

STACK EMISSIONS MONITORING REPORT



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Operator & Address:
Radnor Hills Mineral Water Co Ltd Heartsease Farm Knighton Powys LD7 1LU

Permit Reference:
EPR Permit: EPR/AB3697CN

Release Point:
Boiler 6

Sampling Date(s):
29th October 2024

SOCOTEC Job Number:	LSW 241048
Report Date:	14th November 2024
Version:	1
Report By:	Amy Tanner
MCERTS Number:	MM 21 1644
MCERTS Level:	MCERTS Level 2 - Team Leader
Technical Endorsements:	1, 2 & 4
Report Approved By:	Jose Navarro
MCERTS Number:	MM 19 1542
Business Title:	MCERTS Level 2 - Project Manager
Technical Endorsements:	1, 2, 3 & 4
Signature:	



1015



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EXECUTIVE SUMMARY

MONITORING OBJECTIVES

Radnor Hills Mineral Water Co Ltd operates a steam/heat raising boiler process at Knighton which is subject to EPR Permit EPR/AB3697CN, under the Environmental Permitting Regulations 2016.

SOCOTEC LTD were commissioned by Benjamin Price to carry out stack emissions monitoring to determine the release of prescribed pollutants from the following Plant under normal operating conditions.

The results of these tests shall be used to demonstrate compliance with a set of emission limit values for prescribed pollutants as specified in the Plant's EPR Permit, EPR/AB3697CN.

Plant

Boiler 6

Operator

Radnor Hills Mineral Water Co Ltd
Heartsease Farm
Knighton
Powys
LD7 1LU

EPR Permit: EPR/AB3697CN

Stack Emissions Monitoring Test House

SOCOTEC - Cirencester Laboratory
Units C & D
Bankside Trade Park
Cirencester
GL7 1YT
UKAS and MCERTS Accreditation Number: 1015

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.
The results of this testing relate only to the emission release point(s) listed in the report.
MCERTS accredited results will only be claimed where both the sampling and analytical stages are MCERTS accredited.
This test report shall not be reproduced, except in full, without written approval of SOCOTEC LTD.

EXECUTIVE SUMMARY

EMISSIONS SUMMARY					
Parameter	Units	Result	Calculated Uncertainty +/-	Emission Limit Value (ELV)	Accreditation
Sulphur Dioxide	mg/m ³	5.6	0.98	35	MCERTS
Oxides of Nitrogen (as NO ₂)	mg/m ³	116	4.0	200	MCERTS
Carbon Monoxide	mg/m ³	21	1.7	-	MCERTS
Oxygen	% v/v	14.6	0.305	-	MCERTS
Moisture	%	7.21	0.36	-	MCERTS
Stack Gas Temperature	°C	164	-	-	MCERTS

ND = None Detected,

Results at or below the limit of detection are highlighted by bold italic text.

The above volumetric flow rate is calculated using data from the preliminary survey. Mass emissions for non isokinetic tests are calculated using these values. For all isokinetic testing the mass emission is calculated using test specific flow data and not the above values.

Reference conditions are 273K, 101.3kPa, dry gas 3% Oxygen.

EXECUTIVE SUMMARY

MONITORING TIMES			
Parameter	Sampling Date(s)	Sampling Times	Sampling Duration
Sulphur Dioxide Run 1	29 October 2024	10:10 - 11:10	60 minutes
Combustion Gases	29 October 2024	10:10 - 11:10	60 minutes

EXECUTIVE SUMMARY

PROCESS DETAILS

Parameter	Process Details
Description of process	Steam/heat raising boiler
Continuous or batch	Continuous
Product Details	Steam and Heat
Part of batch to be monitored (if applicable)	Any representative period
Normal load, throughput or continuous rating	Rated Thermal Input 4.11 MW
Fuel used during monitoring	LPG
Abatement	None
Plume Appearance	Steam plume visible

EXECUTIVE SUMMARY

Monitoring Methods

The selection of standard reference / alternative methods employed by SOCOTEC is determined, wherever possible by the hierarchy of method selection outlined in Environment Agency technical Guidance 'Monitoring stack emissions: techniques and standards for periodic monitoring'.

MONITORING METHODS							
Species	Method Standard Reference Method / Alternative Method	SOCOTEC Technical Procedure	UKAS Lab Number	Method Accreditation	Limit of Detection (LOD)	Calculated MU +/- % Result	Calculated MU +/- % ELV
Sulphur Dioxide	SRM - BS EN 14791	AE 112	1015	MCERTS	0.258 mg/m ³	17.3%	2.79%
Oxides of Nitrogen	SRM - BS EN 14792:2017	AE 102	1015	MCERTS	1.44 mg/m ³	3.5%	2.02%
Carbon Monoxide	SRM - BS EN 15058:2017	AE 102	1015	MCERTS	0.39 mg/m ³	8.2%	N/A - No ELV
Oxygen	AM - BS EN 14789:2017	AE 102	1015	MCERTS	0.01%	2.1%	N/A - No ELV
Moisture	SRM - BS EN 14790	AE 105	1015	MCERTS	0.1%	5.0%	N/A - No ELV

EXECUTIVE SUMMARY

Analytical Methods

The following tables list the analytical methods employed together with the custody details. Unless otherwise stated the samples are archived at the analysis lab location.

SAMPLING METHODS WITH SUBSEQUENT ANALYSIS							
Species	Analytical Technique	Analytical Procedure	UKAS Lab Number	Analysis Accreditation	Analysis Lab	Analysis Report No. Date of Analysis	Archive Period
Sulphur Dioxide	Ion Chromatography	ASC/SOP/110	1252	MCERTS	SOCOTEC (Bretby)	ASC/64862	8 Weeks

ON-SITE TESTING							
Species	Analytical Technique	Analytical Procedure	UKAS Lab Number	Accreditation	Laboratory	Data Archive Location	Archive Period
Oxides of Nitrogen	Chemiluminescence	AE 102	1015	MCERTS	SOCOTEC (Cirencester)	SOCOTEC (Cirencester)	5 years
Carbon Monoxide	Non Dispersive Infra Red	AE 102	1015	MCERTS	SOCOTEC (Cirencester)	SOCOTEC (Cirencester)	5 years
Oxygen	Zirconia Cell	AE 102	1015	MCERTS	SOCOTEC (Cirencester)	SOCOTEC (Cirencester)	5 years
Moisture	Gravimetric	AE 105	1015	MCERTS	SOCOTEC (Cirencester)	-	-

EXECUTIVE SUMMARY

DUCT CHARACTERISTICS		
	Value	Units
Shape	Circular	-
Depth	0.60	m
Width	-	m
Area	0.28	m ²
Port Depth	0	mm

SAMPLING LINES & POINTS		
	Isokinetic	Non-Iso & Gases
Sample port size	-	2"
Number of lines used	-	1
Number of points / line	-	1
Duct orientation	-	Vertical
Filtration	-	Out Stack

SAMPLING PLATFORM	
General Platform Information	
Permanent / Temporary Platform / Ground level / Floor Level / Roof	Permanent platform
Inside / Outside	Inside

M1 Platform requirements	
Is there a sufficient working area so work can be performed in a compliant manner	Yes
Platform has 2 levels of handrails (approximately 0.5 m & 1.0 m high)	N/A
Platform has vertical base boards (approximately 0.25 m high)	N/A
Platform has removable chains / self closing gates at the top of ladders	N/A
Handrail / obstructions do not hamper insertion of sampling equipment	N/A
Depth of Platform = >Stack depth / diameter + wall and port thickness + 1.5m	N/A

Sampling Platform Improvement Recommendations (if applicable)

The sampling location meets all the requirements as specified in EA Guidance Note M1.

EXECUTIVE SUMMARY

Sampling & Analytical Method Deviations

Velocity Survey

Unable to perform a velocity survey due to sample port location and size. Therefore no mass emissions were reported

APPENDICES

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APPENDIX 1 - Monitoring Schedule, Calibration Checklist & Monitoring Team

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 3 - Measurement Uncertainty Budget Calculations

APPENDIX 1 - Monitoring Schedule, Calibration Checklist & Monitoring Team

MONITORING SCHEDULE					
Species	Method Standard Reference Method / Alternative Method	SOCOTEC Technical Procedure	UKAS Lab Number	MCERTS Accredited Method	Number of Samples
Sulphur Dioxide	SRM - BS EN 14791	AE 112	1015	MCERTS	1
Oxides of Nitrogen	SRM - BS EN 14792:2017	AE 102	1015	MCERTS	1
Carbon Monoxide	SRM - BS EN 15058:2017	AE 102	1015	MCERTS	1
Oxygen	AM - BS EN 14789:2017	AE 102	1015	MCERTS	1
Moisture	SRM - BS EN 14790	AE 105	1015	MCERTS	1

APPENDIX 1 - Monitoring Schedule, Calibration Checklist & Monitoring Team

CALIBRATEABLE EQUIPMENT CHECKLIST					
Extractive Sampling		Instrumental Analyser/s		Miscellaneous	
Equipment	Equipment I.D.	Equipment	Equipment I.D.	Equipment	Equipment I.D.
Control Box DGM	P2947	Horiba PG-250 Analyser	P1339	Laboratory Balance	P3225
Box Thermocouples	-	FT-IR	-	Tape Measure	-
Meter In Thermocouple	-	FT-IR Oven Box	-	Stopwatch	P2733
Meter Out Thermocouple	-	Bernath 3006 FID	-	Protractor	-
Control Box Timer	-	Signal 3030 FID	-	Barometer	-
Oven Box	-	Servomex	-	Digital Micromanometer	P1909
Probe	-	JCT Heated Head Filter	-	Digital Temperature Meter	P1639
Probe Thermocouple	-	Thermo FID	-	Stack Thermocouple	-
Probe	-	Stackmaster	-	Mass Flow Controller	-
Probe Thermocouple	-	FTIR Heater Box for Heated Line	-	MFC Display module	-
S-Pitot	-	Anemometer	-	1m Heated Line (1)	-
L-Pitot	P2511	Ecophysics NOx Analyser	-	1m Heated Line (2)	-
Site Balance	P3321	Chiller (JCT/MAK 10)	P2542	1m Heated Line (3)	-
Last Impinger Arm	-	Heated Line Controller (1)	P9645	5m Heated Line (1)	-
Dioxins Cond. Thermocouple	-	Heated Line Controller (2)	-	10m Heated Line (1)	-
Callipers	-	Site temperature Logger	-	10m Heated Line (2)	-
Small DGM	-			15m Heated Line (1)	-
Heater Controller	-			20m Heated Line (1)	P2546
Inclinometer (Swirl Device)	P3079			20m Heated Line (2)	-

NOTE: If the equipment I.D is represented by a dash (-), then this piece of equipment has not been used for this test.

CALIBRATION GASES					
Gas (traceable to ISO 17025)	Cylinder I.D Number	Supplier	ppm	%	Analytical Tolerance +/- %
Oxygen	CJ16	BOC	-	9.99	2.0
Nitric Oxide	CB42	BOC	203.9	-	2.0
Carbon Monoxide	CB42	BOC	101.7	-	2.0

STACK EMISSIONS MONITORING TEAM

MONITORING TEAM								
Personnel	MCERTS Number	MCERTS		TE / H&S Qualifications and Expiry Date				
		Level	Expiry	TE1	TE2	TE3	TE4	H&S
Jose Navarro	MM 19 1542	MCERTS Level 2	Dec-25	Oct-30	Apr-29	Dec-25	Mar-26	May-29
Amy Tanner	MM 21 1644	MCERTS Level 2	Sep-26	May-28	Apr-29	-	Jul-28	Sep-26

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

SULPHUR DIOXIDE SUMMARY					
Test	Sampling Times	Concentration mg/m ³	LOD mg/m ³	ELV mg/m ³	Emission Rate g/hr
Run 1	10:10 - 11:10 29 October 2024	5.6	0.258	35	-
Field Blank	-	0.588	-	-	-

Reference conditions are 273K, 101.3kPa, dry gas 3% Oxygen.

SULPHUR DIOXIDE QUALITY ASSURANCE CHECKLIST

	Barometric Pressure Kpa	Average Oxygen Value for Referencing %	Total Sample Volume @ ref Conditions m ³	Mean Sampling Rate l/min	Pre Sampling Leak Rate l/min	Post Sampling Leak Rate l/min	Acceptable Leak Rate l/min	Leak Tests Acceptable?
Run 1	102.8	14.6	0.090	4.2	0.01	0.01	0.08	Yes

	Filter Material	Filter Size mm	Max. Filtration Temp. °C	Temperature during storage / transit <25°C	Type of Absorbers	Absorption Solutions
Run 1	Sinter	15 micron	180	N/A	PTFE	0.3% Hydrogen Peroxide

SULPHUR DIOXIDE ABSORPTION EFFICIENCY

Parameter	Total ug	IMP C ug	Absorption Efficiency %	Acceptable Absorption Efficiency %	Absorption Efficiency Acceptable ?
Run 1	506.5	ND	100	95	Yes

ND - None Detected

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

COMBUSTION GASES SUMMARY

Test	Sampling Time and Date	Concentration mg/m ³	LOD mg/m ³	ELV mg/m ³	Emission Rate g/hr
Oxides of Nitrogen	10:10 - 11:10 29 October 2024	116	1.44	200	N/A
Carbon Monoxide	10:10 - 11:10 29 October 2024	21.0	0.39	-	N/A

Test	Sampling Time and Date	Concentration %	LOD %
Oxygen	10:10 - 11:10 29 October 2024	14.58	0.01

Reference conditions are 273K, 101.3kPa, dry gas 3% Oxygen.

PRE-SAMPLING CALIBRATION DATA

Date	29 October 2024
Start Time	09:41
End Time	09:49

Chiller Temperature (°C)	2.2
Requirement	< 4°C
Compliant	Yes

Gas	Range (ppm / %)	Zero Reading at analyser	Span Reading at analyser	Zero Check at analyser	Zero Check down line	Span Check down line	Response Time (Secs)	Leak Rate %
Nitric Oxide	250	0.00	196.5	0.20	0.10	196.6	35	-0.05
Carbon Monoxide	100	0.10	158.4	0.10	0.10	158.5	36	-0.06
Oxygen	25	0.03	10.02	0.03	0.02	10.01	38	0.10

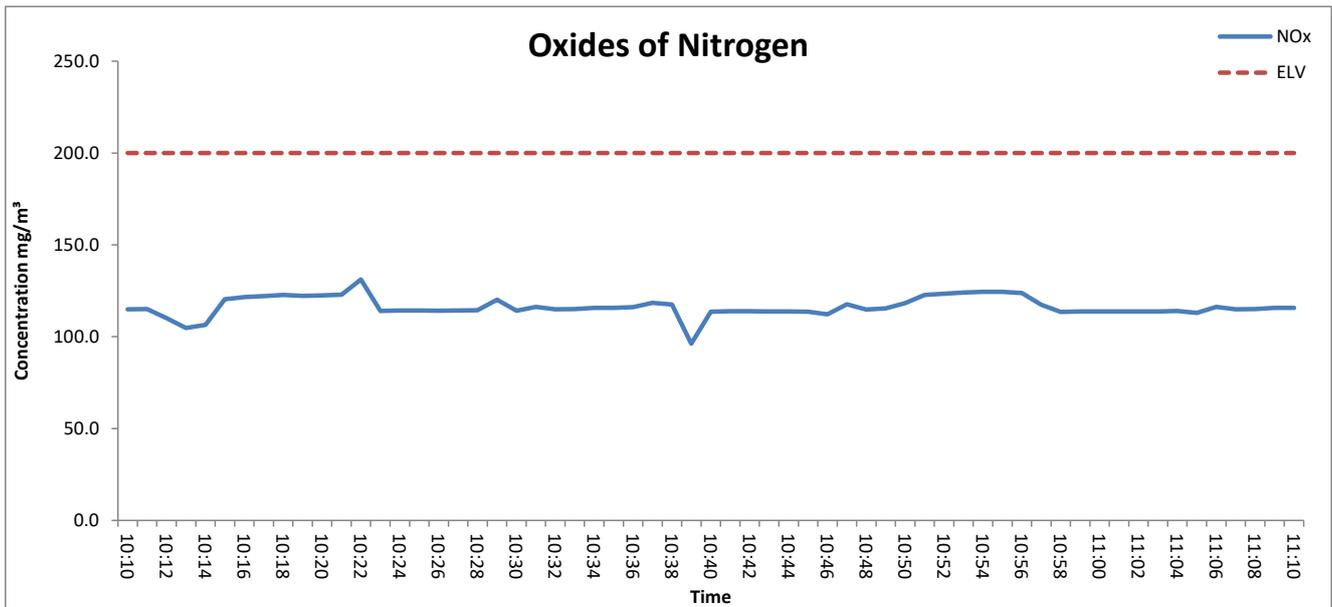
POST-SAMPLING CALIBRATION DATA

Date	29 October 2024
Start Time	11:15
End Time	11:26

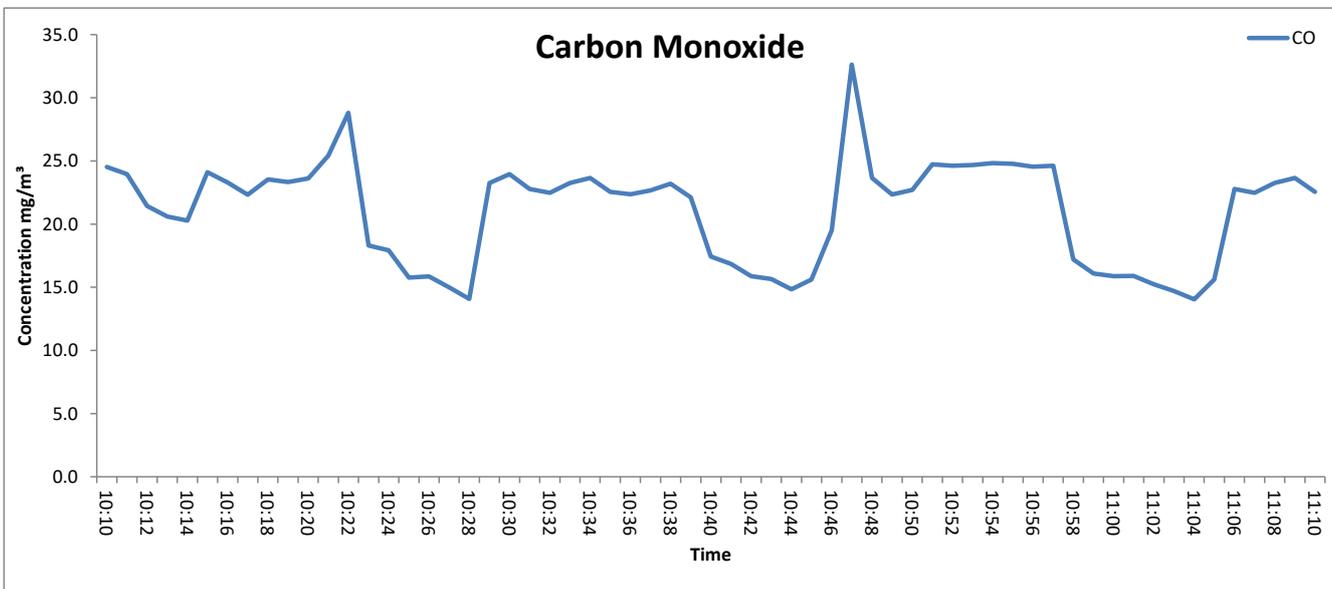
Chiller Temperature (°C)	2.4
Requirement	< 4°C
Compliant	Yes

Gas	Zero Check at Analyser	Span Check at Analyser	Zero Drift (%)	Span Drift (%)	Corrected for Zero Drift	Corrected for Span Drift	Corrected Values ppm / %
Nitric Oxide	0.10	196.4	-0.05	0.00	x	x	N/A - not corrected
Carbon Monoxide	0.20	158.5	0.06	0.00	x	x	N/A - not corrected
Oxygen	0.01	10.00	-0.20	0.00	x	x	N/A - not corrected

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts
OXIDES OF NITROGEN (as NO₂) EMISSIONS CHART

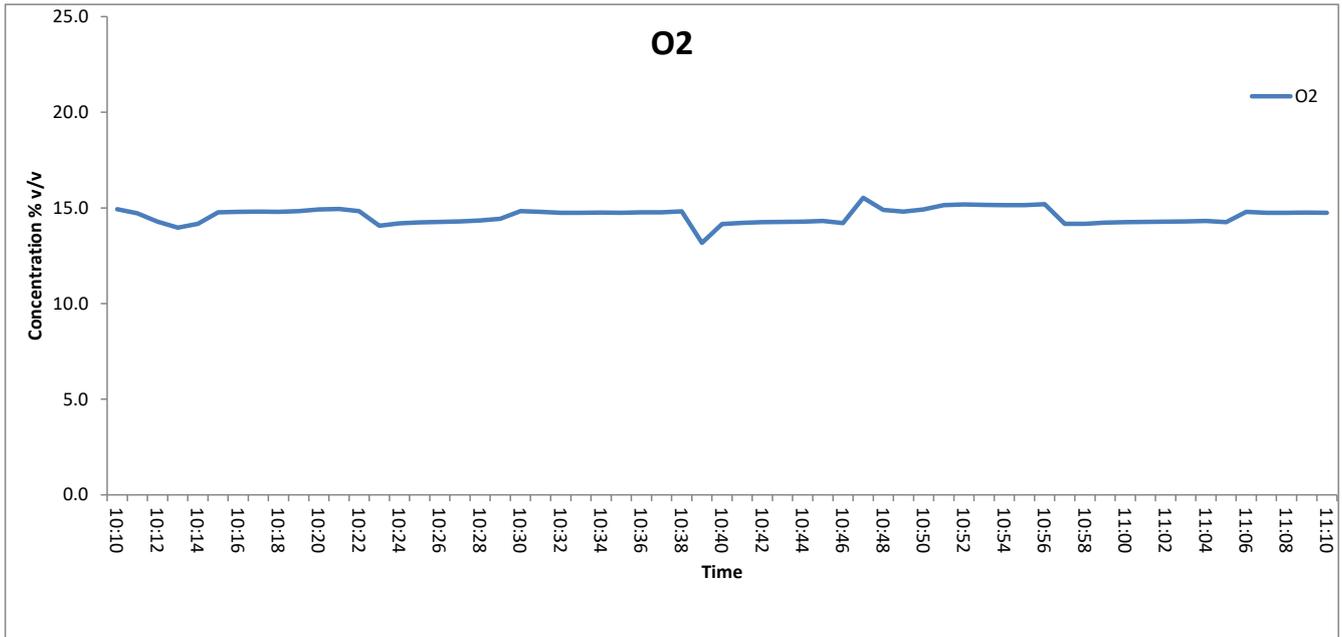


CARBON MONOXIDE EMISSIONS CHART



APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

OXYGEN EMISSIONS CHART



APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

MOISTURE CALCULATIONS

Moisture Determination - Non Isokinetic							
Test Number	Sampling Time and Date	Start Weight	End Weight	Total gain	Concentration	LOD	Uncertainty
		kg	kg	kg	%	%	%
Run 1	10:10 - 11:10 29 October 2024	3.0843	3.0921	0.0078	7.2	0.10	5.0

Moisture Quality Assurance							
Test Number	Sampling Duration	Total Volume Sampled	Sampling Rate	Start Leak Rate	End Leak Rate	Acceptable Leak Rate	Leak Tests Acceptable?
	mins	l	l/min	l/min	l/min	l/min	
Run 1	60	125	2.1	0.01	0.04	0.04	Yes

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - NON-ISOKINETIC SULPHUR DIOXIDE

Run	Sampled Volume m ³	Sampled Gas Temp K	Sampled Gas Pressure kPa	Sampled Gas Humidity % by volume	Oxygen Content % by volume	Limit of Detection % by mass	Leak %
MU required	<=2%	<2.5 k	<=1%	<=1%	<=10%	≤ 5% of ELV	<=2%
Run 1	0.0001	2.000	0.500	1.000	0.100	0.064	-
as a %	0.094	0.697	0.486	1.000	0.686	1.112	0.238
compliant?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Run	Volume (STP) m ³	Mass of Sulphur Dioxide mg	O2 Correction -	Leak mg/m ³	Lab Uncertainty mg	Combined uncertainty
Run 1	0.0867	0.9280	2.8054	0.0078	-	-
MU as mg/m ³	0.0742	0.3893	0.0879	0.0078	0.2707	0.488
MU as %	1.3159	6.9036	1.5586	0.1375	4.8	-

R1 - Uncertainty expressed at a 95% confidence level (where k = 2)	0.976	mg/m³	17.31	% Result	2.79	% ELV
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(k is a coverage factor which gives a 95% confidence in the quoted figures)

Reference – SOCOTEC Technical Procedure AE150 Estimation of Uncertainty of Measurement

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - MOISTURE

Run	Sampled Volume m ³	Sampled Gas Temp K	Sampled Gas Pressure kPa	Sampled Gas Humidity % by volume	Oxygen Content % by volume	Leak %
MU required	≤ 2%	≤ 2%	≤ 1%	≤ 1%	≤ 10%	≤ 2%
Run 1	0.0000417	2.0	0.50	1.0	0.1	-
as a %	0.03	0.46	0.49	1.0	0.69	0.48
compliant?	Yes	Yes	Yes	Yes	Yes	Yes

Run	Volume (STP) m ³	Mass Gained mg	O2 Correction -	Leak mg/m ³	Uncollected Mass mg	Combined uncertainty
Run 1	0.08	7800	2.8	172.9	58	-
MU as % v/v	0.09	0.10	0.07	0.02	0.06	0.17
MU as %	1.2	1.3	1.56	0.3	0.7	-

R1 - Uncertainty expressed at a 95% confidence level (where k = 2)	0.34	% v/v	4.96	%
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Reference – SOCOTEC Technical Procedure AE150 Estimation of Uncertainty of Measurement

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - OXIDES OF NITROGEN

Limit value	200	mg/m ³
Concentration @ Ref conditions	116.2	mg/m ³
Cal gas conc	418	mg/m ³
Analyser Full Scale	513	mg/m ³

	Value	Units	specification	MU Met?
Response time	35	seconds	180	Yes
Logger sampling interval	60	seconds	-	-
Measurement period	60	minutes	-	-
Number of readings in measurement	60	-	-	-
Repeatability at zero	0.11	% full scale	<1 % range	Yes
Repeatability at span level	0.1	% full scale	<2 % range	Yes
Deviation from linearity	-0.40	% of value	<2 % range	Yes
Zero drift	-0.05	% full scale	<5% range / 24hr	Yes
Span drift	0.00	% full scale	<5% range / 24hr	Yes
volume or pressure flow dependence	0.25	% of full scale/3 kPa	<2 % / 3 kPa	Yes
atmospheric pressure dependence	0.25	% of full scale/2 kPa	<3% / 2 kPa	Yes
ambient temperature dependence zero / span	0.25	% full scale/10K	<3% range / 10 K	Yes
Combined interference	0.01	% range	<4% of Range	Yes
dependence on voltage	0.02	% full scale/10V	< 0.1%vol /10 volt	Yes
Influence of Vibration	N/A	% of upper limit of Cal range	<2%	-
losses in the line (leak)	0.02	% of value	< 2% of value	Yes

Performance characteristic	Uncertainty	Value of uncertainty quantity
repeatability	$U_r = S_r$	0.0037
lack of fit	U_{lof}	-0.2309
short term zero drift	$U_{d,z}$	-0.0294
short term span drift	$U_{d,s}$	0.0000
influence of Ambient Temp at Zero	$U_{t,z}$	0.0191
influence of Ambient Temp at Span	$U_{t,s}$	0.0344
influence of sample gas pressure	U_p	0.0000
influence of sample gas flow	U_{fit}	0.1732
influence of supply voltage	U_v	0.0445
Combined Interference	U_i	0.0042
Uncertainty of Cal gas	U_{adj}	2.0390

Measurement uncertainty (Concentration Measured)	116.23	mg/m ³
Combined uncertainty	2.06	mg/m ³
Expanded at a 95% confidence interval	4.04	mg/m ³

Expanded uncertainty expressed with a level of confidence of 95%	2.02	% ELV
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Expanded uncertainty expressed with a level of confidence of 95%	4.0	mg/m³
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Expanded uncertainty expressed with a level of confidence of 95%	3.5	% value
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Reference – SOCOTEC Technical Procedure AE150 Estimation of Uncertainty of Measurement

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - CARBON MONOXIDE

Limit value	-	mg/m ³
Concentration @ Ref conditions	21.0	mg/m ³
Cal gas conc	127.1	mg/m ³
Analyser Full Scale	125	mg/m ³

Performance characteristics	Value	Units	specification	MU Met?
Response time	36	seconds	180	Yes
Logger sampling interval	60	seconds	-	-
Measurement period	60	minutes	-	-
Number of readings in measurement	60	-	-	-
Repeatability at zero	0.1	% full scale	<1 % range	Yes
Repeatability at span level	0.2	% full scale	<2 % range	Yes
Deviation from linearity	0.61	% of value	<2 % range	Yes
Zero drift	0.06	% full scale	<5% range / 24hr	Yes
Span drift	0.00	% full scale	<5% range / 24hr	Yes
volume or pressure flow dependence	0.1	% of full scale/3 kPa	<2 % / 3 kPa	Yes
atmospheric pressure dependence	0.22	% of full scale/2 kPa	<3% / 2 kPa	Yes
ambient temperature dependence zero / span	0.5	% full scale/10K	<3% range / 10 K	Yes
Combined interference	0.03	% of Range	<4% of Range	Yes
dependence on voltage	-0.03	% full scale/10V	< 0.1%vol /10 volt	Yes
Influence of Vibration	N/A	% of upper limit of Cal range	<2%	N/A
losses in the line (leak)	0.00	% of value	< 2% of value	Yes
Uncertainty of calibration gas	1.00	% of value	< 2% of value	Yes

N/A - Horiba's are not effected by Vibration

Performance characteristic	Uncertainty	Value of uncertainty quantity
repeatability	$U_r = S_r$	0.003
lack of fit	U_{lof}	0.12
short term zero drift	$U_{d,z}$	0.35
short term span drift	$U_{d,s}$	0.04
influence of Ambient Temp zero	$U_{t,z}$	0.01
influence of Ambient Temp span	$U_{t,s}$	0.01
influence of sample gas pressure	U_p	0.00
influence of sample gas flow	U_{fit}	0.07
influence of supply voltage	U_v	-0.02
Combined Interference	U_i	0.60
Uncertainty of Cal gas	U_{adj}	0.51

Measurement uncertainty (Concentration Measured)	7.4	mg/m ³
Combined uncertainty	0.9	mg/m ³
Expanded uncertainty	1.7	mg/m ³

Expanded uncertainty expressed with a level of confidence of 95%	-	% ELV
Expanded uncertainty expressed with a level of confidence of 95%	1.7	mg/m ³
Expanded uncertainty expressed with a level of confidence of 95%	8.2	% value

Reference – SOCOTEC Technical Procedure AE150 Estimation of Uncertainty of Measurement

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - OXYGEN

Reference	3	%vol
Reported Concentration	14.58	%vol
Calibration gas	9.99	%vol
Analyser Full Scale	25	%vol

	Value	Units	specification	MU Met?
Response time	38	seconds	180	Yes
Logger sampling interval	60	seconds	-	-
Measurement period	60	minutes	-	-
Number of readings in measurement	60	-	-	-
Repeatability at zero	0.25	% full scale	<1 % range	Yes
Repeatability at span level	0.15	% full scale	<2 % range	Yes
Deviation from linearity	0.13	% of value	<2 % range	Yes
Zero drift	-0.20	% full scale	<5% range / 24hr	Yes
Span drift	0.00	% full scale	<5% range / 24hr	Yes
volume or pressure flow dependence	0.03	% of full scale/3 kPa	<2 % / 3 kPa	Yes
atmospheric pressure dependence	0.05	% of full scale/2 kPa	<3% / 2 kPa	Yes
ambient temperature dependence	-0.08	% full scale/10K	<3% range / 10 K	Yes
Combined interference	0.14	% range	<4% of Range	Yes
dependence on voltage	0.00	% full scale/10V	< 0.1%vol /10 volt	Yes
losses in the line (leak)	0.14	% of value	< 2% of value	Yes
Uncertainty of calibration gas	0.1	% of value	< 2% of value	Yes

Performance characteristic	Uncertainty	Value of uncertainty quantity
repeatability	$U_r = S_r$	0.0083
lack of fit	U_{lof}	0.0751
short term zero drift	$U_{d,z}$	-0.1156
short term span drift	$U_{d,s}$	0.0000
influence of Ambient Temp at Zero	$U_{t,z}$	-0.0001
influence of Ambient Temp at Span	$U_{t,s}$	0.0003
influence of sample gas pressure	U_p	0.0000
influence of sample gas flow	U_{fit}	0.0173
influence of supply voltage	U_v	0.0001
Combined Interference	U_i	0.0485
Uncertainty of Cal gas	U_{adj}	0.0500

Measurement uncertainty (Concentration Measured)	14.58	% vol
Combined uncertainty	0.16	% vol
Expanded uncertainty	0.30	% vol

Expanded uncertainty expressed with a level of confidence of 95%	0.30	% vol
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Expanded uncertainty expressed with a level of confidence of 95%	2.09	% value
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Maximum permissible uncertainty is 6% of value or 0.3% by volume.

Reference – SOCOTEC Technical Procedure AE150 Estimation of Uncertainty of Measurement

END OF REPORT

Thank you for choosing SOCOTEC for your environmental monitoring needs. We hope our services have met your requirements and that you are fully satisfied with your experience of working with us, we really do value your custom and would welcome your feedback. We would appreciate it if you could take a moment to complete a short online questionnaire so that we can improve our operations and address any areas that have not met with your expectations, by clicking on the following

https://www.surveymonkey.co.uk/r/CAE_customer_feedback_weblink