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Stack Emissions Testing Report Commissioned by
Blackmore Vale Farm Cream Dairy Ltd

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

EPR Permit: EPR/HP3492EZ

Stack Reference
A1 - Anaerobic Digestion CHP

Dates of the Monitoring Campaign
16th December 2016


Job Reference Number
CSW-2573

Report Written by
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Report Date
18th January 2017

Version
Version 1

Signature of Report Approver


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Executive Summary

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MONITORING OBJECTIVES

Blackmore Vale Farm Cream Dairy Ltd, Shaftsbury

A1 - Anaerobic Digestion CHP

16th December 2016

Overall Aim of the Monitoring Campaign

Exova Catalyst were commissioned by Blackmore Vale Farm Cream Dairy Ltd to carry out stack emissions testing on the A1 - Anaerobic Digestion CHP 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, Non-Methane VOCs, Total VOCs (as Carbon), Oxides of Nitrogen (as NO₂), Carbon Monoxide

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MONITORING RESULTS

Blackmore Vale Farm Cream Dairy Ltd, Shaftsbury

A1 - Anaerobic Digestion CHP

16th December 2016

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	20.9	1.6	350	g/hr	10.5	1.1	-
Non-Methane VOCs	¹ mg/m ³	< 0.24	0.05	75	g/hr	< 0.12	6.2	-
Total VOCs (as Carbon)	¹ mg/m ³	566	226	1000	g/hr	286	26.9	-
Oxides of Nitrogen (as NO ₂)	¹ mg/m ³	528	158	500	g/hr	267	25.0	-
Carbon Monoxide	¹ mg/m ³	431	86	1400	g/hr	218	20.7	-
Oxygen	% v/v	Dry 5.7	0.3					
Water Vapour	% v/v	11.4	0.5					
Stack Gas Temperature	°C	197						
Stack Gas Velocity	m/s	7.5	0.44					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	1030	75.8					
Volumetric Flow Rate (REF)	¹ m ³ /hr	505	37.2					

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

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

* The MU is calculated from values in LFTGN 08 [2010]. i.e. 20% of the Result for CO, 30% of the Result for NO_x & 40% of the Result for TVOCs)

** The result is considered to be an 'Approach to Limit' if it is above the Limit, but below the Limit once the MU is subtracted from it. The Result is considered to be Non-Compliant if, even after subtracting the MU from the Result, the Result is still above the Limit in LFTGN 08 [2010] or the calculated MU (See the Measurement Uncertainty Calculations in Appendix 2 of this Test Report) is above 6% for CO, 10% for NO_x & 15% for TVOCs

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MONITORING DATE(S) & TIMES

Blackmore Vale Farm Cream Dairy Ltd, Shaftsbury
A1 - Anaerobic Digestion CHP
16th December 2016

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Sulphur Dioxide	R1	mg/m ³	20.9	g/hr	10.5	16/12/2016	12:16 - 13:16	60
Non-Methane VOCs	R1	mg/m ³	< 0.24	g/hr	< 0.12	16/12/2016	12:16 - 13:16	60
Total VOCs (as Carbon)	R1	mg/m ³	566	g/hr	286	16/12/2016	12:16 - 13:16	60
Oxides of Nitrogen (as NO ₂)	R1	mg/m ³	528	g/hr	267	16/12/2016	12:16 - 13:16	60
Carbon Monoxide	R1	mg/m ³	431	g/hr	218	16/12/2016	12:16 - 13:16	60
Oxygen	R1	% v/v	5.7			16/12/2016	12:16 - 13:16	60
Velocity & Volumetric Flow Rate	R1					16/12/2016	11:45 - 11:52	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

Blackmore Vale Farm Cream Dairy Ltd, Shaftsbury

A1 - Anaerobic Digestion CHP

16th December 2016

Standard Operating Conditions

Parameter	Value
Process Status	Normal
Capacity (of 100%) and Tonnes / Hour	151 kWe
Continuous or Batch Process	Continuous
Feedstock (if applicable)	N/A
Abatement System	None
Abatement System Running Status	N/A
Fuel	Biogas
Plume Appearance	None Visible

Site Specific Operating Conditions

Parameter	Status
Gas Composition	circa 54% Methane

Executive Summary

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MONITORING & ANALYTICAL METHODS

Blackmore Vale Farm Cream Dairy Ltd, Shaftsbury

A1 - Anaerobic Digestion CHP

16th December 2016

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	CAT	CAT-AP-01	IC	Yes	CAT	Yes	0.265 mg/m ³
Non-Methane VOCs	CEN/TS 13649	CAT-TP-16	Yes	CAT	In House	GC-FID	No	RPS	No	0.393 mg/m ³
Water Vapour	EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.1 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.32 mg/m ³
Oxides of Nitrogen (as NO ₂)	EN 14792	CAT-TP-21	Yes	CAT	Chemiluminescence by Horiba PG-250				Yes	0.41 mg/m ³
Carbon Monoxide	EN 15058	CAT-TP-21	Yes	CAT	NDIR by Horiba PG-250				Yes	0.25 mg/m ³
Oxygen	EN 14789	CAT-TP-21	Yes	CAT	Dry Zirconia Cell by Horiba PG-250				Yes	0.1 %
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	Yes	CAT	Pitot Tube and Thermocouple				Yes	1.2 m/s

ANALYSIS LABORATORIES

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

Exova Catalyst (CAT)	ISO 17025 Accreditation Number: 4279
RPS Laboratories Ltd (RPS)	ISO 17025 Accreditation Number: 0605

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
All	All	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
Sample Port Size	-	2" 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

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.

Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	30.0		> 5 Pa	Yes
Mean Velocity	m/s	7.53		-	-
Lowest Gas Velocity	m/s	7.53		-	-
Highest Gas Velocity	m/s	7.53		-	-
Ratio of Above	: 1	1.00		< 3 : 1	Yes
Maximum Angle of Swirl	°	NM		< 15°	NA
No Local Negative Flow	-	Yes		-	Yes

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

Executive Summary

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PLANT PHOTOS

Photo 1



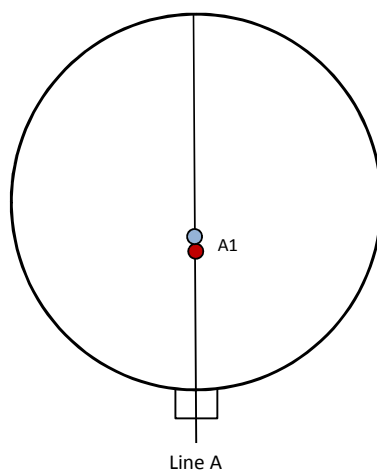
Photo 2



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	Andrew Benson	MCERTS Level 2	MM 06 752	TE1 TE2 TE3 TE4
Technician	Wayne Rossouw	MCERTS Level 1	MM 10 1083	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 39.1	Digital Manometer (1)	CAT 3.121
Control Box DGM (2)	-	Horiba PG-250	-	Digital Manometer (2)	CAT 3116
Box Thermocouples (1)	-	Servomex 4900	-	Digital Temperature Meter	-
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	CAT 14.53
Umbilical (1)	-	ABB AO2020-URAS26	-	Barometer	CAT 13.8
Umbilical (2)	-	Servomex 5200MP	-	Stack Thermocouple (1)	-
Oven Box (1)	-	JCT JCC P1 Cooler	CAT 4.46	Stack Thermocouple (2)	-
Oven Box (2)	-	Gasmet DX4000	-	Stack Thermocouple (3)	-
Heated Probe (1)	-	Gasmet Sampling System	-	1m Heated Line (1)	-
Heated Probe (2)	-	Bernath 3006 FID	CAT 8.90	1m Heated Line (2)	-
Heated Probe (3)	-	Ankersmid APP100	CAT 12.64	1m Heated Line (3)	-
S-Pitot (1)	CAT 21.P76	Mass Flow Controller (1)	CAT 6.30	5m Heated Line (1)	-
S-Pitot (2)	-	Mass Flow Controller (2)	CAT 6.31	15m Heated Line (1)	-
L-Pitot	-	Mass View (1)	CAT 25.5	20m Heated Line (1)	CAT 20.24
Site Balance	CAT 17.8	Mass View (2)	CAT 25.6	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.8	Easylogger EN-EL-12 Bit	CAT 11.24	Dual Channel Heater Controller	-
Last Impinger Arm	-	Easylogger EN-EL-12 Bit	CAT 11.43	Single Channel Heater Controller	-
Callipers	CAT 23.9	Bioaerosols Temperature Logger	-	Laboratory Balance	-
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.19

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-21
Carbon Monoxide	EN 15058	CAT-TP-21
Oxygen	EN 14789	CAT-TP-21
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	197.0
Average Stack Gas Pressure	Pa	30.0
Average Stack Static Pressure, P _{static}	kPa	0.057
Average Barometric Pressure, P _b	kPa	100.8
Average Pitot Tube Calibration Coefficient, C _p	-	0.84

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)	-	12.60	11.16	0.1260	44.01	1.9635	0.24740
O ₂	-	5.67	5.02	0.0567	32.00	1.4277	0.08097
N ₂	-	81.73	72.38	0.8173	28.01	1.2498	1.02148
Moisture (H ₂ O)	-	-	11.43	0.1143	18.02	0.8037	0.09190

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	1.350
Wet Density (STP), P _{STW}	kg/m ³	1.287
Dry Density (Actual), P _{Actual}	kg/m ³	0.781
Average Wet Density (Actual), P _{ActualW}	kg/m ³	0.745

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)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	197.0	0.00
Total Pressure	kPa	100.9	101.3
Moisture	%	11.43	0.00
Oxygen (Dry)	%	5.7	5.0

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	1030
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	596
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	528
Gas Volumetric Flowrate REF ¹	m ³ /hr	505

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

(1 of 1)

Parameter	Units	Value
Date of Survey	-	16/12/2016
Time of Survey	-	11:45 - 11:52
Atmospheric Pressure	kPa	100.8
Average Stack Static Pressure	Pa	57
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with KIMO MP 200 (500Pa)	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C_p	-	0.84
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)		57.0				
Mean		30.0	197.0	0.745	7.53	
1	0.11	30.0	197.0	0.745	7.53	

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	$u(\Delta p_i)$	1.091	Pa
- Resolution	$u(res)$	0.00087	
- Calibration	$u(cal)$	0.094	
- Drift	$u(drift)$	0.083	
- Lack of Fit	$u(fit)$	0.011	
- Overall corrections to dynamic measurements	$u(C_f)$	0.189	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00008	-
- $\phi_{O_2,w}$	-	5.023	
- $\phi_{CO_2,w}$	-	11.159	
- Oxygen, dry	$u(\phi_{O_2,d})$	0.174	
- Carbon Dioxide, dry	$u(\phi_{CO_2,d})$	0.386	
- Water Vapour	$u(\phi_{H_2O})$	0.583	
- Oxygen, wet	$u(\phi_{O_2,w})$	0.157	
- Carbon Dioxide, wet	$u(\phi_{CO_2,w})$	0.349	
Standard uncertainty associated with the stack temperature	$u(T_c)$	2.398	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.695	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	1.091	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00401	-
Standard uncertainty associated with the local velocities	$u(v_i)$	0.223	Pa
Standard uncertainty associated with the mean velocity	$u(\bar{v})$	0.223	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	0.436	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	5.80	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV,w)$	75.8	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00141	
- $u^2(qV,w)$	-	1495	
- $u(qV,w)$	-	38.7	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV,w)$	7.36	%

SULPHUR DIOXIDE: RESULTS SUMMARY

Blackmore Vale Farm Cream Dairy Ltd, Shaftsbury
A1 - Anaerobic Digestion CHP

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	20.9		20.9
Uncertainty	±mg/m ³	1.6		1.6
Mass Emission	g/hr	10.5		10.5
Uncertainty	±g/hr	1.1		1.1

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	11.4		11.4
Uncertainty	±% v/v	0.5		0.5

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	< 0.21		< 0.21

General Sampling Information

Parameter	Value
Standard	EN 14791
Technical Procedure	CAT-TP-09
Name of Analytical Laboratory	CAT
Analytical Laboratory's Procedure	CAT-AP-01
ISO 17025 Accredited Analysis?	Yes
Date of Sample Analysis	22/12/2016
Probe Material	Stainless Steel
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
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	-	12:16 - 13:16	
Sampling Dates	-	16/12/2016	
Sampling Device	-	MFC / MV	
Duration	mins	60	
Volume Sampled (STP, Dry)	m ³	0.0926	
Volume Sampled (STP, Wet)	m ³	0.1046	
Volume Sampled (REF)	m ³	0.0888	
Sample Flow Rate	l/min	1.48	
Laboratory Result for Front Impingers	µg/ml	5.90	
Laboratory Result for Back Impinger	µg/ml	0.05	
Volume in Front Impingers	ml	312.5	
Volume in Back Impinger	ml	158.4	
Mass in Front Impingers	µg	1843.8	
Mass in Back Impinger	µg	< 7.9	
Total Mass Collected	µg	1851.7	
Calculated Concentration	mg/m ³	20.86	
Liquid Trap Start Mass	g	1513.7	
Liquid Trap End Mass	g	1521.3	
Silica Trap Start Mass	g	1703.8	
Silica Trap End Mass	g	1705.8	
Total Mass Of Water Vapour	g	9.6	
Calculated Water Vapour	% v/v	11.43	

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

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	16/12/2016	
Average Volume Sampled (REF)	m ³	0.0888	
Laboratory Result for Impingers	µg/ml	< 0.05	
Volume in Impingers	ml	366.4	
Total Mass Collected	µg	< 18.3	
Calculated Concentration	mg/m ³	< 0.21	

SULPHUR DIOXIDE: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	1.48	
Pre-Sampling Leak Rate	l/min	0.00	
Post-Sampling Leak Rate	l/min	0.00	
Allowable Leak Rate	l/min	0.03	
Leak Test Acceptable	-	Yes	

Absorption Efficiency	Units	Run 1	
Absorption Efficiency	%	100.0	
Allowable Absorption Efficiency	%	N/A ²	
Absorption Efficiency Acceptable	-	N/A 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)	%	4.2	
Allowable MU	%	20	
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	2.00	
Pre-Sampling Leak Rate	l/min	0.01	
Post-Sampling Leak Rate	l/min	0.01	
Allowable Leak Rate	l/min	0.04	
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.	x	

SULPHUR DIOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (STP)	V _m	0.0926		uV _m	m ³	0.0019	
Leak	L	0.00		uL	%	-	
Laboratory Result	L _r	2.90		uL _r	%	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (STP)	%	2.00		≤2%
Leak	%	0.00		≤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	0.0926		225.16	
Leak	L	mg/m ³	0.00		1.00	
Laboratory Result	L _r	mg/m ³	0.605		1.00	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.4172	
Leak	mg/m ³	0.00	
Laboratory Result	mg/m ³	0.6050	

Oxygen Correction Part of MU Budget			
Measured Quantities	Units	Run 1	
O ₂ Correction Factor	-	1.04	
Stack Gas O ₂ Content	% v/v	5.67	
MU for O ₂ Correction	-	0.03	
Overall MU For O ₂ Measurement	%	3.26	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.73	
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	1.44	
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	1.59	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	1.59	
Reported Uncertainty	mg/m ³	1.59	
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	%	7.6	
Reported Uncertainty	%	7.6	

NON-METHANE VOCs : RESULTS SUMMARY

BV Dairy, Shaftsbury
A1 - Anaerobic Digestion CHP

Sample Runs

Parameter	Units	Run 1	Mean
Non-Methane VOCs	mg/m ³	< 0.24	< 0.24

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
ISO 17025 Accredited Analysis?	See Executive Summary
Date of Sample Analysis	12/01/2017
Probe Material	Stainless Steel
Sample Tube Type	Coconut Shell Charcoal
Dynamic Dilution Employed	Yes
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.

APPENDIX 2

NON-METHANE VOCs : SAMPLING DETAILS

RUN 1

Parameter	Units	Value
Sampling Times	-	12:16 - 13:16
Sampling Dates	-	16/12/2016
Sampling Device	-	MV
Duration	mins	60
N ₂ to Stack Gas Dilution Ratio	: 1	4.5
Volume Sampled (REF)	m ³	0.0042

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	< 0.5	< 0.5	1.0	0.5	0.5	1.0	< 0.235	< 0.235	0.235	100.0

Reference Conditions

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

NON-METHANE VOCs : SAMPLING DETAILS

BLANK 1

Parameter	Units	Value
Sampling Dates	-	16/12/2016
Sampling Device	-	MV
Average Volume Sampled (REF)	m ³	0.0042

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	< 0.235

Reference Conditions

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	0.500	
Pre-Sampling Leak Rate	l/min	0.000	
Post-Sampling Leak Rate	l/min	0.000	
Allowable Leak Rate	l/min	0.025	
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	

APPENDIX 2

NON-METHANE VOCs : QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	0.500	
Sampling Leak Rate	l/min	0.000	
Allowable Leak Rate	l/min	0.025	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	Allowed	
Allowable for Non-Methane VOCs	mg/m ³	0.2	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)	Vm	0.0044		uVm	m ³	0.0	
Leak	L	0.000		uL	%	-	
Laboratory Result	Lr	10.00		uLr	%	-	

Uncertainty as a Percentage				Requirement of Standard
Measured Quantities	Units	Run 1		
Sampled Volume (STP)	%	2.00		≤2%
Leak	%	0.00		≤5%
Laboratory Result	%	10.00		No Requirement

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	Vm	m ³	0.0044	53.07	
Leak	L	mg/m ³	0.000	1.00	
Laboratory Result	Lr	mg/m ³	0.024	1.00	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.0047	
Leak	mg/m ³	0.0000	
Laboratory Result	mg/m ³	0.0235	

Oxygen Correction Part of MU Budget			
Measured Quantities	Units	Run 1	
O ₂ Correction Factor	-	1.04	
Stack Gas O ₂ Content	% v/v	5.67	
MU for O ₂ Correction	-	0.03	
Overall MU For O ₂ Measurement	%	3.26	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.024	
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.047	
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	0.05	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.047	
Reported Uncertainty	mg/m ³	0.047	
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 Dairy Ltd, Shaftsbury
A1 - Anaerobic Digestion CHP

Sample Runs

Parameter	Units	Run 1			Mean
Concentration	mg/m ³	566			566
Uncertainty	±mg/m ³	33			33
Mass Emission	g/hr	286			286
Uncertainty	±g/hr	27			27

General Sampling Information

Parameter	Value
Standard	EN 12619:2013
Technical Procedure	CAT-TP-20
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 7% O ₂ in N ₂ (5 Grade)
Span Gas Reference Number	CYL-1.0201n in N ₂ CYL1.0195A in AIR
Span Gas Expiry Date	22/09/2020 24/08/2020
Span Gas Start Pressure (bar)	140 20
Gas Cylinder Concentration (ppm)	821.09 805
Span Gas Set Point (ppm)	815.73
Span Gas Uncertainty (%)	2 2
Zero Gas Type	7% O ₂ in N ₂ (5 Grade)
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A1

This is the blended concentration of both propane cylinders

FORMAT: Number Used / Number Required

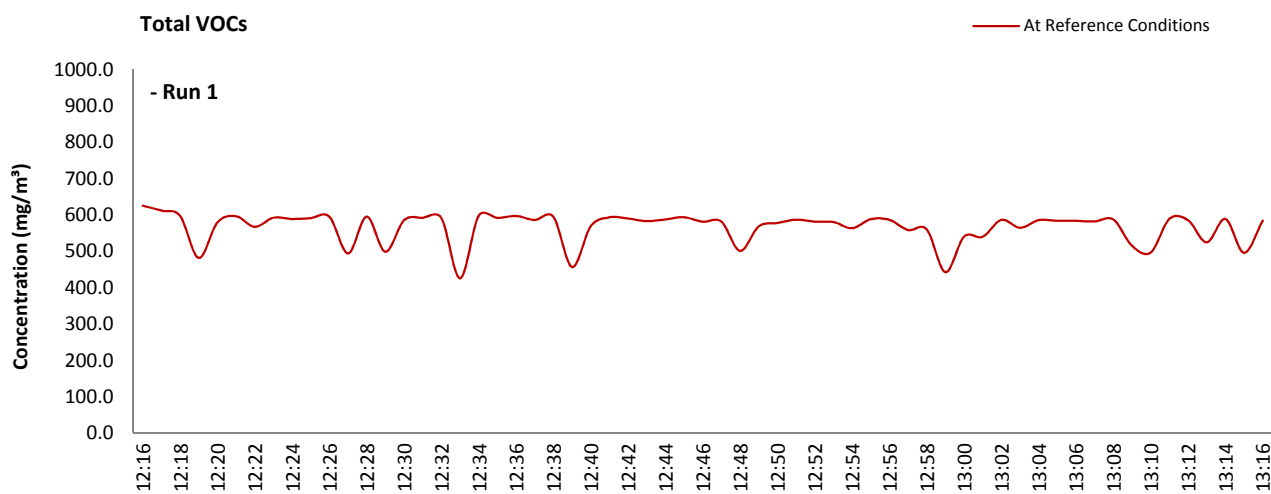
FORMAT: Number Used / Number Required

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	-	12:16 - 13:16		
Sampling Dates	-	16/12/2016		
Instrument Range	ppm	1000		
Span Gas Value	ppm	815.7		

Quality Assurance

	Zero Drift	Units	Run 1		
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.00		
	Zero Down Sampling Line (Post)	ppm	0.01		
	Zero Drift	ppm	0.01		
	Allowable Zero Drift	± ppm	40.79		
	Zero Drift Acceptable	-	Yes		

	Span Drift	Units	Run 1		
CAL 1	Span Down Sampling Line (Pre)	ppm	808.00		
	Span Down Sampling Line (Post)	ppm	815.00		
	Span Drift	ppm	7.00		
	Allowable Span Drift	± ppm	40.79		
	Span Drift Acceptable	-	Yes		

Test Conditions	Units	Run 1		
Run Ambient Temperature Range	°C	9 - 11		

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	541.84		mg/m ³ (STP, dry)
Range Used	1000.0		ppm
Range Used [A]	1606.1		mg/m ³
Cal gas conc.	815.7		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.	1310.2		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	0.10		% of value
Zero drift	0.001		% full scale
Span drift	0.87		% 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)	0.86		% 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	2.72		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)	2.68		mg/m ³
Uncertainty of calibration gas	8.85		mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		541.84	mg/m ³
Expanded uncertainty	k = 1.96	9.64	mg/m ³
Expanded uncertainty		18.90	mg/m ³
Uncertainty corrected to std conds. (O ₂)		19.72	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	3.49	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	1.89	% 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	5.84	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	5.09	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	15.7	% 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 Q 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 Dairy Ltd, Shaftsbury
A1 - Anaerobic Digestion CHP

Sample Runs

Parameter	Units	Run 1			Mean
Concentration	mg/m ³	528			528
Uncertainty	±mg/m ³	31			31
Mass Emission	g/hr	267			267
Uncertainty	±g/hr	25			25

General Sampling Information

Parameter	Value
Standard	EN 14792
Technical Procedure	CAT-TP-21
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	22/04/2016 - 97%
Span Gas Type	Nitrogen Monoxide
Span Gas Reference Number	CYL-4.0182
Span Gas Expiry Date	02/09/2020
Span Gas Start Pressure (bar)	80
Gas Cylinder Concentration (ppm)	405.3
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

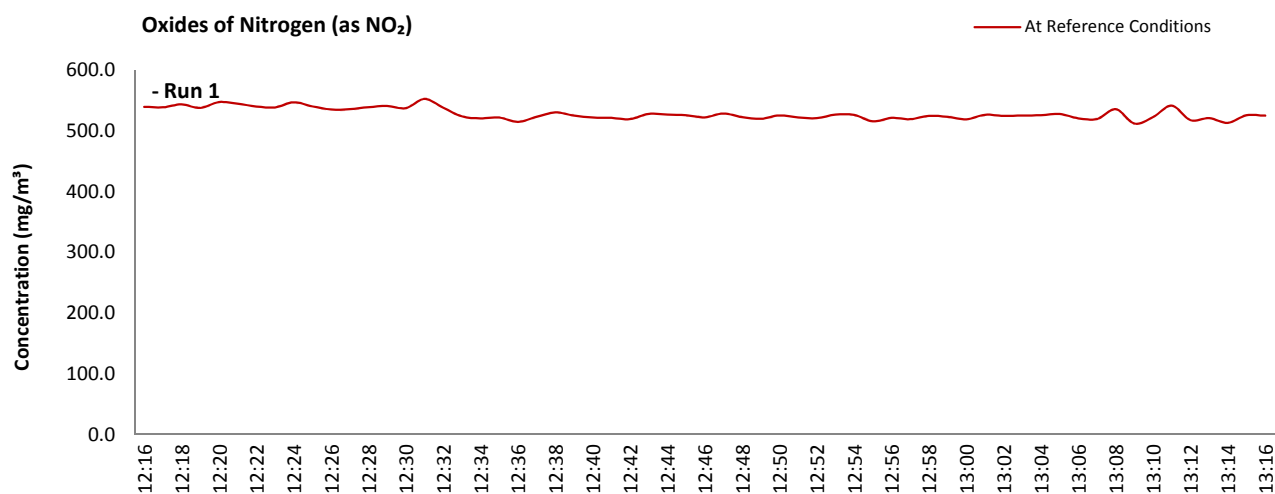
FORMAT: Number Used / Number Required

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	-	12:16 - 13:16	
Sampling Dates	-	16/12/2016	
Instrument Range	ppm	500	
Span Gas Value	ppm	243.6	

Quality Assurance

Conditioning Unit Temperature	Units	Run 1	
Average Temperature	°C	2.8	
Allowable Temperature	< °C	4.0	
Temperature Acceptable	-	Yes	

Zero Drift	Units	Run 1	
Zero Down Sampling Line (Pre)	ppm	0.90	
Zero Down Sampling Line (Post)	ppm	5.40	
Zero Drift	ppm	4.50	
Allowable Zero Drift	± ppm	12.18	
Zero Drift Acceptable	-	Yes	

Span Drift	Units	Run 1	
Span Down Sampling Line (Pre)	ppm	244.60	
Span Down Sampling Line (Post)	ppm	239.60	
Span Drift	ppm	-5.00	
Allowable Span Drift	± ppm	12.18	
Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	9 - 11	

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	505.95		mg/m ³ (STP, dry)
Ration 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]	125.0		mg/m ³
Lower of [A] or [B]	125.0		mg/m ³
Cal gas conc.	500.0		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	0.47		% of value
Zero drift	1.84		% 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	97.0		%
Losses in the line (leak)	0.00		% 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	0.34		mg/m ³
Drift	5.31		mg/m ³
Volume or pressure flow dependence	0.003		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	0.44		mg/m ³
Losses in the line (leak)	0.00		mg/m ³
Uncertainty of calibration gas blending	4.09		mg/m ³
Uncertainty of calibration gas	5.84		mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		505.95	mg/m ³
Expanded uncertainty		8.93	mg/m ³
Expanded uncertainty	k = 1.96	17.50	mg/m ³
Uncertainty corrected to std conds. (O ₂)		18.27	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	3.46	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	3.50	% 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	5.83	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	5.94	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	11.0	% 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 Q 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 Dairy Ltd, Shaftsbury
A1 - Anaerobic Digestion CHP

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	431		431
Uncertainty	±mg/m ³	26		26
Mass Emission	g/hr	218		218
Uncertainty	±g/hr	21		21

General Sampling Information

Parameter	Value
Standard	EN 15058
Technical Procedure	CAT-TP-21
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	CYL-2.0058
Span Gas Expiry Date	07/09/2017
Span Gas Start Pressure (bar)	120
Gas Cylinder Concentration (ppm)	4060.36
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

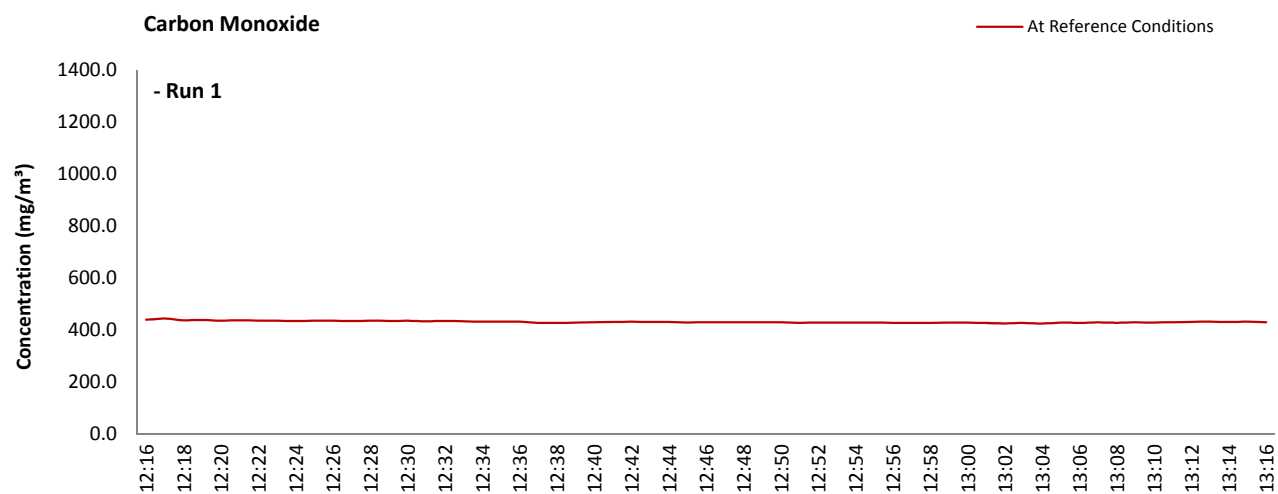
FORMAT: Number Used / Number Required

Reference Conditions

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

CARBON MONOXIDE: DATA TREND

Graphical Trend of Data



CARBON MONOXIDE: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	12:16 - 13:16	
Sampling Dates	-	16/12/2016	
Instrument Range	ppm	2000	
Span Gas Value	ppm	1120.7	

Quality Assurance

Conditioning Unit Temperature	Units	Run 1	
Average Temperature	°C	2.8	
Allowable Temperature	< °C	4.0	
Temperature Acceptable	-	Yes	

Zero Drift	Units	Run 1	
Zero Down Sampling Line (Pre)	ppm	2.00	
Zero Down Sampling Line (Post)	ppm	4.00	
Zero Drift	ppm	2.00	
Allowable Zero Drift	± ppm	56.04	
Zero Drift Acceptable	-	Yes	

Span Drift	Units	Run 1	
Span Down Sampling Line (Pre)	ppm	1100.00	
Span Down Sampling Line (Post)	ppm	1080.00	
Span Drift	ppm	-20.00	
Allowable Span Drift	± ppm	56.04	
Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	9 - 11	

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	412.64		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]	95.0		mg/m ³
Lower of [A] or [B]	95.0		mg/m ³
Cal gas conc.	1400.0		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	0.31		% of value
Zero drift	0.18		% full scale
Span drift	-1.82		% 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)	1.87		% 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	0.17		mg/m ³
Drift	-2.86		mg/m ³
Volume or pressure flow dependence	0.002		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)	4.46		mg/m ³
Uncertainty of calibration gas blending	3.34		mg/m ³
Uncertainty of calibration gas	4.76		mg/m ³

		RUN 1		Units
Measurement uncertainty	Result	412.64		mg/m ³
Combined uncertainty		7.89		mg/m ³
Expanded uncertainty	k = 1.96	15.47		mg/m ³
Uncertainty corrected to std conds. (O ₂)		16.15		mg/m ³ (REF)

	RUN 1		Units
Expanded uncertainty (no O ₂) - at 95% Confidence	3.75		% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	1.11		% 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	6.00		% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	4.83		% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	7.6		% 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 Q 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.

OXYGEN: RESULTS SUMMARY

Blackmore Vale Farm Cream Dairy Ltd, Shaftsbury
A1 - Anaerobic Digestion CHP

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	% v/v	5.7		5.7
Uncertainty	±% v/v	0.3		0.3

General Sampling Information

Parameter	Value
Standard	EN 14789
Technical Procedure	CAT-TP-21
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	CYL-11.0261
Span Gas Expiry Date	18/11/2021
Span Gas Start Pressure (bar)	40
Gas Cylinder Concentration (% v/v)	21.23
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

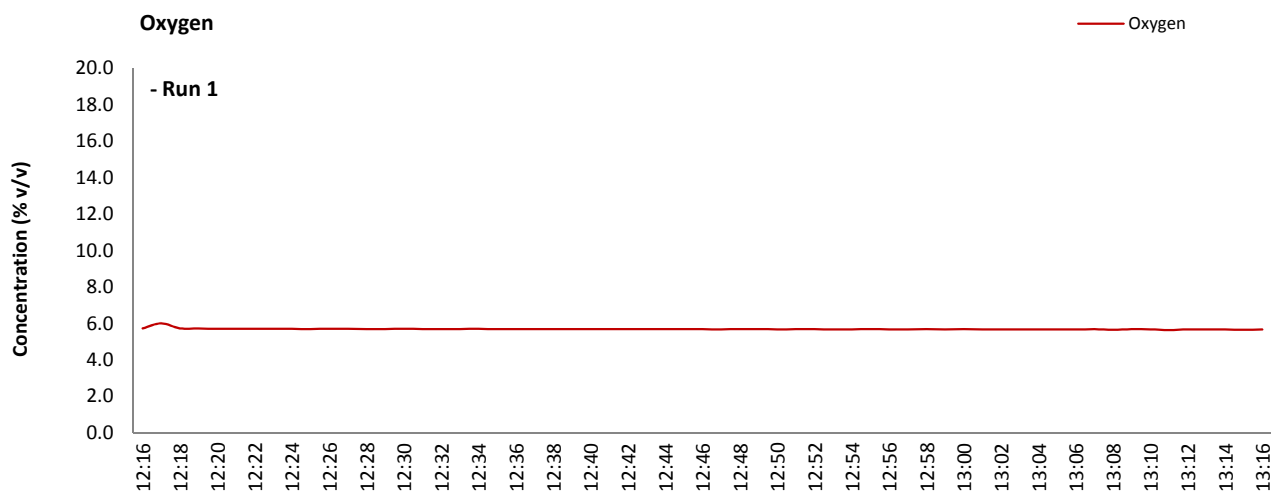
NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

OXYGEN: DATA TREND

Graphical Trend of Data



OXYGEN: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	12:16 - 13:16	
Sampling Dates	-	16/12/2016	
Instrument Range	% v/v	25	
Span Gas Value	% v/v	7.00	

Quality Assurance

Conditioning Unit Temperature	Units	Run 1	
Average Temperature	°C	2.8	
Allowable Temperature	< °C	4.0	
Temperature Acceptable	-	Yes	

Zero Drift	Units	Run 1	
Zero Down Sampling Line (Pre)	% v/v	0.10	
Zero Down Sampling Line (Post)	% v/v	0.32	
Zero Drift	% v/v	0.22	
Allowable Zero Drift	± % v/v	0.35	
Zero Drift Acceptable	-	Yes	

Span Drift	Units	Run 1	
Span Down Sampling Line (Pre)	% v/v	7.06	
Span Down Sampling Line (Post)	% v/v	7.10	
Span Drift	% v/v	0.04	
Allowable Span Drift	± % v/v	0.35	
Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	9 - 11	

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	5.67		%vol
Range Used	25.0		%vol
Cal gas conc.	21.2		%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	0.07		% of value
Zero drift	0.00		% full scale
Span drift	0.57		% 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	0.01		%vol
Drift	0.02		%vol
Volume or pressure flow dependence	0.0003		%vol
Atmospheric pressure dependence	0.02		%vol
Ambient temperature dependence	-0.01		%vol
Combined interference (from MCERTS Certificate)	0.08		%vol
Dependence on voltage	0.002		%vol
Losses in the line (leak)	0.00		%vol
Uncertainty of calibration gas	0.07		%vol

		RUN 1		Units
Measurement uncertainty	Result	5.67		%vol
Combined uncertainty		0.14		%vol
Expanded uncertainty	k = 1.96	0.27		%vol

	RUN 1		Units
Expanded uncertainty (no O ₂) - at 95% Confidence	4.69		% of Value
Result of Compliance with Uncertainty Requirement in M2	COMPLIANT		-

Requirement for SRM is that Uncertainty should be 0.5%vol absolute or 6% relative whichever is the lower, on a dry gas basis. Ref EA TGN M2.