

Report on a Periodic Emission Monitoring Programme

Determination of Emissions to Atmosphere from Specified
Installations

Monitoring and Report Undertaken
by Cirrus Environmental Solutions Ltd

Client: Furness Property Solutions Ltd

Site: Shildon

Emission Point: Boiler 2

Project Ref No.: 08163-EM-2023-2-V1

Date of Issue: 21st December 2023

Report on the Periodic Monitoring of Emissions to Atmosphere

Client:	Furness Property Solutions Ltd
Operator Address:	Unit 8c Hackworth Industrial Park Shildon County Durham DL4 1HF

Monitoring Dates: 24 November 2023

Project Reference: 08163-EM-2023-2-V1

Emission Point: Boiler 2

Monitoring Organisation: Cirrus Environmental Solutions Ltd

Address: Unit 8 Boldon Court
Boldon Business Park
Boldon
Tyne & Wear
NE35 9PY

Report Date: 21st December 2023

Report Approved by: Rachel Bowman

Position: Director

Approver Signature: 

Cirrus Environmental Solutions Ltd has produced this report within the terms of the contract with the client and taking account of the resources devoted to it by the agreement of the client.

Cirrus Environmental Solutions Ltd disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. This report is confidential to the client and we accept no responsibility of whatever nature to third parties to whom this report or any part of the report is made known.

Report Contents

Section No.	Section Heading	Page No.
	Report Version History	4
Part 1: Executive Summary		
Section: 1	Monitoring Objectives	5
Section: 2	Monitoring Results	6
Section: 3	Operating Information	7
Section: 4	Monitoring Deviations	8
Part 2: Supporting Information		
Appendix: 1	Staff and Methodology Details	9
Appendix: 2	Calculations and Field Data: Boiler 2	10
Appendix: 3	Uncertainty of Measurements	x

Report Version History

Report No.	Date of Issue	Reason to Issue
08163-EM-2023-2-V1	21st December 2023	First issue

PART 1: EXECUTIVE SUMMARY

Section: 1 Monitoring Objectives

- 1.1 Cirrus Environmental Solutions Ltd was commissioned to undertake a programme of stack emission monitoring by Mike Furness representing Furness Property Solutions Ltd. The monitoring was carried out at the Shildon site.
- 1.2 The purpose of the programme was to assist Furness Property Solutions Ltd to evaluate the required test parameters for plant performance / investigative reasons.
- 1.3 The objective was to determine the following emissions to atmosphere:

Parameter	Boiler 2	Monitoring Method	Accreditation of Monitoring
Velocity		BS EN 16911-1	Non-accredited
Carbon Monoxide		BS ISO 12039	Non-accredited
Oxides of Nitrogen (as NO ₂)		BS ISO 10849	Non-accredited
Carbon Dioxide		BS ISO 12039	Non-accredited
Particulate		BS EN 13284-1	Non-accredited

Section: 2 Monitoring Results

2.1 Monitoring Results – Boiler 2

Parameter	Velocity (m/s)	Volumetric Flow Rate	Measurement Uncertainty (% _{REL})
Velocity	10.3 m/s	1813 m ³ /hr actual 1041 m ³ /hr STP	--

Parameter	Emission Limit (mg/m ³)	Concentration (mg/m ³)	Measurement Uncertainty (% _{REL})	Mass Emission Rate (g/hr)
Carbon Monoxide	--	189.55	1.65	197.39
Oxides of Nitrogen (as NO ₂)	--	105.09	7.07	109.43
Carbon Dioxide	N/A	7.22 %vol	3.95 %vol	147.6 kg/hr
Particulate Run 1	--	3.56	3.15	3.84

All results are expressed at the following reference conditions:

Standard temperature and pressure (273 K, 101.3 kPa) as a wet gas without correction for oxygen.

Uncertainties are calculated at a 95% CI.

Results relate to test times only.

2.2 Monitoring Times – Boiler 2

Parameter	Sampling Date	Sampling Period	Sample Duration (hr:min)
Velocity	24-Nov-23	-	-
Carbon Monoxide	24-Nov-23	11:32 - 12:32	01:00
Oxides of Nitrogen (as NO ₂)	24-Nov-23	11:32 - 12:32	01:00
Carbon Dioxide	24-Nov-23	11:32 - 12:32	01:00
Particulate Run 1	24-Nov-23	10:43 - 11:43	01:00

Section: 3 Operating Information

3.1 Process Details – Boiler 2

Parameter	Process Details
Process status	Operational
Continuous / batch monitored	Batch
Whole or part of batch	Whole batch
Feedstock	Scrap wood
Load	Normal
Fuel	NA
Abatement type	None
Plume appearance	Visible plume above stack
Process problems	Temperature control issues
Comments	None

3.2 Continuous Emissions Monitoring Equipment (CEMs)

There was no CEM installed.

Section: 4 Monitoring Deviations

Emission Point	Substance Deviations
Boiler 2	None

Emission Point	Monitoring Deviations
Boiler 2	None

Emission Point	Other Relevant Issues
Boiler 2	None

PART 2: SUPPORTING INFORMATION

Appendix: 1 Staff and Methodology Details

A.1.1 Monitoring Organisation Staff Details

Staff Member	Designation	Project Role	MCERTS No.	MCERTS Level	Technical Endorsements
Rachel Bowman	Director	Report Reviewer, Report Approver	MM 03 364	--	--
Dan Rutherford	Technician	Site Member, Report Author	MM 19 1516	Trainee	--
Owen Ferris	Assistant	Site Member	--	--	--

A.1.2 Methodology Details

Emission Parameter	Standard Method	Monitoring Procedure
Velocity	BS EN 16911-1	SOP/em/doc1
Carbon Monoxide	BS ISO 12039	SOP/em/doc3
Oxides of Nitrogen (as NO ₂)	BS ISO 10849	SOP/em/doc3
Carbon Dioxide	BS ISO 12039	SOP/em/doc20
Particulate	BS EN 13284-1	SOP/em/doc5

A.1.3 Subsequent Analysis

Lab Analysis	Analytical Technique	Accreditation of Analysis	UKAS Lab Number	Laboratory	Laboratory Location
Particulate (Filter)	Gravimetric	MCERTS	4114	Cirrus	Sunderland
Particulate (Rinse)	Gravimetric	MCERTS	1668	Marchwood	Manchester

A.1.4 Equipment

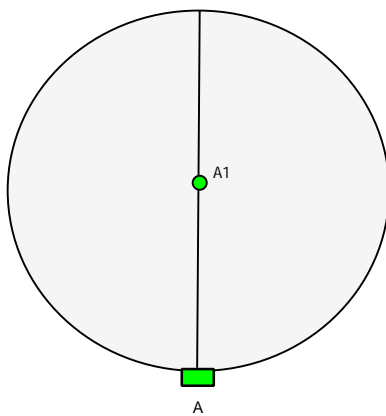
Sampling		Instrumental Analysis	
Equipment	I.D.	Equipment	I.D.
Pitot	0017	Combustion Gas Analyser	0115
Manometer	0181	Stackmite Sampler	0138
Stack Thermocouple	0099	Nozzle	0087
Temperature Indicator	0105	0	0
Barometer	0102	0	0
Tape Measure	0194	0	0
Stopwatch	DR PC	0	0

Appendix: 2 Calculations and Field Data: Boiler 2

A.2.1 Stack & Sampling Plane Details – Boiler 2

Orientation of stack	Vertical	Duct diameters to upstream disturbance	5
Cross sectional shape	Circular	Duct diameters to downstream disturbance	5
Dimensions	0.25	Number of Sample Ports on Stack	1
Area	0.05	Number of Sample Ports Used	1
Port type and size	Hole 4 inches	Reason to reduce traverses	N/A

A.2.2 Stack Diagram/Photo – Boiler 2



- VELOCITY / ISOKINETIC SAMPLE POINT
- VELOCITY / ISOKINETIC SAMPLE POINT NOT POSSIBLE
- SINGLE POINT SAMPLE POINT
- SAMPLE PORT AVAILABLE
- SAMPLE PORT NOT AVAILABLE

A.2.3 Stack Gas Profile Characteristics – Boiler 2

Process Operator	Furness Property Solutions Ltd
Site Name	Shildon
Measurement Point	Boiler 2
Date	24-Nov-23

Stack Moisture %vol	2.0
Stack O2 %vol	20.9
Stack CO2 %vol	0.04
Stack CO + N2 %vol	79.06
Molecular Wt, dry (Md) g/g mole	28.84
Molecular Wt, wet (Ms) g/g mole	28.63
Static Pressure (Ps) mm H2O	5
Barometric pressure (Pbar) kPa	100.5
Pitot Coefficient (Cp)	0.83

Pitot type	L-type
Pitot leak check acceptable?	PASS

Traverse Line A					
Traverse Point No.	Distance into Stack m	Static Pressure	5.0	mm H2O	
		Temperature oC	ΔP mm H2O	Velocity m/s	Swirl Degrees
1	0.13	189.3	5.8	10.3	1

Gas Velocity Summary

Gas Velocity (m/s)	Minimum	10.26
	Maximum	10.26
	Mean	10.26
Ratio of Gas Velocity Max:Min		1.0
Mean Temperature (oC)		189.3
Volumetric Flow (m3/hr)		1813
Volumetric Flow (m3/hr) STP		1041

Sample Point Requirements	Criteria	PASS / FAIL
Angle of Gas Flow with regard to duct axis	$\leq 15^\circ$	PASS
Negative airflow	None	PASS
Minimum Stack Pressure, mm H2O	≥ 0.5	PASS
Ratio maximum: minimum gas velocity	$\leq 3:1$	PASS

Homogeneity

Is a Homogeneity test Required	No
Homogeneity Test Carried out at this visit	No
Previous Homogeneity Test Carried out	N/A
Homogeneity Test Result	N/A

A.2.4 Calibration of Instrumental Analysers – Boiler 2

Calibration Gas Parameter		CO	NO			CO2
Analyser ID		0134 RASI 800	0134 RASI 800			0134 RASI 800
LOD (ppm / %vol)		2.80	1.75			0.10
SD repeatability at Zero (ppm / %)		1.40	0.88			0.05
2x SD repeatability at Zero (ppm)		2.80	1.75			0.10

Calibration Gas Parameter		CO (ppm)	NO (ppm)			CO2 (%vol)
ELV (mg/m3)		0	0			--
Range		100	100			8
Certified Concentration		101.0	101.7			20.9
Cylinder No.		3	3			1
Cylinder Uncertainty +/- %		1	1			0.1

1st Zero		0.0	0.0			0.0
Span		101.0	101.0			20.9
2nd Zero		0.0	0.0			0.0
Span acceptable?		Pass	Pass			Pass
2nd zero acceptable?		Pass	Pass			Pass
Calibration acceptable?		Pass	Pass			Pass

Zero (end)		0.0	0.0			0.0
Span (end)		0.0	0.0			0.0

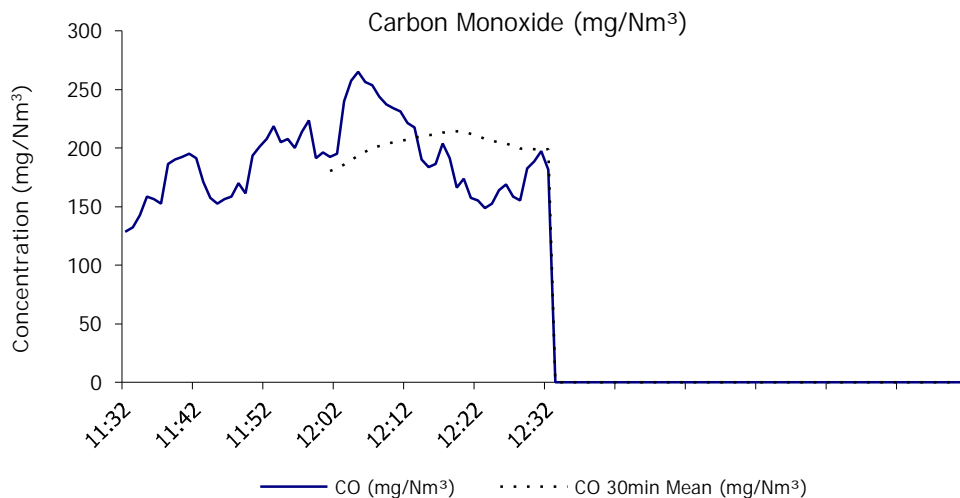
Zero Drift		0.0	0.0			0.0
Span Drift		0.0	0.0			0.0
Zero Drift acceptable?		Pass	Pass			Pass
Span Drift acceptable?		Pass	Pass			Pass
Analyser Drift acceptable?		PASS	PASS			PASS

A.2.5 Carbon Monoxide – Boiler 2

Process Operator	Furness Property Solutions Ltd
Site Name	Shildon
Sampling Point	Boiler 2

24-Nov-23 Time	CO Conc. mg/Nm ³	30min Mean mg/Nm ³	24-Nov-23 Time	CO Conc. mg/Nm ³	30min Mean mg/Nm ³	24-Nov-23 Time	CO Conc. mg/Nm ³	30min Mean mg/Nm ³	24-Nov-23 Time	CO Conc. mg/Nm ³	30min Mean mg/Nm ³
11:32	128.75		12:03	240.00	185.96						
11:33	132.50		12:04	257.50	189.79						
11:34	142.50		12:05	265.00	193.33						
11:35	158.75		12:06	256.25	196.67						
11:36	156.25		12:07	253.75	200.04						
11:37	152.50		12:08	243.75	201.96						
11:38	186.25		12:09	237.50	203.54						
11:39	190.00		12:10	233.75	204.92						
11:40	192.50		12:11	231.25	206.13						
11:41	195.00		12:12	221.25	207.13						
11:42	191.25		12:13	217.50	208.67						
11:43	171.25		12:14	190.00	209.75						
11:44	157.50		12:15	183.75	210.79						
11:45	152.50		12:16	186.25	211.79						
11:46	156.25		12:17	203.75	213.29						
11:47	158.75		12:18	191.25	214.00						
11:48	170.00		12:19	166.25	214.17						
11:49	161.25		12:20	173.75	213.50						
11:50	193.75		12:21	157.50	212.04						
11:51	201.25		12:22	155.00	210.29						
11:52	207.50		12:23	148.75	207.96						
11:53	218.75		12:24	152.50	206.21						
11:54	205.00		12:25	163.75	204.75						
11:55	207.50		12:26	168.75	203.71						
11:56	200.00		12:27	158.75	201.88						
11:57	213.75		12:28	155.00	199.58						
11:58	223.75		12:29	182.50	199.29						
11:59	191.25		12:30	188.75	199.04				Minimum		128.75
12:00	196.25		12:31	197.50	199.21				Maximum		265.00
12:01	192.50	180.17	12:32	181.25	198.75				Mean		189.55
12:02	195.00	182.38							Mass Emissions (g/hr)		197.39

A.2.5.1 Emissions Profile – Carbon Monoxide – Boiler 2

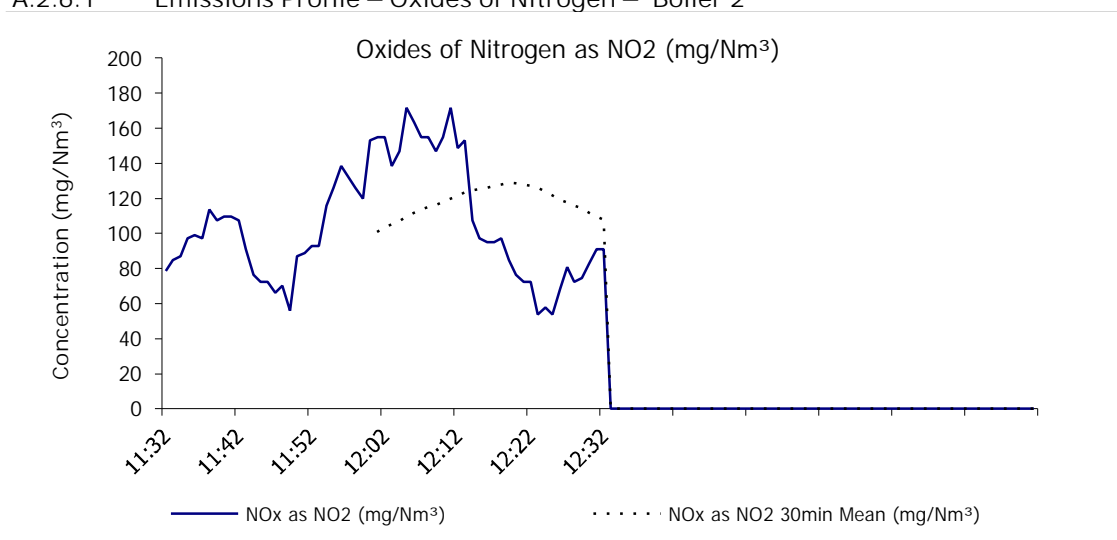


A.2.6 Oxides of Nitrogen – Boiler 2

Process Operator	Furness Property Solutions Ltd
Site Name	Shildon
Sampling Point	Boiler 2

24-Nov-23 Time	NOx Conc. mg/Nm ³	30min Mean mg/Nm ³	24-Nov-23 Time	NOx Conc. mg/Nm ³	30min Mean mg/Nm ³	24-Nov-23 Time	NOx Conc. mg/Nm ³	30min Mean mg/Nm ³	24-Nov-23 Time	NOx Conc. mg/Nm ³	30min Mean mg/Nm ³
11:32	78.58		12:03	138.54	105.18						
11:33	84.78		12:04	146.81	107.18						
11:34	86.85		12:05	171.63	109.66						
11:35	97.19		12:06	163.36	111.80						
11:36	99.25		12:07	155.09	113.73						
11:37	97.19		12:08	155.09	115.11						
11:38	113.73		12:09	146.81	116.42						
11:39	107.53		12:10	155.09	117.93						
11:40	109.59		12:11	171.63	120.00						
11:41	109.59		12:12	148.88	121.38						
11:42	107.53		12:13	153.02	123.45						
11:43	90.98		12:14	107.53	124.48						
11:44	76.51		12:15	97.19	125.31						
11:45	72.37		12:16	95.12	126.07						
11:46	72.37		12:17	95.12	127.03						
11:47	66.17		12:18	97.19	127.93						
11:48	70.31		12:19	84.78	128.89						
11:49	55.83		12:20	76.51	128.55						
11:50	86.85		12:21	72.37	128.00						
11:51	88.92		12:22	72.37	127.31						
11:52	93.05		12:23	53.76	126.00						
11:53	93.05		12:24	57.90	124.07						
11:54	115.80		12:25	53.76	121.66						
11:55	126.14		12:26	68.24	119.31						
11:56	138.54		12:27	80.64	117.59						
11:57	132.34		12:28	72.37	115.80						
11:58	126.14		12:29	74.44	114.28						
11:59	119.93		12:30	82.71	111.94					Minimum	53.76
12:00	153.02		12:31	90.98	109.80					Maximum	171.63
12:01	155.09	100.84	12:32	90.98	107.66					Mean	105.09
12:02	155.09	103.39								Mass Emissions (g/hr)	109.43

A.2.6.1 Emissions Profile – Oxides of Nitrogen – Boiler 2



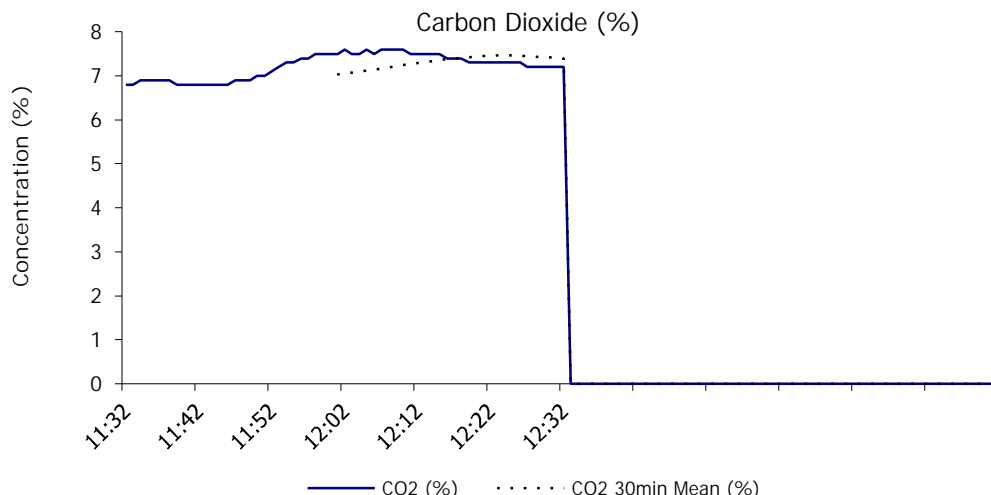
A.2.7 Carbon Dioxide – Boiler 2

Process Operator	Furness Property Solutions Ltd
Site Name	Shildon
Sampling Point	Boiler 2

24-Nov-23 Time	CO2 Conc. %	30min Mean %	24-Nov-23 Time	CO2 Conc. %	30min Mean %	24-Nov-23 Time	CO2 Conc. %	30min Mean %	24-Nov-23 Time	CO2 Conc. %	30min Mean %
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08						
11:32	6.80		12:03	7.50	7.08					Minimum	6.80
11:32	6.80		12:03	7.50	7.08					Maximum	7.60
11:32	6.80	7.03	12:03	7.50	7.08				Mean	7.22	
11:32	6.80	7.03	12:03	7.50	7.08				Mass Emissions (g/hr)	147648	

Process Operator	Furness Property Solutions Ltd
Site Name	Shildon
Sampling Point	Boiler 2

A.2.7.1 Emissions Profile – Carbon Dioxide – Boiler 2



A.2.8 Particulates – (Stackmite) – Boiler 2

A.2.8.1 Field Data – Particulates (Stackmite) – Run 1

BLANK							
Testers Notes: --							
Date	Blank Time		Leak Check (l/min)	Filter Position	Filter Type	Filter Size	Cirrus Blank Ref.
	Start	Finish	Pre-test				3844
24-Nov-23	10:38	10:41	0	In-Stack	GFA	25	CES 31452

RUN 1							
Testers Notes: --							
Date	Sampling Time		Leak Check (l/min)	Filter Position	Filter Type	Filter Size	Cirrus Sample Ref.
	Start	Finish	Pre-test				3842
24-Nov-23	10:43	11:43	0	In-Stack	GFA	25	CES 31454

Traverse Point	Elapsed Time	ΔP mmH2O	Pull Rate l/min	Volume Litres	Stack Temp °C	Meter Temp °C	Velocity m/s
Centre	5	6.0	18.3	95	189	18	10.4
Centre	10	6.0	18.3	190	189	18	10.4
Centre	15	6.0	18.3	285	189	18	10.4
Centre	20	6.0	18.3	380	189	18	10.4
Centre	25	6.0	18.3	475	189	18	10.4
Centre	30	6.0	18.3	570	189	18	10.4
Centre	35	6.0	18.3	665	189	18	10.4
Centre	40	6.0	18.3	760	189	18	10.4
Centre	45	6.0	18.3	855	189	18	10.4
Centre	50	6.0	18.3	950	189	18	10.4
Centre	55	6.0	18.3	1045	189	18	10.4
Centre	60	6.0	18.3	1140	189	18	10.4
Total	60			1045.0			
Average		6.0	18.3		189.0	18.0	10.4

A.2.8.2 Isokinetic Sampling Equations – Particulates (Stackmite)

Absolute pressure of stack gas, Ps	Units	Run 1
Barometric pressure, Pb	mm Hg	753.8
Stack static pressure, Pstatic	mmH2O	5
Ps = Pb + (Pstatic * 0.0098)	mm Hg	754.2
Volume of water collected, Vwstd	Units	Run 1
Impinger volume collected	ml	
Silica gel weight increase	g	
Total volume of liquid collected, Vlc	ml	
Vwstd = 0.0012422 x Vlc	m3	
Volume of gas metered dry, Vmstd	Units	Run 1
Volume of gas sampled through gas meter, Vm	m3	1.045
Gas meter correction factor, Yd	-	1.0180
Average dry gas meter temperature, Tm	oC	18.0
$Vmstd = \frac{(0.3592)(Vm)(Pb)(Yd)}{Tm + 273}$	m3	0.990
Volume of gas metered wet, Vmstw	Units	Run 1
Vmstw = Vmstd + Vwstd	m3	0.990
Moisture content, Bwo	Units	Run 1
$Bwo = \frac{Vwstd}{Vmstd + Vwstd}$	m3	0.0200
	%	2.00
Molecular weight of dry gas stream, Md	Units	Run 1
CO2	%	0.04
O2	%	20.90
Total	%	20.94
N2 = (100 - Total)	%	79.06
$Md = 0.44(\%CO2) + 0.32(\%O2) + 0.28(\%N2)$	g/gmol	28.84
Molecular weight of stack gas (wet), Ms	Units	Run 1
$Ms = Md(1 - Bwo) + 18(Bwo)$	g/gmol	28.63
Velocity of stack gas, Vs	Units	Run 1
Average stack gas temperature, Ts	oC	189.0
Mean Velocity of stack gas Actual	m/s	10.4
Mean Velocity of stack gas (stp)	m/s	6.1
Actual flow of stack gas, Qa	Units	Run 1
Diameter of stack, Ds	m	0.25
Area of stack, As	m2	0.049
$Qa = (3600)(As)(Vs)$	m3/hr	1838
Dry total flow of stack gas, Qstd	Units	Run 1
Conversion factor (K/mm Hg)	-	0.3592
$Qstd = \frac{(Qa)(Ps)(0.3592)(1-Bwo)}{Ts + 273}$	m3/hr	1056
Wet total flow of stack gas, Qstw	Units	Run 1
$Qstw = \frac{(Qa)(Ps)(0.3592)}{Ts + 273}$	m3/hr	1078
Percent Isokinetic, %I	Units	Run 1
Nozzle diameter, Dn	mm	7.70
Nozzle area, An	mm2	46.57
Total sampling time, Θ	min	60
$\%I = \frac{(4.6398E6)(Ts+273)(Vmstd)}{(Ps)(Vs)(An)(\Theta)(1-Bwo)}$	%	96.8
Acceptable Isokinetic Range 95% to 115%	-	PASS

A.2.8.3 Concentration – Particulates (Stackmite)

Particulate Concentration	Units	Blank	Run 1
Filter Ref:	-	3844	3842
Acetone Wash Ref:	-	CES 31452	CES 31454
Mass of particulate collected on filter, Mf	mg	< 0.03	0.03
Mass of particulate collected in probe, Mp	mg	< 0.20	3.50
Total Mass of collected particulate, Mn	mg	< 0.23	3.53
Particulate Concentration Wet, Cw	Units	Blank	Run 1
$C_w = \frac{M_n}{V_{mstw}}$	mg/m ³	< 0.23	3.56
Particulate Concentration Dry, Cd	Units	Blank	Run 1
$C_d = \frac{M_n}{V_{mstd}}$	mg/m ³	< 0.23	3.56
Particulate Emission Rates, E @ ref cond.	Units	Blank	Run 1
$E = ((C)(Q))/1000$	g/hr	< 0.25	3.84

Appendix: 3 Uncertainty of Measurements

A.3.1 Uncertainty of Measurement – Carbon Monoxide – Boiler 2

Uncertainty calculation for Gaseous Measurement CO		
Limit value	--	mg/m3 (Ref. Conditions)
Analyser Full Scale	125.0	mg/m3
Span gas concentration	126.3	mg/m3
Measured concentration	189.5	mg/m3 (Measured)
Measured concentration	185.8	mg/m3 (Ref. Conditions)

Uncertainty component	Value of Uncertainty	
Standard deviation of repeatability (max)	0.18	Urs
Lack of fit	1.10	Ufit
Drift	0.00	Uodr
losses in the line (leak)	0.00	Uleak
Uncertainty of calibration gas	1.09	Ucalib
Uncertainty in factor	9.69	Uf
vol or pressure flow dependence	0.00	Uspres
atmospheric pressure dependence	0.00	Uapres
ambient temperature dependence	-0.02	Utemp
Dependence on voltage	0.00	Uvolt
N2O interference	0.01	Uinterf
CO2 interference	0.01	Uinterf
CH4 interference	0.01	Uinterf
H2O interference	0.01	Uinterf

Measurement value	189.55	mg/m3 (Measured)
Combined uncertainty	1.56	mg/m3 (Measured)
Expanded uncertainty at CI 95%	3.1	mg/m3 (Ref. Conditions)
Expanded uncertainty at CI 95%	1.6	as % Value
Expanded uncertainty at CI 95%	--	as % of ELV

A.3.2 Uncertainty of Measurement – Oxides of Nitrogen as NO2 – Boiler 2

Uncertainty calculation for Gaseous Measurement NOx		
Limit value	--	mg/m3 (Ref. Conditions)
Analyser Full Scale	205.4	mg/m3
Span gas concentration	208.8	mg/m3
Measured concentration	104.4	mg/m3 (Measured)
Measured concentration	102.3	mg/m3 (Ref. Conditions)

Uncertainty component	Value of Uncertainty	
Standard deviation of repeatability (max)	0.11	Urs
Lack of fit	0.60	Ufit
Drift	0.00	Uodr
losses in the line (leak)	0.00	Uleak
Uncertainty of calibration gas	0.60	Ucalib
Uncertainty in factor	5.33	Uf
vol or pressure flow dependence	0.00	Uspres
atmospheric pressure dependence	0.00	Uapres
ambient temperature dependence	-1.95	Utemp
Dependence on voltage	0.00	Uvolt
NH3 interference	0.00	Uinterf
CO2 interference	0.12	Uinterf
H2O interference	0.00	Uinterf
NOx converter efficiency	3.01	Uinterf

Measurement value	104.36	mg/m3 (Measured)
Combined uncertainty	3.69	mg/m3 (Measured)
Coverage factor k =	2	
Expanded uncertainty	7.4	mg/m3 (Measured)
Expanded uncertainty at CI 95%	7.2	mg/m3 (Ref. Conditions)
Expanded uncertainty at CI 95%	7.1	as % Value
Expanded uncertainty at CI 95%	--	as % of ELV

A.3.3 Uncertainty of Measurement – Carbon Dioxide – Boiler 2

Uncertainty calculation for Gaseous Measurement CO2		
Limit value	N/A	%vol (Ref Conditions)
Analyser Full Scale	8	%vol
Span gas concentration	20.9	%vol
Measured concentration	7.2	%vol (Measured)
Measured concentration	7.1	%vol (Ref Conditions)

Uncertainty component	Value of Uncertainty	
Standard deviation of repeatability (max)	0.08	Urs
Lack of fit	0.52	Ufit
Drift	0.00	Uodr
losses in the line (leak)	0.00	Uleak
Uncertainty of calibration gas	0.00	Ucalib
Uncertainty in factor	0.37	Uf
vol or pressure flow dependence	0.00	Uspres
atmospheric pressure dependence	0.00	Uapres
ambient temperature dependence	-1.95	Utemp
dependence on voltage	0.00	Uvolt
N2O interference	0.01	Uinterf
CO2 interference	0.00	Uinterf
CH4 interference	0.01	Uinterf
H2O interference	0.00	Uinterf

Measurement value	7.22	%vol (Measured)
Combined uncertainty	2.02	%vol (Measured)
Coverage factor k =	2	
Expanded uncertainty	4.03	%vol (Measured)
Expanded uncertainty at CI 95%	3.95	%vol (Ref. Conditions)
Expanded uncertainty at CI 95%	55.87	as % Value
Expanded uncertainty at CI 95%	N/A	as % of ELV

A.3.4 Uncertainty of Measurement – Particulates (Stackmite) – Boiler 2

Measurement of Uncertainty Particulate Run 1

Limit Value	--	mg/m3
Measured concentration	3.56	mg/m3
Reference oxygen	-	% by volume

Measured Quantities	Value	Uncertainty			Uncertainty (%)	Uncertainty (%) at ELV	Requirement of Standard
Sampled Volume, Vm	1.045	uVm	0.0040	m3	0.38		<=2%
Sampled Gas Temperature, Tm	291	uTm	1.2221	K	0.42		<=1%
Sampled gas Pressure, pm	100.5	upm	0.0536	kPa	0.05		<=1%
Sampled gas Humidity, Hm	2.00	uHm	0.0092	% by Volume	0.46		<=1%
Oxygen content, O2,m	-	uO2,m	-	% by Volume	-		<=5%
Mass collected	0.02721	um	0.1786	mg	656.27	#VALUE!	<5% of limit value
Leak, L	0.00	uL	0.2011	l/min	1.15		<=2%
Uncollected Mass, UCM	3.50	uUCM	0.2945	mg	3.50		<=10%

Parameter	Uncertainty in Measurement units		Uncertainty in Result	
	Volume (standard conditions), V	0.9921	m3	0.01
Mass collected	0.02721	mg	0.02	mg/m3
Factor for O2 Correction, fc	-	-	-	mg/m3
Leak, L	0.00	%	0.00	mg/m3
Uncollected Mass, UCM	3.50	mg	0.05	mg/m3
Combined Uncertainty			0.06	mg/m3

Expanded Uncertainty Expressed with a level of confidence of 95%	0.11	mg/m3
	3.15	%

END OF REPORT