

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
Monitoring Dates: 17th September 2020
Site Address: 194 London Road, Boston, PE21 7HU

Report Number: ES-0226 Version: 1 Visit: 1 in 2020

Date of Report: 15th October 2020

Report Author: Andy Dykes

MCERTS No: MM 04 500 MCERTS Level: 2 (TE1, TE2, TE3, TE4)

Approved By: Nicky Kane Function: Senior Team Leader

MCERTS No: MM 08 998 MCERTS Level: 2 (TE1, TE2, TE3, TE4)

Signed: 

T: 01274 738668

E: sales@envirocare.org

Envirocare Technical Consultancy Ltd

Bradford Chamber Business Park, New Lane, Bradford, BD4 8BX

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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

A1 - Biomass Boiler

Substance	Emission Limit Value (mg/m ³)	Periodic Monitoring Result (mg/m ³)	Uncertainty as a % of ELV (95% confidence)	Reference Conditions	Date	Start and End Times	Monitoring Reference Method	Accreditation for Use of Method
Total Particulate Matter	60	1.6	0.30	273K, 101.3kPa, DRY, 11% O ₂	17/09/2020	12:51-13:51	BS EN 13284-1	MCERTS
Carbon Monoxide	150	43.5	1.7	273K, 101.3kPa, DRY, 11% O ₂	17/09/2020	12:52-13:52	BS EN 15058	MCERTS
Oxides of Nitrogen (as NO ₂)	400	114	1.8	273K, 101.3kPa, DRY, 11% O ₂	17/09/2020	12:52-13:52	BS EN 14792	MCERTS
Total VOC	20	4.3	9.5	273K, 101.3kPa, WET, 11% O ₂	17/09/2020	12:52-13:52	BS EN 12619	MCERTS
Oxygen	N/A	12.7%	1.2	273K, 101.3kPa, DRY	17/09/2020	12:52-13:52	BS EN 14789	MCERTS
Volumetric Flow	N/A	5,370 m ³ /h	-	273K, 101.3kPa	17/09/2020	12:25-12:35	BS EN 16911-1	MCERTS

*Uncertainty expressed in terms of emission concentration.

Operating Information

A1 - Biomass Boiler

Date	Process Type	Fuel	Feedstock	Abatement	Load	Operating Status
17/09/2020	Biomass Boiler	Natural Gas	Woodchip	Cyclone & ESP	Normal Load	Normal

*information provided by Site

Monitoring Deviations

A1 - Biomass Boiler

Substance Deviations	Monitoring Deviations	Other Relevant Issues
None	None	None

Supporting Information

Appendix 1: General Information

Monitoring Organisation Staff Details

Personnel	Function in Monitoring Campaign	MCERTS Level	MCERTS Number
Mr A Dykes	Team Leader	2 (TE1, TE2, TE3, TE4)	MM 04 500
Mr K Wells	Team Leader	2 (TE1)	MM 06 701

Monitoring Methods

Pollutant Species	Standard	Technique	ISO 17025 Analysis	Analysis Lab	Envirocare Internal Procedure
Volumetric Flow	BS EN ISO 16911-1	Pitot & Thermocouple	Yes	ENV	ETC-SE-24a
Total Particulate Matter	BS EN 13284-1	Gravimetric	Yes	RPS	ETC-SE-01
Carbon Monoxide	BS EN 15058	NDIR	Yes	ENV	ETC-SE-10b
Oxides of Nitrogen	BS EN 14792	Chemiluminescence	Yes	ENV	ETC-SE-10b
Oxygen	BS EN 14789	Zirconium Cell	Yes	ENV	ETC-SE-10b
Total VOC	BS EN 12619	FID	Yes	ENV	ETC-SE-04

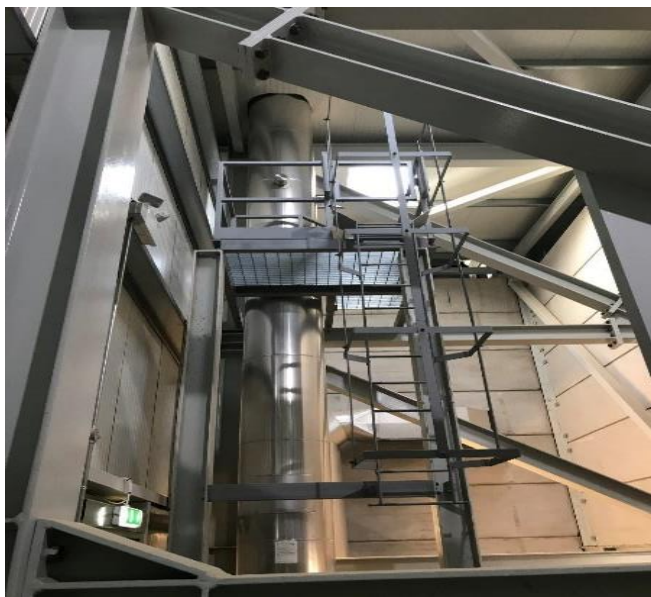
Analysis Laboratories & Accreditation Details	
Envirocare (ENV)	ISO 17025 Accreditation Number: 2522
RPS Laboratories Ltd (RPS)	ISO 17025 Accreditation Number: 0605

Equipment Checklist

Equipment ID	Model Number	Purpose
ETC-S08.02	Millenium Console	Isokinetic Sampler
ES-09.01	Oven Box	Sample Filter Heater
ETC-S04.02	Sampling Probe	Integrated Probe
10-17-19-9	S-Type Pitot	Duct Flow Measurement
BA7	Site Balance	Moisture Measurement
VC11	Vernier Caliper	Nozzle measurement
ETC-S12.01	Horiba PG 350	Multi-component Gas Analyser
ETC-S03.50	M&C Gas Conditioner	Sample gas conditioner
ETC-S13.03	SK PD Thermo-FID	Flame Ionisation Detector
ES-07.01	Heated Filter	Gas Sample Clean-up
ETC-S05.01	10m Winkler Heated line	PTFE cored heated sample line
TM67	5M Tape Measure	Duct dimension measurement
ES-11.02 (BA12)	Barometer	Ambient pressure measurement

Appendix 2: A1 - Biomass Boiler Results and Calculations

Picture of the sampling location and positions



Flow Criteria Measurements

Duct Diameter (cm)	Cross Sectional Area (m ²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Stack Gas Mr (g/mol)	Pitot Coefficient
60.0	0.28	1036	20.0	29.0	0.846

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	0.38	0.40	0.40	0.39	7.8	123	5
	A2	51.2	0.34	0.40	0.42	0.39	7.7	124	4

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	0.40	0.35	0.32	0.36	7.4	122	3
	B2	51.2	0.35	0.32	0.30	0.32	7.1	124	3

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Corrected Stack Gas Volume Flow
Value	7.5	1.1:1	123	396	7621	5370
Units	m/s	-	°C	K	m ³ /hr	Nm ³ /hr

Total Particulate Matter - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	ES-8.02	-
Gas Meter Coefficient	1.0	-
Pitot Coefficient	0.846	-
Stack Gas Molecular Weight	29.0	g/mole
Static Pressure in Stack	0.25	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	8.86	mm
Average Gas Meter Temperature	25.8	°C
Average Stack Temperature	141	°C
Average Stack Velocity	7.5	m/s
Isokineticity	102.6	%
Total Sampling Time	60	min
Gas Meter Difference	1129	L
Corrected Gas Meter Volume	1129	L
Mean Sampling Rate	18.8	L/min

Date	Operators
17/09/2020	AD/KW

Parameter	Before	After	Unit
Barometric Pressure	1031	1031	mbar
Ambient Temperature	19.0	20.0	°C
Leak Check	0.12	-	L/min
Time	12:51	13:51	-

Parameter	Value	Unit
STP Dry Gas Meter Volume	1050	NL
Mass of Water Vapour Collected	70.6	g
Volume of Water Vapour Collected	87.9	NL
Stack Gas Water Vapour Content	8.0	% v/v
Corrected TPM Emission	1.8	mg/Nm³
Corrected to 11% Oxygen	1.6	mg/Nm ³
Mass Emission Rate	0.01	kg/hr

Total Particulate Matter - Analysis Results

Sampling Run Number	Probe Wash Mass (mg)	Corrected Probe Wash Mass (mg)
Blank	<0.5	<0.5
1	0.62	0.62

Sampling Run Number	Filter Reference	Filter Type	Filter Mass	Filter Mass (mg)	Total Mass Deposit (mg)
			Change (mg)		
Blank	207687	Quartz	<0.04	<0.5	<0.54
1	206248	Quartz	1.23	0.62	1.85

Sampling Run Number	Measured	Impinger Mass (g)				Collected Mass (g)
		1	2	3	4	
1	Before	615.5	622.8	610.2	704.2	70.6
	After	656.3	631.2	613.2	722.6	

Parameter	Value	Unit
Emission Limit Value (ELV)	60	mg/m ³
Overall Blank Value (OBV)	0.51	mg/m ³
OBV <10% of ELV	YES	-

Date of Analysis	01/10/2020
Analytical Laboratory	RPS
Analytical Method	Gravimetric
Accreditation	UKAS

Instrumental Gas Analyser Calibrations

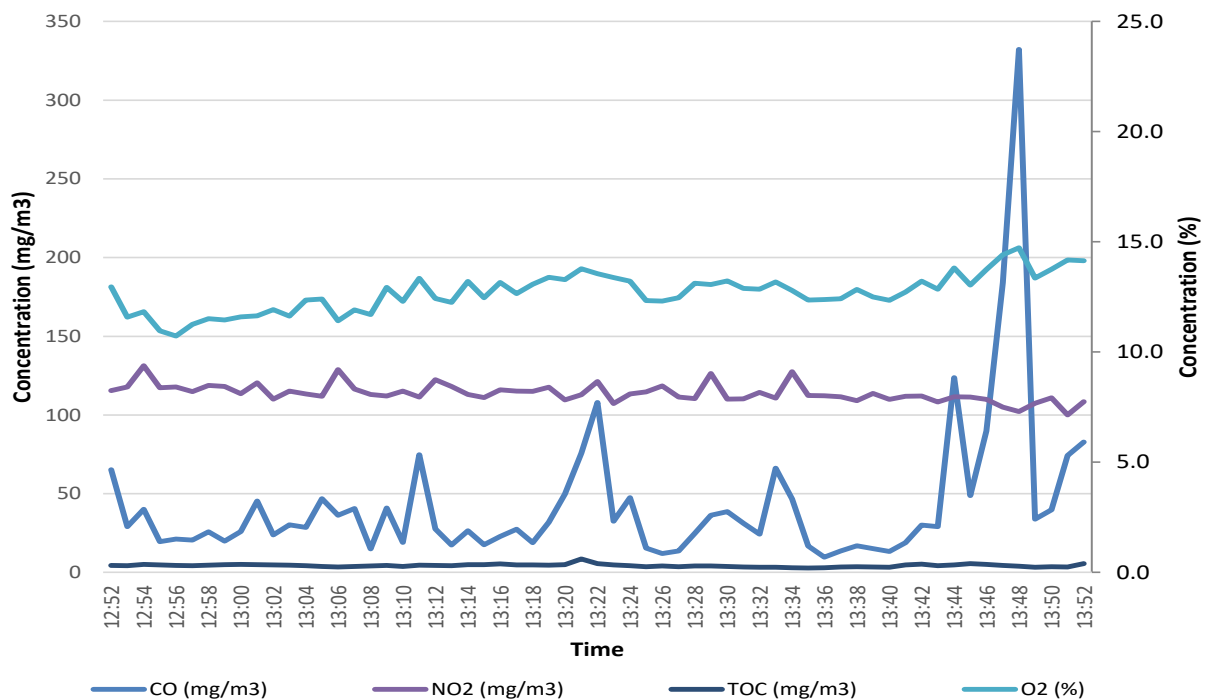
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
17/09/2020	AD/KW	ETC-S12.01	ETC-S13.03

Calibration Gas	Certified Concentration	T90 Time	Analyser Span	Pre-sample Cal		Post-sample Cal		Adjustment Required	Data Valid
				Zero	Span	Zero	Span		
Carbon Monoxide	162ppm	25	162	0.00	162	0.00	163	No	Yes
Nitric Oxide	199ppm	25	200	0.00	200	0.10	197	No	Yes
Propane	79.9ppm	20	79	0.00	80	0.60	80.5	No	Yes
Oxygen	21.16%	25	21.16	0.00	21.16	0.00	21.19	No	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O ₂ Correction
		Average	Max	Min			
Carbon Monoxide	1	43.5	332	9.7	mg/m ³	-	11%
Oxides of Nitrogen (as NO ₂)	1	114	131	100	mg/m ³	NO _x as NO ₂	11%
Total VOC	1	4.3	8.6	2.8	mg/m ³	VOC as C	11%
Oxygen	1	12.7	14.7	10.7	%	-	-

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	18.8	L/min
Leak Rate	0.12	L/min
Barometric Pressure	1031	mbar
Average Stack Temperature	141	°C
Sampled Stack Gas Volume	1129	L

Parameter	Value	Unit
Mean Emission Concentration	1.60	mg/m ³
Monitoring Duration	60	min
Console ID	ES-8.02	-
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	0.01
Leak Rate	Rect	<2% of sampling rate	0.38	0.12	L/min	0.64	0.006	0.00003
Time	Std	1sec in 1hour = 0.028%	2.0	1.0	sec	0.03	0.0004	0.000002
Gasmeter Volume	Std	<2%	22.6	4.2	L	0.37	0.006	0.00004
Temperature	Std	1% of value	4.1	0.24	°C	0.17	0.003	0.00001
Pressure	Std	1% of value	10.3	1.0	mbar	0.10	0.002	0.000002
Total								0.008
Combined Standard Uncertainty [(sum u²)^{0.5}]								0.09
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								11.2
Expanded Total Uncertainty (mg/m³) (95% confidence)								0.18
Expanded Total Uncertainty as a % of emission limit value (95% confidence)								0.30

Uncertainty of Carbon Monoxide by Horiba Analyser

Parameter	Value	Unit
Emission Limit Value (ELV)	150	mg/m ³
Reading	34.8	ppm
Span Gas Certified Value	162.0	ppm
Range	200	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)	0.00	Rectangular	1.7	0.00	0.00
Span Drift (ppm)	-1.0	Rectangular	1.7	-0.58	0.33
Linearity (% of value)	0.22	Rectangular	1.7	0.04	0.002
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.12	0.01
Interference (% of value)	2.9	Rectangular	1.7	0.58	0.34
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	0.40	0.16
Standard deviation of repeatability at span point (% of range)	0.24	Rectangular	-	0.48	0.23
Total					1.1
Combined Standard Uncertainty [(sum u²)^{0.5}]					1.0
Expanded Total Uncertainty (ppm) (95% confidence)					2.0
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					5.9
Expanded Total Uncertainty (mg/m³) (95% confidence)					2.5
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					1.7

Uncertainty of Oxides of Nitrogen by Horiba gas Analyser

Parameter	Value	Unit
Emission Limit Value (ELV)	400	mg/m ³
Reading	55.5	ppm
Span Gas Certified Value	199	ppm
Range	250	ppm

Cal Gas
NO

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	-0.10	Rectangular	1.7	-0.06	0.003
Span Drift (ppm)	3.0	Rectangular	1.7	1.7	3.0
Linearity (% of value)	0.20	Rectangular	1.7	0.06	0.004
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.19	0.04
Interference (% of value)	1.2	Rectangular	1.7	0.38	0.15
Standard deviation of repeatability at zero point (% of range)	0.00	Rectangular	-	0.00	0.00
Standard deviation of repeatability at span point (% of range)	0.09	Rectangular	-	0.23	0.05
Total					3.2
Combined Standard Uncertainty [(sum u²)^{0.5}]					1.8
Expanded Total Uncertainty (ppm) (95% confidence)					3.5
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					6.4
Expanded Total Uncertainty (mg/m³) (95% confidence)					7.2
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					1.8

Uncertainty of Total VOC by M&A 2 - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	20	mg/m ³
Reading	2.7	ppm
Span Gas Certified Value	79.9	ppm
Range	100	ppm

Cal Gas
C ₃ H ₈

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	-0.60	Rectangular	1.7	-0.35	0.12
Span Drift (ppm)	-0.50	Rectangular	1.7	-0.29	0.08
Linearity (% of value)	0.46	Rectangular	1.7	0.01	0.0001
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.01	0.0001
Noise (ppm)	0.10	Rectangular	1.7	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.7	0.02	0.0002
Standard deviation of repeatability at zero point (% of range)	0.32	Rectangular	-	0.32	0.10
Standard deviation of repeatability at span point (% of range)	0.24	Rectangular	-	0.24	0.06
Total					0.37
Combined Standard Uncertainty [(sum u²)^{0.5}]					0.61
Expanded Total Uncertainty (ppm) (95% confidence)					1.2
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					44.2
Expanded Total Uncertainty (mg/m³) (95% confidence)					1.9
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					9.5

Uncertainty of Oxygen by Horiba Analyser

Parameter	Value	Unit
Reading	12.7	%
Span Gas Certified Value	21.16	%
Range	25	%

Cal Gas
O ₂

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (%vol)	0.00	Rectangular	1.7	0.00	0.00
Span Drift (%vol)	-0.03	Rectangular	1.7	-0.02	0.0003
Linearity (% of value)	0.63	Rectangular	1.7	0.05	0.002
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.04	0.002
Interference (% of value)	0.56	Rectangular	1.7	0.04	0.002
Standard deviation of repeatability at zero point (% of range)	0.00	Rectangular	-	0.00	0.00
Standard deviation of repeatability at span point (% of range)	0.02	Rectangular	-	0.01	0.00003
Total					0.01
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$					0.08
Expanded Total Uncertainty (%) (95% confidence)					0.15
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					1.2