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Stack Emissions Testing Report Commissioned by
Blackmore Vale Cream Ltd

Installation Name & Address
Blackmore Vale Cream Ltd
Wincombe Lane
Shaftsbury
SP7 0PD

EPR Permit: HP3492EZ

Stack Reference
A1 - Engine

Dates of the Monitoring Campaign
19th September 2023


Job Reference Number
ERE-23339

Report Written by
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Report Date
17th October 2023

Version
Version 1

Signature of Report Approver


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APPENDIX 1 - Monitoring Personnel & List of Equipment

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Executive Summary

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MONITORING OBJECTIVES

Blackmore Vale Cream Ltd, Shaftsbury

A1 - Engine

19th September 2023

Overall Aim of the Monitoring Campaign

Element were commissioned by Blackmore Vale Cream Ltd to carry out stack emissions testing on the A1 - Engine at Shaftsbury.

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values (ELVs) as specified in the Site's Permit.

Special Requirements

There were no special requirements.

Target Parameters

Sulphur Dioxide, Total VOCs (as Carbon), Oxides of Nitrogen (as NO₂), Carbon Monoxide

Executive Summary

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MONITORING RESULTS

Blackmore Vale Cream Ltd, Shaftsbury

A1 - Engine

19th September 2023

where MU = Measurement Uncertainty associated with the Result

Concentration				
Parameter	Units	Result	MU +/-	Limit
Sulphur Dioxide	¹ mg/m ³	36.0	2.0	350
Total VOCs (as Carbon)	¹ mg/m ³	693	32.1	1000
Oxides of Nitrogen (as NO ₂)	¹ mg/m ³	427	21.1	500
Carbon Monoxide	¹ mg/m ³	444	22.6	1400
Oxygen	% v/v	Dry 5.0	0.20	
Water Vapour	% v/v	14.1	0.6	

¹ Reference Conditions (REF) are: 273K, 101.3kPa, dry gas, 5% oxygen.

Executive Summary

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MONITORING DATE(S) & TIMES

Blackmore Vale Cream Ltd, Shaftsbury

A1 - Engine

19th September 2023

Parameter		Units	Concentration		Sampling Date(s)	Sampling Times	Duration mins
Sulphur Dioxide	R1	mg/m ³	36.0		19/09/2023	11:33 - 12:33	60
Total VOCs (as Carbon)	R1	mg/m ³	693		19/11/2023	11:33 - 12:33	60
Oxides of Nitrogen (as NO ₂)	R1	mg/m ³	427		19/09/2023	11:33 - 12:33	60
Carbon Monoxide	R1	mg/m ³	444		19/09/2023	11:33 - 12:33	60
Oxygen	R1	% v/v	5.0		19/09/2023	11:33 - 12:33	60

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

Blackmore Vale Cream Ltd, Shaftsbury

A1 - Engine

19th September 2023

Standard Operating Conditions

Parameter	Value
Process Status	Operating
Capacity (of 100%) and Tonnes / Hour	75% (100% MCR 190KWe)
Continuous or Batch Process	Continuous
Feedstock (if applicable)	N/A
Abatement System	None
Abatement System Running Status	N/A
Fuel	Biogas
Plume Appearance	No visible plume

Executive Summary

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MONITORING & ANALYTICAL METHODS

Blackmore Vale Cream Ltd, Shaftsbury

A1 - Engine

19th September 2023

Parameter	Monitoring				Analysis				Overall Status	LOD (Average)
	Standard	Technical Procedure	Sampling Status	Testing Lab	Analytical Procedure	Analytical Technique	Analysis Status	Analysis Lab		
Sulphur Dioxide	EN 14791	MD 009	MCERTS	EET	CAT-AP-01	IC	17025	EET	17025	0.052 mg/m ³
Water Vapour	EN 14790	MD 005	MCERTS	EET	MD 105	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	MD 020	MCERTS	EET	Flame Ionisation Detection by Signal 3010HM				MCERTS	0.32 mg/m ³
Oxides of Nitrogen (as NO ₂)	EN 14792	MD 021	MCERTS	EET	Chemiluminescence by Horiba PG-250				MCERTS	0.41 mg/m ³
Carbon Monoxide	EN 15058	MD 021	MCERTS	EET	NDIR by Horiba PG-250				MCERTS	0.39 mg/m ³
Oxygen	EN 14789	MD 021	MCERTS	EET	Dry Zirconia Cell by Horiba PG-250				MCERTS	0.1 %

ANALYSIS LABORATORIES

(with short name reference as appears in the table above)

Element (Stockport Lab - EET)	ISO 17025 Accreditation Number: 4279
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SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
All	All	There are no deviations associated with the sampling employed.

Executive Summary

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SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.22
Width	m	-
Area	m ²	0.04
Port Depth	cm	2
Orientation of Duct	-	Horizontal
Number of Ports	-	1
Sample Port Size	-	1" BSP

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	On Ground
Inside / Outside	Inside

Platform Details

EA Technical Guidance Note M1 / EN 15259 Platform Requirements	Value
Sufficient working area to manipulate probe and operate the measuring instruments	Yes
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	N/A
Platform has vertical base boards (approx. 0.25m high)	N/A
Platform has chains / self closing gates at top of ladders	N/A
There are no obstructions present which hamper insertion of sampling equipment	Yes
Safe Access Available	Yes
Easy Access Available	Yes

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and EN 15259, and therefore there are no improvement recommendations.

EN 15259 Homogeneity Test Requirements

There is no requirement to perform a EN 15259 Homogeneity Test on this Stack.

Executive Summary

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PLANT PHOTOS

Photo 1



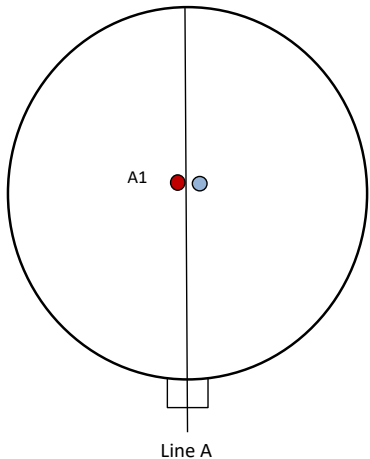
Photo 2



Photo 3



SAMPLE POINTS



- where
- = isokinetic point sampled at
 - = isokinetic point not sampled at
 - = combustion gases sample point
 - = non-isokinetic sample point

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel, List of Equipment & Methods and Technical Procedures Used

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Darren Price	MCERTS Level 2	MM 03 176	TE1 TE2 TE3 TE4

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM (1)	-	Horiba PG-250	CAT 9.25	Digital Manometer (1)	-
Control Box DGM (2)	-	Horiba PG-350E	-	Digital Manometer (2)	-
Box Thermocouples (1)	-	Servomex 4900	-	Digital Temperature Meter	-
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	-
Umbilical (1)	-	ABB AO2020-URAS26	-	Barometer	-
Umbilical (2)	-	Testo 350 XL	-	Stack Thermocouple (1)	-
Oven Box (1)	-	Signal 200SM	CAT 8.50	Stack Thermocouple (2)	-
Oven Box (2)	-	Gasmet DX4000	-	Stack Thermocouple (3)	-
Heated Probe (1)	-	Gasmet Sampling System	-	1m Heated Line (1)	-
Heated Probe (2)	-	Signal 3010HM	CAT 8.50	1m Heated Line (2)	-
Heated Probe (3)	-	M&C PSS	CAT 4.00168	1m Heated Line (3)	-
S-Pitot (1)	-	Mass Flow Controller (1)	-	5m Heated Line (1)	-
S-Pitot (2)	-	Mass Flow Controller (2)	-	15m Heated Line (1)	-
L-Pitot	-	Mass View (1)	CAT 25.106	20m Heated Line (1)	CAT 20.1023
Site Balance	-	Mass View (2)	CAT 25.107	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.82	Squirrel 2020	CAT DL#04	Dual Channel Heater Controller	-
Last Impinger Arm	CAT 17.82	Easylogger EN-EL-12 Bit	-	Single Channel Heater Controller	CAT 20.1023
Callipers	-	Bioaerosols Temperature Logger	-	Laboratory Balance	-
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.144

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Sulphur Dioxide	EN 14791	MD 009
Water Vapour	EN 14790	MD 005
Total VOCs (as Carbon)	EN 12619:2013	MD 020
Oxides of Nitrogen (as NO ₂)	EN 14792	MD 021
Carbon Monoxide	EN 15058	MD 021
Oxygen	EN 14789	MD 021

SULPHUR DIOXIDE: RESULTS SUMMARY

Blackmore Vale Cream Ltd, Shaftsbury
A1 - Engine

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	36.0	36.0
Uncertainty	±mg/m ³	2.0	2.0

Parameter	Units	Run 1	Mean
Water Vapour	% v/v	14.1	14.1
Uncertainty	±% v/v	0.60	0.60

Blank Runs

Parameter	Units	Blank 1	Maximum
Concentration	mg/m ³	0.05	0.05

General Sampling Information

Parameter	Value
Standard	EN 14791
Technical Procedure	MD 009
Name of Analytical Laboratory	EET
Analytical Laboratory's Procedure	CAT-AP-01
ISO 17025 Accredited Analysis?	17025
Date of Sample Analysis	27/09/2023
Probe Material	Titanium
Filter Housing Material	Titanium
Impinger Material	Quartz Glass
Absorption Solution	0.3% Hydrogen Peroxide
Positioning of Filter	Out Stack Heated Head
Filter Size and Material	0.1µm Glass Fibre
Number of Sampling Lines Used	1/1
Number of Sampling Points Used	1/1
Sample Point I.D.'s	A1

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

SULPHUR DIOXIDE: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	11:33 - 12:33
Sampling Dates	-	19/09/2023
Sampling Device	-	MFC / MV
Duration	mins	60
Volume Sampled (STP, Dry)	m ³	0.3477
Volume Sampled (STP, Wet)	m ³	0.4049
Volume Sampled (REF)	m ³	0.3468
Sample Flow Rate	l/min	5.57
Laboratory Result for Front Impingers	µg/ml	47.58
Laboratory Result for Back Impinger	µg/ml	0.09
Volume in Front Impingers	ml	262.0
Volume in Back Impinger	ml	100.7
Mass in Front Impingers	µg	12466.0
Mass in Back Impinger	µg	9.1
Total Mass Collected	µg	12475.0
Calculated Concentration	mg/m ³	35.98
Liquid Trap Start Mass	g	2380.9
Liquid Trap End Mass	g	2420.3
Silica Trap Start Mass	g	920.4
Silica Trap End Mass	g	926.9
Total Mass Of Water Vapour	g	45.9
Calculated Water Vapour	% v/v	14.12

Where: MFC stands for Mass Flow Controller, MV stands for Mass View Flowmeter

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	19/09/2023
Average Volume Sampled (REF)	m ³	0.3468
Laboratory Result for Impingers	µg/ml	0.05
Volume in Impingers	ml	315.1
Total Mass Collected	µg	15.8
Calculated Concentration	mg/m ³	0.05

SULPHUR DIOXIDE: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	5.6	
Pre-Sampling Leak Rate	l/min	0.08	
Post-Sampling Leak Rate	l/min	0.06	
Allowable Leak Rate	l/min	0.11	
Leak Test Acceptable	-	Yes	
Absorption Efficiency	Units	Run 1	
Absorption Efficiency	%	99.9	
Allowable Absorption Efficiency	%	N/A ²	
Absorption Efficiency Acceptable	-	Yes ²	
² The concentration is less than 30% of the ELV, therefore no assessment against an allowable efficiency is required.			
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	4.3	
Allowable MU	%	20.0	
MU Acceptable	%	Yes	
Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	
Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	No	

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	5.0	
Pre-Sampling Leak Rate	l/min	0.09	
Post-Sampling Leak Rate	l/min	0.09	
Allowable Leak Rate	l/min	0.10	
Leak Test Acceptable	-	Yes	
Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m ³	35.0	
Blank Acceptable	-	Yes	

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
There are no deviations associated with the sampling employed.	wx	

SULPHUR DIOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value		Standard uncertainty		
	Symbol	Run 1	Symbol	Units	Run 1
Sampled Volume (STP)	V_m	0.3477	uV_m	m ³	0.0070
Leak	L	1.08	uL	%	-
Laboratory Result	L_r	0.90	uL_r	%	-

Measured Quantities	Uncertainty as a Percentage		Requirement of Standard
	Units	Run 1	
Sampled Volume (STP)	%	2.00	≤2%
Leak	%	1.08	≤2%
Laboratory Result	%	0.90	No Requirement

Measured Quantities	Uncertainty in Measurement Units			Sensitivity Coefficient	
	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V_m	m ³	0.3477	103.46	
Leak	L	mg/m ³	0.224	1.00	
Laboratory Result	L_r	mg/m ³	0.324	1.00	

Measured Quantities	Uncertainty in Result	
	Units	Run 1
Sampled Volume (STP)	mg/m ³	0.720
Leak	mg/m ³	0.2239
Laboratory Result	mg/m ³	0.3238

Measured Quantities	Oxygen Correction Part of MU Budget	
	Units	Run 1
O ₂ Correction Factor	-	1.00
Stack Gas O ₂ Content	% v/v	5.04
MU for O ₂ Correction	-	0.03
Overall MU For O ₂ Measurement	%	3.13

Parameter	Units	Run 1
Combined uncertainty	mg/m ³	0.82
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	1.61
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	1.96
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	1.96
Reported Uncertainty	mg/m ³	1.96
Expanded uncertainty (95% confidence), without Oxygen Correction	%	4.5
Expanded uncertainty (95% confidence), with Oxygen Correction	%	5.5
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	5.5
Reported Uncertainty	%	5.5

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Blackmore Vale Cream Ltd, Shaftsbury

A1 - Engine

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	693	693
Uncertainty	±mg/m ³	32.1	32.1

General Sampling Information

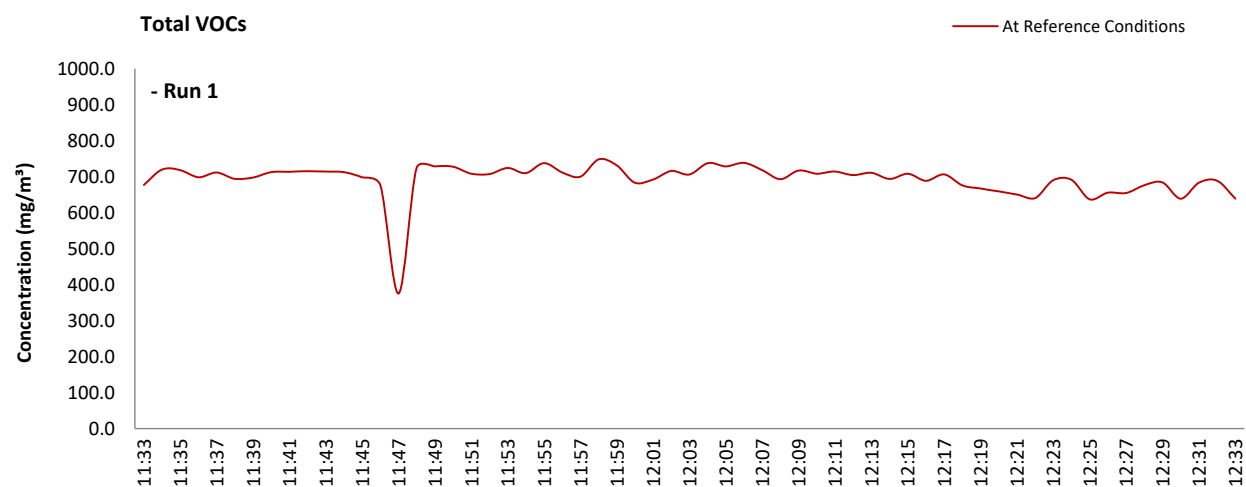
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	MD 020	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	12.0506	
Span Gas Expiry Date	19/01/2025	
Span Gas Start Pressure (bar)	50	
Gas Cylinder Concentration (ppm)	635	
Span Gas Set Point (ppm)	635.00	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Synthetic Air (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



TOTAL VOCs (as CARBON): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	11:33 - 12:33
Sampling Dates	-	19/11/2023
Instrument Range	ppm	1000
Span Gas Value	ppm	635.0

Quality Assurance

Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm -1.00
	Zero Down Sampling Line (Post)	ppm 18.00
	Zero Drift	ppm 19.00
	Zero Drift	% 2.97
	Drift Correction Applied	2-5% Yes
	Allowable Zero Drift	± ppm 31.75
	Zero Drift Acceptable	- Yes

Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm 639.00
	Span Down Sampling Line (Post)	ppm 612.00
	Span Drift	ppm -27.00
	Span Drift	% -4.23
	Drift Correction Applied	2-5% Yes
	Allowable Span Drift	± ppm 31.75
	Span Drift Acceptable	- Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	15 - 16

Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run)	1
There are no deviations associated with the sampling employed.	x

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1	Units
Limit value	1000.0	mg/m ³ (REF)
Allowable MU	15.0	%
Measured concentration	691.39	mg/m ³ (STP, dry)
Range Used	1000.0	ppm
Range Used [A]	1606.1	mg/m ³
Cal gas conc.	635.0	ppm
Conversion	1.61	ppm to mg/m ³
MCERTS Range [B]	15.0	mg/m ³
Lower of [A] or [B]	15.0	mg/m ³
Cal gas conc.	1019.9	mg/m ³

Performance characteristics	RUN 1	Units
Response time	15	seconds
Number of readings in measurement	60	-
Repeatability at zero	0.15	% full scale
Repeatability at span level	0.80	% full scale
Deviation from linearity	0.10	% of value
Zero drift	0.00	% full scale
Span drift	0.00	% full scale
Volume or pressure flow dependence	2.00	% of full scale
Atmospheric pressure dependence	0.80	% of value/kPa
Ambient temperature dependence	1.00	% full scale/10K
Combined interference	1.20	% range
Dependence on voltage	0.10	% full scale/10V
Losses in the line (leak)	0.00	% of value
Uncertainty of calibration gas	2.00	% of value

Performance characteristic	RUN 1	Units
Standard deviation of repeatability at zero	use rep at span	mg/m ³
Standard deviation of repeatability at span level	0.10	mg/m ³
Lack of fit	0.01	mg/m ³
Drift	0.00	mg/m ³
Volume or pressure flow dependence	0.00	mg/m ³
Atmospheric pressure dependence	0.03	mg/m ³
Ambient temperature dependence	0.14	mg/m ³
Combined interference (from MCERTS Certificate)	0.10	mg/m ³
Dependence on voltage	0.01	mg/m ³
Losses in the line (leak)	0.00	mg/m ³
Uncertainty of calibration gas	7.98	mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		691.39	mg/m ³
Expanded uncertainty		7.99	mg/m ³
Expanded uncertainty	k = 1.96	15.65	mg/m ³
Uncertainty corrected to std conds. (O ₂)		15.70	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	2.26	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	1.57	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	15.0	% at ELV
Result of Compliance with Uncertainty Requirement	N/A	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	4.63	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	4.34	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	15.5	% at ELV
Result of Compliance with Uncertainty Requirement	COMPLIANT	-

Requirement for SRM is that Uncertainty should be <15% of the value at the ELV, on a dry gas basis, or if O₂ correction is applied less than 15% + the uncertainty associated with the O₂ correction (using sqrt of sum squares to add uncertainty components).

OXIDES OF NITROGEN (as NO₂): RESULTS SUMMARY

Blackmore Vale Cream Ltd, Shaftsbury

A1 - Engine

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	427	427
Uncertainty	±mg/m ³	21.1	21.1

General Sampling Information

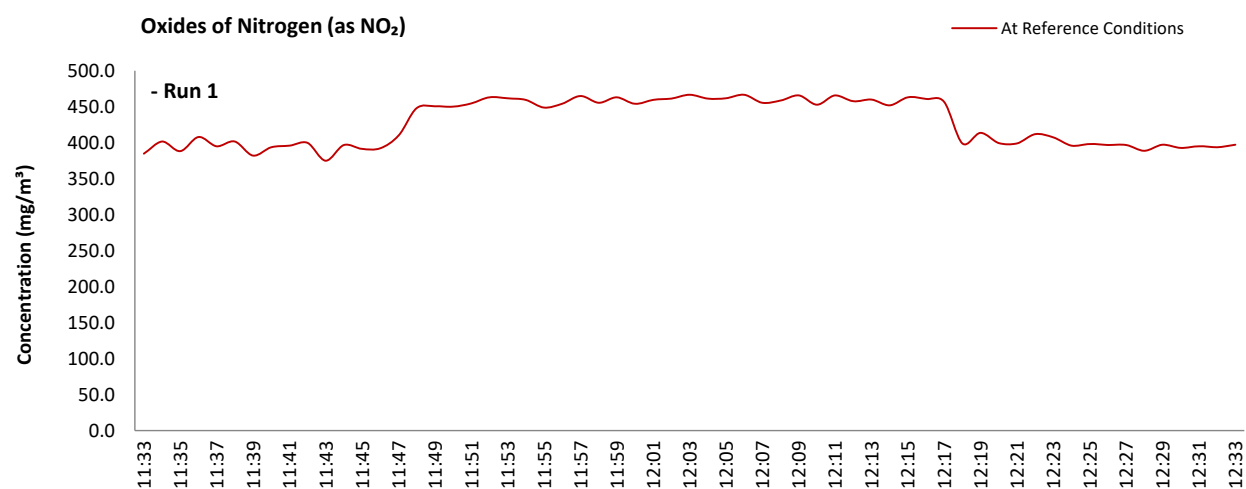
Parameter	Value	
Standard	EN 14792	
Technical Procedure	MD 021	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Date & Result of Last Converter Check	09/11/2022 - 95.2%	
Span Gas Type	Nitrogen Monoxide	
Span Gas Reference Number	12.0532	
Span Gas Expiry Date	18/01/2025	
Span Gas Start Pressure (bar)	200	
Gas Cylinder Concentration (ppm)	268.9	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

OXIDES OF NITROGEN (as NO₂): DATA TREND

Graphical Trend of Data



APPENDIX 2

OXIDES OF NITROGEN (as NO₂): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	11:33 - 12:33
Sampling Dates	-	19/09/2023
Instrument Range	ppm	500
Span Gas Value	ppm	268.9

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.5
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

Zero Drift	Units	Run 1
Zero at Analyser (Pre)	ppm	0.00
Zero at Analyser (Post)	ppm	1.90
Zero Drift	ppm	1.90
Zero Drift	%	0.71
Drift Correction Applied	2-5%	No
Allowable Zero Drift	± %	5.00
Zero Drift Acceptable	-	Yes

Span Drift	Units	Run 1
Span at Analyser (Pre)	ppm	268.90
Span at Analyser (Post)	ppm	259.20
Span Drift	ppm	-9.70
Zero Adj. Span Drift	%	4.31
Drift Correction Applied	2-5%	Yes
Allowable Span Drift	± %	5.00
Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	15 - 16

Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run)	1
There are no deviations associated with the sampling employed.	x

OXIDES OF NITROGEN (as NO₂): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1	Units
Limit value	500.0	mg/m ³ (REF)
Allowable MU	10.0	%
Measured concentration	425.91	mg/m ³ (STP, dry)
Ratio NO / NO ₂	5	%
Range Used	500.0	ppm
Range Used [A]	1026.1	mg/m ³
Cal gas conc.	268.9	ppm
Conversion	2.05	ppm to mg/m ³
MCERTS Range [B]	125.0	mg/m ³
Lower of [A] or [B]	125.0	mg/m ³
Cal gas conc.	551.9	mg/m ³

Performance characteristics	RUN 1	Units
Response time	60	seconds
Number of readings in measurement	60	-
Repeatability at zero	0.40	% full scale
Repeatability at span level	0.40	% full scale
Deviation from linearity	0.29	% of value
Zero drift	0.71	% full scale
Span drift	0.00	% full scale
Volume or pressure flow dependence	0.40	% of full scale
Atmospheric pressure dependence	0.30	% of value/kPa
Ambient temperature dependence	0.18	% full scale/10K
Combined interference	0.60	% range
Dependence on voltage	0.40	% full scale/10V
Converter efficiency	95.2	%
Losses in the line (leak)	0.52	% of value
Uncertainty of calibration gas blending	1.40	% of value
Uncertainty of calibration gas	2.00	% of value

Performance characteristic	RUN 1	Units
Standard deviation of repeatability at zero	use rep at span	mg/m ³
Standard deviation of repeatability at span level	0.05	mg/m ³
Lack of fit	0.21	mg/m ³
Drift	0.00	mg/m ³
Volume or pressure flow dependence	0.00	mg/m ³
Atmospheric pressure dependence	0.11	mg/m ³
Ambient temperature dependence	0.03	mg/m ³
Combined interference (from MCERTS Certificate)	0.43	mg/m ³
Dependence on voltage	0.05	mg/m ³
Converter efficiency	0.59	mg/m ³
Losses in the line (leak)	1.28	mg/m ³
Uncertainty of calibration gas blending	3.44	mg/m ³
Uncertainty of calibration gas	4.92	mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		425.91	mg/m ³
Expanded uncertainty		6.19	mg/m ³
Expanded uncertainty	k = 1.96	12.13	mg/m ³
Uncertainty corrected to std conds. (O ₂)		12.16	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	2.85	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	2.43	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	10.0	% at ELV
Result of Compliance with Uncertainty Requirement	N/A	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	4.95	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	4.72	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	10.8	% at ELV
Result of Compliance with Uncertainty Requirement	COMPLIANT	-

Requirement for SRM is that Uncertainty should be <10% of the value at the ELV, on a dry gas basis, or if O₂ correction is applied less than 10% + the uncertainty associated with the O₂ correction (using sqrt of sum squares to add uncertainty components).

CARBON MONOXIDE: RESULTS SUMMARY

Blackmore Vale Cream Ltd, Shaftsbury

A1 - Engine

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	444	444
Uncertainty	±mg/m ³	22.6	22.6

General Sampling Information

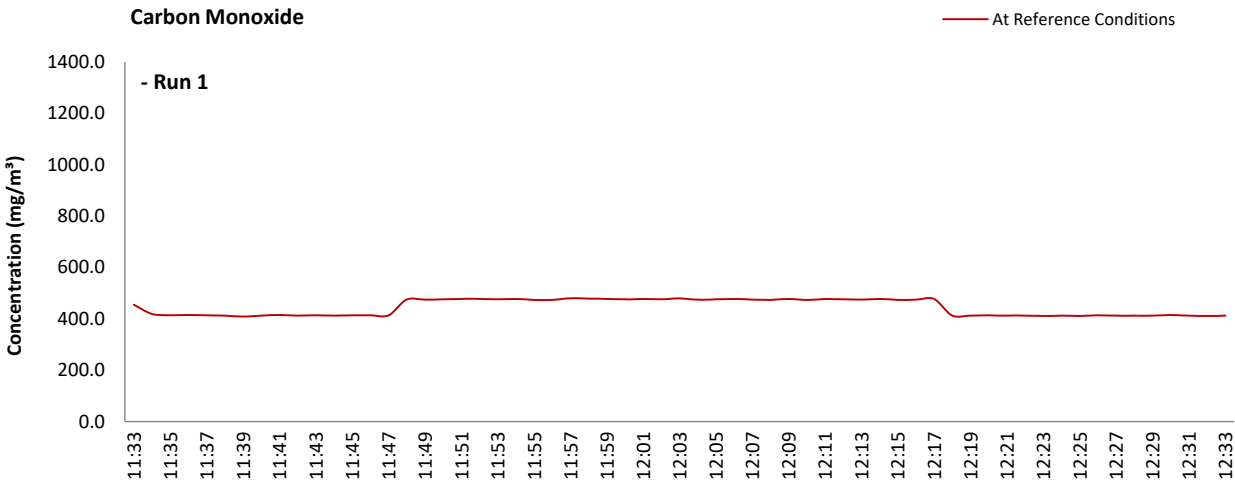
Parameter	Value	
Standard	EN 15058	
Technical Procedure	MD 021	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Carbon Monoxide	
Span Gas Reference Number	12.0532	
Span Gas Expiry Date	18/01/2025	
Span Gas Start Pressure (bar)	200	
Gas Cylinder Concentration (ppm)	1216.1	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

CARBON MONOXIDE: DATA TREND

Graphical Trend of Data



APPENDIX 2

CARBON MONOXIDE: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	11:33 - 12:33
Sampling Dates	-	19/09/2023
Instrument Range	ppm	2000
Span Gas Value	ppm	1216.1

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.5
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

Zero Drift	Units	Run 1
Zero at Analyser (Pre)	ppm	0.00
Zero at Analyser (Post)	ppm	-4.00
Zero Drift	ppm	-4.00
Zero Drift	%	0.33
Drift Correction Applied	2-5%	No
Allowable Zero Drift	± %	5.00
Zero Drift Acceptable	-	Yes

Span Drift	Units	Run 1
Span at Analyser (Pre)	ppm	1216.00
Span at Analyser (Post)	ppm	1221.00
Span Drift	ppm	5.00
Zero Adj. Span Drift	%	0.74
Drift Correction Applied	2-5%	No
Allowable Span Drift	± %	5.00
Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	15 - 16

Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run)	1
There are no deviations associated with the sampling employed.	x

CARBON MONOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1	Units
Limit value	1400.0	mg/m ³ (REF)
Allowable MU	6.0	%
Measured concentration	443.14	mg/m ³ (STP, dry)
Range Used	2000.0	ppm
Range Used [A]	2498.4	mg/m ³
Cal gas conc.	1216.1	ppm
Conversion	1.25	ppm to mg/m ³
MCERTS Range [B]	95.0	mg/m ³
Lower of [A] or [B]	95.0	mg/m ³
Cal gas conc.	1519.2	mg/m ³

Performance characteristics	RUN 1	Units
Response time	60	seconds
Number of readings in measurement	60	-
Repeatability at zero	0.40	% full scale
Repeatability at span level	0.40	% full scale
Deviation from linearity	0.46	% of value
Zero drift	-0.33	% full scale
Span drift	0.74	% full scale
Volume or pressure flow dependence	0.40	% of full scale
Atmospheric pressure dependence	0.30	% of value/kPa
Ambient temperature dependence	0.05	% full scale/10K
Combined interference	0.73	% range
Dependence on voltage	0.40	% full scale/10V
Losses in the line (leak)	1.23	% of value
Uncertainty of calibration gas blending	1.40	% of value
Uncertainty of calibration gas	2.00	% of value

Performance characteristic	RUN 1	Units
Standard deviation of repeatability at zero	use rep at span	mg/m ³
Standard deviation of repeatability at span level	0.05	mg/m ³
Lack of fit	0.25	mg/m ³
Drift	0.00	mg/m ³
Volume or pressure flow dependence	0.00	mg/m ³
Atmospheric pressure dependence	0.08	mg/m ³
Ambient temperature dependence	0.01	mg/m ³
Combined interference (from MCERTS Certificate)	0.40	mg/m ³
Dependence on voltage	0.05	mg/m ³
Losses in the line (leak)	3.16	mg/m ³
Uncertainty of calibration gas blending	3.58	mg/m ³
Uncertainty of calibration gas	5.12	mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		443.14	mg/m ³
Expanded uncertainty	k = 1.96	7.01	mg/m ³
Expanded uncertainty		13.75	mg/m ³
Uncertainty corrected to std conds. (O ₂)		13.79	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	3.10	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	0.98	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	6.0	% at ELV
Result of Compliance with Uncertainty Requirement	N/A	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	5.10	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	4.16	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	7.2	% at ELV
Result of Compliance with Uncertainty Requirement	COMPLIANT	-

Requirement for SRM is that Uncertainty should be <6% of the value at the ELV, on a dry gas basis, or if O₂ correction is applied less than 6% + the uncertainty associated with the O₂ correction (using sqrt of sum squares to add uncertainty components).

APPENDIX 2

OXYGEN: RESULTS SUMMARY

Blackmore Vale Cream Ltd, Shaftsbury
A1 - Engine

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	% v/v	5.0	5.0
Uncertainty	±% v/v	0.20	0.20

General Sampling Information

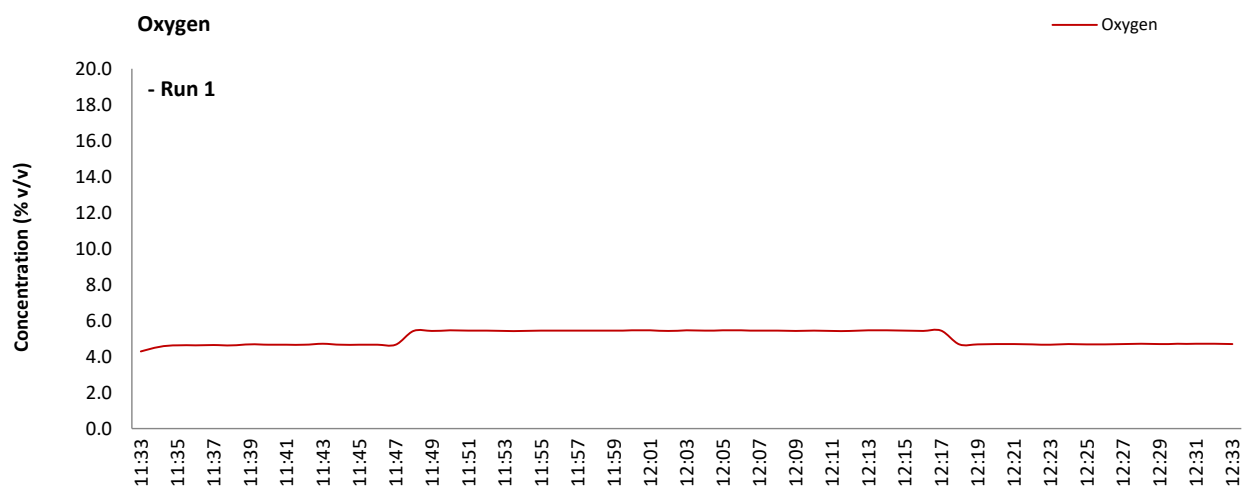
Parameter	Value
Standard	EN 14789
Technical Procedure	MD 021
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Type	Synthetic Air (5 Grade)
Span Gas Reference Number	12.0506
Span Gas Expiry Date	19/01/2025
Span Gas Start Pressure (bar)	50
Gas Cylinder Concentration (% v/v)	8.39
Span Gas Uncertainty (%)	2
Zero Gas Type	Nitrogen (5 Grade)
Number of Sampling Lines Used	1/1
Number of Sampling Points Used	1/1
Sample Point I.D.'s	A1

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

OXYGEN: DATA TREND

Graphical Trend of Data



APPENDIX 2

OXYGEN: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	11:33 - 12:33
Sampling Dates	-	19/09/2023
Instrument Range	% v/v	25.0
Span Gas Value	% v/v	8.4

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	3.5
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

Zero Drift	Units	Run 1
Zero at Analyser (Pre)	% v/v	0.00
Zero at Analyser (Post)	% v/v	0.04
Zero Drift	% v/v	0.04
Zero Drift	%	0.48
Drift Correction Applied	2-5%	No
Allowable Zero Drift	± %	5.00
Zero Drift Acceptable	-	Yes

Span Drift	Units	Run 1
Span at Analyser (Pre)	% v/v	8.40
Span at Analyser (Post)	% v/v	8.54
Span Drift	% v/v	0.14
Zero Adj. Span Drift	%	1.19
Drift Correction Applied	2-5%	No
Allowable Span Drift	± %	5.00
Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	15 - 16

Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run)	1
There are no deviations associated with the sampling employed.	x

OXYGEN: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	N/A		%vol
Allowable MU	6.0		%
Measured concentration	5.04		%vol
Range Used	25.0		%vol
Cal gas conc.	8.4		%vol

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.04		% full scale
Repeatability at span level	0.04		% full scale
Deviation from linearity	0.12		% of value
Zero drift	0.48		% full scale
Span drift	1.19		% full scale
Volume or pressure flow dependence	0.20		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	-0.07		% full scale/10K
Combined interference	0.56		% range
Dependence on voltage	0.02		% full scale/10V
Losses in the line (leak)	0.00		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		%vol
Standard deviation of repeatability at span level	0.01		%vol
Lack of fit	0.02		%vol
Drift	0.00		%vol
Volume or pressure flow dependence	0.00		%vol
Atmospheric pressure dependence	0.02		%vol
Ambient temperature dependence	-0.01		%vol
Combined interference (from MCERTS Certificate)	0.08		%vol
Dependence on voltage	0.00		%vol
Losses in the line (leak)	0.00		%vol
Uncertainty of calibration gas	0.06		%vol

		RUN 1		Units
Measurement uncertainty	Result	5.04		%vol
Combined uncertainty		0.10		%vol
Expanded uncertainty	k = 1.96	0.20		%vol

	RUN 1		Units
Expanded uncertainty (no O ₂) - at 95% Confidence	4.04		% of Value
Result of Compliance with Uncertainty Requirement	COMPLIANT		-

Requirement for SRM is that Uncertainty should be 0.3% vol absolute or 6% relative whichever is the lower, on a dry gas basis. Source, EN 14789.

VERSION HISTORY

Version Number	Record of changes made within this version of the document
V1	The original document issued to the client