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ENVIRONMENTAL SERVICES

Report for the Periodic Monitoring of Emissions to Atmosphere

Stack Emissions Test Report Commissioned by: Trademark Yorkshire Ltd

Trademark Yorkshire Ltd

EP3 - Natgraph Tunnel Oven

Permit No:	N/A
Installation:	ITM Power Ltd (Sheffield)
Monitoring Dates:	25th - 26th July 2023
Site Address:	ITM Power Ltd, 22 Atlas Way, Sheffield, S4 7QQ

Report Number:	ES-1429	Version: 1	Visit: 1 in 2023
Date of Report:	17th Augut 2023		
Report Author:	Ryan Bromwell		
MCERTS No:	MM 20 1592	MCERTS Level:	2 (TE1, TE2, TE3, TE4)
Approved By:	Andy Dykes	Function:	Operations Manager
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YOUR INDUSTRY EXPERTS

MCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS TESTING 2522

Contents

Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Trademark Yorkshire Ltd to carry out emissions monitoring, to determine the compliance of EP3 - Natgraph Tunnel Oven with the conditions specified in the operators permit (N/A) 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	EP3 - Natgraph Tunnel Oven
Total VOC	✓
Water Vapour	✓
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)

		Concentration				Mass Emission				
Substance		**Limit (mg/m³)**	**Result (mg/m³)**	**Measurement Uncertainty (MU) +/-**	**Reference Conditions**	**Limit (g/hr)**	**Result (g/hr)**	**Measurement Uncertainty (MU) +/-**	**Sampling Date**	**Sampling Times**
Total VOC	R1	-	2.6	1.2	273k, 101.3kPa, Wet Gas	-	3.8	1.7	26/07/2023	10:20-11:20
Water Vapour	R1	-	1.2%	-	As Measured	-	-	-	26/07/2023	10:20-11:20
Volumetric Flow (Actual)	R1	-	1,882 m³/h	85.2	As Measured	-	-	-	26/07/2023	09:50-09:55
Volumetric Flow (REF)	R1	-	1,445 m³/h	65.4	273k, 101.3kPa, Wet Gas	-	-	-	26/07/2023	09:50-09:55

Reference conditions (REF) are: 273k, 101.3kPa, Wet Gas

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	Drying Oven
Continuous or Batch Process	Batch
Operating Status	Normal
Feedstock	Various metal Componants and Solvents
Normal Load, Throughput or Continuous Rating	20 Plates
Abatement System	N/A
Abatement System Status	N/A
Process Fuel	Natural Gas
Plume Appearance	None

Monitoring Deviations

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

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
Mr R Bromwell	Team Leader	2 (TE1, TE2, TE3, TE4)	MM 20 1592
Mr J Doyle	Team Leader	Trainee	MM 22 1757

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			
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

Envirocare: 2522 | RPS Laboratories Ltd (RPS): 0605

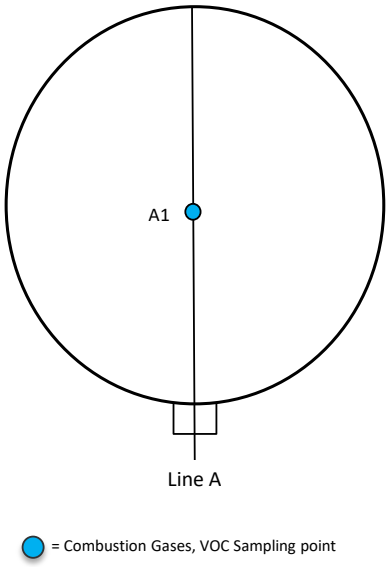
Equipment Checklist

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	**Equipment I.D.**	**Equipment Type**	**Equipment I.D.**	**Equipment Type**	**Equipment I.D.**
Control Box DGM	8.09	Horiba PG-250	12.04	Tape Measure	17.12
Box Thermocouples	2.01a	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	3.35	Horiba PG-350	-	Stopwatch	10.01
Box Thermocouple Out	3.36	JCT JCC Cooler	3.40b	Barometer	11.1
Control Box Timer	10.01a	MAK10 Cooler	-	Digital Manometer	24.04
Umbilical	2.01a	Horiba PS200 Cooler	-	Digital Temperature Meter	24.04
Oven Box	9.07	M&C PSS Gas Preparation	-	Dual Channel Heat Controller	6.04
Heated Probe (1)	4.07	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	4.22	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	1.07	SK-Thermo FID	13.04	5m Heated Line	-
Stack Thermocouple (2)	-	Bernath 3006 FID	-	10m Heated Line	5.08
S-Type Pitot (1)	10-17-19-8	Testo 350XL	-	20m Heated Line	-
S-Type Pitot (2)	8.10(b)	M&C PSP 4000	-	30m Heated Line	7.04
L-Type Pitot	20.05L	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	3.04
Site Balance	18.09	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	18.09a	Analyser Temperature Logger	19.1	Dioxins Kit Thermocouple	-
1KG Check Weight	18.09b	-	-	Sample Temperature Logger	-
Digital Callipers	16.08	-	-	Laboratory Balance	SE--

Appendix 2: EP3 - Natgraph Tunnel Oven Results and Calculations

Picture of the sampling location

Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.28
Width	m	-
Area	m²	0.06
Port Depth	cm	10.0
Orientation of Stack / Duct	-	Horizontal
Sampling Port Size	-	4" BSP
Number of Ports	-	1

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	Temporary
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	Yes
	Ports on vertical ducts 1.2m to 1.5m above platform floor	No
	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	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
0.28	0.06	1011	23.0	20.9	0.50	1.2	28.8	0.994

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	14.0	36.0	36.0	36.0	0.4	8.5	82	2

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Stack Gas Volume Flow (STP Wet)	Stack Gas Volume Flow (REF)
Value	8.5	1.0:1	81.7	355	1882	1445	1445
Units	m/s	-	°C	K	m^3/hr	Nm^3/hr	Nm^3/hr

Instrumental Gas Analyser Calibrations

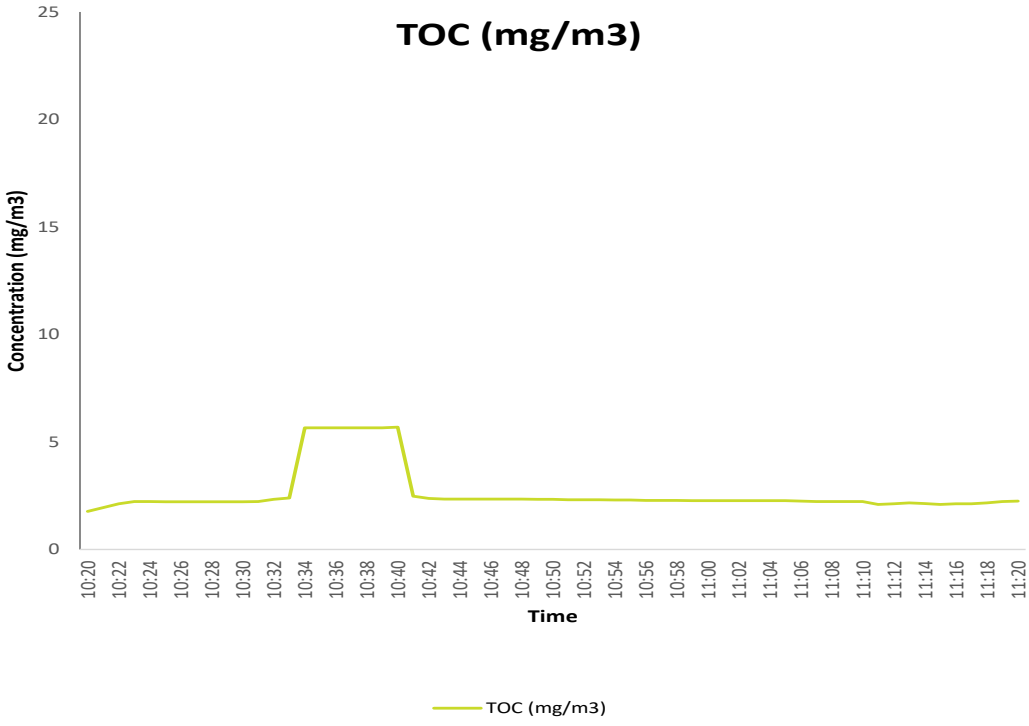
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
26/07/2023	RB / JD	IFID	13.11

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			
Propane	80.96ppm	100ppm	25	80.8	2.0	81.1	1.6	81.1	2.0	-1.6	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O_2 Correction
		Average	Max	Min			
Total VOC	1	2.6	5.7	1.8	mg/m^3	VOC as C	-

Instrumental Gas Analyser Chart - Run 1



Uncertainty

Uncertainty of Total VOC by FID - Run1

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m³
Reading	1.64	ppm
Span Gas Certified Value	81.0	ppm
Range	100	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)	0.40	Rectangular	1.7	0.23	0.05
Span Drift (ppm)	0.00	Rectangular	1.7	0.00	0.00
Linearity (% of value)	0.24	Rectangular	1.7	0.002	0.000005
Setting Gas Divider (% of value)	0.35	Normal	1.0	0.006	0.00003
Noise (ppm)	0.10	Rectangular	1.7	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.7	0.009	0.00009
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	0.14
				Combined Standard Uncertainty [(sum u²)$^{0.5}$]	0.37
				Expanded Total Uncertainty (ppm) (95% confidence)	0.72
				Expanded Total Uncertainty as a % of emission conc. (95% confidence)	44.2
				Expanded Total Uncertainty (mg/m³) (95% confidence)	1.2
				Expanded Total Uncertainty as a % of emission limit value (95% confidence)	-

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	1882	m³/hr

Performance Characteristics & Source Value	Value	Units
Standard Uncertainty - Pitot tube Coefficient	0.005	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.00003	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.006	-
Standard Uncertainty - Mean Velocity	0.05	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.10	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	1.2	%
Standard Uncertainty - Volumetric Flow Rate	43.5	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	85.2	m³/hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.5	%
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.