bag Filter and Cyclone
Abatement System Running Status	On
Fuel	N/A
Plume Appearance	None Visible

MONITORING & ANALYTICAL METHODS

North West Biomass, Kinmel Bay
Stela Drying Stack 2 -A2
23rd April 2021

	Monitoring				Analysis					
Parameter	**Standard**	**Technical Procedure**	**Sampling Status**	**Testing Lab**	**Analytical Procedure**	**Analytical Technique**	**Analysis Status**	**Analysis Lab**	**Overall Status**	**LOD (Average)**
Total Particulate Matter	EN 13284-1	CAT-TP-01	MCERTS	EET	CAT-TP-03	Gravimetric	MCERTS	EET	MCERTS	0.14 mg/m³
Water Vapour	EN 14790	CAT-TP-05	MCERTS	EET	CAT-TP-05	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	MCERTS	EET	Pitot Tube and Thermocouple				MCERTS	1.8 m/s

ANALYSIS LABORATORIES

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

Element Materials Technology (EET)	ISO 17025 Accreditation Number: 4279

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
TPM	Run 1	One out of two sampling lines was used due to sampling location restrictions, 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	2.00
Width	m	-
Area	m²	3.14
Port Depth	cm	14
Orientation of Duct	-	Vertical
Number of Ports	-	2
Sample Port Size	-	5" Flange

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	Temporary
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)	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	No
Safe Access Available	Yes
Easy Access Available	Yes

Sampling Location / Platform Improvement Recommendations

Although this platform does not meet the requirements in the Environment Agency's Technical Guidance Note M1 and EN 15259, it is adequate for the testing carried out on this stack.

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)

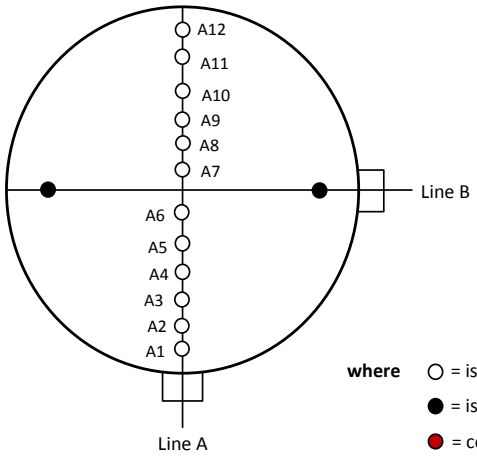
Criteria in EN 15259	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	70.6	> 5 Pa	Yes
Mean Velocity	m/s	10.43	-	-
Lowest Gas Velocity	m/s	9.55	-	-
Highest Gas Velocity	m/s	10.80	-	-
Ratio of Above	: 1	1.13	< 3 : 1	Yes
Maximum Angle of Swirl	°	4.00	< 15°	Yes
No Local Negative Flow	-	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	Michael Biagioni	MCERTS Level 2	MM 17 1444	TE1 TE3 TE4
Team Leader	Danny Pryke	MCERTS Level 2	MM 03 168	TE1 TE2 TE3 TE4
Technician	Danny Worthington	MCERTS Level 1	MM 19 1594	None

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	**Equipment I.D.**
Control Box DGM (1)	CAT 7.95
Control Box DGM (2)	-
Box Thermocouples (1)	CAT 3.31
Box Thermocouples (2)	-
Umbilical (1)	CAT 3.31
Umbilical (2)	-
Oven Box (1)	-
Oven Box (2)	-
Heated Probe (1)	CAT 5.39
Heated Probe (2)	CAT 5.35
Heated Probe (3)	-
S-Pitot (1)	CAT 21S.71
S-Pitot (2)	-
L-Pitot	-
Site Balance	CAT 17.46
500g / 1Kg Check Weights	CAT 17.46
Last Impinger Arm	-
Callipers	CAT 23.52
Tubes Kit Thermocouple	-

Instrumental Analysers	
Equipment Type	**Equipment I.D.**
Horiba PG-250 SRM	-
Horiba PG-250	-
Servomex 5200 MP	-
Eco Physics CLD 822Mh	-
ABB AO2020-URAS26	-
Testo 350 XL	-
JCT JCC P1 Cooler	-
ProtIR 204M	-
Gasmet Sampling System	-
Bernath 3006 FID	-
M&C PSS	-
Mass Flow Controller (1)	-
Mass Flow Controller (2)	-
Mass View 10 l(1)	-
Mass View 2l (2)	-
Hioki 5043 (V)	-
Hioki 5043 (V)	-
Bioaerosols Temperature Logger	-
Electronic Refrigerator	-

Miscellaneous Items	
Equipment Type	**Equipment I.D.**
Digital Manometer (1)	CAT 3.33
Digital Manometer (2)	CAT 3.84
Digital Temperature Meter	CAT 3.33
Stopwatch	CAT 14.53
Barometer	CAT MET
Stack Thermocouple (1)	CAT 4.117
Stack Thermocouple (2)	CAT 4.1360
Stack Thermocouple (3)	-
1m Heated Line (1)	-
1m Heated Line (2)	-
10m Heated Line (3)	CAT 20.109
5m Heated Line (1)	-
15m Heated Line (1)	-
20m Heated Line (1)	-
20m Heated Line (2)	-
Dual Channel Heater Controller	-
Single Channel Heater Controller	-
Laboratory Balance	CAT 1.18, 1.18a, 1.18b
Tape Measure	CAT 16.96

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	EN 13284-1	CAT-TP-01
Water Vapour	EN 14790	CAT-TP-05
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	2.00
Stack Width, W	m	-
Stack Area, A	m^2	3.14
Average Stack Gas Temperature, T_a	°C	53.9
Average Stack Gas Pressure	mmH_2O	8.6
Average Stack Static Pressure, P_{static}	kPa	0.032
Average Barometric Pressure, P_b	kPa	102.7
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	20.70	0.2080	32.00	1.4277	0.29696
N_2	-	79.14	78.75	0.7914	28.01	1.2498	0.98913
Moisture (H_2O)	-	-	0.49	0.0049	18.02	0.8037	0.00392

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	1.285
Dry Density (Actual), P_{Actual}	kg/m^3	1.090
Average Wet Density (Actual), $P_{ActualW}$	kg/m^3	1.088

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	53.9	0.0
Total Pressure	kPa	102.7	101.3
Moisture	%	0.49	0.49

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m^3/hr	117965
Gas Volumetric Flowrate (STP, Wet)	m^3/hr	99902
Gas Volumetric Flowrate (STP, Dry)	m^3/hr	99415
Gas Volumetric Flowrate REF [1]	m^3/hr	99902

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	-	10:00 - 10:15
Atmospheric Pressure	kPa	102.7
Average Stack Static Pressure	Pa	32
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with Liquid Incline Manometer	

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	-	1

		Sampling Line A					Sampling Line B - Restricted Access				
Traverse Point	Depth m	ΔP mmH_2O	Temp °C	Wet Density kg/m^3	Velocity m/s	Swirl °	ΔP	Temp °C	Wet Density kg/m^3	Velocity m/s	Swirl °
STATIC (Units: Pa)		*32.0*									
Mean		**8.6**	**53.9**	**1.088**	**10.43**						
1	0.04	7.2	54.0	1.088	9.55	2.0					
2	0.13	7.4	53.0	1.091	9.67	3.0					
3	0.24	8.0	54.0	1.088	10.07	2.0					
4	0.35	8.4	54.0	1.088	10.32	3.0					
5	0.50	9.2	54.0	1.088	10.80	4.0					
6	0.71	9.2	54.0	1.088	10.80	2.0					
7	1.29	9.2	54.0	1.088	10.80	3.0					
8	1.50	9.0	54.0	1.088	10.68	3.0					
9	1.65	9.0	54.0	1.088	10.68	2.0					
10	1.76	8.8	54.0	1.088	10.56	3.0					
11	1.87	9.0	54.0	1.088	10.68	4.0					
12	1.96	8.8	54.0	1.088	10.56	2.0					

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)	2.053	Pa
- Resolution	u(res)	0.52154	
- Calibration	u(cal)	0.741	
- Drift	u(drift)	1.096	
- Lack of Fit	u(fit)	0.857	
- Overall corrections to dynamic measurements	u(Cf)	3.216	
Standard uncertainty associated with the molar mass of the gas	u(M)	0.00003	-
- φO_2,w	-	20.699	
- φCO_2,w	-	0.060	
- Oxygen, dry	u(ϕO_2,d)	0.637	
- Carbon Dioxide, dry	u(ϕCO_2,d)	0.002	
- Water Vapour	u(ϕH_2O)	0.025	
- Oxygen, wet	u(ϕO_2,w)	0.634	
- Carbon Dioxide, wet	u(ϕCO_2,w)	0.002	
Standard uncertainty associated with the stack temperature	u(Tc)	1.668	K
Standard uncertainty associated with the absolute pressure in the duct	u(pc)	175.704	Pa
- Atmospheric Pressure	u(patm)	175.692	
- Static Pressure	u(pstat)	2.053	
Standard uncertainty associated with the density in the duct	u(ρ)	0.00586	-
Standard uncertainty associated with the local velocities	u(vi)	1.250	Pa
Standard uncertainty associated with the mean velocity	u(v)	0.363	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	Uc(v)	0.711	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	Uc,rel(v)	6.82	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	Uc(qV,w)	9657.0	m^3/hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00174	
- $u^2(qV,w)$	-	24275486	
- u(qV,w)	-	4927.0	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	Uc,rel(qV,w)	8.19	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

North West Biomass, Kinmel Bay
Stela Drying Stack 2 -A2

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	5.2		5.2
Uncertainty	±mg/m³	0.39		0.39
Mass Emission	g/hr	536		536
Uncertainty	±g/hr	59.7		59.7

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.49		0.49
Uncertainty	±% v/v	0.060		0.060

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	0.14		0.14

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	1 / 2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	12 / 12	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1 - A12	

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	770.3
Stack static pressure, P_{static}	mmH_2O	1.2
$P_s = (P_b + (P_{static} / 13.6)$	mmHg	770.4
Volume of water vapour collected, V_{wstd}		
Total mass collected in impingers (liquid trap)	g	1.0
Total mass collected in impingers (silica trap)	g	3.9
Total mass of liquid collected, V_{lc}	g	4.9
$V_{wstd} = (0.001246)(V_{lc})$	m^3	0.0061
Volume of gas metered dry, V_{mstd}		
Volume of gas sample through gas meter, V_m	m^3	1.2870
Gas meter correction factor, Y_d	-	1.0160
Average dry gas meter temperature, T_m	°C	18.9
Average pressure drop across orifice, ΔH	mmH_2O	49.3
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m^3	1.2454
Moisture content, B_{wo} & R_{wv}		
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m^3	0.0049
B_{wo} as a percentage	% v/v	0.49
Reported Water Vapour, checked with Tables in EN 14790, Rwv	% v/v	0.49
Volume of gas metered wet, V_{mstw}		
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m^3	1.2515
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	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	0.06
Total	% v/v	0.12
N_2	% v/v	99.88
$M_d = 0.44(\%CO_2)+0.32(\%O_2)+0.28(\%N_2)$	g/gmol	28.01
Molecular weight of stack gas (wet), M_s		
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	27.96
Velocity of stack gas, V_s		
Pitot tube velocity constant, K_p	-	34.97
Velocity pressure coefficient, C_p	-	0.84
Average of velocity heads, ΔP_{avg}	mmH_2O	8.83
Average square root of velocity heads, √ΔP	$\sqrt{mmH_2O}$	2.97
Average stack gas temperature, T_s	°C	52.9
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s} + 273)) / (\sqrt{(M_s)(P_s)})$	m/s	10.74
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	3.14
$Q_a = (60)(A_s)(V_s)$	m^3/min	2024.4
Conversion factor (K/mm.Hg), C_f	-	0.3592
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m^3/min	1718.9
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m^3/min	1710.5
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	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	6.99
Nozzle area, A_n	mm^2	38.38
Total sampling time, q	min	60
$\%I = (4.6398E^6)(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	99.3

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	10:24 - 11:24
Sampling Dates	-	23/04/2021
Sampling Device	-	ISO
Volume Sampled (REF)	m^3	1.2515
Filter I.D. Number	-	47-79813
Start Filter Mass	g	0.14853
End Filter Mass	g	0.14875
Total Mass on Filter	g	0.00022
Probe Rinse I.D. Number	-	PR-47-79813
Start Probe Rinse Mass	g	2.53084
End Probe Rinse Mass	g	2.53712
Total Mass in Probe Rinse	g	0.00628
Total Mass Collected	mg	6.50
Calculated Concentration	mg/m^3	5.19
Balance Uncertainty / LOD	mg/m^3	0.14

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	23/04/2021
Average Volume Sampled (REF)	m^3	1.2515
Filter I.D. Number	-	47-77450
Start Filter Mass	g	0.14826
End Filter Mass	g	0.14815
Total Mass on Filter	g	-0.00011
Probe Rinse I.D. Number	-	PR-47-77450
Start Probe Rinse Mass	g	2.84042
End Probe Rinse Mass	g	2.84045
Total Mass in Probe Rinse	g	0.00004
Total Mass Collected	mg	-0.07
Calculated Concentration	mg/m^3	-0.06
Balance Uncertainty / LOD	mg/m^3	0.14

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	21.8
Pre-Sampling Leak Rate	l/min	0.34
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)	%	12.3
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	%	99.3
Allowable Isokinetic Range	%	95 - 115
Isokineticity Acceptable	-	Yes

Weighing Uncertainty Criteria	Units	Run 1
Overall Weighing Uncertainty	± mg	0.36
Overall Weighing Uncertainty	± mg/m³	0.29
ELV [Daily ELV for IED]	mg/m³	N/A
Allowable Weighing Uncertainty	mg/m³	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	54

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	SELECT

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	0.27
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/m³	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 (x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	Run Number 1	
One out of two sampling lines was used due to sampling location restrictions, however the number of sample points used on the available line were increased to the minimum required by the Standard	x	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

	Value		Standard uncertainty		
Measured Quantities	**Symbol**	**Run 1**	**Symbol**	**Units**	**Run 1**
Sampled Volume (Actual)	V_m	1.2870	uV_m	m³	0.0257
Sampled Gas Temperature	T_m	291.9	uT_m	K	2.00
Sampled Gas Pressure	ρ_m	102.7	$u\rho_m$	kPa	0.50
Sampled Gas Humidity	H_m	0.00	uH_m	% v/v	1.00
Leak	L	1.56	uL	%	-
Mass of Particulate	m	6.50	um	mg	0.18
Uncollected Mass	UCM	-0.07	uUCM	mg	-

	Uncertainty as a Percentage		
Measured Quantities	**Units**	**Run 1**	**Requirement of Standard**
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.69	≤1%
Sampled Gas Pressure	%	0.49	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	1.56	≤2%
Mass of Particulate	%	-	<5% of ELV
Uncollected Mass	%	-	-

	Uncertainty in Measurement Units			Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 1**
Sampled Volume (STP)	V_m	m³	1.2454	4.17
Leak	L	mg/m³	0.047	1.00
Mass of Particulate	L_r	mg	6.500	0.80
Uncollected Mass	UCM	mg	-0.04	0.80

	Uncertainty in Result	
Measured Quantities	**Units**	**Run 1**
Sampled Volume (STP)	mg/m³	0.127
Leak	mg/m³	0.0468
Mass of Particulate	mg/m³	0.1438
Uncollected Mass	mg/m³	-0.0338

	Oxygen Correction Part of MU Budget	
Measured Quantities	**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/m³	0.20
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m³	0.39
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m³	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m³	0.39
Reported Uncertainty	mg/m³	0.39
Expanded uncertainty (95% confidence), without Oxygen Correction	%	7.6
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	7.6
Reported Uncertainty	%	7.6

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