

Report for the Periodic Monitoring of Emissions to Atmosphere

Saint Gobain Professional Services UK & Ireland

A1 - Biomass Boiler

Permit No: EPR/A2/1
Installation: Calders & Grandidge (Boston)
Monitoring Dates: 16th February 2022
Site Address: 194 London Road, Boston, Lincolnshire, PE21 7HJ

Report Number: ES-0645 Version: 1 Visit: 1 in 2022
Date of Report: 16th March 2022
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MCERTS No: MM 06 701 MCERTS Level: 2 (TE1,TE4)

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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Saint Gobain Professional Services UK & Ireland to carry out emissions monitoring, to determine the compliance of A1 - Biomass Boiler with the conditions specified in the operators permit (EPR/A2/1) for emissions to atmosphere. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

Emission Point Identification

Substances to be Monitored	A1 - Biomass Boiler
Total Particulate Matter	✓
Carbon Monoxide	✓
Oxides of Nitrogen (as NO ₂)	✓
Total VOC	✓
Oxygen	✓
Volumetric Flow	✓

Special requirements: none

Opinions and interpretations expressed within this report are outside the scope of Envirocare Technical Consultancy's MCERTS and UKAS accreditation. Envirocare accepts no responsibility for information in this report that was provided by the client, the client's representative or employees of the client. Where such information has been provided by external sources this is identified in footnotes of the respective tables.

Executive Summary

Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

Substance		Concentration			Reference Conditions	Mass Emission			Sampling Date	Sampling Times
		Limit (mg/m ³)	Result (mg/m ³)	Measurement Uncertainty (MU) +/-		Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-		
Total Particulate Matter	R1	60	9.8	0.20	273k, 101.3kPa, Dry, 11% O ₂	-	33.1	1.7	16/02/2022	10:32-11:32
Carbon Monoxide	R1	150	113	9.4	273k, 101.3kPa, Dry, 11% O ₂	-	384	36.8	16/02/2022	10:30-11:30
Oxides of Nitrogen (as NO ₂)	R1	400	97.8	15.5	273k, 101.3kPa, Dry, 11% O ₂	-	332	54.8	16/02/2022	10:30-11:30
Total VOC	R1	20	6.9	1.2	273k, 101.3kPa, Dry, 11% O ₂	-	23.5	4.3	16/02/2022	10:30-11:30
Oxygen	R1	-	15.0%	0.26	273k, 101.3kPa, Dry	-	-	-	16/02/2022	10:30-11:30
Volumetric Flow	R1	-	3,397 m ³ /h	160	273k, 101.3kPa, Dry, 11% O ₂	-	-	-	16/02/2022	10:10-10:15

Reference conditions (REF) are: 273k, 101.3kPa, Dry, 11% O₂.

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	Boiler Process
Continuous or Batch Process	Continuous (when in operation)
Operating Status	Normal operation
Feedstock	Woodchip (Biomass)
Normal Load, Throughput or Continuous Rating	N/A
Abatement System	Cyclone / ESP
Abatement System Status	Normal operation
Process Fuel	Natural Gas
Plume Appearance	Not Visible from Sampling Location

Monitoring Deviations

Parameter	Run	Deviation
All Parameters	Run 1	There are no deviations associated with the monitoring undertaken.

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
Mr K Wells	Team Leader	2 (TE1, TE4)	MM 06 701
Mr A Dykes	Operations Manager	2 (TE1, TE2, TE3, TE4)	MM 04 500

Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
Volumetric Flow	BS EN ISO 16911-1	ETC-SE-24a	Yes	Pitof Tube and Thermocouple			
Total Particulate Matter	BS EN 13284-1	ETC-SE-01	Yes	Envirocare	ETC-AP-01	Gravimetric	Yes
Carbon Monoxide	BS EN 15058	ETC-SE-10 (a/b)	Yes	NDIR by Horiba PG-250 or PG350E			
Oxides of Nitrogen	BS EN 14792	ETC-SE-10 (a/b)	Yes	Chemiluminescence by Horiba PG-250 or Horiba PG-350			
Oxygen	BS EN 14789	ETC-SE-10 (a/b)	Yes	Dry Zirconia Cell by Horiba PG-250 or Dry Paramagnetic by Horiba PG-350E			
Total VOC	BS EN 12619	ETC-SE-04	Yes	Flame Ionisation Detector by M&C Thermo FID or Sick 3006 FID			

RPS Laboratories Ltd (RPS) - Accreditation Number: 0605 | Marchwood Scientific Services - Accreditation Number: 1668 | Olfasense - Accreditation Number: 2430

Equipment Checklist

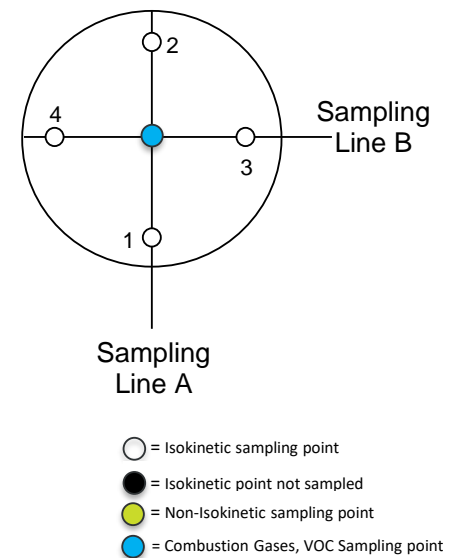
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.1	Horiba PG-250	-	Tape Measure	ETC-S17.05
Box Thermocouples	ETC-S2.10a	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	ETC-S3.32	Horiba PG-350	-	Stopwatch	ETC-S10.09
Box Thermocouple Out	ETC-S3.33	JCT JCC Cooler	-	Barometer	ETC-S11.03
Control Box Timer	-	MAK10 Cooler	-	Digital Manometer	ETC-S24.04a
Umbilical	ETC-S2.10a	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S24.04a
Oven Box	-	M&C PSS Gas Preparation	ETC-S7.08	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.22	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	ETC-S1.32	SK-Thermo FID	ETC-S13.07	5m Heated Line	-
Stack Thermocouple (2)	ETC-S1.52	Bernath 3006 FID	-	10m Heated Line	ETC-S5.08
S-Type Pitot (1)	ETC-S4632	Testo 350XL	-	20m Heated Line	-
S-Type Pitot (2)	-	M&C PSP 4000	-	30m Heated Line	-
L-Type Pitot	-	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	ETC-S3.57d
Site Balance	ETC-S18.09	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	ETC-S18.09a	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.09b	-	-	Sample Temperature Logger	-
Digital Callipers	ETC-S16.02	-	-	Laboratory Balance	-

Appendix 2: A1 - Biomass Boiler Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.60
Width	m	-
Area	m ²	0.28
Port Depth	cm	5.0
Orientation of Stack / Duct	-	Vertical
Sampling Port Size	-	4" BSP
Number of Ports	-	2

Manual Sampling Points	Used / Required
Number of Sampling Lines	2 / 2
Number of Sampling Points	2 / 2
Instrumental Sampling Points	Used / Required
Number of Sampling Lines	1 / 1
Number of Sampling Points	1 / 1

Platform Type and Location	
Platform Type - Permanent / Temporary	Permanent
Location - Inside / Outside	Inside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	Yes
Position & Work Space	Sufficient work area to manipulate probe & operate the measurement instruments	Yes
	Depth of work area > internal diameter of stack and wall thickness plus 1.5m	No
	Ports on vertical ducts 1.2m to 1.5m above platform floor	Yes
	Platform has chains / self closing gates at top of ladders	Yes
Fall Prevention	Platform has adequate drainage to prevent accumulation of free-standing water	Yes
	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
Access	Gaps between handrails not >0,5m	Yes
	Platform has vertical base boards (approx. 0.25m high)	Yes
	Access to sampling ports unhindered by obstructions	Yes
	Easy & safe access and egress available	Yes

Sampling Location / Platform Recommendations

The Sampling location meets all the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259, and no improvement actions are required.

Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m ²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
0.60	0.28	992	10.0	14.9	5.0	7.2	28.5	0.85

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (cmH ₂ O)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	8.8	0.44	0.44	0.44	0.44	8.7	140	4
	A2	51.2	0.50	0.50	0.50	0.50	9.2	140	3

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (cmH ₂ O)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
B	B1	8.8	0.56	0.56	0.56	0.56	9.8	140	5
	B2	51.2	0.48	0.48	0.48	0.48	9.1	140	4

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow Actual	Stack Gas Volume Flow @ STP Wet	Stack Gas Volume Flow @ REF Conditions
Value	9.2	1.1:1	140	413	9347	6048	3397
Units	m/s	-	°C	K	m ³ /hr	Nm ³ /hr	Nm ³ /hr

Total Particulate Matter - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.1	-
Gas Meter Coefficient	1.016	-
Pitot Coefficient	0.846	-
Stack Gas Molecular Weight	29.6	g/mole
Static Pressure in Stack	-0.28	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	8.10	mm
Average Gas Meter Temperature	16.5	°C
Average Stack Temperature	147	°C
Average Stack Velocity	9.1	m/s
Isokineticity	104.4	%
Total Sampling Time	60	min
Gas Meter Difference	1106.0	L
Corrected Gas Meter Volume	1123.7	L
Mean Sampling Rate	18.7	L/min

Date	Operators
16/02/2022	KW/AD

Parameter	Before	After	Unit
Barometric Pressure	996	996	mbar
Ambient Temperature	10.0	10.0	°C
Leak Check	0.05	-	L/min
Time	10:32	11:32	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	1.042	Nm ³
Gas Meter Volume (REF)	0.631	Nm ³
Stack Gas Water Vapour Content	7.2	% v/v
Stack Gas Oxygen Content	14.9	% v/v
TPM Concentration (REF)	9.8	mg/Nm ³
TPM Mass Emissions (REF)	33.1	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Dry, 11% O₂

Total Particulate Matter - Analysis Results

Sampling Run Number	Probe Wash Mass (mg)
Blank	<0.25
1	1.25

Sampling Run Number	Filter Reference	Filter Type	Filter Mass	Probe Wash Mass (mg)	Total Mass Deposit (mg)
			Change (mg)		
Blank	47-1812	47mm GFA	0.1	<0.25	0.35
1	47-1813	47mm GFA	4.91	1.25	6.16

Sampling Run Number	Measured	Impinger Mass (g)				Collected Mass (g)
		1	2	3	4	
1	Before	1489.0	1301.2	1259.6	1603.2	64.9
	After	1534.0	1311.6	1263.7	1608.6	

Parameter	Value	Unit
Emission Limit Value (ELV)	60	mg/m ³
Overall Blank Value (OBV)	0.55	mg/m ³
OBV <10% of ELV	YES	-

Date of Analysis	03/03/2022
Analytical Laboratory	Envirocare
Analytical Method	Gravimetric
Accreditation	MCERTS

Instrumental Gas Analyser Calibrations

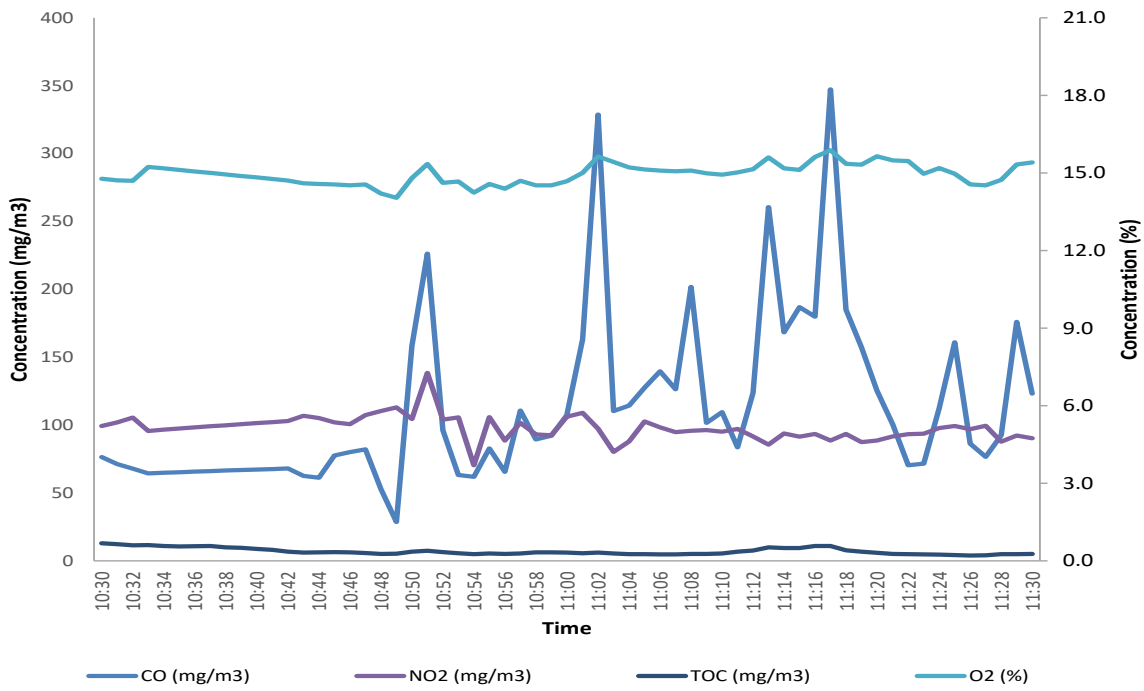
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
16/02/2022	KW/AD	ETC-S12.05	ETC-S13.07

Calibration Gas	Certified Concentration	Analyser Range	T90 Time	Analyser Span	Pre-sample Cal		Post-sample Cal		Zero Drift	Span Drift	Drift Acceptable
					Zero	Span	Zero	Span			
Carbon Monoxide	151.7ppm	500ppm	45	150.5	0.00	150.5	0.50	151	0.33	0.00	Yes
Nitrogen Monoxide	200.6ppm	500ppm	45	199.6	0.00	199.6	0.20	198.6	0.10	-0.60	Yes
Propane	81.911ppm	100ppm	20	82	0.00	82	0.20	82.4	0.00	0.49	Yes
Oxygen	21.2%	25%	40	21.18	0.01	21.18	0.03	21.16	0.14	-0.24	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O ₂ Correction
		Average	Max	Min			
Carbon Monoxide	1	112.9	347.3	28.5	mg/m ³	-	11%
Oxides of Nitrogen (as NO ₂)	1	97.85	138.41	70.44	mg/m ³	NO _x as NO ₂	11%
Total VOC	1	6.9	12.8	3.9	mg/m ³	VOC as C	11%
Oxygen	1	14.95	15.88	14.04	%	-	-

Instrumental Gas Analyser Chart - Run 1



Uncertainty

Uncertainty of Total Particulate Matter - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	60	mg/m ³
Mean Sampling Rate	18.7	L/min
Leak Rate	0.05	L/min
Barometric Pressure	996	mbar
Average Stack Temperature	147	°C
Sampled Stack Gas Volume	1106.0	L

Parameter	Value	Unit
Mean Emission Concentration	9.8	mg/m ³
Monitoring Duration	60	min
Console ID	8.1	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 13284-1		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
		Uncertainty Criteria	Max. Value					
Weighing Procedure	Std	5% of limit value	3.0	0.09	mg	0.15	0.09	0.008
Leak Rate	Rect	<2% of sampling rate	0.37	0.05	L/min	0.27	0.02	0.0002
Time	Std	1sec in 1hour = 0.028%	2.0	1.0	sec	0.03	0.003	0.00001
Gasmeter Volume	Std	<2%	22.1	4.1	L	0.37	0.04	0.001
Temperature	Std	1% of value	4.2	0.24	°C	0.16	0.02	0.0003
Pressure	Std	1% of value	10.0	1.0	mbar	0.10	0.01	0.0001
Total								0.01
Combined Standard Uncertainty [(sum u²)^{0.5}]								0.10
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								2.0
Expanded Total Uncertainty (mg/m³) (95% confidence)								0.20
Expanded Total Uncertainty as a % of emission limit value (95% confidence)								0.33

Uncertainty of Carbon Monoxide by Horiba Analyser

Parameter	Value	Unit
Emission Limit Value (ELV)	150	mg/m ³
Reading	90.3	ppm
Span Gas Certified Value	151.7	ppm
Range	500	ppm

Cal Gas
CO

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	-0.50	Rectangular	1.73	-0.29	0.08
Span Drift (ppm)	-0.50	Rectangular	1.73	-0.29	0.08
Linearity (% of value)	0.52	Rectangular	1.73	0.27	0.07
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.32	0.10
Interference (% of value)	0.73	Rectangular	1.73	0.38	0.14
Standard deviation of repeatability at zero point (% of range)	0.55	Rectangular	-	2.8	7.6
Standard deviation of repeatability at span point (% of range)	0.52	Rectangular	-	2.6	6.8
Total					14.8
Combined Standard Uncertainty [(sum u²)^{0.5}]					3.8
Expanded Total Uncertainty (ppm) (95% confidence)					7.5
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					8.3
Expanded Total Uncertainty (mg/m³) (95% confidence)					9.4
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					6.3

Uncertainty of Oxides of Nitrogen by Horiba gas Analyser

Parameter	Value	Unit	Cal Gas
Emission Limit Value (ELV)	400	mg/m ³	NO
Reading	47.7	ppm	
Span Gas Certified Value	200.6	ppm	
Range	500	ppm	

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	-0.20	Rectangular	1.73	-0.12	0.01
Span Drift (ppm)	1.0	Rectangular	1.73	0.58	0.33
Linearity (% of value)	0.73	Rectangular	1.73	0.20	0.04
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.17	0.03
Interference (% of value)	0.60	Rectangular	1.73	0.17	0.03
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	1.0	1.0
Standard deviation of repeatability at span point (% of range)	0.73	Rectangular	-	3.7	13.3
Total					14.8
Combined Standard Uncertainty [(sum u²)^{0.5}]					3.8
Expanded Total Uncertainty (ppm) (95% confidence)					7.5
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					15.8
Expanded Total Uncertainty (mg/m³) (95% confidence)					15.5
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					3.9

Uncertainty of Total VOC by SK - Run 1

Parameter	Value	Unit	Cal Gas
Emission Limit Value (ELV)	20	mg/m ³	C ₃ H ₈
Reading	4.3	ppm	
Span Gas Certified Value	81.9	ppm	
Range	100	ppm	

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	-0.20	Rectangular	1.73	-0.12	0.01
Span Drift (ppm)	-0.40	Rectangular	1.73	-0.23	0.05
Linearity (% of value)	0.53	Rectangular	1.73	0.01	0.0002
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.02	0.00
Noise (ppm)	0.10	Rectangular	1.73	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.73	0.02	0.001
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	0.20	0.04
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	0.20	0.04
Total					0.15
Combined Standard Uncertainty [(sum u²)^{0.5}]					0.39
Expanded Total Uncertainty (ppm) (95% confidence)					0.76
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					17.7
Expanded Total Uncertainty (mg/m³) (95% confidence)					1.2
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					6.1

Uncertainty of Oxygen by Horiba Analyser

Parameter	Value	Unit	Cal Gas
Reading	14.95	%	O ₂
Span Gas Certified Value	21.20	%	
Range	25	%	

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (%vol)	-0.03	Rectangular	1.73	-0.02	0.0003
Span Drift (%vol)	0.02	Rectangular	1.73	0.01	0.0001
Linearity (% of value)	1.3	Rectangular	1.73	0.11	0.01
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.05	0.003
Interference (% of value)	0.56	Rectangular	1.73	0.05	0.002
Standard deviation of repeatability at zero point (% of range)	0.04	Rectangular	-	0.01	0.0001
Standard deviation of repeatability at span point (% of range)	0.04	Rectangular	-	0.01	0.0001
Total					0.02
Combined Standard Uncertainty [(sum u²)^{0.5}]					0.13
Expanded Total Uncertainty (%) (95% confidence)					0.26
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					1.8

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	9347	L/min
Performance Characteristics & Source Value		
Standard Uncertainty - Pitot tube Coefficient	0.01	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.00005	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.004	-
Standard Uncertainty - Mean Velocity	0.06	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.12	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	1.3	%
Standard Uncertainty - Volumetric Flow Rate	225	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	441	m ³ /hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.7	%
95% confidence interval factor - 1.96		

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.