ENVIRONMENTAL SERVICES

Report for the Periodic Monitoring of Emissions to Atmosphere

Stack Emissions Test Report Commissioned by: Environmental Monitoring Solutions Ltd

Holmfirth Dryers Ltd

Boiler 2

Permit No:	N/A
Installation:	Holmfirth
Monitoring Dates:	22nd June 2022
Site Address:	Ribbleden Dye Works, Dunford Rd, Holmfirth, HD9 2DP

Report Number:	ES-0911	Version: 1	Visit: 1 in 2022
Date of Report:	21st July 2022		
Report Author:	Kriss Wells		
MCERTS No:	MM 06 701	MCERTS Level:	2 (TE1,TE2,TE4)

Approved By:	Andy Dykes	Function:	Operations Manager
MCERTS No:	MM 04 500	MCERTS Level:	2 (TE1, TE2, TE3, TE4)

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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Environmental Monitoring Solutions Ltd to carry out emissions monitoring at Holmfirth Dryers Ltd, to determine the compliance of Boiler 2 as part of the the Part A permit application process. 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	Boiler 2
Carbon Monoxide	✓
Oxides of Nitrogen (as NO_2)	✓
Total VOC	✓
Oxygen	✓
Volumetric Flow	✓
Water Vapour	✓

Special requirements: none

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Executive Summary

Monitoring Results

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

		Concentration				Mass Emission				
Substance		**Limit (mg/m^3)**	**Result (mg/m^3)**	**Measurement Uncertainty (MU) +/-**	**Reference Conditions**	**Limit (g/hr)**	**Result (g/hr)**	**Measurement Uncertainty (MU) +/-**	**Sampling Date**	**Sampling Times**
Water Vapour	R1	-	11.7%	-	273K, 101.3kPa	-	-	-	22/06/2022	09:30-10:30
Carbon Monoxide	R1	-	1.6	6.3	273k, 101.3kPa, Dry, 3% O2.	-	10.3	39.7	22/06/2022	09:30-10:30
Oxides of Nitrogen (as NO_2)	R1	-	181	2.4	273k, 101.3kPa, Dry, 3% O2.	-	1135	57.0	22/06/2022	09:30-10:30
Total VOC	R1	-	4.9	9.0	273k, 101.3kPa, Dry, 3% O2.	-	30.6	56.3	22/06/2022	09:30-10:30
Oxygen	R1	-	6.4%	0.09	273k, 101.3kPa, Dry, 3% O2.	-	-	-	22/06/2022	09:30-10:30
Volumetric Flow	R1	-	6,280 m^3/h	304	273k, 101.3kPa, Dry, 3% O2.	-	-	-	22/06/2022	08:35-08:45

Reference conditions (REF) are: 273k, 101.3kPa, Dry, 3% O2.

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	Boiler
Continuous or Batch Process	Continuous
Operating Status	Normal
Feedstock	Natural Gas
Normal Load, Throughput or Continuous Rating	100%
Abatement System	None
Abatement System Status	-
Process Fuel	Natural Gas
Plume Appearance	None

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,TE2,TE4)	MM 06 701
Mr C Welsh	Technician	Trainee	MM 20 1692

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	Pitot Tube and Thermocouple			
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			
Water Vapour	BS EN 14790	ETC-SE-11	Yes	ENV	ETC-SE-11	Gravimetric	Yes

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

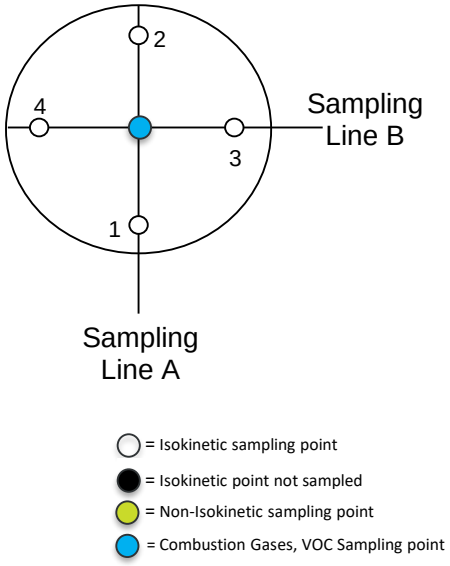
Equipment Checklist

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	ETC-S12.01	Stopwatch	ETC-S10.14
Box Thermocouple Out	ETC-S3.33	JCT JCC Cooler	-	Barometer	ETC-SMet office
Control Box Timer	ETC-S10.14	MAK10 Cooler	-	Digital Manometer	ETC-S24.04
Umbilical	ETC-S2.10b	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S24.04
Oven Box	ETC-S9.06	M&C PSS Gas Preparation	ETC-S3.41b	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.12	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	ETC-S1.12	SK-Thermo FID	ETC-S13.07	5m Heated Line	-
Stack Thermocouple (2)	ETC-S1.36	Bernath 3006 FID	-	10m Heated Line	ETC-S5.08
S-Type Pitot (1)	ETC-S4629	Testo 350XL	-	20m Heated Line	-
S-Type Pitot (2)	-	M&C PSP 4000	ETC-S7.08	30m Heated Line	-
L-Type Pitot	-	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	-
Site Balance	ETC-S18.02	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	ETC-S18.02a	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.02b	-	-	Sample Temperature Logger	-
Digital Callipers	ETC-S16.08	-	-	Laboratory Balance	-

Appendix 2: Boiler 2 Results and Calculations

Picture of the sampling location

Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.90
Width	m	-
Area	m²	0.64
Port Depth	cm	9.0
Orientation of Stack / Duct	-	Horizontal
Sampling Port Size	-	4" BSP
Number of Ports	-	2

Manual Sampling Points	Used / Required
Number of Sampling Lines	1 / 1
Number of Sampling Points	1 / 1
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	Outside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	No
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	N/A
	Platform has adequate drainage to prevent accumulation of free-standing water	N/A
Fall Prevention	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	N/A
	Gaps between handrails not >0,5m	N/A
Access	Platform has vertical base boards (approx. 0.25m high)	N/A
	Access to sampling ports unhindered by obstructions	N/A
	Easy & safe access and egress available	No

Sampling Location / Platform Recommendations

All sampling platforms should be designed in accordance with the requirements specified in Environment Agency Guidance Note M1 and BS EN 15259.

Water Vapour Measurements

Parameter	Value	Unit
Sampling Date	22/06/2022	-
Start Time	09:30	-
End Time	10:30	-
Barometric Pressure	1020	mbar

Parameter	Value	Unit
Stack Temperature	182.0	°C
Corrected Volume	228.1	L
Collected Mass	24.2	g
Stack Gas Water Vapour Content	11.7	% v/v

Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
0.90	0.64	1020	13.0	6.4	8.0	5.7	28.9	0.846

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (cmH2O)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	13.1	0.20	0.20	0.20	0.20	6.2	217	13
	A2	76.9	0.21	0.21	0.21	0.21	6.3	216	11

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (cmH2O)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
B	B1	13.1	0.20	0.20	0.20	0.20	6.2	217	13
	B2	76.9	0.23	0.23	0.23	0.23	6.7	216	10

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	6.36	1.1:1	217	490	14577	8185	6280
Units	m/s	-	°C	K	m³/hr	Nm³/hr	Nm³/hr

Instrumental Gas Analyser Calibrations

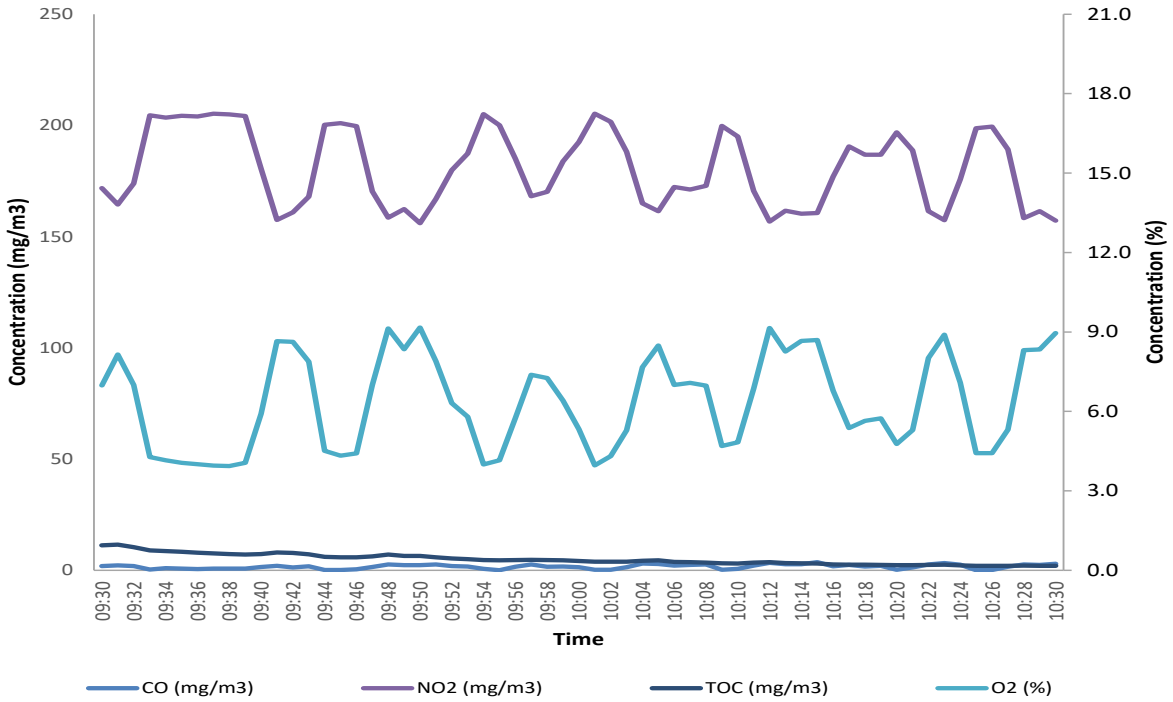
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
22/06/2022	KW/CW	ETC-S12.01	ETC-S13.07

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	160.81ppm	200ppm	22	160.8	0.20	160.8	0.00	156.4	0.00	-2.7	Yes
Nitrogen Monoxide	201.66ppm	250ppm	28	201.7	0.10	201.7	-0.10	201.8	-0.05	0.10	Yes
Propane	804.62ppm	1000ppm	16	804	0.02	802.3	0.50	802.1	0.06	-0.30	Yes
Oxygen	21.23%	25%	24	21.23	0.01	21.23	0.00	21.23	0.00	0.00	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O_2 Correction
		Average	Max	Min			
Carbon Monoxide	1	1.6	3.6	0.03	mg/m^3	-	3%
Oxides of Nitrogen (as NO_2)	1	180.69	205.27	156.02	mg/m^3	NO_x as NO_2	3%
Total VOC	1	4.9	11.5	1.97	mg/m^3	VOC as C	3%
Oxygen	1	6.36	9.17	3.94	%	-	-

Instrumental Gas Analyser Chart - Run 1



Uncertainty

Uncertainty of Carbon Monoxide by Horiba Analyser

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m³
Reading	1.3	ppm
Span Gas Certified Value	160.8	ppm
Range	200	ppm

Cal Gas
CO

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u²
Zero Drift/Lower limit of detection (ppm)	0.20	Rectangular	1.7	0.12	0.01
Span Drift (ppm)	4.4	Rectangular	1.7	2.5	6.5
Linearity (% of value)	1.1	Rectangular	1.7	0.01	0.0001
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.005	0.00002
Interference (% of value)	-0.48	Rectangular	1.7	-0.004	0.00001
Standard deviation of repeatability at zero point (% of range)	0.10	Rectangular	-	0.20	0.04
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	0.40	0.16
				Total	6.7
				Combined Standard Uncertainty [(sum u²)$^{0.5}$]	2.6
				Expanded Total Uncertainty (ppm) (95% confidence)	5.1
				Expanded Total Uncertainty as a % of emission conc. (95% confidence)	385
				Expanded Total Uncertainty (mg/m³) (95% confidence)	6.3

Uncertainty of Oxides of Nitrogen by Horiba gas Analyser

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m³
Reading	88.0	ppm
Span Gas Certified Value	201.7	ppm
Range	250	ppm

Cal Gas
NO

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u²
Zero Drift/Lower limit of detection (ppm)	0.10	Rectangular	1.7	0.06	0.003
Span Drift (ppm)	-0.10	Rectangular	1.7	-0.06	0.003
Linearity (% of value)	0.63	Rectangular	1.7	0.32	0.10
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.31	0.09
Interference (% of value)	0.63	Rectangular	1.7	0.32	0.10
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)	0.10	Rectangular	-	0.25	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)	1.4
				Expanded Total Uncertainty (mg/m³) (95% confidence)	2.4

Uncertainty of Total VOC by SK - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m³
Reading	3.0	ppm
Span Gas Certified Value	804.6	ppm
Range	1000	ppm

Cal Gas
C_3H_8

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u²
Zero Drift/Lower limit of detection (ppm)	-0.48	Rectangular	1.7	-0.28	0.08
Span Drift (ppm)	0.20	Rectangular	1.7	0.12	0.01
Linearity (% of value)	0.40	Rectangular	1.7	0.01	0.00005
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	0.0003
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	2.0	4.0
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	2.0	4.0
				Total	8.1
				Combined Standard Uncertainty [(sum u²)$^{0.5}$]	2.8
				Expanded Total Uncertainty (ppm) (95% confidence)	5.6
				Expanded Total Uncertainty as a % of emission conc. (95% confidence)	184
				Expanded Total Uncertainty (mg/m³) (95% confidence)	9.0

Uncertainty of Oxygen by Horiba Analyser

Parameter	Value	Unit
Reading	6.36	%
Span Gas Certified Value	21.23	%
Range	25	%

Cal Gas
O_2

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u²
Zero Drift/Lower limit of detection (%vol)	0.05	Rectangular	1.7	0.03	0.001
Span Drift (%vol)	0.00	Rectangular	1.7	0.00	0.00
Linearity (% of value)	0.82	Rectangular	1.7	0.03	0.001
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.02	0.0005
Interference (% of value)	0.00	Rectangular	1.7	0.00	0.00
Standard deviation of repeatability at zero point (% of range)	0.02	Rectangular	-	0.01	0.00003
Standard deviation of repeatability at span point (% of range)	0.02	Rectangular	-	0.01	0.00003
				Total	0.002
				Combined Standard Uncertainty [(sum u²)$^{0.5}$]	0.05
				Expanded Total Uncertainty (%) (95% confidence)	0.09
				Expanded Total Uncertainty as a % of emission conc. (95% confidence)	1.5

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	14577	L/min

Performance Characteristics & Source Value	Value	Units
Standard Uncertainty - Pitot tube Coefficient	0.01	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.0001	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.002	-
Standard Uncertainty - Mean Velocity	0.06	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.11	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	1.7	%
Standard Uncertainty - Volumetric Flow Rate	360	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	706	m³/hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.8	%

95% confidence interval factor - 1.96

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V1	Original version of the document issued to client.