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Stack Emissions Testing Report Commissioned by
Blackmore Vale Farm Cream Ltd

Installation Name & Address
Blackmore Vale Farm Cream Ltd
BV Dairy
Wincombe Lane
Shaftesbury
Dorset
SP7 8QD

EPR Permit: EPR/H3492EZ

Stack Reference
A1 - Anaerobic Digester CHP

Dates of the Monitoring Campaign
2nd August 2019

Job Reference Number
ESW-3701

Report Written by
Dale Padfield Team Leader MCERTS Level 2 MM 13 1224 TE1 TE2 TE3 TE4

Report Approved by
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Report Date
15th August 2019

Version
Version 1

Signature of Report Approver


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Executive Summary

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MONITORING OBJECTIVES

Blackmore Vale Farm Cream Ltd, Shaftesbury

A1 - Anaerobic Digester CHP

2nd August 2019

Overall Aim of the Monitoring Campaign

Element were commissioned by Blackmore Vale Farm Cream Ltd to carry out stack emissions testing on the A1 - Anaerobic Digester CHP at Shaftesbury.

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

The stack temperature measurement was taken from the sample point inside the engine unit, as requested by the client.

Target Parameters

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

Executive Summary

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MONITORING RESULTS

Blackmore Vale Farm Cream Ltd, Shaftesbury

A1 - Anaerobic Digester CHP

2nd August 2019

where MU = Measurement Uncertainty associated with the Result

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Sulphur Dioxide	¹ mg/m ³	0.43	0.05	350	g/hr	0.3	0.0	-
Non-Methane VOCs	¹ mg/m ³	0.48	0.10	75	g/hr	0.4	0.1	-
Total VOCs (as Carbon)	¹ mg/m ³	516.4	23	1000	g/hr	378.9	30.9	-
Oxides of Nitrogen (as NO ₂)	¹ mg/m ³	452.5	19	500	g/hr	332.0	26.6	-
Carbon Monoxide	¹ mg/m ³	453.0	19	1400	g/hr	332.4	26.8	-
Oxygen	% v/v	Dry 5.3	0.1					
Water Vapour	% v/v	5.8	0.4					
Exit Stack Gas Temperature (Post Heat exchanger)	°C	166						
Turbo Gas Temperature (Pre Heat exchanger)	°C	375						
Stack Gas Velocity	m/s	9.3	0.5					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	1269	87					
Volumetric Flow Rate (REF)	¹ m ³ /hr	734	50					

NOTE: VOLUMETRIC FLOW RATE & VELOCITY DATA TAKEN FROM THE PRELIMINARY VELOCITY TRAVERSE.

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

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MONITORING DATE(S) & TIMES

Blackmore Vale Farm Cream Ltd, Shaftesbury

A1 - Anaerobic Digester CHP

2nd August 2019

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Sulphur Dioxide	R1	mg/m³	0.4	g/hr	0.3	02/08/2019	12:10 - 13:10	60
Non-Methane VOCs	R1	mg/m³	0.48	g/hr	0.4	02/08/2019	12:10 - 13:10	60
Total VOCs (as Carbon)	R1	mg/m³	516.4	g/hr	378.9	02/08/2019	12:10 - 13:10	60
Oxides of Nitrogen (as NO₂)	R1	mg/m³	452.5	g/hr	332.0	02/08/2019	12:10 - 13:10	60
Carbon Monoxide	R1	mg/m³	453.0	g/hr	332.4	02/08/2019	12:10 - 13:10	60
Oxygen	R1	% v/v	5.33			02/08/2019	12:10 - 13:10	60
Velocity Traverse	R1					02/08/2019	13:08 - 13:10	

All results are expressed at the respective reference conditions.

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PROCESS DETAILS

Blackmore Vale Farm Cream Ltd, Shaftesbury

A1 - Anaerobic Digester CHP

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Standard Operating Conditions

Parameter	Value
Process Status	Normal Operation
Capacity (of 100%) and Tonnes / Hour	100% Capacity
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Bio Waste
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	Bio-Gas
Plume Appearance	No Plume Visible

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MONITORING & ANALYTICAL METHODS

Blackmore Vale Farm Cream Ltd, Shaftesbury

A1 - Anaerobic Digester CHP

2nd August 2019

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	ISO 17025 Testing	Testing Lab	Analytical Procedure	Analytical Technique	ISO 17025 Analysis	Analysis Lab		
Sulphur Dioxide	EN 14791	CAT-TP-09	Yes	EET	CAT-AP-01	IC	Yes	EET	Yes	0.124 mg/m ³
Non-Methane VOCs	CEN/TS 13649	CAT-TP-16	Yes	EET	In-house (N)	GC-FID	No	RPS	No	0.074 mg/m ³
Water Vapour	EN 14790	CAT-TP-05	Yes	EET	CAT-TP-05	Gravimetric	Yes	EET	Yes	0.1 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	Yes	EET	Flame Ionisation Detection by Sick 3006 FID				Yes	0.32 mg/m ³
Oxides of Nitrogen (as NO ₂)	EN 14792	CAT-TP-39	Yes	EET	Chemiluminescence by Horiba PG-350E				Yes	0.41 mg/m ³
Carbon Monoxide	EN 15058	CAT-TP-39	Yes	EET	NDIR by Horiba PG-350E				Yes	0.25 mg/m ³
Oxygen	EN 14789	CAT-TP-39	Yes	EET	Dry Paramagnetic Cell by Horiba PG-350E				Yes	0.1 %
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	Yes	EET	Pitot Tube and Thermocouple				Yes	1.2 m/s

ANALYSIS LABORATORIES

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

Element Stockport (EET)	ISO 17025 Accreditation Number: 4279
RPS Laboratories Ltd (RPS)	ISO 17025 Accreditation Number: 0605

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
All	1	There are no deviations associated with the sampling employed.

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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	5
Orientation of Duct	-	Vertical
Number of Ports	-	2
Sample Port Size	-	4" BSP

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	MEWP
Inside / Outside	Outside

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)	Yes
Platform has vertical base boards (approx. 0.25m high)	Yes
Platform has chains / self closing gates at top of ladders	Yes
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

Due to the nature of the access into the duct, it is not possible to conduct a full velocity profile, however no particulate phase sampling was required and all gaseous species were considered to be mixed sufficiently for the purposes of these tests. There is also no requirement to undertake a homogeneity test as per EN 15259 and as such the location cannot be compared against that or the criteria within TGN M1. The sampling location used in this instance has been approved for use by the Environment Agency.

EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	50.0	> 5 Pa	Yes
Mean Velocity	m/s	9.27	-	-
Lowest Gas Velocity	m/s	9.27	-	-
Highest Gas Velocity	m/s	9.27	-	-
Ratio of Above	: 1	1.00	< 3 : 1	Yes
Maximum Angle of Swirl	°	NM	< 15°	NM
No Local Negative Flow	-	Yes	-	Yes

Where NM = Not Measured as no Isokinetic sampling was performed.

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PLANT PHOTOS

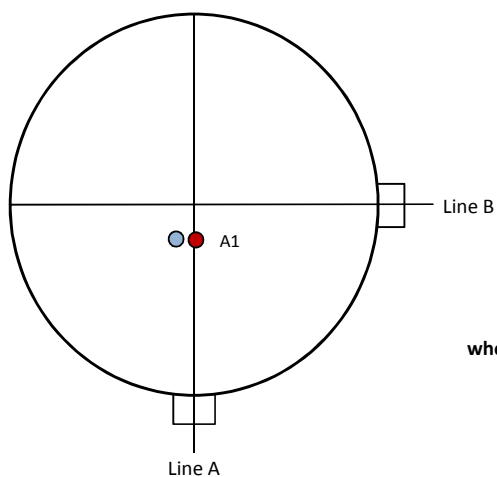
Photo 1



Photo 2



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	Dale Padfield	MCERTS Level 2	MM 13 1224	TE1 TE2 TE3 TE4
Trainee	Tom Ellis	MCERTS Trainee	MM 19 1540	None

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)	CAT 7.7	Horiba PG-250	CAT 39.21	Digital Manometer (1)	-
Control Box DGM (2)	-	Horiba PG-250	-	Digital Manometer (2)	-
Box Thermocouples (1)	CAT 3.20	Servomex 4900	CAT 24.8	Digital Temperature Meter	-
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	-
Umbilical (1)	CAT 3.20	ABB AO2020-URAS26	-	Barometer	CAT 13.3
Umbilical (2)	-	Testo 350 XL	-	Stack Thermocouple (1)	CAT 4.415 / 4.536
Oven Box (1)	CAT 12.60	JCT JCC P1 Cooler	CAT 4.204	Stack Thermocouple (2)	CAT 4.432 / 4.981
Oven Box (2)	-	Gasmet DX4000	-	Stack Thermocouple (3)	CAT 4.541
Heated Probe (1)	CAT 5.68	Gasmet Sampling System	-	1m Heated Line (1)	-
Heated Probe (2)	CAT 5.69	Bernath 3006 FID	-	1m Heated Line (2)	-
Heated Probe (3)	CAT 5.70	M&C PSS	CAT 12.91	1m Heated Line (3)	-
S-Pitot (1)	CAT 21p.52	Mass Flow Controller (1)	CAT 6.34	5m Heated Line (1)	CAT 20.3
S-Pitot (2)	CAT 21p.64 / 21p.66	Mass Flow Controller (2)	CAT 6.35	15m Heated Line (1)	-
L-Pitot	CAT 21L.8	Mass View (1)	CAT 25.78	20m Heated Line (1)	CAT 20.135
Site Balance	CAT 17.14	Mass View (2)	CAT 25.79	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.14	Easylogger EN-EL-12 Bit	-	Dual Channel Heater Controller	CAT 3.41
Last Impinger Arm	CAT 4.81/4.82/4.893	Hioki 5043 (V)	CAT 11.106	Single Channel Heater Controller	-
Callipers	CAT 23.77	Bioaerosols Temperature Logger	-	Laboratory Balance	-
Tubes Kit Thermocouple	CAT 4.53	Electronic Refrigerator	-	Tape Measure	CAT 16.1

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Sulphur Dioxide	EN 14791	CAT-TP-09
Non-Methane VOCs	CEN/TS 13649	CAT-TP-16
Water Vapour	EN 14790	CAT-TP-05
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20
Oxides of Nitrogen (as NO ₂)	EN 14792	CAT-TP-39
Carbon Monoxide	EN 15058	CAT-TP-39
Oxygen	EN 14789	CAT-TP-39
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.22
Stack Width, W	m	-
Stack Area, A	m ²	0.04
Average Stack Gas Temperature, T _a	°C	165.7
Average Stack Gas Pressure	Pa	50.0
Average Stack Static Pressure, P _{static}	kPa	0.115
Average Barometric Pressure, P _b	kPa	101.9
Average Pitot Tube Calibration Coefficient, C _p	-	0.85

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	13.00	12.25	0.1300	44.01	1.9635	0.25526
O ₂	-	5.33	5.03	0.0533	32.00	1.4277	0.07613
N ₂	-	81.67	76.96	0.8167	28.01	1.2498	1.02071
Moisture (H ₂ O)	-	-	5.76	0.0576	18.02	0.8037	0.04633

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P _{STD}	kg/m ³	1.352
Wet Density (STP), P _{STW}	kg/m ³	1.320
Dry Density (Actual), P _{Actual}	kg/m ³	0.847
Average Wet Density (Actual), P _{ActualW}	kg/m ³	0.828

Where: P_{STD} = sum of component concentrations, kg/m³ (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m³ (including water vapour)

$P_{Actual} = P_{STD} \times (T_{STP} / (P_{STP})) \times ((P_{static} + P_b) / T_a)$

$P_{ActualW}$ (at each sampling point) = $P_{STW} \times (T_s / P_s) \times (P_a / T_a)$

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	165.7	0.0
Total Pressure	kPa	102.0	101.3
Moisture	%	5.76	0.00
Oxygen (Dry)	%	5.3	5.0

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	1269
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	795
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	749
Gas Volumetric Flowrate REF ¹	m ³ /hr	734

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE TO EN 16911-1 (MID)

(1 of 1)

Parameter	Units	Value
Date of Survey	-	02/08/2019
Time of Survey	-	13:08 - 13:10
Atmospheric Pressure	kPa	101.9
Average Stack Static Pressure	Pa	115
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with KIMO MP 210 (500Pa)	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C _p	-	0.85
Number of Lines Available	-	1
Number of Lines Used	-	1

Sampling Line A						
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °
STATIC (Units: Pa)		115.0				
Mean		50.0	165.7	0.828	9.27	
1	0.11	50.0	165.7	0.828	9.27	

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE TO EN 16911-1 (MID) - MEASUREMENT UNCERTAINTY

(1 of 1)

Performance characteristics (Uncertainty Components)	Uncertainty	Value	Units
Standard Uncertainty on the coefficient of the Pitot Tube	$u(k)$	0.005	-
Standard Uncertainty associated with the mean local dynamic pressures	$u(\Delta p_i)$	1.185	Pa
- Resolution	$u(res)$	0.00087	
- Calibration	$u(cal)$	0.260	
- Drift	$u(drift)$	0.083	
- Lack of Fit	$u(fit)$	0.059	
- Overall corrections to dynamic measurements	$u(Cf)$	0.404	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00007	-
- $\phi_{O_2,w}$	-	5.025	
- $\phi_{CO_2,w}$	-	12.251	
- Oxygen, dry	$u(\phi_{O_2,d})$	0.163	
- Carbon Dioxide, dry	$u(\phi_{CO_2,d})$	0.398	
- Water Vapour	$u(\phi_{H_2O})$	0.294	
- Oxygen, wet	$u(\phi_{O_2,w})$	0.155	
- Carbon Dioxide, wet	$u(\phi_{CO_2,w})$	0.377	
Standard uncertainty associated with the stack temperature	$u(T_c)$	2.238	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.696	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	1.185	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00446	-
Standard uncertainty associated with the local velocities	$u(v_i)$	0.243	Pa
Standard uncertainty associated with the mean velocity	$u(\bar{v})$	0.243	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	0.476	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	5.13	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV,w)$	86.8	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00122	
- $u^2(qV,w)$	-	1962	
- $u(qV,w)$	-	44.3	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV,w)$	6.84	%

SULPHUR DIOXIDE: RESULTS SUMMARY

Blackmore Vale Farm Cream Ltd, Shaftesbury

A1 - Anaerobic Digester CHP

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	0.43	0.43
Uncertainty	±mg/m ³	0.05	0.05
Mass Emission	g/hr	0.32	0.32
Uncertainty	±g/hr	0.04	0.04

Parameter	Units	Run 1	Mean
Water Vapour	% v/v	5.76	5.76
Uncertainty	±% v/v	0.43	0.43

Blank Runs

Parameter	Units	Blank 1	Maximum
Concentration	mg/m ³	< 0.13	< 0.13

General Sampling Information

Parameter	Value	
Standard	EN 14791	
Technical Procedure	CAT-TP-09	
Name of Analytical Laboratory	EET	
Analytical Laboratory's Procedure	CAT-AP-01	
ISO 17025 Accredited Analysis?	Yes	
Date of Sample Analysis	07/08/2019	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Impinger Material	Polyethylene	
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	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.

SULPHUR DIOXIDE: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	12:10 - 13:10
Sampling Dates	-	02/08/2019
Sampling Device	-	MFC / MV
Duration	mins	60
Volume Sampled (STP, Dry)	m ³	0.1243
Volume Sampled (STP, Wet)	m ³	0.1319
Volume Sampled (REF)	m ³	0.1217
Sample Flow Rate	l/min	1.98
Laboratory Result for Front Impingers	µg/ml	0.18
Laboratory Result for Back Impinger	µg/ml	0.16
Volume in Front Impingers	ml	195.4
Volume in Back Impinger	ml	107.2
Mass in Front Impingers	µg	35.2
Mass in Back Impinger	µg	17.2
Total Mass Collected	µg	52.3
Calculated Concentration	mg/m ³	0.43
Liquid Trap Start Mass	g	1556.4
Liquid Trap End Mass	g	1558.5
Silica Trap Start Mass	g	1358.9
Silica Trap End Mass	g	1362.9
Total Mass Of Water Vapour	g	6.1
Calculated Water Vapour	% v/v	5.76

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

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	02/08/2019
Average Volume Sampled (REF)	m ³	0.1217
Laboratory Result for Impingers	µg/ml	< 0.05
Volume in Impingers	ml	308.1
Total Mass Collected	µg	< 15.4
Calculated Concentration	mg/m ³	< 0.13

SULPHUR DIOXIDE: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	2.0	
Pre-Sampling Leak Rate	l/min	0.00	
Post-Sampling Leak Rate	l/min	0.00	
Allowable Leak Rate	l/min	0.04	
Leak Test Acceptable	-	Yes	
Absorption Efficiency	Units	Run 1	
Absorption Efficiency	%	67.2	
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)	%	7.5	
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?	-	Yes	

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	1.5	
Pre-Sampling Leak Rate	l/min	0.01	
Post-Sampling Leak Rate	l/min	0.01	
Allowable Leak Rate	l/min	0.03	
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
The absorption efficiency was less than the required 90%.	wx

SULPHUR DIOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value		Standard uncertainty		
	Symbol	Run 1	Symbol	Units	Run 1
Sampled Volume (STP)	V _m	0.1243	uV _m	m ³	0.0025
Leak	L	0.05	uL	%	-
Laboratory Result	L _r	2.90	uL _r	%	-

Uncertainty as a Percentage				Requirement of Standard
Measured Quantities	Units	Run 1		
Sampled Volume (STP)	%	2.00		≤2%
Leak	%	0.05		≤2%
Laboratory Result	%	2.90		No Requirement

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	0.1243	3.46	
Leak	L	mg/m ³	0.000	1.00	
Laboratory Result	L _r	mg/m ³	0.012	1.00	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.009	
Leak	mg/m ³	0.0001	
Laboratory Result	mg/m ³	0.0125	

Oxygen Correction Part of MU Budget			
Measured Quantities	Units	Run 1	
O ₂ Correction Factor	-	1.02	
Stack Gas O ₂ Content	% v/v	5.33	
MU for O ₂ Correction	-	0.03	
Overall MU For O ₂ Measurement	%	3.19	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.02	
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.03	
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	0.03	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.05	
Reported Uncertainty	mg/m ³	0.05	
Expanded uncertainty (95% confidence), without Oxygen Correction	%	6.9	
Expanded uncertainty (95% confidence), with Oxygen Correction	%	7.6	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	10.6	
Reported Uncertainty	%	10.6	

APPENDIX 2

NON-METHANE VOCs : RESULTS SUMMARY

Blackmore Vale Farm Cream Ltd, Shaftesbury

A1 - Anaerobic Digester CHP

Sample Runs

Parameter	Units	Run 1	Mean
Non-Methane VOCs	mg/m ³	0.48	0.48

General Sampling Information

Parameter	Value	
Standard	CEN/TS 13649	
Technical Procedure	CAT-TP-16	
Name of Analytical Laboratory	RPS	
Analytical Laboratory's Procedure	In-house (N)	
ISO 17025 Accredited Analysis?	See Executive Summary	
Date of Sample Analysis	06/08/2019	
Probe Material	Titanium	
Sample Tube Type	Coconut Shell Charcoal	
Dynamic Dilution Employed	Yes	
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.

APPENDIX 2

NON-METHANE VOCs : SAMPLING DETAILS

RUN 1

Parameter	Units	Value
Sampling Times	-	12:10 - 13:10
Sampling Dates	-	02/08/2019
Sampling Device	-	MV
Duration	mins	60
N ₂ to Stack Gas Dilution Ratio	: 1	4
Volume Sampled (REF)	m ³	0.0135

Where: MV stands for Mass View (Mass Flow Controller Technology)

Parameter	Lab Result (Front) µg	Lab Result (Back) µg	Lab Result (Total) µg	LOD (Front) µg	LOD (Back) µg	LOD (Total) µg	Concentration mg/m ³	Reported Concentration (Blank Reviewed) mg/m ³	Reported LOD mg/m ³	Adsorption Efficiency %
Non-Methane VOCs	6.0	< 0.5	6.5	0.5	0.5	1.0	0.482	0.482	0.074	100.0

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

APPENDIX 2

NON-METHANE VOCs : SAMPLING DETAILS

BLANK 1

Parameter	Units	Value
Sampling Dates	-	02/08/2019
Sampling Device	-	MV
Average Volume Sampled (REF)	m ³	0.0135

Where: MV stands for Mass View (Mass Flow Controller Technology)

Parameter	Lab Result (Front) µg	Lab Result (Back) µg	Lab Result (Total) µg	Concentration mg/m ³
Non-Methane VOCs	< 0.5	< 0.5	1.0	< 0.074

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

NON-METHANE VOCs : QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	0.2	
Pre-Sampling Leak Rate	l/min	0.00	
Post-Sampling Leak Rate	l/min	0.00	
Allowable Leak Rate	l/min	0.01	
Leak Test Acceptable	-	Yes	

Adsorption Efficiency	Units	Run 1	
Non-Methane VOCs	%	100.0	
Allowable Adsorption Efficiency	%	95	
Adsorption Efficiency Acceptable	-	Yes	

Temperature at Sample Tubes	Units	Run 1	
Temperature	°C	15	
Allowable Temperature	°C	40	
Temperature Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

NON-METHANE VOCs : QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1		
Expected Sampling Rate	l/min	0.5		
Sampling Leak Rate	l/min	0.00		
Allowable Leak Rate	l/min	0.03		
Leak Test Acceptable	-	Yes		

Validity of Blank vs ELV	Units	Blank 1	Allowed	
Allowable for Non-Methane VOCs	mg/m ³	0.1	7.5	

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	

NON-METHANE VOCS : MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value		Standard uncertainty		
	Symbol	Run 1	Symbol	Units	Run 1
Sampled Volume (STP)	V _m	0.0138	uV _m	m ³	0.0003
Leak	L	0.45	uL	%	-
Laboratory Result	L _r	10.00	uL _r	%	-

Uncertainty as a Percentage				Requirement of Standard
Measured Quantities	Units	Run 1		
Sampled Volume (STP)	%	2.00		≤2%
Leak	%	0.45		≤5%
Laboratory Result	%	10.00		No Requirement

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	0.0138	34.98	
Leak	L	mg/m ³	0.001	1.00	
Laboratory Result	L _r	mg/m ³	0.048	1.00	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.010	
Leak	mg/m ³	0.0013	
Laboratory Result	mg/m ³	0.0482	

Oxygen Correction Part of MU Budget			
Measured Quantities	Units	Run 1	
O ₂ Correction Factor	-	1.02	
Stack Gas O ₂ Content	% v/v	5.33	
MU for O ₂ Correction	-	0.03	
Overall MU For O ₂ Measurement	%	3.19	

Parameter	Units	Run 1
Combined uncertainty	mg/m ³	0.049
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.096
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	0.096
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.096
Reported Uncertainty	mg/m ³	0.096
Expanded uncertainty (95% confidence), without Oxygen Correction	%	20.0
Expanded uncertainty (95% confidence), with Oxygen Correction	%	20.0
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	20.0
Reported Uncertainty	%	20.0

NOTE: Uncertainties reported in mg/m³ are based upon the summation of all Speciated VOCs Measured.

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Blackmore Vale Farm Cream Ltd, Shaftesbury
A1 - Anaerobic Digester CHP

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	516.4	516.4
Uncertainty	±mg/m ³	23.0	23.0
Mass Emission	g/hr	378.9	378.9
Uncertainty	±g/hr	30.9	30.9

General Sampling Information

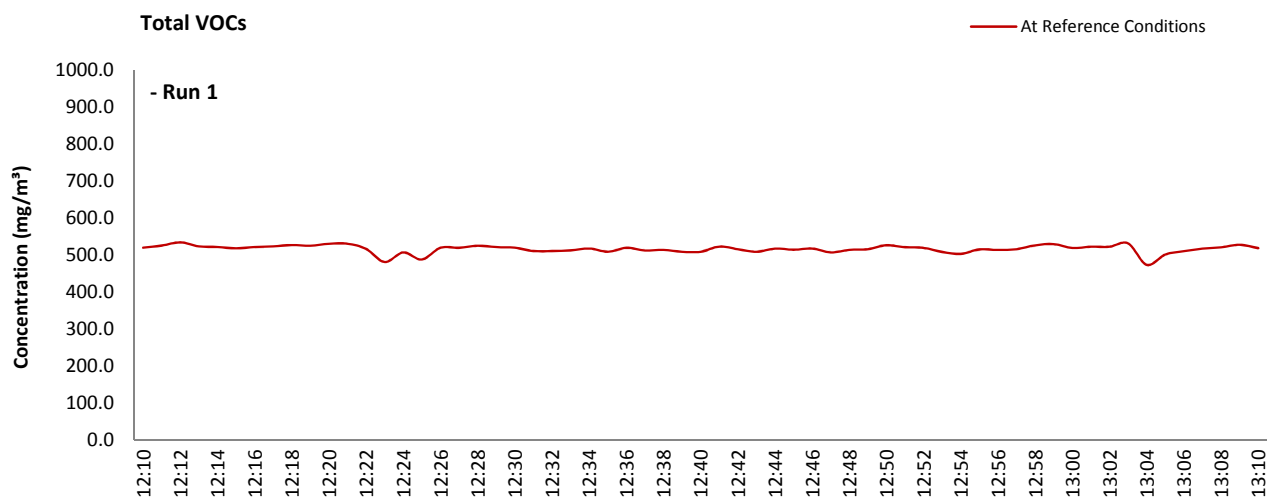
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	CAT-TP-20	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane in 6% O ₂ in N ₂ (5 Grade)	
Span Gas Reference Number	12.0156 in N ₂ 1.0290a in AIR	
Span Gas Expiry Date	14/04/2020 09/09/2021	
Span Gas Start Pressure (bar)	95 110	
Gas Cylinder Concentration (ppm)	886.45 800	
Span Gas Set Point (ppm)	861.75	This is the blended concentration of both propane cylinders
Span Gas Uncertainty (%)	2 2	
Zero Gas Type	6% O ₂ in N ₂ (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	-	12:10 - 13:10
Sampling Dates	-	02/08/2019
Instrument Range	ppm	1000
Span Gas Value	ppm	861.8

Quality Assurance

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	7.00
	Zero Down Sampling Line (Post)	ppm	4.00
	Zero Drift	ppm	-3.00
CAL 2	Zero Down Sampling Line (Pre)	ppm	
	Zero Down Sampling Line (Post)	ppm	
	Zero Drift	ppm	
CAL 3	Zero Down Sampling Line (Pre)	ppm	
	Zero Down Sampling Line (Post)	ppm	
	Zero Drift	ppm	
	Allowable Zero Drift	± ppm	43.09
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	855.00
	Span Down Sampling Line (Post)	ppm	864.00
	Span Drift	ppm	9.00
CAL 2	Span Down Sampling Line (Pre)	ppm	
	Span Down Sampling Line (Post)	ppm	
	Span Drift	ppm	
CAL 3	Span Down Sampling Line (Pre)	ppm	
	Span Down Sampling Line (Post)	ppm	
	Span Drift	ppm	
	Allowable Span Drift	± ppm	43.09
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	20 - 25

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)
TGN M2 Allowable MU	15.0	%
Measured concentration	505.68	mg/m ³ (STP, dry)
Range Used	1000.0	ppm
Range Used [A]	1606.1	mg/m ³
Cal gas conc.	861.8	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.	1384.1	mg/m ³

Performance characteristics	RUN 1	Units
Response time	45	seconds
Number of readings in measurement	60	-
Repeatability at zero	2.00	% full scale
Repeatability at span level	0.00	% full scale
Deviation from linearity	0.06	% of value
Zero drift	-0.35	% full scale
Span drift	1.05	% full scale
Volume or pressure flow dependence	1.60	% of full scale
Atmospheric pressure dependence	0.30	% of value/kPa
Ambient temperature dependence	1.40	% full scale/10K
Combined interference	0.45	% range
Dependence on voltage	0.50	% full scale/10V
Losses in the line (leak)	1.51	% of value
Uncertainty of calibration gas	2.83	% 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	0.00	mg/m ³
Lack of fit	0.01	mg/m ³
Drift	0.27	mg/m ³
Volume or pressure flow dependence	0.00	mg/m ³
Atmospheric pressure dependence	0.01	mg/m ³
Ambient temperature dependence	0.20	mg/m ³
Combined interference (from MCERTS Certificate)	0.04	mg/m ³
Dependence on voltage	0.06	mg/m ³
Losses in the line (leak)	4.40	mg/m ³
Uncertainty of calibration gas	8.26	mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		505.68	mg/m ³
Expanded uncertainty	k = 1.96	9.37	mg/m ³
Expanded uncertainty		18.36	mg/m ³
Uncertainty corrected to std conds. (O ₂)		18.75	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	3.63	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	1.84	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	15.0	% at ELV
Result of Compliance with Uncertainty Requirement in M2	N/A	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	4.46	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	3.20	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	15.2	% at ELV
Result of Compliance with Uncertainty Requirement in M2	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). Ref EA TGN M2.

OXIDES OF NITROGEN (as NO₂): RESULTS SUMMARY

Blackmore Vale Farm Cream Ltd, Shaftesbury
A1 - Anaerobic Digester CHP

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	452.5	452.5
Uncertainty	±mg/m ³	18.8	18.8
Mass Emission	g/hr	332.0	332.0
Uncertainty	±g/hr	26.6	26.6

General Sampling Information

Parameter	Value
Standard	EN 14792
Technical Procedure	CAT-TP-39
Probe Material	Titanium
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Date & Result of Last Converter Check	18/10/2018 - 95.5%
Span Gas Type	Nitrogen Monoxide
Span Gas Reference Number	12.0222
Span Gas Expiry Date	14/05/2021
Span Gas Start Pressure (bar)	190
Gas Cylinder Concentration (ppm)	412.1
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

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

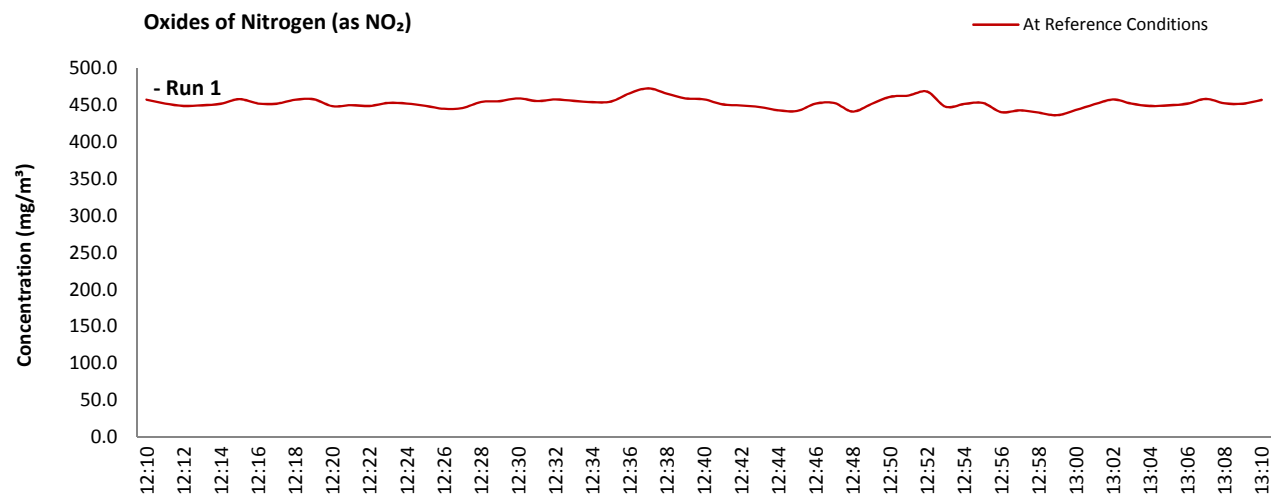
FORMAT: Number Used / Number Required

Reference Conditions

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

OXIDES OF NITROGEN (as NO₂): DATA TREND

Graphical Trend of Data



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

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:10 - 13:10
Sampling Dates	-	02/08/2019
Instrument Range	ppm	500
Span Gas Value	ppm	243.6

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.2
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	ppm
	Zero at Analyser (Post)	ppm
	Zero Drift	ppm
CAL 2	Zero at Analyser (Pre)	ppm
	Zero at Analyser (Post)	ppm
	Zero Drift	ppm
CAL 3	Zero at Analyser (Pre)	ppm
	Zero at Analyser (Post)	ppm
	Zero Drift	ppm
Allowable Zero Drift		± ppm
Zero Drift Acceptable		-

Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	ppm
	Span at Analyser (Post)	ppm
	Span Drift	ppm
CAL 2	Span at Analyser (Pre)	ppm
	Span at Analyser (Post)	ppm
	Span Drift	ppm
CAL 3	Span at Analyser (Pre)	ppm
	Span at Analyser (Post)	ppm
	Span Drift	ppm
Allowable Span Drift		± ppm
Span Drift Acceptable		-

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	20 - 25

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)
TGN M2 Allowable MU	10.0	%
Measured concentration	443.12	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.	243.6	ppm
Conversion	2.05	ppm to mg/m ³
MCERTS Range [B]	205.0	mg/m ³
Lower of [A] or [B]	205.0	mg/m ³
Cal gas conc.	500.0	mg/m ³

Performance characteristics	RUN 1	Units
Response time	31	seconds
Number of readings in measurement	60	-
Repeatability at zero	0.00	% full scale
Repeatability at span level	0.10	% full scale
Deviation from linearity	0.15	% of value
Zero drift	-0.20	% full scale
Span drift	-1.19	% full scale
Volume or pressure flow dependence	0.10	% of full scale
Atmospheric pressure dependence	0.10	% of value/kPa
Ambient temperature dependence	0.04	% full scale/10K
Combined interference	0.63	% range
Dependence on voltage	-0.23	% full scale/10V
Converter efficiency	95.5	%
Losses in the line (leak)	0.16	% 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	0.01	mg/m ³
Lack of fit	0.18	mg/m ³
Drift	-3.63	mg/m ³
Volume or pressure flow dependence	0.00	mg/m ³
Atmospheric pressure dependence	0.06	mg/m ³
Ambient temperature dependence	0.01	mg/m ³
Combined interference (from MCERTS Certificate)	0.75	mg/m ³
Dependence on voltage	-0.03	mg/m ³
Converter efficiency	0.58	mg/m ³
Losses in the line (leak)	0.42	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		443.12	mg/m ³
Expanded uncertainty	k = 1.96	7.34	mg/m ³
Expanded uncertainty		14.38	mg/m ³
Uncertainty corrected to std conds. (O ₂)		14.69	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	3.25	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	2.88	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	10.0	% at ELV
Result of Compliance with Uncertainty Requirement in M2	N/A	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	4.15	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	3.92	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	10.3	% at ELV
Result of Compliance with Uncertainty Requirement in M2	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). Ref EA TGN M2.

CARBON MONOXIDE: RESULTS SUMMARY

Blackmore Vale Farm Cream Ltd, Shaftesbury
A1 - Anaerobic Digester CHP

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	453.0	453.0
Uncertainty	±mg/m ³	19.3	19.3
Mass Emission	g/hr	332.4	332.4
Uncertainty	±g/hr	26.8	26.8

General Sampling Information

Parameter	Value
Standard	EN 15058
Technical Procedure	CAT-TP-39
Probe Material	Titanium
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	12.0156
Span Gas Expiry Date	14/04/2020
Span Gas Start Pressure (bar)	95
Gas Cylinder Concentration (ppm)	4249.5
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

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

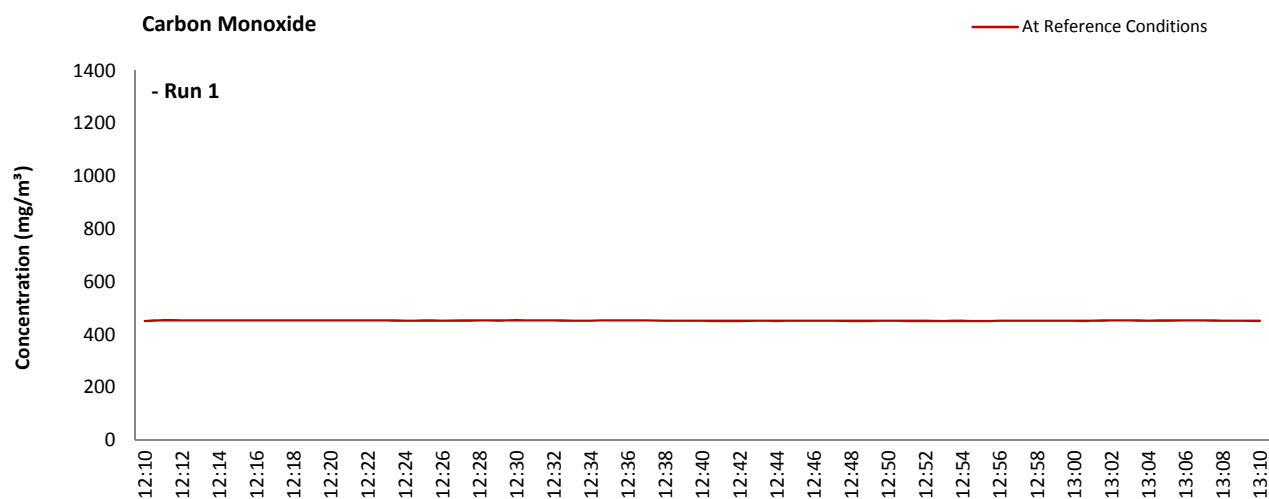
FORMAT: Number Used / Number Required

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	-	12:10 - 13:10
Sampling Dates	-	02/08/2019
Instrument Range	ppm	2000
Span Gas Value	ppm	1120.7

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.2
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	ppm	0.00
	Zero at Analyser (Post)	ppm	-1.00
	Zero Drift	ppm	-1.00
CAL 2	Zero at Analyser (Pre)	ppm	
	Zero at Analyser (Post)	ppm	
	Zero Drift	ppm	
CAL 3	Zero at Analyser (Pre)	ppm	
	Zero at Analyser (Post)	ppm	
	Zero Drift	ppm	
	Allowable Zero Drift	± ppm	56.04
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	ppm	1121.00
	Span at Analyser (Post)	ppm	1106.00
	Span Drift	ppm	-15.00
CAL 2	Span at Analyser (Pre)	ppm	
	Span at Analyser (Post)	ppm	
	Span Drift	ppm	
CAL 3	Span at Analyser (Pre)	ppm	
	Span at Analyser (Post)	ppm	
	Span Drift	ppm	
	Allowable Span Drift	± ppm	56.04
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	20 - 25

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)
TGN M2 Allowable MU	6.0	%
Measured concentration	443.57	mg/m ³ (STP, dry)
Range Used	2000.0	ppm
Range Used [A]	2498.4	mg/m ³
Cal gas conc.	1120.7	ppm
Conversion	1.25	ppm to mg/m ³
MCERTS Range [B]	75.0	mg/m ³
Lower of [A] or [B]	75.0	mg/m ³
Cal gas conc.	1400.0	mg/m ³

Performance characteristics	RUN 1	Units
Response time	28	seconds
Number of readings in measurement	60	-
Repeatability at zero	0.10	% full scale
Repeatability at span level	0.20	% full scale
Deviation from linearity	0.33	% of value
Zero drift	-0.09	% full scale
Span drift	-1.34	% full scale
Volume or pressure flow dependence	0.10	% of full scale
Atmospheric pressure dependence	0.22	% of value/kPa
Ambient temperature dependence	-0.20	% full scale/10K
Combined interference	-0.48	% range
Dependence on voltage	-0.35	% full scale/10V
Losses in the line (leak)	0.62	% 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	0.03	mg/m ³
Lack of fit	0.14	mg/m ³
Drift	-4.15	mg/m ³
Volume or pressure flow dependence	0.00	mg/m ³
Atmospheric pressure dependence	0.05	mg/m ³
Ambient temperature dependence	-0.03	mg/m ³
Combined interference (from MCERTS Certificate)	-0.21	mg/m ³
Dependence on voltage	-0.04	mg/m ³
Losses in the line (leak)	1.60	mg/m ³
Uncertainty of calibration gas blending	3.59	mg/m ³
Uncertainty of calibration gas	5.12	mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		443.57	mg/m ³
Expanded uncertainty	k = 1.96	7.68	mg/m ³
Expanded uncertainty		15.05	mg/m ³
Uncertainty corrected to std conds. (O ₂)		15.37	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	3.39	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	1.08	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	6.0	% at ELV
Result of Compliance with Uncertainty Requirement in M2	N/A	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	4.27	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	2.81	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	6.5	% at ELV
Result of Compliance with Uncertainty Requirement in M2	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). Ref EA TGN M2.

APPENDIX 2

OXYGEN: RESULTS SUMMARY

Blackmore Vale Farm Cream Ltd, Shaftesbury
A1 - Anaerobic Digester CHP

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	% v/v	5.3	5.3
Uncertainty	±% v/v	0.1	0.1

General Sampling Information

Parameter	Value
Standard	EN 14789
Technical Procedure	CAT-TP-39
Probe Material	Titanium
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	11.0326
Span Gas Expiry Date	08/03/2023
Span Gas Start Pressure (bar)	95
Gas Cylinder Concentration (% v/v)	21.64
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

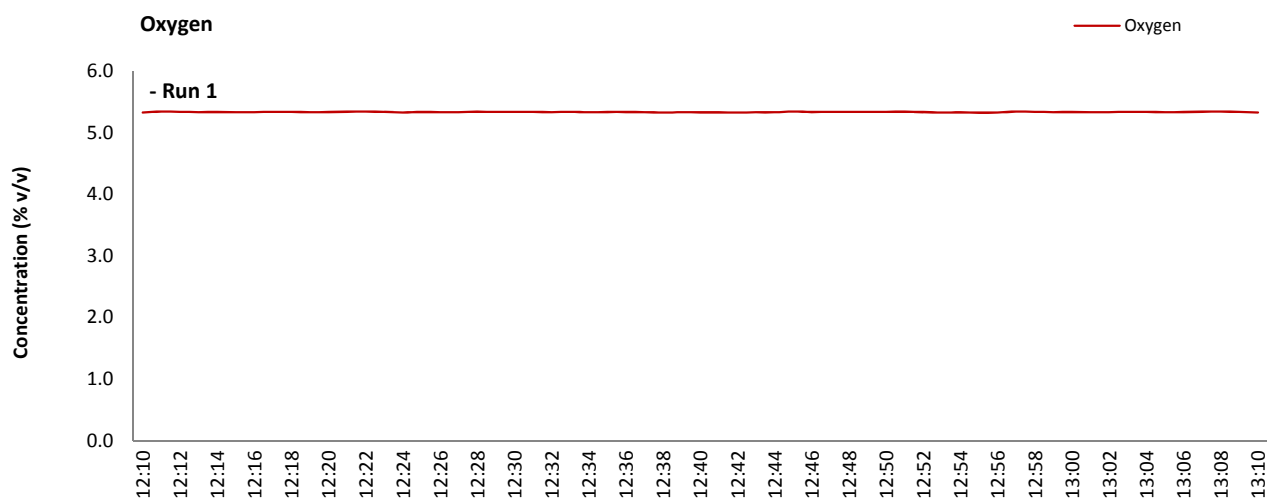
NOTE: Dilution performed to achieve correct span value

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	-	12:10 - 13:10
Sampling Dates	-	02/08/2019
Instrument Range	% v/v	25
Span Gas Value	% v/v	6.0

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.2
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

Zero Drift	Units	Run 1
CAL 1		
Zero at Analyser (Pre)	% v/v	0.00
Zero at Analyser (Post)	% v/v	0.00
Zero Drift	% v/v	0.00
CAL 2		
Zero at Analyser (Pre)	% v/v	
Zero at Analyser (Post)	% v/v	
Zero Drift	% v/v	
CAL 3		
Zero at Analyser (Pre)	% v/v	
Zero at Analyser (Post)	% v/v	
Zero Drift	% v/v	
Allowable Zero Drift	± % v/v	0.30
Zero Drift Acceptable	-	Yes

Span Drift	Units	Run 1
CAL 1		
Span at Analyser (Pre)	% v/v	5.98
Span at Analyser (Post)	% v/v	5.98
Span Drift	% v/v	0.00
CAL 2		
Span at Analyser (Pre)	% v/v	
Span at Analyser (Post)	% v/v	
Span Drift	% v/v	
CAL 3		
Span at Analyser (Pre)	% v/v	
Span at Analyser (Post)	% v/v	
Span Drift	% v/v	
Allowable Span Drift	± % v/v	0.30
Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	20 - 25

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
TGN M2 Allowable MU	6.0		%
Measured concentration	5.33		%vol
Range Used	25.0		%vol
Cal gas conc.	21.6		%vol

Performance characteristics	RUN 1		Units
Response time	41		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.02		% full scale
Repeatability at span level	0.02		% full scale
Deviation from linearity	0.05		% of value
Zero drift	0.00		% full scale
Span drift	0.00		% full scale
Volume or pressure flow dependence	0.10		% of full scale
Atmospheric pressure dependence	0.19		% of value/kPa
Ambient temperature dependence	-0.21		% full scale/10K
Combined interference	0.00		% 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	0.00		%vol
Lack of fit	0.01		%vol
Drift	0.00		%vol
Volume or pressure flow dependence	0.00		%vol
Atmospheric pressure dependence	0.01		%vol
Ambient temperature dependence	-0.03		%vol
Combined interference (from MCERTS Certificate)	0.00		%vol
Dependence on voltage	0.00		%vol
Losses in the line (leak)	0.00		%vol
Uncertainty of calibration gas	0.06		%vol

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		5.33	%vol
Expanded uncertainty		0.07	%vol
Expanded uncertainty	k = 1.96	0.14	%vol

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	2.59	% of Value
Result of Compliance with Uncertainty Requirement in M2	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.