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Stack Emissions Testing Report Commissioned by

Installation Name & Address
Atritor Ltd
12 The Stampings
Blue Ribbon Park
Coventry
West Midlands
CV6 5RE

PPC Permit: PPC/028

Stack Reference
PMA1 Scrubber

Dates of the Monitoring Campaign
18th August 2020

Job Reference Number
EST-5708

Report Written by
Alex Powell Team Leader MCERTS Level 2 MM 10 1082 TE1 TE2 TE3 TE4

Report Approved by
Michelle Edwards Team Leader MCERTS Level 2 MM 05 659 TE1 TE2 TE3 TE4

Report Date
1st September 2020

Version
Version 1

Signature of Report Approver
[redacted]

CONTENTS

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

MONITORING OBJECTIVES

Atritor Ltd, Coventry
PMA1 Scrubber
18th August 2020

Overall Aim of the Monitoring Campaign

Element were commissioned by to carry out stack emissions testing for Atritor Ltd on the PMA1 Scrubber at Coventry.

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values (ELVs) as specified in the Site's Permit.

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter

Executive Summary

MONITORING RESULTS

Atritor Ltd, Coventry
PMA1 Scrubber
18th August 2020

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	12.5	3.4	50	g/hr	318	86.8	-
Water Vapour	% v/v	0.19	0.01					
Stack Gas Temperature	°C	21.3						
Stack Gas Velocity	m/s	14.8	0.25					
Volumetric Flow Rate (ACTUAL)	m³/hr	28050	1357					
Volumetric Flow Rate (REF) [1]	m³/hr	25323	1225					

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

MONITORING DATE(S) & TIMES

Atritor Ltd, Coventry
PMA1 Scrubber
18th August 2020

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m³	12.5	g/hr	318	18/08/2020	10:08 - 11:08, 11:09 - 12:09	120
Velocity Traverse	R1					18/08/2020	09:42 - 09:50	

All results are expressed at the respective reference conditions.

Executive Summary

(Page 4 of 7)

PROCESS DETAILS

Atritor Ltd, Coventry
PMA1 Scrubber
18th August 2020

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operation
Capacity (of 100%) and Tonnes / Hour	Standard Operating Capacity
Continuous or Batch Process	Batch
Feedstock (if applicable)	Railyway Lines/Cast Iron - Mark V
Abatement System	Wet Scrubber
Abatement System Running Status	On
Fuel	Induction Furnace
Plume Appearance	No Visible Plume

Site Specific Operating Conditions

Parameter	Status
Furnace Operations	Melting - 10:08, Casting - 10:10, Knocking Out - 10:30, Moulding - 11:15

MONITORING & ANALYTICAL METHODS

Atritor Ltd, Coventry
PMA1 Scrubber
18th August 2020

	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	0.1 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
All Parameters	All Runs	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Rectangular
Depth	m	0.75
Width	m	0.70
Area	m²	0.53
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	On Ground
Inside / Outside	Outside

Platform Details

EA Technical Guidance Note M1 / EN 15259 Platform Requirements	Value
Sufficient working area to manipulate probe and operate the measuring instruments	Yes
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	N/A
Platform has vertical base boards (approx. 0.25m high)	N/A
Platform has chains / self closing gates at top of ladders	N/A
There are no obstructions present which hamper insertion of sampling equipment	Yes
Safe Access Available	Yes
Easy Access Available	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	132.7	> 5 Pa	Yes
Mean Velocity	m/s	14.26	-	-
Lowest Gas Velocity	m/s	12.80	-	-
Highest Gas Velocity	m/s	15.23	-	-
Ratio of Above	: 1	1.19	< 3 : 1	Yes
Maximum Angle of Swirl	°	11.00	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

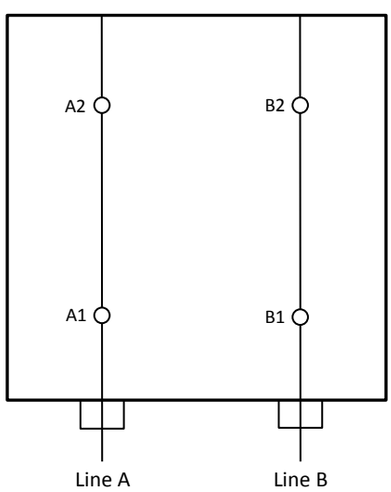
Executive Summary

(Page 7 of 7)

PLANT PHOTOS

Photo 1

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	Alex Powell	MCERTS Level 2	MM 10 1082	TE1 TE2 TE3 TE4
Trainee	Waqas Khan	MCERTS Trainee	MM 19 1520	None

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	**Equipment I.D.**
Control Box DGM (1)	CAT 7.32
Control Box DGM (2)	-
Box Thermocouples (1)	CAT 3.28
Box Thermocouples (2)	-
Umbilical (1)	CAT 3.28
Umbilical (2)	-
Oven Box (1)	-
Oven Box (2)	-
Heated Probe (1)	CAT 5.64
Heated Probe (2)	-
Heated Probe (3)	-
S-Pitot (1)	CAT 21P.121
S-Pitot (2)	-
L-Pitot	-
Site Balance	CAT 17.70
500g / 1Kg Check Weights	CAT 17.70
Last Impinger Arm	-
Callipers	CAT 23.21
Tubes Kit Thermocouple	-

Instrumental Analysers	
Equipment Type	**Equipment I.D.**
Horiba PG-250	-
Horiba PG-350E	-
Servomex 5200 MP	-
Eco Physics CLD 822Mh	-
ABB AO2020-URAS26	-
Testo 350 XL	-
JCT JCC P1 Cooler	-
Gasmet DX4000	-
Gasmet Sampling System	-
Bernath 3006 FID	-
M&C PSS	-
Mass Flow Controller (1)	-
Mass Flow Controller (2)	-
Mass View (1)	-
Mass View (2)	-
Hioki 5043 (V)	-
Easylogger EN-EL-12 Bit	-
Bioaerosols Temperature Logger	-
Electronic Refrigerator	-

Miscellaneous Items	
Equipment Type	**Equipment I.D.**
Digital Manometer (1)	CAT 3.166
Digital Manometer (2)	CAT 3.169
Digital Temperature Meter	CAT 3.166
Stopwatch	CAT 14.53
Barometer	CAT 13.26
Stack Thermocouple (1)	CAT 4.1290
Stack Thermocouple (2)	-
Stack Thermocouple (3)	-
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
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 16.57

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	0.75
Stack Width, W	m	0.70
Stack Area, A	m²	0.53
Average Stack Gas Temperature, T_a	°C	20.2
Average Stack Gas Pressure	Pa	165.4
Average Stack Static Pressure, P_{static}	kPa	-2.098
Average Barometric Pressure, P_b	kPa	100.7
Average Pitot Tube Calibration Coefficient, C_p	-	0.85

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m³ p	Conc kg/m³ p_i
CO_2 (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O_2 (Estimated)	-	20.80	20.76	0.2080	32.00	1.4277	0.29696
N_2	-	79.14	78.99	0.7914	28.01	1.2498	0.98913
Moisture (H_2O)	-	-	0.19	0.0019	18.02	0.8037	0.00150

Where: p = M / 22.41

p_i = r x p

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P_{STD}	kg/m³	1.287
Wet Density (STP), P_{STW}	kg/m³	1.286
Dry Density (Actual), P_{Actual}	kg/m³	1.167
Average Wet Density (Actual), $P_{ActualW}$	kg/m³	1.166

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	20.2	0.0
Total Pressure	kPa	98.6	101.3
Moisture	%	0.19	0.19

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m³/hr	26945
Gas Volumetric Flowrate (STP, Wet)	m³/hr	24425
Gas Volumetric Flowrate (STP, Dry)	m³/hr	24379
Gas Volumetric Flowrate REF [1]	m³/hr	24425

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

(1 of 1)

Parameter	Units	Value
Date of Survey	-	18/08/2020
Time of Survey	-	09:42 - 09:50
Atmospheric Pressure	kPa	100.7
Average Stack Static Pressure	Pa	-2098
Result of Pitot Stagnation Test	-	Fail
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	-	0.85
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/m³**	**Velocity m/s**	**Swirl °**	**ΔP Pa**	**Temp °C**	**Wet Density kg/m³**	**Velocity m/s**	**Swirl °**
STATIC (Units: Pa)		*-2088.0*					*-2107.0*				
Mean		**160.4**	**20.2**	**1.166**	**14.02**		**170.4**	**20.1**	**1.166**	**14.50**	
1	0.19	132.7	20.2	1.166	12.80	9.0	163.6	20.0	1.167	14.21	11.0
2	0.56	188.0	20.2	1.166	15.23	6.0	177.1	20.2	1.166	14.79	8.0

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)	3.111	Pa
- Resolution	u(res)	0.52154	
- Calibration	u(cal)	2.847	
- Drift	u(drift)	1.096	
- Lack of Fit	u(fit)	4.213	
- Overall corrections to dynamic measurements	u(Cf)	8.678	
Standard uncertainty associated with the molar mass of the gas	u(M)	0.00003	-
- $\varphi O_2,w$	-	20.761	
- $\varphi CO_2,w$	-	0.060	
- Oxygen, dry	u(ϕO_2,d)	0.637	
- Carbon Dioxide, dry	u(ϕCO_2,d)	0.002	
- Water Vapour	u(ϕH_2O)	0.010	
- Oxygen, wet	u(ϕO_2,w)	0.636	
- Carbon Dioxide, wet	u(ϕCO_2,w)	0.002	
Standard uncertainty associated with the stack temperature	u(Tc)	1.496	K
Standard uncertainty associated with the absolute pressure in the duct	u(pc)	175.706	Pa
- Atmospheric Pressure	u(patm)	175.692	
- Static Pressure	u(pstat)	2.200	
Standard uncertainty associated with the density in the duct	u(ρ)	0.00630	-
Standard uncertainty associated with the local velocities	u(vi)	0.171	Pa
Standard uncertainty associated with the mean velocity	u(v)	0.124	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	Uc(v)	0.244	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	Uc,rel(v)	1.71	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	Uc(qV,w)	1303.8	m^3/hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00061	
- $u^2(qV,w)$	-	442523	
- u(qV,w)	-	665.2	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	Uc,rel(qV,w)	4.84	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

Atritor Ltd, Coventry
PMA1 Scrubber

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	12.5		12.5
Uncertainty	±mg/m³	3.4		3.4
Mass Emission	g/hr	318		318
Uncertainty	±g/hr	86.8		86.8

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.19		0.19
Uncertainty	±% v/v	0.01		0.01

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	2.9		2.9

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, 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	755.3
Stack static pressure, P_{static}	mmH_2O	-212.9
$P_s = (P_b + (P_{static} / 13.6)$	mmHg	739.7
Volume of water vapour collected, V_{wstd}		
Total mass collected in impingers (liquid trap)	g	-11.3
Total mass collected in impingers (silica trap)	g	15.4
Total mass of liquid collected, V_{lc}	g	4.1
$V_{wstd} = (0.001246)(V_{lc})$	m^3	0.0051
Volume of gas metered dry, V_{mstd}		
Volume of gas sample through gas meter, V_m	m^3	3.0565
Gas meter correction factor, Y_d	-	0.9750
Average dry gas meter temperature, T_m	°C	25.3
Average pressure drop across orifice, ΔH	mmH_2O	68.6
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m^3	2.7290
Moisture content, B_{wo} & R_{wv}		
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m^3	0.0019
B_{wo} as a percentage	% v/v	0.19
Reported Water Vapour, checked with Tables in EN 14790, Rwv	% v/v	0.19
Volume of gas metered wet, V_{mstw}		
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m^3	2.7341
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	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	28.82
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_2O	18.06
Average square root of velocity heads, √ΔP	$\sqrt{mmH_2O}$	4.25
Average stack gas temperature, T_s	°C	21.3
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s} + 273)) / (\sqrt{(M_s)(P_s)})$	m/s	14.84
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	0.53
$Q_a = (60)(A_s)(V_s)$	m^3/min	467.5
Conversion factor (K/mm.Hg), C_f	-	0.3592
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m^3/min	422.1
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m^3/min	421.3
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	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	5.97
Nozzle area, A_n	mm^2	28.03
Total sampling time, q	min	120
$\%I = (4.6398E^6)(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	101.1

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	10:08 - 11:08, 11:09 - 12:09
Sampling Dates	-	18/08/2020
Sampling Device	-	ISO
Volume Sampled (REF)	m^3	2.7341
Filter I.D. Number	-	47-73027
Start Filter Mass	g	0.15126
End Filter Mass	g	0.17245
Total Mass on Filter	g	0.02119
Probe Rinse I.D. Number	-	PR-47-73027
Start Probe Rinse Mass	g	2.96787
End Probe Rinse Mass	g	2.98098
Total Mass in Probe Rinse	g	0.01311
Total Mass Collected	mg	34.30
Calculated Concentration	mg/m^3	12.54
Balance Uncertainty / LOD	mg/m^3	0.10

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	18/08/2020
Average Volume Sampled (REF)	m^3	2.7341
Filter I.D. Number	-	47-73002
Start Filter Mass	g	0.15235
End Filter Mass	g	0.15230
Total Mass on Filter	g	-0.00005
Probe Rinse I.D. Number	-	PR-47-73002
Start Probe Rinse Mass	g	2.85889
End Probe Rinse Mass	g	2.86692
Total Mass in Probe Rinse	g	0.00803
Total Mass Collected	mg	7.98
Calculated Concentration	mg/m^3	2.92
Balance Uncertainty / LOD	mg/m^3	0.10

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	24.8
Pre-Sampling Leak Rate	l/min	0.18
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)	%	6.0
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	%	101.1
Allowable Isokinetic Range	%	95 - 115
Isokineticity Acceptable	-	Yes

Weighing Uncertainty Criteria	Units	Run 1
Overall Weighing Uncertainty	± mg	0.49
Overall Weighing Uncertainty	± mg/m³	0.18
ELV [Daily ELV for IED]	mg/m³	50.00
Allowable Weighing Uncertainty	mg/m³	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	23

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	20.0
Pre-Sampling Leak Rate	l/min	0.20
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	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 (x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	Run Number 1	
There are no deviations associated with the sampling employed.	wx	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

	Value		Standard uncertainty		
Measured Quantities	**Symbol**	**Run 1**	**Symbol**	**Units**	**Run 1**
Sampled Volume (Actual)	V_m	3.0565	uV_m	m^3	0.0611
Sampled Gas Temperature	T_m	298.3	uT_m	K	2.00
Sampled Gas Pressure	ρ_m	98.6	$u\rho_m$	kPa	0.50
Sampled Gas Humidity	H_m	0.00	uH_m	% v/v	1.00
Leak	L	0.72	uL	%	-
Mass of Particulate	m	34.30	um	mg	0.26
Uncollected Mass	UCM	7.98	uUCM	mg	-

	Uncertainty as a Percentage		
Measured Quantities	**Units**	**Run 1**	**Requirement of Standard**
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.67	≤1%
Sampled Gas Pressure	%	0.51	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	0.72	≤2%
Mass of Particulate	%	0.19	<5% of ELV
Uncollected Mass	%	-	-

	Uncertainty in Measurement Units			Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 1**
Sampled Volume (STP)	V_m	m^3	2.7290	4.60
Leak	L	mg/m^3	0.052	1.00
Mass of Particulate	L_r	mg	34.297	0.37
Uncollected Mass	UCM	mg	4.61	0.37

	Uncertainty in Result	
Measured Quantities	**Units**	**Run 1**
Sampled Volume (STP)	mg/m^3	0.325
Leak	mg/m^3	0.0525
Mass of Particulate	mg/m^3	0.0951
Uncollected Mass	mg/m^3	1.6858

	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/m^3	1.72
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m^3	3.37
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m^3	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m^3	3.37
Reported Uncertainty	mg/m^3	3.37
Expanded uncertainty (95% confidence), without Oxygen Correction	%	26.9
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	26.9
Reported Uncertainty	%	26.9

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