

# Report for the Periodic Monitoring of Emissions to Atmosphere

Stack Emissions Test Report Commissioned by: Environmental Monitoring Solutions Ltd

## Holmfirth Dryers Ltd

### Boiler 1

Permit No: N/A  
Installation: Holmfirth  
Monitoring Dates: 21st June 2022  
Site Address: Ribblesden Dye Works, Dunford Rd, Holmfirth, HD9 2DP

Report Number: ES-0911                      Version: 1                      Visit: 1 in 2022  
Date of Report: 21st July 2022  
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MCERTS No: MM 06 701                      MCERTS Level: 2 (TE1,TE2,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 1 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 1
Carbon Monoxide	✓
Oxides of Nitrogen (as NO <sub>2</sub> )	✓
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)

Substance	Limit (mg/m <sup>3</sup> )	Concentration			Reference Conditions	Mass Emission			Sampling Date	Sampling Times
		Result (mg/m <sup>3</sup> )	Measurement Uncertainty (MU) +/-			Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-		
Water Vapour	R1	-	10.9%	-	273K, 101.3kPa	-	-	-	21/06/2022	11:20-12:20
Carbon Monoxide	R1	-	1.3	6.3	273k, 101.3kPa, Dry, 3% O <sub>2</sub> .	-	5.9	29.6	21/06/2022	11:20-12:20
Oxides of Nitrogen (as NO <sub>2</sub> )	R1	-	178	2.4	273k, 101.3kPa, Dry, 3% O <sub>2</sub> .	-	831	46.6	21/06/2022	11:20-12:20
Total VOC	R1	-	6.4	9.0	273k, 101.3kPa, Dry, 3% O <sub>2</sub> .	-	30.1	42.0	21/06/2022	11:20-12:20
Oxygen	R1	-	6.9%	0.10	273k, 101.3kPa, Dry, 3% O <sub>2</sub> .	-	-	-	21/06/2022	11:20-12:20
Volumetric Flow	R1	-	4,679 m <sup>3</sup> /h	255	273k, 101.3kPa, Dry, 3% O <sub>2</sub> .	-	-	-	21/06/2022	10:22-10:32

Reference conditions (REF) are: 273k, 101.3kPa, Dry, 3% O<sub>2</sub>.

# 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

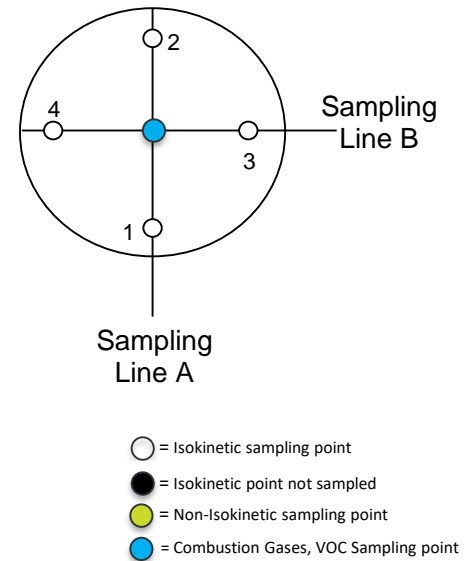
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.1	Horiba PG-250	-	Tape Measure	ETC-S17.05
Box Thermocouples	ETC-S2.10a	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	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 1 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	m <sup>2</sup>	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
Fall Prevention	Platform has adequate drainage to prevent accumulation of free-standing water	N/A
	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	N/A
Access	Gaps between handrails not >0,5m	N/A
	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	21/06/2022	-
Start Time	11:20	-
End Time	12:20	-
Barometric Pressure	1019	mbar

Parameter	Value	Unit
Stack Temperature	182.0	°C
Corrected Volume	225.3	L
Collected Mass	22.2	g
Stack Gas Water Vapour Content	10.9	% v/v

## Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m <sup>2</sup> )	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	1019	17.0	6.9	8.0	5.7	28.9	0.846

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (cmH <sub>2</sub> O)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	13.1	0.12	0.12	0.12	0.12	4.5	181	11
	A2	76.9	0.13	0.13	0.13	0.13	4.8	182	9

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (cmH <sub>2</sub> O)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
B	B1	13.1	0.11	0.11	0.11	0.11	4.4	182	12
	B2	76.9	0.11	0.11	0.11	0.11	4.5	181	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	4.56	1.1:1	182	455	10450	6314	4679
Units	m/s	-	°C	K	m <sup>3</sup> /hr	Nm <sup>3</sup> /hr	Nm <sup>3</sup> /hr



## Instrumental Gas Analyser Calibrations

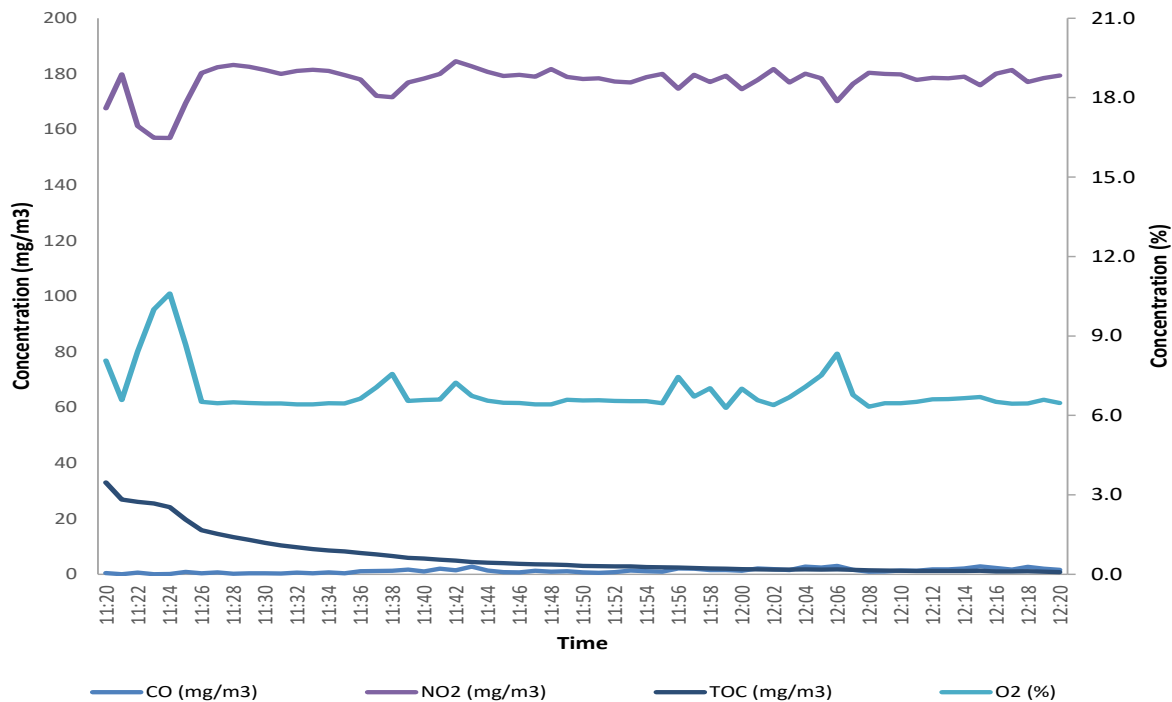
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
21/06/2022	KW/CW	ETC-S12.01	ETC-S13.07

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 <sub>2</sub> Correction
		Average	Max	Min			
Carbon Monoxide	1	1.3	3.0	0.06	mg/m <sup>3</sup>	-	3%
Oxides of Nitrogen (as NO <sub>2</sub> )	1	177.53	184.49	156.94	mg/m <sup>3</sup>	NO <sub>x</sub> as NO <sub>2</sub>	3%
Total VOC	1	6.4	33.0	0.77	mg/m <sup>3</sup>	VOC as C	3%
Oxygen	1	6.86	10.61	6.29	%	-	-

## Instrumental Gas Analyser Chart - Run 1



## Uncertainty

### Uncertainty of Carbon Monoxide by Horiba Analyser

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m <sup>3</sup>
Reading	1.0	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 u <sup>2</sup>
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	0.00004
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.004	0.00001
Interference (% of value)	-0.48	Rectangular	1.7	-0.003	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
<b>Total</b>					6.7
<b>Combined Standard Uncertainty [(sum u<sup>2</sup>)<sup>0.5</sup>]</b>					2.6
<b>Expanded Total Uncertainty (ppm) (95% confidence)</b>					5.1
<b>Expanded Total Uncertainty as a % of emission conc. (95% confidence)</b>					500
<b>Expanded Total Uncertainty (mg/m<sup>3</sup>) (95% confidence)</b>					6.3

### Uncertainty of Oxides of Nitrogen by Horiba gas Analyser

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m <sup>3</sup>
Reading	86.5	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 u <sup>2</sup>
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	0.31	0.10
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.30	0.09
Interference (% of value)	0.63	Rectangular	1.7	0.31	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
<b>Total</b>					0.36
<b>Combined Standard Uncertainty [(sum u<sup>2</sup>)<sup>0.5</sup>]</b>					0.60
<b>Expanded Total Uncertainty (ppm) (95% confidence)</b>					1.2
<b>Expanded Total Uncertainty as a % of emission conc. (95% confidence)</b>					1.4
<b>Expanded Total Uncertainty (mg/m<sup>3</sup>) (95% confidence)</b>					2.4

## Uncertainty of Total VOC by SK - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m <sup>3</sup>
Reading	4.0	ppm
Span Gas Certified Value	804.6	ppm
Range	1000	ppm

Cal Gas
C <sub>3</sub> H <sub>8</sub>

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u <sup>2</sup>
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	0.0001
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.01	0.0002
Noise (ppm)	0.10	Rectangular	1.7	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.7	0.02	0.0005
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
<b>Total</b>					8.1
<b>Combined Standard Uncertainty [(sum u<sup>2</sup>)<sup>0.5</sup>]</b>					2.8
<b>Expanded Total Uncertainty (ppm) (95% confidence)</b>					5.6
<b>Expanded Total Uncertainty as a % of emission conc. (95% confidence)</b>					139
<b>Expanded Total Uncertainty (mg/m<sup>3</sup>) (95% confidence)</b>					9.0

## Uncertainty of Oxygen by Horiba Analyser

Parameter	Value	Unit
Reading	6.86	%
Span Gas Certified Value	21.23	%
Range	25	%

Cal Gas
O <sub>2</sub>

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u <sup>2</sup>
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	0.001
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
<b>Total</b>					0.003
<b>Combined Standard Uncertainty [(sum u<sup>2</sup>)<sup>0.5</sup>]</b>					0.05
<b>Expanded Total Uncertainty (%) (95% confidence)</b>					0.10
<b>Expanded Total Uncertainty as a % of emission conc. (95% confidence)</b>					1.4

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	10450	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	0.003	-
Standard Uncertainty - Mean Velocity	0.07	m/s
<b>Expanded Uncertainty Mean Velocity (95% confidence)</b>	0.14	m/s
<b>Expanded Uncertainty Mean Velocity (95% Confidence), Relative</b>	3.0	%
<b>Standard Uncertainty - Volumetric Flow Rate</b>	290	-
<b>Standard Uncertainty - Volumetric Flow Rate (95% Confidence)</b>	569	m <sup>3</sup> /hr
<b>Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative</b>	5.4	%
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.