

# Report for the Periodic Monitoring of Emissions to Atmosphere

## Sheffield Teaching Hospitals

### EP1 - HV Generator 2

Permit No: -  
Installation: Royal Hallamshire  
Monitoring Dates: 27th November 2024  
Site Address: Glossop Road, Broomhall, Sheffield, S10 2JF

Report Number:	ES-1960	Version:	1	Visit:	1 in 2024
Date of Report:	23rd December 2024				
Report Author:	Danny Pryke				
MCERTS No:	MM 03 163	MCERTS Level:	2 (TE1, TE2, TE3, TE4)		
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# Contents

Executive Summary	
Monitoring Objectives	3
Monitoring Results	4
Operating Information	5
Monitoring Deviations	5
Supporting Information	
Appendix 1: General Information	5 - 6
Appendix 2: Results and Calculations	7 - 10

# Executive Summary

## Monitoring Objectives

Envirocare Technical Consultancy were contracted by Sheffield Teaching Hospitals to carry out emissions monitoring, to determine the compliance of EP1 - HV Generator 2 with the conditions specified in the operators permit (-) 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	EP1 - HV Generator 2
Carbon Monoxide	✓
Oxides of Nitrogen (as NO <sub>2</sub> )	✓
Oxygen	✓
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
Carbon Monoxide	R1	-	120	1.6	273k, 101.3kPa, Dry Gas, 3% O <sub>2</sub>	-	-	-	27/11/2024	10:06-10:36
Oxides of Nitrogen (as NO <sub>2</sub> )	R1	-	3608	43.8		-	-	-	27/11/2024	10:06-10:36
Oxygen	R1	-	14.7%	0.13	As Measured, Dry Gas	-	-	-	27/11/2024	10:06-10:36

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

# Supporting Information

## Appendix 1: General Information

### Operating Information

Parameter	Process Details
Process Type	Back Up Generator
Continuous or Batch Process	Continuous Process
Operating Status	5.020 Mw Input - Normal Operation
Feedstock	Diesel
Normal Load, Throughput or Continuous Rating	Normal Load
Abatement System	N/A
Abatement System Status	N/A
Process Fuel	Diesel
Plume Appearance	Natural Gas

### 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 D Pryke	Team Leader	2 (TE1, TE2, TE3, TE4)	MM 03 163
Mr R Robinson	Technician	Trainee	MM 21 1660

## Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
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			
Water Vapour	BS EN 14790	ETC-SE-11	Yes	ENV	ETC-SE-11	Gravimetric	Yes

Envirocare: 2522 | RPS Laboratories Ltd (RPS): 0605 | Marchwood Scientific Services: 1668 | Air Spectrum: 8382 | Olfasense UK Ltd: 2430

## Equipment Checklist

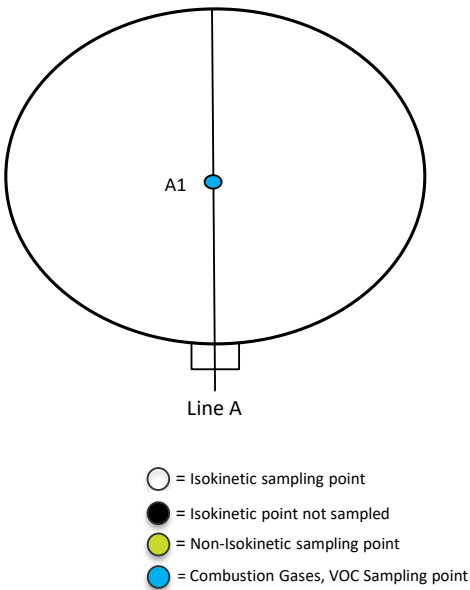
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	-	Horiba PG-250	12.03	Tape Measure	17.12
Box Thermocouples	-	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	-	Horiba PG-350	-	Stopwatch	10.04
Box Thermocouple Out	-	JCT JCC Cooler	-	Barometer	11.08
Control Box Timer	-	MAK10 Cooler	-	Digital Manometer	24.09
Umbilical	-	Horiba PS200 Cooler	-	Digital Temperature Meter	24.09
Oven Box	-	M&C PSS Gas Preparation	3.46(b)	Dual Channel Heat Controller	-
Heated Probe (1)	-	Gasmet DX4000 FTIR	-	1m Heated Line	-
Heated Probe (2)	-	Gasmet Sampling System	-	3m Heated Line	-
Stack Thermocouple (1)	-	SK-Thermo FID	-	5m Heated Line	-
Stack Thermocouple (2)	-	Bernath 3006 FID	-	10m Heated Line	-
S-Type Pitot (1)	-	Testo 350XL	-	20m Heated Line	5.21
S-Type Pitot (2)	-	M&C PSP 4000	-	30m Heated Line	-
L-Type Pitot	-	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	-
Site Balance	-	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	-
500g Check Weight	-	Analyser Temperature Logger	-	Dioxins Kit Thermocouple	-
1KG Check Weight	-	-	8.07 (B)	Sample Temperature Logger	-
Digital Callipers	-	-	-	Laboratory Balance	-

# Appendix 2: EP1 - HV Generator 2 Results and Calculations

Picture of the sampling location



Sampling Points Diagram



## Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.65
Width	m	-
Area	m <sup>2</sup>	0.33
Port Depth	cm	0.00
Orientation of Stack / Duct	-	Vertical
Sampling Port Size	-	1" BSP
Number of Ports	-	1

Manual Sampling Points	Used / Required
Number of Sampling Lines	N/A
Number of Sampling Points	N/A
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	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	No
	Ports on vertical ducts 1.2m to 1.5m above platform floor	No
	Platform has chains / self closing gates at top of ladders	No
Fall Prevention	Platform has adequate drainage to prevent accumulation of free-standing water	Yes
	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
	Gaps between handrails not >0,5m	Yes
Access	Platform has vertical base boards (approx. 0.25m high)	Yes
	Access to sampling ports unhindered by obstructions	Yes
	Easy & safe access and egress available	Yes

## Sampling Location / Platform Recommendations

Due to sampling location restrictions only one sampling line is currently accessible, in an ideal world these restrictions would be removed allowing access to both sampling lines.

Instrumental Gas Analyser Calibrations

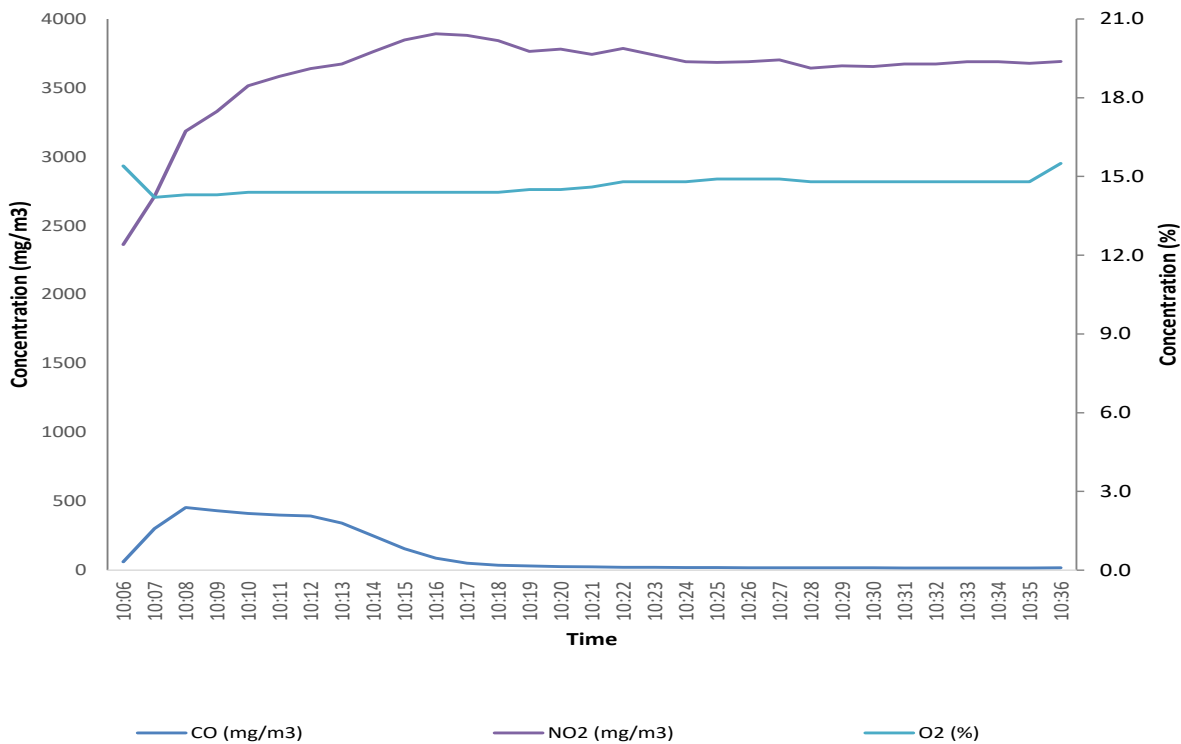
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
27/11/2024	DP/RR	12.13	-

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	162ppm	200ppm	23	162	0.00	162	0.00	162	0.00	-0.12	Yes
Nitrogen Monoxide	202ppm	500ppm	23	202	0.10	202	0.10	202	0.05	0.10	Yes
Oxygen	20.86%	25%	25	20.9	0.03	20.9	0.03	20.9	0.14	0.05	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O <sub>2</sub> Correction
		Average	Max	Min			
Carbon Monoxide	1	120.11	455.4	15.50	mg/m <sup>3</sup>	-	3%
Oxides of Nitrogen (as NO <sub>2</sub> )	1	3608	3892	2363.3	mg/m <sup>3</sup>	NO <sub>x</sub> as NO <sub>2</sub>	3%
Oxygen	1	14.7	15.5	14.2	%	-	-

Instrumental Gas Analyser Chart - Run 1





## Uncertainty

### Uncertainty of Carbon Monoxide by Horiba Gas Analyser - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m <sup>3</sup>
Reading	96.1	ppm
Span Gas Certified Value	162	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)	0.00	Rectangular	1.73	0.00	0.000
Span Drift (ppm)	0.2	Rectangular	1.73	0.12	0.01
Linearity (% of value)	0.40	Rectangular	1.73	0.22	0.05
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.34	0.11
Interference (% of value)	-0.48	Rectangular	1.73	-0.27	0.07
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>					0.45
<b>Combined Standard Uncertainty [(sum u<sup>2</sup>)<sup>0.5</sup>]</b>					0.67
<b>Expanded Total Uncertainty (ppm) (95% confidence)</b>					1.3
<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>					1.6
<b>Expanded Total Uncertainty as a % of emission limit value (95% confidence)</b>					-

### Uncertainty of Oxides of Nitrogen by Horiba Gas Analyser - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m <sup>3</sup>
Reading	1757.8	ppm
Span Gas Certified Value	202	ppm
Range	500	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)	0.00	Rectangular	1.73	0.00	0.000
Span Drift (ppm)	-0.30	Rectangular	1.73	-0.17	0.03
Linearity (% of value)	0.62	Rectangular	1.73	6.3	39.6
Setting Gas Divider (% of value)	0.35	Normal	1.00	6.2	37.9
Interference (% of value)	0.63	Rectangular	1.73	6.4	40.9
Standard deviation of repeatability at zero point (% of range)	0.00	Rectangular	-	0.000	0.000
Standard deviation of repeatability at span point (% of range)	0.10	Rectangular	-	0.50	0.25
<b>Total</b>					119
<b>Combined Standard Uncertainty [(sum u<sup>2</sup>)<sup>0.5</sup>]</b>					10.9
<b>Expanded Total Uncertainty (ppm) (95% confidence)</b>					21.3
<b>Expanded Total Uncertainty as a % of emission conc. (95% confidence)</b>					1.2
<b>Expanded Total Uncertainty (mg/m<sup>3</sup>) (95% confidence)</b>					43.8
<b>Expanded Total Uncertainty as a % of emission limit value (95% confidence)</b>					-

Uncertainty of Oxygen by Horiba Gas Analyser - Run 1

Parameter	Value	Unit	Cal Gas
Reading	14.7	%	O <sub>2</sub>
Span Gas Certified Value	20.9	%	
Range	25.0	%	

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u <sup>2</sup>
Zero Drift/Lower limit of detection (%vol)	-0.01	Rectangular	1.73	-0.01	0.00003
Span Drift (%vol)	-0.04	Rectangular	1.73	-0.02	0.0005
Linearity (% of value)	0.37	Rectangular	1.73	0.03	0.001
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.05	0.003
Interference (% of value)	0.00	Rectangular	1.73	0.00	0.00
Standard deviation of repeatability at zero point (% of range)	0.02	Rectangular	-	0.005	0.00003
Standard deviation of repeatability at span point (% of range)	0.02	Rectangular	-	0.005	0.00003
Total					0.004
Combined Standard Uncertainty $[(\sum u^2)^{0.5}]$					0.07
Expanded Total Uncertainty (%) (95% confidence)					0.13
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					0.9

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.