



Report for the Periodic Monitoring of Emissions to Air

Part 1: Executive Summary

Permit Number:	VP 3635SY & Viscose V 201/16
Operator:	Viscose Closures Ltd
Installation:	A1 Scrubber, A2 Rocket & Thermal Oxidiser

Test Report:	ALL100161/21/PR-1
Monitoring Dates:	06 – 07/10/2021
Client / Organisation:	Mr Robbert Rodenburg
Address:	Viscose Closures Ltd
	Ferryboat Close
	Enterprise Park
	Swansea
Date of Report:	01/11/2021
Report Approved By:	Phillip Ruck BSc
MCERTS Number/Level/Technical Endorsement	MM 11 1117 Level 2, TE1, TE2, TE3, TE4
Designation:	Stack Emissions Co-ordinator
Signed:	 Phillip Ruck
Reviewed:	 Robert Lethbridge

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N/A	Sampling personnel
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N/A	Equipment Checklist
N/A	Appendix 2
N/A	A1 Scrubber stack details including gas measurements (10 pages)
N/A	Appendix 3
N/A	A2 Rocket stack details including gas measurements (10 pages)
N/A	Appendix 4
N/A	Thermal Oxidiser stack details including gas measurements (20 pages)
N/A	Appendix 5 (Uncertainty)
N/A	Appendix 6 (Subcontracted analysis results)
N/A	Appendix 7 (Instrumental analyser details)
N/A	Appendix 8 (Annual calibration details & analysis data retained at permanent laboratory)



Monitoring objectives

At the request of Mr Robbert Rodenburg of Viscose Closures Ltd, Anchem Laboratories Limited has carried out an “emissions to atmosphere” monitoring regime in the exhaust ductwork of the A1, A2 and Thermal Oxidiser process stacks at their Llansamlet plant. This is the annual emissions monitoring regime to be carried out for 2021 and has been undertaken to meet the requirements of their Local Authority & Environment Agency Permits.

Emission point	Reference number	Substance to be monitored	Specific requirements
A1 Scrubber	100161/1	Ammonia (NH ₃)	None
	100161/2	Carbon disulphide (CS ₂)	None
	100161/3	Hydrogen sulphide (H ₂ S)	None
A2 Rocket	100161/4	Ammonia (NH ₃)	None
	100161/5	Carbon disulphide (CS ₂)	None
	100161/6	Hydrogen sulphide (H ₂ S)	None
Thermal Oxidiser	100161/7	Particulates	2-hour sampling
	100161/8	Pre - RTO TOC*	2-hour sampling with 15-minute mean values
	100161/9	Post – RTO TOC*	2-hour sampling with 15-minute mean values
	100161/10	Carbon Monoxide	2-hour sampling with 15-minute mean values
		Nitrogen Oxides (as NO ₂)	2-hour sampling with 15-minute mean values

*note that where TOC has been referred within this report, it refers to total gaseous organic compounds (propane equivalent) as defined by the methodology.



Test Report ALL100161/21/PR-1**Monitoring results**

Emission Point	A1 Scrubber		
Reference Number	100161/1	100161/2	100161/3
Substance to be Monitored	Ammonia	Carbon disulphide	Hydrogen sulphide
Emission Limit Value	190	105	2
Periodic Monitoring Result	83.34	29.28	0.31
Uncertainty	±10.79	±5.93	±0.03
Units	mg/Nm ³		
Reference Conditions	273K, 101.3kPa without correction for moisture content or oxygen.		
Date of Sampling	06/10/2021		
Start/End Time	09:33 – 10:18	10:00 – 12:01	10:35 – 11:35
Average Volumetric flow @ reference conditions / m³/hr	31724.9		
Standard Reference Method	BS EN 14791	BS EN 13649	US EPA M11
Technical Procedure Reference	ANC/S/35	ANC/S/23	ANC/S/22
Accreditation Status	MCERTS		
Process Status (Load/Feedstock)	See Process Status (page 10)		



Monitoring results continued

Emission Point	A2 Rocket		
Reference Number	100161/4	100161/5	100161/6
Substance to be Monitored	Ammonia	Carbon disulphide	Hydrogen sulphide
Emission Limit Value	10	17	1
Periodic Monitoring Result	7.76	14.81	0.32
Uncertainty	±1.01	±2.86	±0.03
Units	mg/Nm ³		
Reference Conditions	273K, 101.3kPa without correction for moisture content or oxygen.		
Date of Sampling	06/10/2021		
Start/End Time	13:31 – 14:15	09:47 – 11:56	14:25 – 15:25
Average Volumetric flow @ reference conditions / m³/hr	25131.0		
Standard Reference Method	BS EN 14791	BS EN 13649	US EPA M11
Technical Procedure Reference	ANC/S/35	ANC/S/23	ANC/S/22
Accreditation Status	MCERTS		
Process Status (Load/Feedstock)	See Process Status (page 10)		



Monitoring results continued

Emission Point	Post - Thermal Oxidiser
Reference Number	100161/7
Substance to be Monitored	Particulates
Emission Limit Value	50
Periodic Monitoring Result	0.45
Uncertainty	±0.02
Units	mg/Nm ³
Reference Conditions	273K, 101.3kPa without correction for moisture content or oxygen.
Date of Sampling	07/10/2021
Start/End Time	10:30 – 12:30
Average Volumetric flow @ reference conditions / m³/hr	5390.7
Standard Reference Method	BS EN 13284-1
Technical Procedure Reference	ANC/S/6
Accreditation Status	MCERTS
Process Status (Load/Feedstock)	See Process Status (page 10)



Monitoring results continued

Emission Point	Pre - Thermal Oxidiser	Post - Thermal Oxidiser
Reference Number	100161/8	100161/9
Substance to be Monitored	TOC	TOC
Emission Limit Value	N/A	150
Periodic Monitoring Result	283.9	71.3
Uncertainty	±0.9	±0.8
Units	mg/Nm ³	
Reference Conditions	273K, 101.3kPa without correction for moisture content or oxygen.	
Date of Sampling	07/10/2021	
Start/End Time	10:30 – 12:30	10:30 – 12:30
Average Volumetric flow @ reference conditions / m³/hr	4956.3	5390.7
Standard Reference Method	BS EN 12619	
Technical Procedure Reference	ANC/S/2	
Accreditation Status	MCERTS	
Process Status (Load/Feedstock)	See Process Status (page 10)	



Monitoring results continued

Emission Point	Post Thermal Oxidiser	
Reference Number	100161/10	
Substance to be Monitored	Carbon Monoxide	Oxides of Nitrogen
Emission Limit Value	100	100
Periodic Monitoring Result	0.3	15.1
Uncertainty	±0.1	±0.2
Units	mg/Nm ³	
Reference Conditions	273K, 101.3kPa without correction for moisture content or oxygen.	
Date of Sampling	07/10/2021	
Start/End Time	10:30 – 12:30	
Average Volumetric flow @ reference conditions / m³/hr	5390.7	
Standard Reference Method	BS EN 15058	BS EN 14792
Technical Procedure Reference	ANC/S/29	
Accreditation Status	MCERTS	
Process Status (Load/Feedstock)	See Process Status (page 10)	



Process status

During the sampling period the processes were considered to run continuously, this included some stoppages for product changes and routine maintenance.

Process Information:

06/10/2021 - 202mm



Operating information

Nature of process (continuous or batch)	A1, A2 and Thermal Oxidiser ran continuously
What part of the batch was sampled or whole batch (if applicable)	Not applicable
What fuel was used (if applicable)	Not applicable
What feedstock was used during the monitoring (if applicable)	Raw viscose is utilised for A1 & A2. Sheet product and solvent based printing ink (RTO).
“Normal” load, throughput or continuous rating of plant	Normal loading during monitoring regime
What type of abatement system and whether operating	The A1 process stack utilises a caustic scrubber abatement system. There is no means of abatement present on the A2 Rocket process stack. The Thermal Oxidiser was in operation during the monitoring regime.
The periodic monitoring result and the results from the operators CEMS	There is no CEM fitted with the purpose of monitoring emissions to air on A1 & A2. There is a CO monitor fitted on the RTO, although no data was available during the time of test.



Monitoring Deviations:**Why any substance(s) in the monitoring objectives were not monitored.**

N/A

Why any substance(s) were not monitored in accordance with the monitoring method and any other issues relevant to the monitoring results.

Regarding the monitoring on the A1 scrubber stack, there was only a single traverse to sample from due to platform constraints. No sample points on the traverse were in compliance with the methodology with all points exhibiting swirl $>15^\circ$. As there are no additional suitable sampling planes present on the system, monitoring for ammonia was conducted isokinetically at a single sampling point, while Hydrogen Sulphide was carried out at the centre point. Consequently, the sample location is not compliant for flow measurements, particulates and particulate phase-based measurements. Due to levels of CS_2 found in the sample, there was greater than 10% breakthrough in the sorbent tube, as a consequence these do not meet the requirements of the Technical Specification and shall be treated as semi-quantitative. However, it should be noted that all CEN/TS 13649 CS_2 results were of a low order, all below 30% of the ELV.

There were no other deviations from documented in-house methods ANC/S/22, ANC/S/23 & ANC/S/35.

On the A2 Rocket stack, there was greater than 10% breakthrough in the sorbent tube, as a consequence these do not meet the requirements of the Technical Specification and shall be treated as semi-quantitative. There were no other deviations from documented in-house methods ANC/S/22, ANC/S/23 & ANC/S/35.

There was only a single traverse present on the Pre and Post RTO exhaust duct with which to sample from and take velocity measurements. As a consequence of the above, sampling could only be undertaken across a single traverse. Sampling from a single traverse is a deviation from BS EN 15259 & BS EN 13284-1.

Consequently, the sample locations are non-compliant for flow measurements, particulates and particulate phase-based measurements. The number of sampling points along the available traverse was increased as a consequence of this. Although, as the duct is horizontal it is the only way in which to sample.



Part 2: Supporting information

APPENDIX 1



Sampling personnel

Name	Function	MCERTS number	MCERTS level	Technical endorsements
P Ruck	Team Leader	MM 11 1117	Level 2	TE1, TE2, TE3, TE4
E Jones	Emissions Analyst	MM 17 1417	Level 2	TE1, TE2, TE4



Method specifications

Substance	Standard reference method	Anchem technical procedure
Ammonia	BS EN 14791	ANC/S/35
Carbon disulphide	CEN/TS 13649	ANC/S/23
Hydrogen sulphide	USEPA Method M11	ANC/S/22
Particulate	BS EN 13284-1	ANC/S/6
TOC	BS EN 12619	ANC/S/2
Carbon monoxide	BS EN 15058	ANC/S/29
Oxides of nitrogen	BS EN 14792	ANC/S/29



Equipment checklist

Please see relevant appendices and site-specific protocol associated with monitoring campaign for equipment utilised during monitoring & checklist.



APPENDIX 2

A1 Scrubber

(10 Pages)



Stack diagram



Stack Dimension (m)	1.38m
Homogeneity test previously carried out (yes/no)	No
Is the gas stream homogeneous? (yes/no/unknown)	Unknown



Wet chemistry monitoring sampling data (Isokinetic)

Client	Viscose Closures Ltd
Site	Llansamlet
Emission Point	A1 Scrubber
Date	06/10/2021
Reference Number	100161/1
Determinand	Ammonia
Run	1
Team Leader	PR
Analyst(s)	EJ
X-Sectional Area	1.4957
$\Delta H@$	45.97
Y_d	1.0177
C_p	0.80
k Factor	14.86
Duct static pressure (mmH ₂ O)	5
Absolute stack gas pressure (mm Hg)	766.3
Total gas volume sampled at STP (Litres)	1088.4
Total sampling time (minutes)	45
Moisture (%)	2.81
Dessicant discolouration less than 50%	Yes
Velocity at stack conditions (m/s)	6.30
Volumetric flow at stack conditions (m ³ /s)	9.4
Volumetric Flow at STP Wet Gas (m ³ /hr)	31776.9
% Isokinetic	108.0
Absorption efficiency check (%)	99.98
Oxygen calibration gas concentration/reference	N/A
% Uncertainty of Measurement	12.95

Results summary at STP wet gas with no correction for oxygen

Ammonia	
Concentration (mg/Nm ³) Wet Gas	83.34
Emission Rate (g/h) @ STP wet gas	2648.37

Blank	
Concentration (mg/Nm ³) Wet Gas	0.00

Client	Viscose Closures Ltd
Site	Llansamlet
Emission Point	A1 Scrubber
Date	06/10/2021
Reference Number	100161/1
Team Leader	PR
Analyst(s)	EJ

DGM Inlet (°C)	9
DGM Outlet (°C)	9
Mean Temp (°C)	9
Bar Pressure (mb)	1021
Moisture (%)	2.81
Duct Shape	Circular
Stack C.S.A (m ²)	1.4957

Gas Flow	Out
Port Nipple (cm)	16
Console No.	A/S136
Filter Box No.	A/S136
Tape Measure	A/S383
Timer	A/L146
Barometer No.	A/S542

Stack Internal Area Check
Yes

Field Repeatability
N/A

Static Pressure Check
Yes

% O ₂	% CO ₂	% CO
20.9	0.0	0.0

Traverse Line 1

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch
1	5.0	4.6	2.1	21	28	N/A
2	14.5	1.6	1.3	21	50	N/A
3	26.7	1.4	1.2	21	44	N/A
4	44.6	0.5	0.7	21	42	N/A
5	93.4	0.3	0.5	21	44	N/A
6	111.3	8.8	3.0	21	37	N/A
7	123.5	6.6	2.6	21	30	N/A
8	133.0	6.4	2.5	21	24	N/A

Traverse Line 2

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch
1	5.0	2.0	1.4	21	32	N/A
2	14.5	0.7	0.8	21	30	N/A
3	26.7	-0.7	N/A	21	46	N/A
4	44.6	-1.0	N/A	21	52	N/A
5	93.4	14.9	3.9	21	40	N/A
6	111.3	14.5	3.8	21	31	N/A
7	123.5	10.5	3.2	21	24	N/A
8	133.0	6.9	2.6	21	28	N/A

Average ΔP (mmH ₂ O)
4.87

Average sqrt DP
2.21

Average Stack Temp (°C)
21

Traverse Line 3

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch

Traverse Line 4

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch

Is negative flow present?
Yes

Minimum velocity >5Pa
No

Ratio of gas velocities <3:1
No

Swirl <15°
No

Ref No	100161/1
Date	06/10/2021
Client	Viscose Closures Ltd
Site	Llansamlet
Emission Point	A1 Scrubber
Determinand	Ammonia
Methodology Used	BS EN ISO 21877
Hot Box Setting °C	160
Probe Length (m)	1.5
Pitot no	A/S149
Probe Material	Titanium
Probe Setting (°C)	160
Nozzle diam (mm) & no	9.1

Blank Filter	N/A	K Factor
Filter Code	N/A	14.86

Run No	1
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Test Start	09:33:00
Test End	10:18:00

	Field Blank Leak Check			Max Vacuum
	Open	Sealed	% Leak over 30 secs	
Pre-Test	23.9	0.08	0.7	50.0

Field Blank Pitot Leak Check	
Pre Test	Post Test
Yes	Yes

	Sample Leak Check			Max Vacuum
	Open	Sealed	% Leak over 30 secs	
Pre-Test	23.9	0.04	0.3	50.0

Sample Pitot Leak Check	
Pre Test	Post Test
Yes	Yes

Traverse Point	Minute per Point - (Min) Clock Time	Pump Vacuum	Velocity Head DP (mmH ₂ O)	$\sqrt{\Delta P}$	DH (mmH ₂ O)	Initial DGM Reading	Stack Temp (°C)	Probe Temp (°C)	Filter Temp (°C)	Impinger Temp (°C)	Gas Sample Temperature at Dry Gas Meter		Gas Readings		
						2730.6					Inlet (°C)	Outlet (°C)			
						DGM Readings									
						% O ₂					% CO ₂	%CO			
1	5.0	15	4.0	2.00	59	2850.6	21	160	160	12	10	9	20.9	0.0	0.0
2	10.0	15	3.8	1.95	56	2968.9	21	160	160	12	11	9	20.9	0.0	0.0
3	15.0	15	3.6	1.90	54	3086.5	21	160	160	11	12	10	20.9	0.0	0.0
4	20.0	15	3.8	1.95	56	3208.7	21	160	160	11	13	10	20.9	0.0	0.0
5	25.0	15	3.5	1.87	52	3328.7	21	160	160	12	14	11	20.9	0.0	0.0
6	30.0	15	4.0	2.00	59	3456	21	160	160	13	14	11	20.9	0.0	0.0
7	35.0	15	3.8	1.95	56	3580.4	21	160	160	13	15	12	20.9	0.0	0.0
8	40.0	15	4.0	2.00	59	3710.1	21	160	160	13	15	12	20.9	0.0	0.0
9	45.0	15	3.5	1.87	52	3832.9	21	160	160	14	16	13	20.9	0.0	0.0

Sample Temperature Info:	Temp Unit A/S No	A/L164	Thermocouple A/S No	A/L164	End of Test Temperature (°C)	9	Return to Laboratory Temperature (°C)	4
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Additional Notes

Sampled at a single point due to negative flow and swirl

CEN/TS 13649:2014 Analysis Checksheet

Determinand:	CS2
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Site Information	
Customer	Viscose Ltd
Site	Llansamlet
Date	06/10/21
Stack I.D.	A1 Scrubber
Sample No	100161/02

Equipment Details	
Pump number	A/S055
Dry gas meter number	A/S235
Dry gas meter correction factor	1.0007
Probe length (m)	0.50m
Probe material	Stainless Steel
Barometer number	A/S542
Timer number	A/L146

Stack Details	
Diameter (m)	1.38
Port nipple (cm)	16
Gas flow (Out / In)	Out

Sampling Data	
Run	1
Barometric pressure (mb)	1021
Average dry gas meter temperature (°C)	15
Average stack gas temperature entering sorbent media (°C)	15
Stack gas temperature (°C)	21
Sorbent media	226-01
Total gas volume sampled (Litres)	20.9
Test start time	10:00
Test end time	12:01
Total sampling time (minutes)	121
Pre test leak rate (%)	0.00
Post test leak rate (%)	0.00
Volumetric flow at STP & wet conditions (m ³ /min)	31725
% Uncertainty of measurement	20.2

Condensation visible in sorbent tube (post test)	No
Temperature of tubes transferred to Lab <25°C	Yes

Analysis Results	
Concentration (mg/Nm ³), STP @ wet gas	29.28
Blank concentration (mg/Nm ³), STP @ wet gas	0.05
Emission rate (g/h) @ STP wet gas	928.9

Hydrogen sulphide monitoring sampling data

Client	Viscose Closures Ltd
Site	Llansamlet
Emission Point	A1 Scrubber
Date	06/10/2021
Reference Number	100161/3
Determinand	Hydrogen Sulphide
Run	1
Team Leader	PR
Analyst(s)	EJ
X-Sectional Area	1.4957
$\Delta H@$	45.97
Y_d	1.0177
C_p	0.80
Duct static pressure (mmH ₂ O)	5
Absolute stack gas pressure (mm Hg)	766.3
Total gas volume sampled at STP (Litres)	295.3
Total sampling time (minutes)	60
Moisture (%)	2.81
Dessicant discolouration less than 50%	Yes
Velocity at stack conditions (m/s)	6.29
Volumetric flow at stack conditions (m ³ /s)	9.41
Volumetric Flow at STP Wet Gas (m ³ /hr)	31673
Oxygen calibration gas concentration/reference	N/A
% Uncertainty of Measurement	8.59

Hydrogen Sulphide results summary at STP wet gas with no correction for oxygen

Hydrogen Sulphide	
Concentration (mg/Nm ³) Wet Gas	0.31
Emission Rate (Kg/h) @ STP wet gas	0.01

Blank	
Concentration (mg/Nm ³) Wet Gas	0.15

Client	Viscose Closures Ltd
Site	Llansamlet
Emission Point	A1 Scrubber
Date	06/10/2021
Reference Number	100161/3
Team Leader	PR
Analyst(s)	EJ

DGM Inlet (°C)	9
DGM Outlet (°C)	9
Mean Temp (°C)	9
Bar Pressure (mb)	1021
Moisture (%)	2.81
Duct Shape	Circular
Stack C.S.A (m ²)	1.4957

Gas Flow	Out
Port Nipple (cm)	16
Console No.	A/S136
Filter Box No.	A/S136
Tape Measure	A/S383
Timer	A/L146
Barometer No.	A/S542

Stack Internal Area Check
Yes

Field Repeatability
N/A

Static Pressure Check
Yes

% O ₂	% CO ₂	% CO
20.9	0.0	0.0

Traverse Line 1

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch
1	5.0	4.6	2.1	21	28	N/A
2	14.5	1.6	1.3	21	50	N/A
3	26.7	1.4	1.2	21	44	N/A
4	44.6	0.5	0.7	21	42	N/A
5	93.4	0.3	0.5	21	44	N/A
6	111.3	8.8	3.0	21	37	N/A
7	123.5	6.6	2.6	21	30	N/A
8	133.0	6.4	2.5	21	24	N/A

Traverse Line 2

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch
1	5.0	2.0	1.4	21	32	N/A
2	14.5	0.7	0.8	21	30	N/A
3	26.7	-0.7	N/A	21	46	N/A
4	44.6	-1.0	N/A	21	52	N/A
5	93.4	14.9	3.9	21	40	N/A
6	111.3	14.5	3.8	21	31	N/A
7	123.5	10.5	3.2	21	24	N/A
8	133.0	6.9	2.6	21	28	N/A

Average ΔP (mmH ₂ O)
4.87

Average sqrt DP
2.21

Average Stack Temp (°C)
21

Traverse Line 3

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch

Traverse Line 4

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch

Is negative flow present?
Yes

Minimum velocity >5Pa
No

Ratio of gas velocities <3:1
No

Swirl <15°
No

Ref No	100161/3
Date	06/10/2021
Client	Viscose Closures Ltd
Site	Llansamlet
Emission Point	A1 Scrubber
Determinand	Hydrogen Sulphide
Methodology Used	US EPA M11
Hot Box Setting °C	N/A
Probe Length (m)	1.5
Pitot no	A/S149
Probe Material	PTFE
Probe Setting (°C)	160
Nozzle diam (mm) & no	N/A

Blank Filter	N/A	K Factor
Filter Code	N/A	N/A

Test Start	10:35:00
Test End	11:35:00

	Field Blank Leak Check			Max Vacuum
	Open	Sealed	% Leak over 30 secs	
Pre-Test	23.9	0.08	0.7	50.0

Field Blank Pitot Leak Check	
Pre Test	Post Test
Yes	Yes

	Sample Leak Check			Max Vacuum
	Open	Sealed	% Leak over 30 secs	
Pre-Test	23.9	0.04	0.3	50.0

Sample Pitot Leak Check	
Pre Test	Post Test
Yes	Yes

Traverse Point	Minute per Point - (Min) Clock Time	Pump Vacuum	Velocity Head DP (mmH ₂ O)	$\sqrt{\Delta P}$	DH (mmH ₂ O)	Initial DGM Reading	Stack Temp (°C)	Probe Temp (°C)	Filter Temp (°C)	Impinger Temp (°C)	Gas Sample Temperature at Dry Gas Meter		Gas Readings		
						3916.8					Inlet (°C)	Outlet (°C)			
						DGM Readings							% O ₂	% CO ₂	%CO
1	5.0	20	3.5	1.87	2	3942.3	21	160	N/A	8	16	16	20.9	0.0	0.0
2	10.0	20	3.8	1.95	2	3967.8	21	160	N/A	8	17	16	20.9	0.0	0.0
3	15.0	20	3.6	1.90	2	3993.4	21	160	N/A	8	18	16	20.9	0.0	0.0
4	20.0	20	3.8	1.95	2	4019	21	160	N/A	9	18	17	20.9	0.0	0.0
5	25.0	20	4.0	2.00	2	4044.5	21	160	N/A	9	18	17	20.9	0.0	0.0
6	30.0	20	4.0	2.00	2	4070	21	160	N/A	9	18	17	20.9	0.0	0.0
7	35.0	20	3.8	1.95	2	4095.6	21	160	N/A	10	18	17	20.9	0.0	0.0
8	40.0	20	3.4	1.84	2	4121.2	22	160	N/A	10	19	17	20.9	0.0	0.0
9	45.0	20	3.6	1.90	2	4146.8	22	160	N/A	10	19	17	20.9	0.0	0.0
10	50.0	20	3.8	1.95	2	4172.3	22	160	N/A	10	19	17	20.9	0.0	0.0
11	55.0	20	4.0	2.00	2	4197.8	22	160	N/A	11	19	18	20.9	0.0	0.0
12	60.0	20	3.8	1.95	2	4223.3	22	160	N/A	11	20	18	20.9	0.0	0.0

Sample Temperature Info:	Temp Unit A/S No	A/L164	Thermocouple A/S No	A/L164	End of Test Temperature (°C)	9	Return to Laboratory Temperature (°C)	4
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Additional Notes

Sampled at a single point due to negative flow and swirl

APPENDIX 3

A2 Rocket

(10 Pages)



Stack diagram



Stack Dimension (m)	0.45m x 0.96m
Homogeneity test previously carried out (yes/no)	No
Is the gas stream homogeneous? (yes/no/unknown)	Unknown



Wet chemistry monitoring sampling data (Isokinetic)

Client	Viscose Ltd
Site	Llansamlet
Emission Point	A2 Rocket
Date	06/10/2021
Reference Number	100161/4
Determinand	Ammonia
Run	1
Team Leader	PR
Analyst(s)	EJ
X-Sectional Area	0.4320
$\Delta H@$	45.97
Y_d	1.0177
C_p	0.83
k Factor	2.73
Duct static pressure (mmH ₂ O)	7
Absolute stack gas pressure (mm Hg)	766.5
Total gas volume sampled at STP (Litres)	1095.9
Total sampling time (minutes)	42
Moisture (%)	1.52
Dessicant discolouration less than 50%	Yes
Velocity at stack conditions (m/s)	17.49
Volumetric flow at stack conditions (m ³ /s)	7.6
Volumetric Flow at STP Wet Gas (m ³ /hr)	25136.2
% Isokinetic	104.3
Absorption efficiency check (%)	99.83
Oxygen calibration gas concentration/reference	N/A
% Uncertainty of Measurement	12.95

Results summary at STP wet gas with no correction for oxygen

Ammonia	
Concentration (mg/Nm ³) Wet Gas	7.76
Emission Rate (g/h) @ STP wet gas	195.15

Blank	
Concentration (mg/Nm ³) Wet Gas	0.00

Client	Viscose Ltd
Site	Llansamlet
Emission Point	A2 Rocket
Date	06/10/2021
Reference Number	100161/4
Team Leader	PR
Analyst(s)	EJ

DGM Inlet (°C)	22
DGM Outlet (°C)	22
Mean Temp (°C)	22
Bar Pressure (mb)	1021
Moisture (%)	1.52
Duct Shape	Square
Stack C.S.A (m ²)	0.4320

Gas Flow	Out
Port Nipple (cm)	16
Console No.	A/S136
Filter Box No.	A/S136
Tape Measure	A/S383
Timer	A/L146
Barometer No.	A/S542

Stack Internal Area Check
Yes

Field Repeatability
N/A

Static Pressure Check
Yes

% O ₂	% CO ₂	% CO
20.9	0.0	0.0

Traverse Line 1

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch
1	7.5	21.8	4.7	25	10	N/A
2	22.5	22.8	4.8	25	13	N/A
3	37.5	24.5	4.9	25	12	N/A

Traverse Line 2

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch
1	7.5	30.0	5.5	25	12	N/A
2	22.5	30.7	5.5	25	11	N/A
3	37.5	32.0	5.7	25	10	N/A

Average ΔP (mmH ₂ O)
26.96

Average sqrt DP
5.19

Average Stack Temp (°C)
25

Traverse Line 3

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch

Traverse Line 4

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch

Is negative flow present?
No

Minimum velocity >5Pa
Yes

Ratio of gas velocities <3:1
Yes

Swirl <15°
Yes

Ref No	100161/4
Date	06/10/2021
Client	Viscose Ltd
Site	Llansamlet
Emission Point	A2 Rocket
Determinand	Ammonia
Methodology Used	BS EN ISO 21877
Hot Box Setting °C	160
Probe Length (m)	1.0
Pitot no	A/S159
Probe Material	Titanium
Probe Setting (°C)	160
Nozzle diam (mm) & no	5.8

Blank Filter	N/A	K Factor	Run No	1
Filter Code	N/A	2.73		

Test Start	13:31:00
Test End	14:15:00

	Field Blank Leak Check			Max Vacuum
	Open	Sealed	% Leak over 30 secs	
Pre-Test	29	0.07	0.5	50.0

Field Blank Pitot Leak Check	
Pre Test	Post Test
Yes	Yes

	Sample Leak Check			Max Vacuum
	Open	Sealed	% Leak over 30 secs	
Pre-Test	29	0.09	0.6	50.0

Sample Pitot Leak Check	
Pre Test	Post Test
Yes	Yes

Traverse Point	Minute per Point - (Min) Clock Time	Pump Vacuum	Velocity Head DP (mmH ₂ O)	$\sqrt{\Delta P}$	DH (mmH ₂ O)	Initial DGM Reading	Stack Temp (°C)	Probe Temp (°C)	Filter Temp (°C)	Impinger Temp (°C)	Gas Sample Temperature at Dry Gas Meter		Gas Readings		
						4375.7					Inlet (°C)	Outlet (°C)			
						DGM Readings									
						% O ₂					% CO ₂	%CO			
1	3.5	15	22.0	4.69	60	4462.5	25	160	160	16	22	22	20.9	0.0	0.0
1	7.0	15	21.8	4.67	60	4548.9	25	160	160	16	23	22	20.9	0.0	0.0
2	10.5	15	22.8	4.77	62	4638.7	25	160	160	17	24	23	20.9	0.0	0.0
2	14.0	15	23.0	4.80	63	4725.9	25	160	160	17	24	23	20.9	0.0	0.0
3	17.5	15	23.8	4.88	65	4816.7	25	160	160	17	24	23	20.9	0.0	0.0
3	21.0	15	24.0	4.90	66	4907.8	25	160	160	17	25	23	20.9	0.0	0.0
4	24.5	20	30.0	5.48	82	5008.9	25	160	160	17	25	23	20.9	0.0	0.0
4	28.0	20	30.0	5.48	82	5109.8	25	160	160	18	26	23	20.9	0.0	0.0
5	31.5	20	30.0	5.48	82	5212.1	25	160	160	18	26	23	20.9	0.0	0.0
5	35.0	20	32.0	5.66	87	5317.8	25	160	160	18	26	23	20.9	0.0	0.0
6	38.5	20	32.0	5.66	87	5423.9	25	160	160	18	27	24	20.9	0.0	0.0
6	42.0	20	32.0	5.66	87	5530	25	160	160	18	27	24	20.9	0.0	0.0
										</					

Sample Temperature Info:	Temp Unit A/S No	A/L164	Thermocouple A/S No	A/L164	End of Test Temperature (°C)	8	Return to Laboratory Temperature (°C)	5
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Additional Notes

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CEN/TS 13649:2014 Analysis Checksheet

Determinand:	CS2
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Site Information	
Customer	Viscose Ltd
Site	Llansamlet
Date	06/10/21
Stack I.D.	Rocket
Sample No	100161/05

Equipment Details	
Pump number	A/S601
Dry gas meter number	A/S234
Dry gas meter correction factor	0.9954
Probe length (m)	0.50m
Probe material	Stainless Steel
Barometer number	A/S542
Timer number	A/L146

Stack Details	
Diameter (m)	0.45 by 0.96
Port nipple (cm)	16
Gas flow (Out / In)	Out

Sampling Data	
Run	1
Barometric pressure (mb)	1021
Average dry gas meter temperature (°C)	14
Average stack gas temperature entering sorbent media (°C)	14
Stack gas temperature (°C)	25
Sorbent media	226-01
Total gas volume sampled (Litres)	26.2
Test start time	09:47
Test end time	11:56
Total sampling time (minutes)	129
Pre test leak rate (%)	0.00
Post test leak rate (%)	0.00
Volumetric flow at STP & wet conditions (m ³ /min)	25131
% Uncertainty of measurement	19.3

Condensation visible in sorbent tube (post test)	No
Temperature of tubes transferred to Lab <25°C	Yes

Analysis Results	
Concentration (mg/Nm ³), STP @ wet gas	14.81
Blank concentration (mg/Nm ³), STP @ wet gas	0.39
Emission rate (g/h) @ STP wet gas	372.2

Hydrogen sulphide monitoring sampling data

Client	Viscose Ltd
Site	Llansamlet
Emission Point	A2 Rocket
Date	06/10/2021
Reference Number	100161/6
Determinand	Hydrogen Sulphide
Run	1
Team Leader	PR
Analyst(s)	EJ
X-Sectional Area	0.4320
$\Delta H@$	45.97
Y_d	1.0177
C_p	0.83
Duct static pressure (mmH ₂ O)	7
Absolute stack gas pressure (mm Hg)	766.5
Total gas volume sampled at STP (Litres)	279.5
Total sampling time (minutes)	60
Moisture (%)	1.52
Dessicant discolouration less than 50%	Yes
Velocity at stack conditions (m/s)	17.49
Volumetric flow at stack conditions (m ³ /s)	7.55
Volumetric Flow at STP Wet Gas (m ³ /hr)	25125
Oxygen calibration gas concentration/reference	N/A
% Uncertainty of Measurement	8.59

Hydrogen Sulphide results summary at STP wet gas with no correction for oxygen

Hydrogen Sulphide	
Concentration (mg/Nm ³) Wet Gas	0.32
Emission Rate (Kg/h) @ STP wet gas	0.01

Blank	
Concentration (mg/Nm ³) Wet Gas	0.16

Client	Viscose Ltd
Site	Llansamlet
Emission Point	A2 Rocket
Date	06/10/2021
Reference Number	100161/6
Team Leader	PR
Analyst(s)	EJ

DGM Inlet (°C)	22
DGM Outlet (°C)	22
Mean Temp (°C)	22
Bar Pressure (mb)	1021
Moisture (%)	1.52
Duct Shape	Square
Stack C.S.A (m ²)	0.4320

Gas Flow	Out
Port Nipple (cm)	16
Console No.	A/S136
Filter Box No.	A/S136
Tape Measure	A/S383
Timer	A/L146
Barometer No.	A/S542

Stack Internal Area Check
Yes

Field Repeatability
N/A

Static Pressure Check
Yes

% O ₂	% CO ₂	% CO
20.9	0.0	0.0

Traverse Line 1

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch
1	7.5	21.8	4.7	25	10	N/A
2	22.5	22.8	4.8	25	13	N/A
3	37.5	24.5	4.9	25	12	N/A

Traverse Line 2

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch
1	7.5	30.0	5.5	25	12	N/A
2	22.5	30.7	5.5	25	11	N/A
3	37.5	32.0	5.7	25	10	N/A

Average ΔP (mmH ₂ O)
26.96

Average sqrt DP
5.19

Average Stack Temp (°C)
25

Traverse Line 3

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch

Traverse Line 4

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch

Is negative flow present?
No

Minimum velocity >5Pa
Yes

Ratio of gas velocities <3:1
Yes

Swirl <15°
Yes

Ref No	100161/6
Date	06/10/2021
Client	Viscose Ltd
Site	Llansamlet
Emission Point	A2 Rocket
Determinand	Hydrogen Sulphide
Methodology Used	US EPA M11
Hot Box Setting °C	N/A
Probe Length (m)	1.0
Pitot no	A/S159
Probe Material	PTFE
Probe Setting (°C)	160
Nozzle diam (mm) & no	N/A

Blank Filter	N/A	K Factor
Filter Code	N/A	N/A

Run No	1
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Test Start	14:25:00
Test End	15:25:00

	Field Blank Leak Check			Max Vacuum
	Open	Sealed	% Leak over 30 secs	
Pre-Test	22.2	0.01	0.1	50.0

Field Blank Pitot Leak Check	
Pre Test	Post Test
Yes	Yes

	Sample Leak Check			Max Vacuum
	Open	Sealed	% Leak over 30 secs	
Pre-Test	22.2	0.03	0.3	50.0

Sample Pitot Leak Check	
Pre Test	Post Test
Yes	Yes

Traverse Point	Minute per Point - (Min) Clock Time	Pump Vacuum	Velocity Head DP (mmH ₂ O)	$\sqrt{\Delta P}$	DH (mmH ₂ O)	Initial DGM Reading	Stack Temp (°C)	Probe Temp (°C)	Filter Temp (°C)	Impinger Temp (°C)	Gas Sample Temperature at Dry Gas Meter		Gas Readings		
						5607.2					Inlet (°C)	Outlet (°C)			
						DGM Readings									
						% O ₂					% CO ₂	%CO			
1	5.0	15	21.8	4.67	2	5632.9	25	160	N/A	16	22	22	20.9	0.0	0.0
1	10.0	15	21.8	4.67	2	5658.6	25	160	N/A	16	23	22	20.9	0.0	0.0
2	15.0	15	23.0	4.80	2	5684.3	25	160	N/A	17	24	23	20.9	0.0	0.0
2	20.0	15	22.6	4.75	2	5710	25	160	N/A	17	24	23	20.9	0.0	0.0
3	25.0	15	24.0	4.90	2	5735.7	25	160	N/A	17	24	23	20.9	0.0	0.0
3	30.0	15	24.0	4.90	2	5761.4	25	160	N/A	17	25	23	20.9	0.0	0.0
4	35.0	15	30.0	5.48	2	5787.1	25	160	N/A	17	25	23	20.9	0.0	0.0
4	40.0	15	30.0	5.48	2	5812.8	25	160	N/A	18	26	23	20.9	0.0	0.0
5	45.0	15	30.0	5.48	2	5835.5	25	160	N/A	18	26	23	20.9	0.0	0.0
5	50.0	15	30.0	5.48	2	5858.2	25	160	N/A	18	26	23	20.9	0.0	0.0
6	55.0	15	34.0	5.83	2	5880.9	25	160	N/A	18	27	24	20.9	0.0	0.0
6	60.0	15	32.0	5.66	2	5903.6	25	160	N/A	18	27	24	20.9	0.0	0.0
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Sample Temperature Info:	Temp Unit A/S No	A/L164	Thermocouple A/S No	A/L164	End of Test Temperature (°C)	9	Return to Laboratory Temperature (°C)	7
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Additional Notes

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APPENDIX 4

RTO

(20 Pages)



Stack diagram



Stack Dimension (m)	0.64m
Homogeneity test previously carried out (yes/no)	No
Is the gas stream homogeneous? (yes/no/unknown)	Unknown



Particulate summary results page at STP no correction for oxygen or moisture

Customer	Viscose Closures
Site	Llansamlet
Emission Point	Thermal Oxidiser
Date Sampled	7-Oct-21
Reference Number	100161/7
Determinand	Particulate
Run	1
Team Leader	PR
Analyst(s)	EJ
X-Sectional Area (m ²)	0.3217
$\Delta H@$	48.31
Y_d	1.017
C_p	0.83
k Factor	12.48
Duct Static Pressure (mmH ₂ O)	24.4
Absolute Stack Gas Pressure (mm Hg)	770.5
Total Particulate Gain (mg)	0.98
Filter Conditioning temperature (°C)	350
Filter Material	Quartz
Filter Size (mm)	90
Filtration Device	Out Stack
Probe Rinse (mg)	0.76
Blank Weight Gain (mg)	0.02
Reagent Blank (mg)	0.11
Total Gas Volume Sampled at STP (Litres)	2167.6
% Isokinetic	102.1
Stack moisture (%)	1.64
Dessicant discolouration less than 50%	Yes
Velocity at Stack conditions (m/s)	6.85
Volumetric Flow wet gas (m ³ /hr)	7933.5
Volumetric Flow @ STP Wet Gas (m ³ /hr)	5390.7
Particulate Concentration, wet Gas (mg/Nm ³)	0.45
Particulate Emission Rate (g/h) wet gas @ STP	2
Blank concentration ,wet gas (mg/Nm ³)	0.01
% Uncertainty of Measurement	5.08

Reference Number	100161/7	Customer	Viscose Closures	Emission Point	Thermal Oxidiser
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Filter Number (ST)	2590	Date of Initial Weighing	07/10/2021	Temp (°C)	20	Pressure (mb)	1021
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Initial Weighing

Weight After 1 Minute (mg)	1	497.88
Weight after 2 Minutes (mg)	2	497.88
Weight After 3 Minutes (mg)	3	497.89

Person Carrying Out Initial Weighings	PR	Zero Wt	497.87
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Post Test Weighing

Date of Final Weighing	12/10/2021
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Weight After 1 Minute (mg)	1	498.23
Weight after 2 Minutes (mg)	2	498.23
Weight After 3 Minutes (mg)	3	498.23

Person Carrying Out Final Weighings	PR	Zero Wt	498.23
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Probe Rinse

Acetone Batch Number	JV638439
Reagent Blank (mg)	0.11

Weight After 1 Minute (g)	1	33.90566
Weight after 2 Minutes (g)	2	33.90571
Weight After 3 Minutes (g)	3	33.90574

Person Carrying Out Initial Rinse Weighings	PR
---	----

Extrapolated Weight to Zero (g)	33.90562
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Crucible Cleaned & Re-Conditioned

Weight After 1 Minute (g)	1	33.90487
Weight after 2 Minutes (g)	2	33.90487
Weight After 3 Minutes (g)	3	33.90487

Temp (°C)	20	Pressure (mb)	1028
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Person Carrying Out Final Rinse Weighings	PR
---	----

Extrapolated Weight to Zero (g)	33.90487
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Blank Probe Rinse

Weight After 1 Minute (g)	1	21.40423
Weight after 2 Minutes (g)	2	21.40426
Weight After 3 Minutes (g)	3	21.40428

Temp (°C)	20	Pressure (mb)	1030
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Person Carrying Out Initial Blank Rinse Weighings	PR
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Extrapolated Weight to Zero (g)	21.40421
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Crucible Cleaned & Re-Conditioned

Weight After 1 Minute (g)	1	21.40426
Weight after 2 Minutes (g)	2	21.40426
Weight After 3 Minutes (g)	3	21.40426

Temp (°C)	20	Pressure (mb)	1028
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Person Carrying Out Final Blank Rinse Weighings	PR
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Extrapolated Weight to Zero (g)	21.40426
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Control Weight Processing

	Pre	Post		Pre	Post		Pre	Post	St filter control
C1 1 minute	21.56834	21.56845	C2 1 Minute	21.11674	21.11685	C3 1 Minute	22.36288	22.36299	470.89
C1 2 Minutes	21.56834	21.56844	C2 2 Minutes	21.11675	21.11685	C3 2 Minutes	22.36288	22.36299	Fn Filter control
C1 3 Minutes	21.56834	21.56844	C2 3 Minutes	21.11675	21.11685	C3 3 Minutes	22.36288	22.36299	471.02
Extrapolated	21.56834	21.56845		21.11674	21.11685		22.36288	22.36299	Correction
Wt Change C1	-0.00011		Wt Change C2	-0.00011		Wt Change C3	-0.00011		0.13

Correction Value to be applied to weight gain	-0.00011
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Client	Viscose Closures
Site	Llansamlet
Emission Point	Thermal Oxidiser
Date	07/10/2021
Reference Number	100161/7
Team Leader	PR
Analyst(s)	EJ

DGM Inlet (°C)	16
DGM Outlet (°C)	16
Mean Temp (°C)	16
Bar Pressure (mb)	1024
Moisture (%)	1.64
Duct Shape	Circular
Stack C.S.A (m ²)	0.3217

Gas Flow	Out
Port Nipple (cm)	9
Console No.	A/5694
Filter Box No.	A/5136
Tape Measure	A/5223
Timer	A/5694
Barometer No.	A/5694

Stack Internal Area Check
Yes

Field Repeatability
N/A

Static Pressure Check
Yes

% O ₂	% CO ₂	% CO
20.1	0.0	0.0

Traverse Line 1

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch
1	5.0	2.8	1.7	135	8	N/A
2	9.4	2.9	1.7	135	7	N/A
3	18.9	2.9	1.7	134	7	N/A
4	45.1	3.0	1.7	134	6	N/A
5	54.6	2.9	1.7	134	5	N/A
6	59.0	2.9	1.7	133	7	N/A

Traverse Line 2

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch

Average ΔP (mmH ₂ O)
2.91

Average sqrt DP
1.70

Average Stack Temp (°C)
134

Traverse Line 3

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch

Traverse Line 4

Sampling Point	Distance (cm)	Average Velocity Head ΔP (mmH ₂ O)	$\sqrt{\Delta P}$	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch

Is negative flow present?
No

Minimum velocity >5Pa
Yes

Ratio of gas velocities <3:1
Yes

Swirl <15°
Yes

Ref No	100161/7
Date	07/10/2021
Client	Viscose Closures
Site	Llansamlet
Emission Point	Thermal Oxidiser
Determinand	Particulate
Methodology Used	BS EN 13284-1
Hot Box Setting °C	160
Probe Length (m)	1.0
Pitot no	A/S159
Probe Material	Titanium
Probe Setting (°C)	160
Nozzle diam (mm) & no	9.1

Blank Filter	2590bik	K Factor	Run No	1
Filter Code	2590	12.48		

	Field Blank Leak Check			Max Vacuum
	Open	Sealed	% Leak over 30 secs	
Pre-Test	19.2	0.03	0.3	350.0

	Sample Leak Check			Max Vacuum
	Open	Sealed	% Leak over 30 secs	
Pre-Test	19.2	0.04	0.4	350.0

Test Start	10:30:00
Test End	12:30:00

Field Blank Pitot Leak Check	
Pre Test	Post Test
Yes	Yes

Sample Pitot Leak Check	
Pre Test	Post Test
Yes	Yes

Traverse Point	Minute per Point - (Min) Clock Time	Pump Vacuum	Velocity Head DP (mmH ₂ O)	$\sqrt{\Delta P}$	DH (mmH ₂ O)	Initial DGM Reading	Stack Temp (°C)	Probe Temp (°C)	Filter Temp (°C)	Impinger Temp (°C)	Gas Sample Temperature at Dry Gas Meter		Gas Readings		
						0									
						DGM Readings					Inlet (°C)	Outlet (°C)			
1	5.0	52	3.0	1.73	37	93.7	130	160	160	11	18	18	% O ₂	% CO ₂	%CO
1	10.0	53	3.1	1.76	39	188.5	133	160	160	11	18	18	20.1	0.0	0.0
1	15.0	57	3.0	1.73	37	281.6	134	160	160	11	20	20	20.1	0.0	0.0
1	20.0	56	3.0	1.73	37	374.6	134	160	160	12	21	21	20.1	0.0	0.0
2	25.0	57	3.0	1.73	37	467.9	134	160	160	12	22	22	20.1	0.0	0.0
2	30.0	55	3.0	1.73	37	562.8	134	160	160	12	22	22	20.1	0.0	0.0
2	35.0	56	2.9	1.70	36	655.9	134	160	160	13	23	23	20.1	0.0	0.0
2	40.0	55	3.0	1.73	37	750.9	134	160	160	13	24	24	20.1	0.0	0.0
3	45.0	57	3.1	1.76	39	848.7	134	160	160	14	25	25	20.1	0.0	0.0
3	50.0	58	3.1	1.76	39	946.8	134	160	160	14	26	26	20.1	0.0	0.0
3	55.0	54	3.0	1.73	37	1044.2	134	160	160	15	26	26	20.1	0.0	0.0
3	60.0	55	3.0	1.73	37	1141.2	134	160	160	16	27	27	20.1	0.0	0.0
4	65.0	60	3.1	1.76	39	1238.7	135	160	160	17	27	27	20.1	0.0	0.0
4	70.0	58	3.1	1.76	39	1336.8	135	160	160	17	28	28	20.1	0.0	0.0
4	75.0	57	3.0	1.73	37	1432.1	135	160	160	18	28	28	20.1	0.0	0.0
4	80.0	56	3.0	1.73	37	1527.8	135	160	160	18	28	28	20.1	0.0	0.0
5	85.0	57	3.0	1.73	37	1624.4	135	160	160	18	29	29	20.1	0.0	0.0
5	90.0	57	3.0	1.73	37	1720.3	135	160	160	19	29	29	20.1	0.0	0.0
5	95.0	53	2.9	1.70	36	1816.5	135	160	160	19	29	29	20.1	0.0	0.0
5	100.0	57	3.0	1.73	37	1914.2	135	160	160	19	29	29	20.1	0.0	0.0
6	105.0	56	3.0	1.73	37	2009.8	135	160	160	18	30	30	20.1	0.0	0.0
6	110.0	58	3.0	1.73	37	2106.5	135	160	160	17	30	30	20.1	0.0	0.0
6	115.0	59	3.1	1.76	39	2203.6	135	160	160	17	30	30	20.1	0.0	0.0
6	120.0	57	3.0	1.73	37	2300	135	160	160	16	30	30	20.1	0.0	0.0
Total						2300									
Average			3.0	1.74	37.6		134	160	160	15	26	26	20.1	0.0	0.0

Sample Temperature Info:	Temp Unit A/S No	A/L164	Thermocouple A/S No	A/L164	End of Test Temperature (°C)	n/a	Return to Laboratory Temperature (°C)	n/a
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Additional Notes

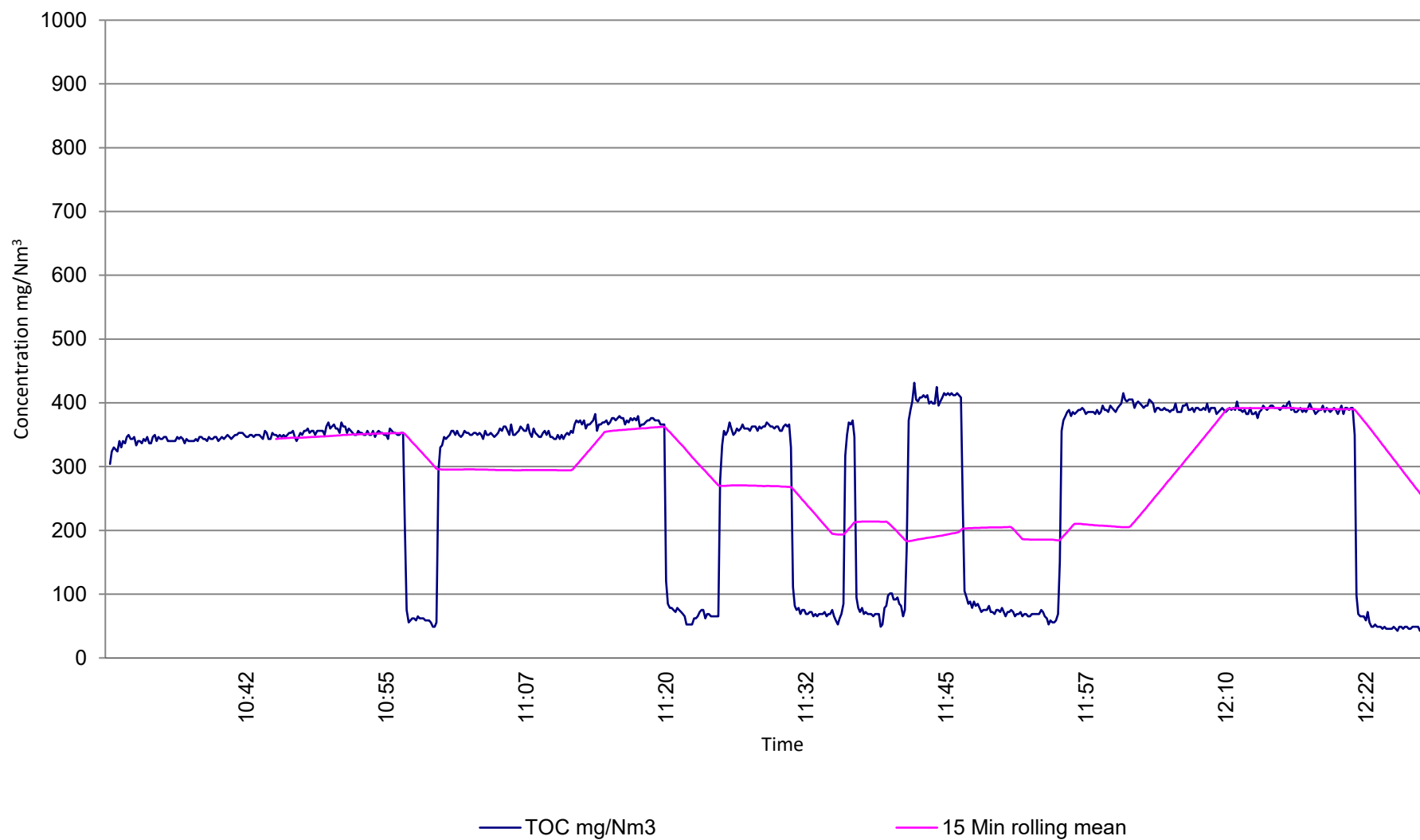
Anchem Laboratories Ltd TOC Summary

Customer name	Viscose
Site location	Llansamlet
Emission point	Pre Thermal Oxidiser
Substance to be monitored	TOC (propane equivalent)
Sample Number	100161/8
Date	07/10/2021
Team leader	Phil Ruck
Analyst(s)	Elliot Jones
Barometric pressure (mb)	1023
Span Gas Concentration (ppm)	804.7
Span Gas Cylinder Reference	5365
Volume flow at STP (m ³ /hour)	4956.3
Start Time	10:30:00
End Time	12:30:00
% Drift	0.00
% Uncertainty	0.33
Average concentration @ STP (mg/Nm ³)	283.88
15 minute rolling mean @ STP (mg/Nm ³)	288.65
Highest 15 minute rolling mean @ STP (mg/Nm ³)	392.18
Emission rate @ STP wet gas (g/hour)	1407
Emission uncertainty concentration	0.9

TOC concentrations measured on the Pre Thermal Oxidiser, at Viscose, Llansamlet

Date: 7/10/2021

Sample No: 100161/8



TOC concentrations measured on the Pre Thermal Oxidiser, at Viscose,
Llansamlet

Date: 7/10/2021

Sample No: 100161/8

Concentration	TOC mg/Nm ³	15 Min rolling mean
Minimum	36.0	183.0
Maximum	431.4	392.2
Average	283.9	288.6

TOC site worksheet

Customer name	Viscose
Site location	Llansamlet
Emission point	Pre Thermal Oxidiser
Substance to be monitored	TOC (propane equivalent)
Date	07/10/2021
Sample Number	100161/8
Homogeneity test previously conducted? (Yes/No)	No
Is the gas stream homogeneous? (Yes/No/Unknown)	Unknown

Preliminary gas test

Sample point number	1	2	3	4	5	6	7	8	9
TOC concentration ppm	220								

Range of analyser	10 ³
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Start of test 10:30Instrument adjustment through analyser

Initial instrument zero gas reading (ppm)	4.0
Instrument span gas reading (ppm)	798.0
Post instrument zero gas reading (ppm)	4.0

System leak test through line

Initial system leak zero gas reading (ppm)	4.0
System leak span gas reading (ppm)	796.0
Post system leak zero gas reading (ppm)	-4.0

% Leak	0.3
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End of test 12:30System leak test through line

Initial drift zero gas reading (ppm)	-4.0
System drift span gas reading (ppm)	796.0
Post drift zero gas reading (ppm)	-4.0

Test Span Drift (%)	0.0
Test Zero Drift (%)	0.0

EN ISO 16911 L-Type Pitot Summary Page

Client	Viscose Closures
Site	Llansamlet
Emission Point	Pre RTO
Date	7-Oct-21
Sample Number	100161/8
X-Sectional Area	0.246
Pitot Tube Factor	1.00
Average DP (kPa)	0.022
% Water Vapour	1.6
Average % Oxygen	20.9
Average % Carbon Dioxide	0.0
Average % Carbon Monoxide	0.0
Average % Nitrogen	79.1
Barometric Pressure (mb)	1024
Arithmetic Average Duct Static Pressure (hPa)	-6.95
Absolute Stack Gas Pressure (KPa)	101.7
Average Stack Gas Temperature (K)	304
Velocity in Stack (m/s)	6.2
Volumetric Flow at Stack Conditions (m ³ /sec)	1.53
Volumetric flow rate at STP - 273K, 101.3KPa (m ³ /sec)	1.38
Volumetric flow rate at STP - 273K, 101.3KPa (m ³ /hour)	4956.34
% Uncertainty of Measurement	5.6

Client	Viscose Closures
Site	Llansamlet
Emission Point	Pre RTO
Date	07/10/2021
Sample Number	100161/8
Bar Pressure (mb)	1024
Moisture (%)	1.64

Gas Flow	In
Port Nipple (cm)	9
Dimension (m)	0.56
Stack C.S.A (m ²)	0.246
Tape Measure	A/S383
Timer	A/S694
Barometer No.	A/S694

Field Performance Criteria	Acceptable
Pitch <±10°	N/A
Swirl <±15°	Yes
Stack Internal Area	Yes
Field Repeatability	N/A
Blockage Check	Yes
Average Stack Temp °C	31

% O ₂	% CO ₂	% CO
20.9	0.0	0.0

Traverse Line 1

Traverse Number	Distance (cm)	Average Velocity m/s	Pressure hPa	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch
1	5.0	6.2	0.23	31	8	N/A
2	8.2	6.1	0.22	31	5	N/A
3	16.6	6.0	0.22	31	6	N/A
4	39.4	5.9	0.21	31	8	N/A
5	47.8	6.1	0.22	31	6	N/A
6	51.0	6.2	0.23	31	7	N/A

Traverse Line 2

Traverse Number	Distance (cm)	Average Velocity m/s	Pressure hPa	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch

Traverse Line 3

Traverse Number	Distance (cm)	Average Velocity m/s	Pressure hPa	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch

Traverse Line 4

Traverse Number	Distance (cm)	Average Velocity m/s	Pressure hPa	Average Stack Temp (°C)	Degree Angle of Swirl	Degree Angle of Pitch

Number of Sample Points
6

Flow Characteristics Meet Requirements of EN ISO 16911?
Yes

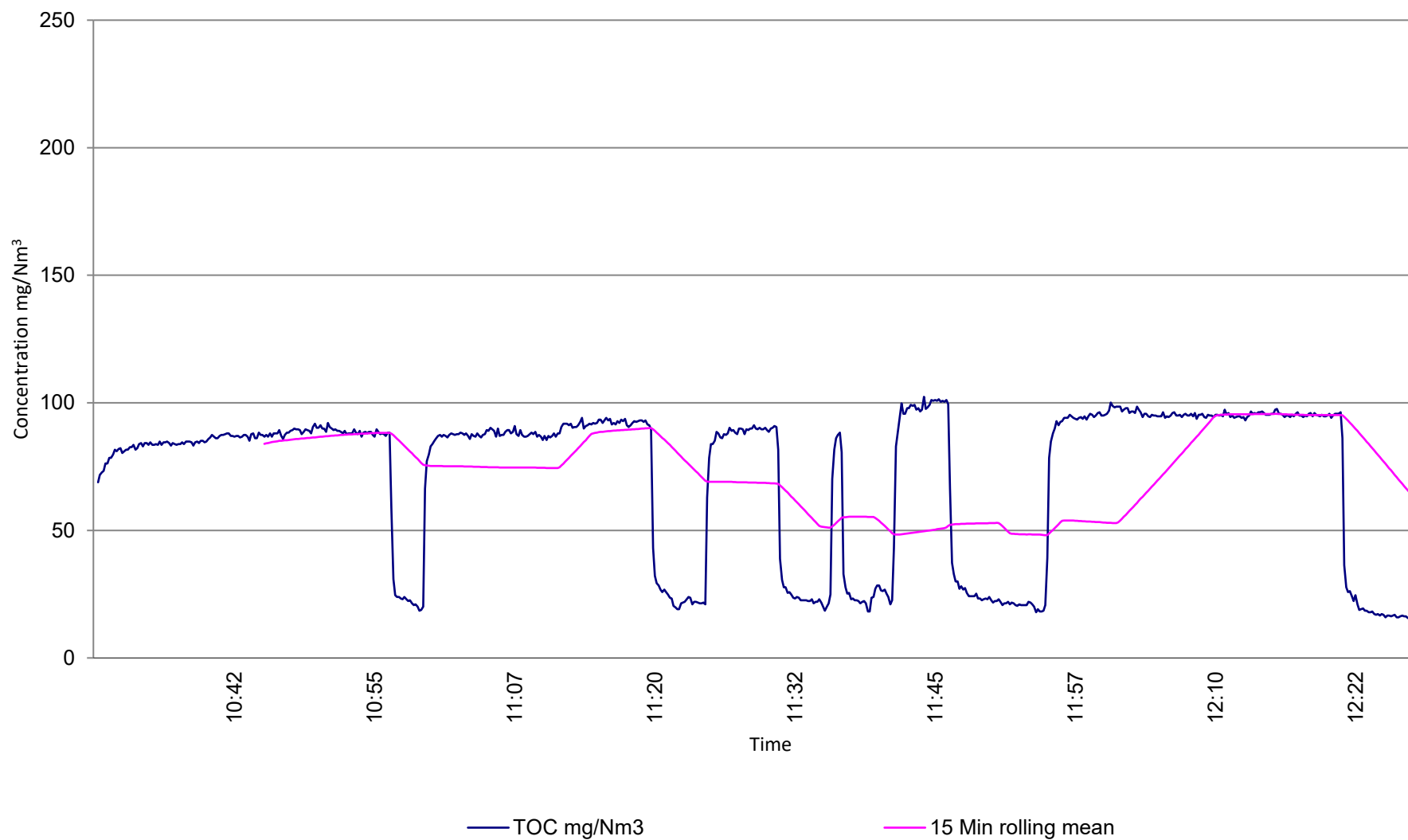
Anchem Laboratories Ltd TOC Summary

Customer name	Viscose
Site location	Llansamlet
Emission point	Post Thermal Oxidiser
Substance to be monitored	TOC (propane equivalent)
Sample Number	100161/9
Date	07/10/2021
Team leader	Phil Ruck
Analyst(s)	Elliot Jones
Barometric pressure (mb)	1023
Span Gas Concentration (ppm)	82.97
Span Gas Cylinder Reference	2733
Volume flow at STP (m ³ /hour)	5390.7
Start Time	10:30:00
End Time	12:30:00
% Drift	1.08
% Uncertainty	1.19
Average concentration @ STP (mg/Nm ³)	71.28
15 minute rolling mean @ STP (mg/Nm ³)	72.60
Highest 15 minute rolling mean @ STP (mg/Nm ³)	95.67
Emission rate @ STP wet gas (g/hour)	384
Emission uncertainty concentration	0.8

TOC concentrations measured on the Post Thermal Oxidiser, at Viscose, Llansamlet

Date: 7/10/2021

Sample No: 100161/9



TOC concentrations measured on the Post Thermal Oxidiser, at Viscose,
Llansamlet

Date: 7/10/2021

Sample No: 100161/9

Concentration	TOC mg/Nm ³	15 Min rolling mean
Minimum	13.4	48.1
Maximum	102.4	95.7
Average	71.3	72.6

TOC site worksheet

Customer name	Viscose
Site location	Llansamlet
Emission point	Post Thermal Oxidiser
Substance to be monitored	TOC (propane equivalent)
Date	07/10/2021
Sample Number	100161/9
Homogeneity test previously conducted? (Yes/No)	No
Is the gas stream homogeneous? (Yes/No/Unknown)	Unknown

Preliminary gas test

Sample point number	1	2	3	4	5	6	7	8	9
TOC concentration ppm	56								

Range of analyser	10 ²
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Start of test 10:30

Instrument adjustment through analyser

Initial instrument zero gas reading (ppm)	0.0
Instrument span gas reading (ppm)	83.3
Post instrument zero gas reading (ppm)	0.4

System leak test through line

Initial system leak zero gas reading (ppm)	0.4
System leak span gas reading (ppm)	83.1
Post system leak zero gas reading (ppm)	0.4

% Leak	0.2
--------	-----

End of test 12:30

System leak test through line

Initial drift zero gas reading (ppm)	0.0
System drift span gas reading (ppm)	82.2
Post drift zero gas reading (ppm)	0.2

Test Span Drift (%)	1.1
Test Zero Drift (%)	0.2

Combustion Gas Monitoring Summary

Sample Number	100161/10
Date	07/10/2021
Customer name	Viscose Closures
Site location	Llansamlet
Emission point	Thermal oxidiser
Emission point dimension (m)	0.64m
Emission point C.S.A. (m²)	0.3217
Team leader	Phil Ruck
Analyst(s)	Elliot Jones
Average Ambient pressure (mb)	1024
Average Ambient temperature (°C)	17
Instrument number	A/S545 (PG-350)
Probe length (m)	0.5m
Timer	A/L146
Homogeneity test previously conducted? (Yes/No)	No
Is the gas stream homogeneous? (Yes/No/Unknown)	Unknown
Test start time	10:30:00
Test end time	12:30:00
Volumetric flow @ reference conditions (m³/hour)	5390.7

Reference conditions

Temperature (K)	273
Pressure (kPa)	101.3
Moisture	Dry
Oxygen (%)	21

Carbon Monoxide

Average concentration CO (mg/m ³)	0.3
Maximum concentration CO (mg/m ³)	1.8
Minimum concentration CO (mg/m ³)	0.0
Mass Emission CO (Kg/hour)	0.00
% Uncertainty of measurement	45.8
Uncertainty Concentration mg/m ³	0.1

Oxides of Nitrogen (as NO₂)

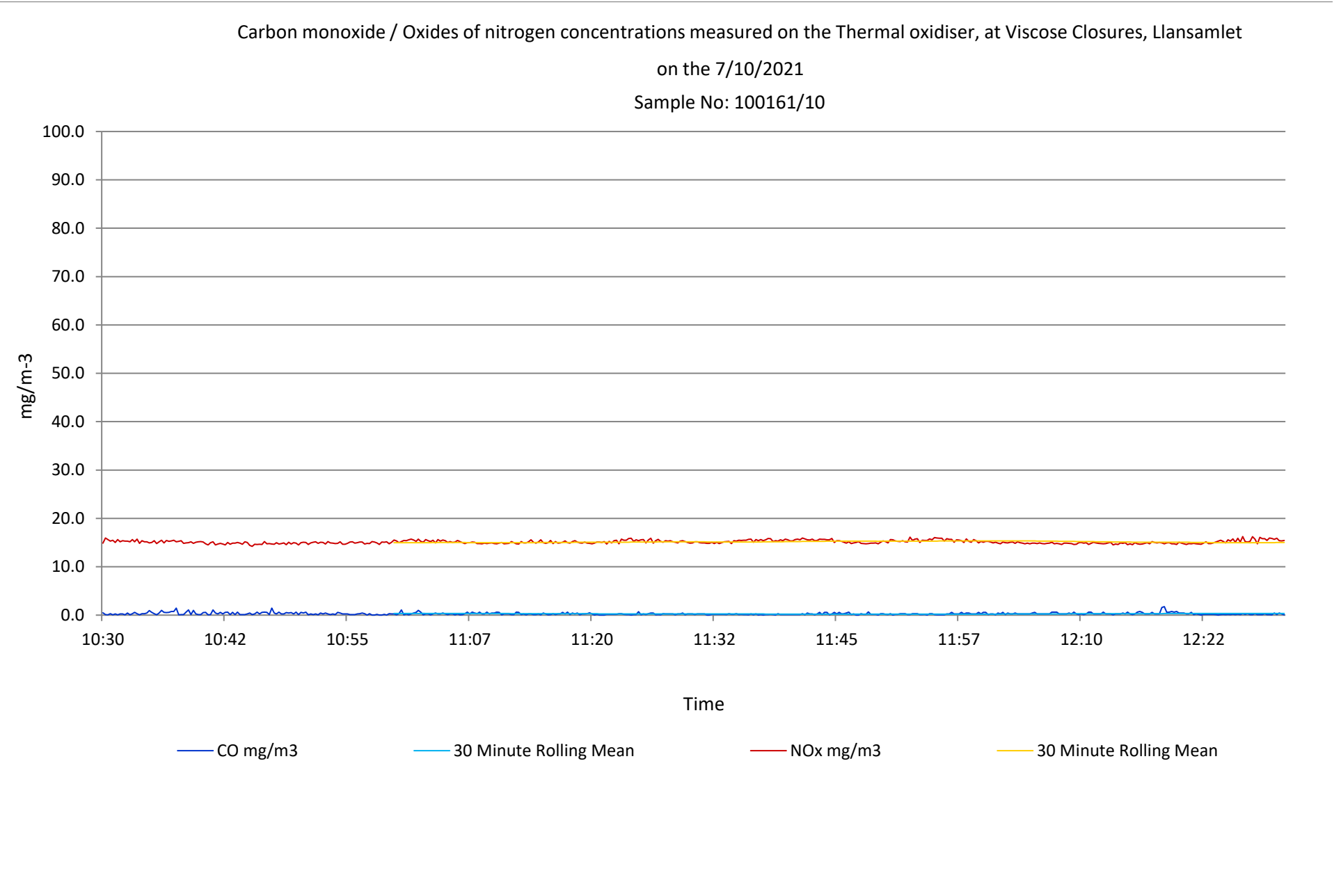
Average concentration NOx (mg/m ³)	15.1
Maximum concentration NOx (mg/m ³)	16.2
Minimum concentration NOx (mg/m ³)	14.2
Mass Emission NOx (Kg/hour)	0.08
% Uncertainty of measurement	1.6
Uncertainty Concentration mg/m ³	0.2

Carbon monoxide / Oxides of nitrogen concentrations measured on the Thermal oxidiser, at Viscose Closures, Llansamlet

on the 7/10/2021

Sample No: 100161/10

Concentration	CO mg/m ³	30 Minute Rolling Mean	NOx mg/m ³	30 Minute Rolling Mean	SO2 mg/m ³	30 Minute Rolling Mean	O ₂ %vol
Minimum	0.0	0.2	14.2	15.0			
Maximum	1.8	0.4	16.2	15.4			
Average	0.3	0.3	15.1	15.1			



Combustion Gas Site Data

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Customer	Viscose Closures
Emission Point	Thermal oxidiser
Date	07/10/2021
Sample No	100161/10

Pre test				
ANALYTE	CO	NO	SO ₂	O ₂
Zero through analyser (ppm)	0	0		
Span Through analyser (ppm)	101.6	155.2		
Zero through analyser (ppm)	0.0	0.3		
Zero Through line (ppm)	-0.40	0.10		
Span Through line (ppm)	101.6	154.9		
Residence Time (seconds)	46.0	48.0		
System T90 (seconds)	60	63		
T90 Value (ppm)	91.4	139.7		
Initial leak test				
	0.0	0.2		
Post test				
ANALYTE	CO	NO	SO ₂	O ₂
Zero Through Line	-0.30	0.00		
Span Through line (ppm)	102.1	153.70		
Span Drift (%)				
	0.5	0.8		
Zero Drift (%)				
	0.1	0.1		

Oxygen cylinder grade/reference	N/A
Nitrogen Monoxide cylinder grade/reference	VC0142 155.2ppm
Sulphur Dioxide cylinder grade/reference	N/A
Carbon Monoxide cylinder grade/reference	VC0142 101.6ppm

Gas conditioning Temperature Validation

Temperature @ Start of Test (°C)	2
Temperature During Test (°C)	2
Temperature @ End of Test (°C)	2
Temperature of Heated Line (°C)	180
Temperature of PD-100 oven (°C)	N/A

Stratification Data

Point	CO ppm	NO ppm	SO ₂ ppm	O ₂ % vol
1	0.38	7.25		
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

APPENDIX 5

(Uncertainty)

(11 Pages)



Uncertainty calculation for BS EN ISO 21877:2019 Determination of mass concentration of ammonia (NH₃), Reference method

A1 Scrubber

Limit value (ELV)	190	mg.m ⁻³	Reference oxygen		% by volume
Measured concentration	83.34	mg.m ⁻³ (at reference conditions)			

Measurement Equation

$$c = \frac{m}{V} f_c$$

Measured Quantities	Symbol	Value	Standard uncertainty	Units	Uncertainty as percentage	Uncertainty at lv	Requirement of std
Sampled Volume Gas	V _m	1.088389623	uV _m	0.001 m ³	0.09		<=2.5%
Sampled gas Temperature	T _m	294	uT _m	2 K	2.00		<=1.0%
Sampled gas Pressure	p _m	102.1651598	uP _m	0.5 kPa	0.49		<=1%
Sampled gas Humidity	H _m	0	uH _m	1 % by volume	1.00		<=1.0%
Oxygen content	O _{2,m}		uO _{2,m}	% by volume			<=5.0%
Concentration in impinger 1	C	273	uC	12.1485 mg/l	4.45		<5.0%
Impinger 1 solution volume	VS	0.342		0.001 l	0.29		<1.0%
Concentration in impinger 2	C	0.1		0.00445 mg/l	4.45		<5.0%
Impinger 2 solution volume	VS	0.15	uVS	0.001 l	0.67		<1.0%
Mass NH ₃	m	93.3318	um	5.91 mg	6.34	2.78	<5% of limit value
Note - Sampled gas humidity, temperature and pressure are values at the gas meter							
Leak	L	0.334728033		%	0.33		<=2.0%

Intermediate calculations

Factor for std conds	fs	0.94				
uncertainty components	symbol	sensitivity coeff	u (in units of fs)			
	p _m	0.009	0.005			
	H _m	0.009	0.009			
	T _m	0.003	0.006			
	ufs		0.012			1.30
Corrected volume	V	1.02	uV	0.013 m ³	$V = V_m f_s$	1.31
Factor for O2 correction	fc	1.00				
uncertainty components	symbol	sensitivity coeff	u			
	O _{2,m}	0.05	0.000		$f_c = \frac{21 - O_{2,ref}}{21 - O_{2,m}}$	
Factor for O2 Correction	ufc	1.00		0.000		0.00

Parameter	Value	Units	Sensitivity coeff	Uncertainty contribution	Uncertainty as %
Corrected Volume (standard condior	V	1.02 m ³	81.77	1.09 mg.m ⁻³	1.31 %
Mass	m	93.33 mg	0.89	5.28 mg.m ⁻³	6.34 %
Factor for O2 Correction	fc	1.00	83.34	0.00 mg.m ⁻³	0.00 %
Leak	L	0.16 mg.m ⁻³	1.00	0.16 mg.m ⁻³	0.19 %
CSA Nozzle		0.08 mg.m ⁻³	1.00	0.08 mg.m ⁻³	0.10 %
Combined uncertainty				5.39 mg.m ⁻³	

Expanded uncertainty as percentage of measured value	12.95	% measured of value	expressed with a level of confidence of 95% (Using a coverage factor k=2)
Expanded uncertainty in units of measurement	10.79	mg.m ⁻³	
Expanded uncertainty as percentage of limit value	5.68	% ELV	

Client	Viscose Ltd	Date	06/10/2021
Emission Point ID	A1 Scrubber	Sample Number	100161/02

CEN/TS 13649 measured concentration (mg/m³)	29.278		
ELV	105		

Measured Quantities	Value	Standard Uncertainty		Uncertainty as %	Symbol
Sampled Volume (m ³)	0.0209	0.001	m ³	4.78	V _m
Sampled gas Temperature (K)	294	1	K	0.34	T _m
Sampled gas Pressure (kPa)	102.10	0.5	kPa	0.49	ρ _m
Sampled gas Humidity (%)	0	1	% Vol	1	H _m
Leak (%)	0.00			0.00	L
Sub Con Laboratory (%)	15.00				
		Factor for Standard Conditions		0.94	f _s
<u>Uncertainty Components</u>	<u>Sensitivity Coeff</u>	<u>Uncertainty (in units of f_s)</u>		$f_s = \frac{(100 - H_m)}{100} \frac{273}{T_m} \frac{\rho_m}{101.3}$	
T _m	0.00	0.00			
ρ _m	0.01	0.00			
H _m	0.01	0.01			
ufs		0.01		1.16	
<u>Corrected Volume (v)</u>	0.02				V
	0.00	$V = V_m f_s$		5.24	uV
<u>Parameter</u>		<u>Sensitivity Coeff</u>			
Corrected Volume	0.02	1495.77	1.53	5.24	V
Leak	0.00	1	0.00	0.00	L
Sub Con Laboratory	2.54	1	2.54	8.66	
Combined Measurement Uncertainty (mg/m³)	2.96				
Measurement Uncertainty					
Combined Uncertainty (mg/m ³)	2.96				
Coverage Factor k	2				
Expanded uncertainty (mg/m ³)	5.93				
Expanded Uncertainty (% ELV)	5.64				
Expanded uncertainty (mg/m³)	5.9271				
Expanded uncertainty (% Value)	20.24				

Client	Viscose Closures Ltd	Date	06/10/2021
Emission Point ID	A1 Scrubber	Reference Number	100161/3

Measured H₂S concentration (mg/m³)	0.31	Reference Oxygen (%)	
ELV	2		

Measured Quantities	Value	Standard Uncertainty		Uncertainty as %	Symbol
Sampled Volume (m ³)	0.2953	0.001	m ³	0.34	V _m
Sampled gas Temperature (K)	294	2	K	0.68	T _m
Sampled gas Pressure (kPa)	102.17	0.5	kPa	0.49	p _m
Sampled gas Humidity (%)	0	1	% Vol	1	H _m
Oxygen content (%)		0.1	% Vol		O _{2,m}
Leak (%)	0.33			0.33	L
Sub Con Laboratory (%)	7.0				
		Factor for Standard Conditions		0.94	f _s
Uncertainty Components	Sensitivity Coeff	Uncertainty (in units of f _s)			
T _m	0.00	0.01		$f_s = \frac{(100 - H_m)}{100} \frac{273}{T_m} \frac{\rho_m}{101.3}$	
p _m	0.01	0.00			
H _m	0.01	0.01			
ufs		0.01		1.30	
Corrected Volume (v)	0.28				V
	0.00	$V = V_m f_s$		1.35	uV
Factor for O ₂ Correction	1.00				f _c
	0.05				O _{2,m}
	0.00	$f_c = \frac{21 - O_{2,ref}}{21 - O_{2,m}}$			u
	0.48				ufc
Parameter		Sensitivity Coeff			
Corrected Volume	0.28	1.12	0.00	1.35	V
Factor for O ₂ Correction	1.00	0.31	0.00	0.48	f _c
Leak	0.00	1	0.00	0.19	L
Sub Con Laboratory	0.01	1	0.01	4.04	
CSA Nozzle	0.00	1	0.00	0.01	
Combined Measurement Uncertainty (mg/m ³)	0.01				
Measurement Uncertainty					
Combined Uncertainty (mg/m ³)	0.01				
Coverage Factor k	2				
Expanded uncertainty (mg/m ³)	0.03				
Expanded Uncertainty (% ELV)	1.32				
Expanded uncertainty (mg/m ³)	0.03				
Expanded uncertainty (% Value)	8.59				

Uncertainty calculation for BS EN ISO 21877:2019 Determination of mass concentration of ammonia (NH₃), Reference method

A2 Rocket

Measurement Equation

$$c = \frac{m}{V} f_c$$

Limit value (ELV)	10	mg.m ⁻³	Reference oxygen		% by volume
Measured concentration	7.76	mg.m ⁻³ (at reference conditions)			

Measured Quantities	Symbol	Value	Standard uncertainty	Units	Uncertainty as percentage	Uncertainty at lv	Requirement of std
Sampled Volume Gas	V _m	1.095882624	uV _m	0.001 m ³	0.09		<=2.5%
Sampled gas Temperature	T _m	298	uT _m	2 k	2.00		<=1.0%
Sampled gas Pressure	p _m	102.1913087	uρ _m	0.5 kPa	0.49		<=1%
Sampled gas Humidity	H _m	0	uH _m	1 % by volume	1.00		<=1.0%
Oxygen content	O _{2,m}		uO _{2,m}	% by volume			<=5.0%
Concentration in impinger 1	C	18.8	uC	0.8366 mg/l	4.45		<5.0%
Impinger 1 solution volume	VS	0.462		0.001 l	0.22		<1.0%
Concentration in impinger 2	C	0.1		0.00445 mg/l	4.45		<5.0%
Impinger 2 solution volume	VS	0.15	uVS	0.001 l	0.67		<1.0%
Mass NH ₃	m	8.6394	um	0.55 mg	6.33	4.92	<5% of limit value
Note - Sampled gas humidity, temperature and pressure are values at the gas meter							
Leak	L	0.620689655		%	0.62		<=2.0%

Intermediate calculations

Factor for std conds	fs	0.92				
uncertainty components	symbol	sensitivity coeff	u (in units of fs)			
	ρ _m	0.009	0.005			
	H _m	0.009	0.009			
	T _m	0.003	0.006			
	ufs		0.012			1.30
Corrected volume	V	1.01	uV	0.013 m ³	$V = V_m f_s$	1.30
Factor for O2 correction	fc	1.00				
uncertainty components	symbol	sensitivity coeff	u			
	O _{2,m}	0.05	0.000		$f_c = \frac{21 - O_{2,ref}}{21 - O_{2,m}}$	
Factor for O2 Correction	ufc	1.00		0.000		0.00

Parameter	Value	Units	Sensitivity coeff	Uncertainty contribution	Uncertainty as %
Corrected Volume (standard conditior	V	1.01 m ³	7.67	0.10 mg.m ⁻³	1.30 %
Mass	m	8.64 mg	0.90	0.49 mg.m ⁻³	6.33 %
Factor for O2 Correction	fc	1.00	7.76	0.00 mg.m ⁻³	0.00 %
Leak	L	0.03 mg.m ⁻³	1.00	0.03 mg.m ⁻³	0.36 %
CSA Nozzle		0.01 mg.m ⁻³	1.00	0.01 mg.m ⁻³	0.18 %
Combined uncertainty				0.50 mg.m ⁻³	

Expanded uncertainty as percentage of measured value	12.95	% measured of value	expressed with a level of confidence of 95% (Using a coverage factor k=2)
Expanded uncertainty in units of measurement	1.01	mg.m ⁻³	
Expanded uncertainty as percentage of limit value	10.06	% ELV	

Client	Viscose Ltd	Date	06/10/2021
Emission Point ID	Rocket	Sample Number	100161/05

CEN/TS 13649 measured concentration (mg/m³)	14.810		
ELV	17		

Measured Quantities	Value	Standard Uncertainty	Uncertainty as %	Symbol
Sampled Volume (m ³)	0.0262	0.001 m ³	3.82	V _m
Sampled gas Temperature (K)	298	1 K	0.34	T _m
Sampled gas Pressure (kPa)	102.10	0.5 kPa	0.49	p _m
Sampled gas Humidity (%)	0	1 % Vol	1	H _m
Leak (%)	0.00		0.00	L
Sub Con Laboratory (%)	15.00			
		Factor for Standard Conditions	0.92	f _s
Uncertainty Components	Sensitivity Coeff	Uncertainty (in units of f_s)	$f_s = \frac{(100 - H_m)}{100} \frac{273}{T_m} \frac{\rho_m}{101.3}$	
T _m	0.00	0.00		
p _m	0.01	0.00		
H _m	0.01	0.01		
ufs		0.01	1.16	
Corrected Volume (v)	0.02			V
	0.00	$V = V_m f_s$	4.30	uV
Parameter		Sensitivity Coeff		
Corrected Volume	0.02	612.67	0.64	4.30
Leak	0.00	1	0.00	0.00
Sub Con Laboratory	1.28	1	1.28	8.66
Combined Measurement Uncertainty (mg/m³)	1.43			
Measurement Uncertainty				
Combined Uncertainty (mg/m ³)	1.43			
Coverage Factor k	2			
Expanded uncertainty (mg/m ³)	2.86			
Expanded Uncertainty (% ELV)	16.84			
Expanded uncertainty (mg/m³)	2.8635			
Expanded uncertainty (% Value)	19.34			

Client	Viscose Ltd	Date	06/10/2021
Emission Point ID	A2 Rocket	Reference Number	100161/6

Measured H₂S concentration (mg/m³)	0.32	Reference Oxygen (%)	
ELV	1		

Measured Quantities	Value	Standard Uncertainty		Uncertainty as %	Symbol
Sampled Volume (m ³)	0.2795	0.001	m ³	0.36	V _m
Sampled gas Temperature (K)	298	2	K	0.67	T _m
Sampled gas Pressure (kPa)	102.19	0.5	kPa	0.49	ρ _m
Sampled gas Humidity (%)	0	1	% Vol	1	H _m
Oxygen content (%)		0.1	% Vol		O _{2,m}
Leak (%)	0.27			0.27	L
Sub Con Laboratory (%)	7.0				
		Factor for Standard Conditions		0.92	f _s
Uncertainty Components	Sensitivity Coeff	Uncertainty (in units of f _s)			
T _m	0.00	0.01		$f_s = \frac{(100 - H_m)}{100} \cdot \frac{273}{T_m} \cdot \frac{\rho_m}{101.3}$	
ρ _m	0.01	0.00			
H _m	0.01	0.01			
ufs		0.01			1.30
Corrected Volume (v)	0.26				V
	0.00	$V = V_m \cdot f_s$		1.36	uV
Factor for O ₂ Correction	1.00				f _c
	0.05				O _{2,m}
	0.00	$f_c = \frac{21 - O_{2,ref}}{21 - O_{2,m}}$			u
	0.48				ufc
Parameter		Sensitivity Coeff			
Corrected Volume	0.26	1.25	0.00	1.36	V
Factor for O ₂ Correction	1.00	0.32	0.00	0.48	f _c
Leak	0.00	1	0.00	0.16	L
Sub Con Laboratory	0.01	1	0.01	4.04	
CSA Nozzle	0.00	1	0.00	0.01	
Combined Measurement Uncertainty (mg/m ³)	0.01				
Measurement Uncertainty					
Combined Uncertainty (mg/m ³)	0.01				
Coverage Factor k	2				
Expanded uncertainty (mg/m ³)	0.03				
Expanded Uncertainty (% ELV)	2.77				
Expanded uncertainty (mg/m ³)	0.03				
Expanded uncertainty (% Value)	8.59				

Uncertainty calculation for EN 13284 Determination of low range mass concentration of dust, Manual Gravimetric Method

Thermal Oxidiser

Limit value (ELV)	50 mg.m ⁻³	Reference oxygen		% by volume
Measured concentration	0.45 mg.m ⁻³ (at reference conditions)			

Measurement Equation

$$c = \frac{m}{V} f_c$$

Measured Quantities	Symbol	Value	Standard uncertainty	Units	Uncertainty as percentage	Uncertainty at lv	Requirement of std
Sampled Volume	V _m	2.17	uV _m	0.001 m ³	0.05		<=2%
Sampled gas Temperature	T _m	407	uT _m	2 K	0.49		<=1%
Sampled gas Pressure	p _m	102.72	uP _m	0.5 kPa	0.49		<=1%
Sampled gas Humidity	H _m	0	uH _m	1 % by volume	1.00		<=1%
Oxygen content	O _{2,m}		uO _{2,m}	% by volume			<=5%
Mass particulate	m	0.98	um	0.02 mg	2.20	0.02	<5% of limit value
Note - Sampled gas humidity, temperature and pressure are values at the gas meter							
Leak	L	0.4		%	0.42		<=2%
Uncollected Mass (Instack filter - no rinse)	UCM	0		mg	0		<=10%

Intermediate calculations

Factor for std conds	fs	0.68				
uncertainty components	symbol	sensitivity coeff	u (in units of fs)			
	p _m	0.007	0.003			
	H _m	0.007	0.007			
	T _m	0.002	0.003			
	ufs		0.008			1.22
Corrected volume	V	1.47	uV	0.018 m ³	$V = V_m \cdot f_s$	1.22
Factor for O2 correction	fc	1.00				
uncertainty components	symbol	sensitivity coeff	u			
	O _{2,m}	0.05	0.000		$f_c = \frac{21 - O_{2,ref}}{21 - O_{2,m}}$	
Factor for O2 Correction	ufc	1.00	0.000			0.00

Parameter	Value	Units	Sensitivity coeff	Uncertainty contribution	Uncertainty as %
Corrected Volume (standard conditi	V	1.47 m ³	0.30	0.01 mg.m ⁻³	1.22 %
Mass	m	0.98 mg	0.45	0.01 mg.m ⁻³	2.20 %
Factor for O2 Correction	fc	1.00	0.45	0.00 mg.m ⁻³	0.00 %
Leak	L	0.00 mg.m ⁻³	1.00	0.00 mg.m ⁻³	0.24 %
Uncollected mass	UCM	0.00 mg	0.45	0.00 mg.m ⁻³	0.00 %
CSA Nozzle		0.00 mg.m ⁻³	1.00	0.00 mg.m ⁻³	0.24 %
Combined measurement uncertainty				0.01 mg.m ⁻³	

Expanded uncertainty as percentage of measured value	5.08	% measured of value	expressed with a level of confidence of 95% (Using a coverage factor k=2)
Expanded uncertainty in units of measurement	0.02	mg.m ⁻³	
Expanded uncertainty as percentage of limit value	0.05	% ELV	

Client	Viscose	Date	07/10/2021
Emission Point ID	Pre Thermal Oxidiser	Sample Number	100161/8

Measured TOC concentration (mg/m ³)	283.88	Calibration Value (mg/m ³)	1567.51
ELV	N/A	Scale used (mg/m ³)	1964.30

Performance Characteristic		Specification	Uncertainty	
Response Time (seconds)	3	<200s		
Logger Sampling Interval (seconds)	10			
Measurement Period (minutes)	120			
Number of Readings in Measurements	720			
Standard dev Repeat @ Zero	0.63	≤±2.0% Range	u _{r0}	N/A
Standard dev Repeat @ Span	0.36	≤±2.0% Range	u _{rs}	0.01
Deviation from Linearity (±)	0.02	≤±2.0% Range	u _{fit}	0.23
Zero Drift (During Measurement)	0.00	% full scale	u _{odr}	0.00
Span Drift (During Measurement)	0.00	% full scale		
Losses in the Line (Leak)	0.25	<2% of value	u _{leak}	0.41
Sensitivity to Sample Gas Flow	1.6	<2.0% of the certification range	u _{spres}	0.00
Sensitivity to Ambient Temp @ Span	1.4	<5.0% of the certification range	u _{temp}	0.00
Sensitivity to Ambient Temp @ Zero	-2.4	<5.0% of the certification range		0.00
Influence of voltage variations	0.50	<2.0% of the certification range	u _{volt}	0.00
Effect of oxygen	0.71	<2% of the certification range	u _{int}	0.00
Measurement Uncertainty				
Combined Uncertainty (mg/m ³)	0.47			
Coverage Factor k	2			
Expanded uncertainty (mg/m ³)	0.94			
Expanded Uncertainty (% ELV)	N/A			
Expanded uncertainty (mg/m ³)	0.94			
Expanded uncertainty (% Value)	0.33			
Requirement in EA TGN M2 is for uncertainty to be < ±15% of the measured value				

ISO 16911 L-Type Pitot Uncertainty

Document Reference: -	ANC365	Issue No: 5	Page 1 of 1
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Client	Viscose Closures
Site	Llansamlet
Emission Point	Pre RTO
Date	07/10/2021
Sample Number	100161/8

Uncertainty	Estimated Value %	Measured Value %	sqr est	sqr meas
Equipment Sources				
Master System Velocity Measurements		1	0	1
Master System Air Density Measurement		0.15	0	0.0225
Tape Measure		2	0	4
Testo			0	0
Thermocouples		1	0	1
Sensitivity to Atmospheric Pressure	2		4	0
Sensitivity to Ambient Temperature	2		4	0
Site Sources				
Stack Internal Area		3.18716E-06	0	1.0158E-11
Uncertainty in Flow Measurement Device Calibration	1		1	0
Uncertainty in Differential Pressure Device Calibration	1		1	0
Time	0		0	0
L-Type Blockage Test		0.00%	0	0
Repeatability at single point			0	0
Swirl/Pitch Meter Position	2		4	0
Temperature on site			0	0
Pressure on Site			0	0
Humidity on Site	0		0	0
Laboratory Sources				
Uncertainty due to Caibration	2		4	0
Repeatability (hPa)		0.97	0	0.9409
Repeatability (m/s)		0.26		
Linearity	2		4	0
Measurement of Duct Diameter		0.67	0	0.4489
Effect of Swirl Angle (Clockwise)		1.2	0	1.44
Effect of Swirl Angle (Anti-clockwise)		0.88	0	0.7744
Sum of squares			31.6267	
		Total Uncertainty	5.6	

Client	Viscose	Date	07/10/2021
Emission Point ID	Post Thermal Oxidiser	Sample Number	100161/9

Measured TOC concentration (mg/m ³)	71.28	Calibration Value (mg/m ³)	163.63
ELV	150	Scale used (mg/m ³)	196.43

Performance Characteristic		Specification	Uncertainty	
Response Time (seconds)	3	<200s		
Logger Sampling Interval (seconds)	10			
Measurement Period (minutes)	120			
Number of Readings in Measurements	720			
Standard dev Repeat @ Zero	0.63	≤±2.0% Range	u _{r0}	N/A
Standard dev Repeat @ Span	0.36	≤±2.0% Range	u _{rs}	0.01
Deviation from Linearity (±)	0.02	≤±2.0% Range	u _{fit}	0.02
Zero Drift (During Measurement)	0.24	% full scale	u _{odr}	0.41
Span Drift (During Measurement)	1.08	% full scale		
Losses in the Line (Leak)	0.24	<2% of value	u _{leak}	0.10
Sensitivity to Sample Gas Flow	1.6	<2.0% of the certification range	u _{spres}	0.00
Sensitivity to Ambient Temp @ Span	1.4	<5.0% of the certification range	u _{temp}	0.00
Sensitivity to Ambient Temp @ Zero	-2.4	<5.0% of the certification range		0.00
Influence of voltage variations	0.50	<2.0% of the certification range	u _{volt}	0.00
Effect of oxygen	0.71	<2% of the certification range	u _{int}	0.00
Measurement Uncertainty				
Combined Uncertainty (mg/m ³)	0.42			
Coverage Factor k	2			
Expanded uncertainty (mg/m ³)	0.85			
Expanded Uncertainty (% ELV)	0.57			
Expanded uncertainty (mg/m ³)	0.85			
Expanded uncertainty (% Value)	1.19			
Requirement in EA TGN M2 is for uncertainty to be < ±15% of the measured value				

Uncertainty Budget for Oxides of nitrogen

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Client	Viscose Closures	Date	07/10/2021
Emission Point ID	Thermal oxidiser	Sample Number	100161/10

Measured NOx concentration (mg/m³)	15.13	Calibration Value (mg/m³)	318.16
ELV	100	Scale used (mg/m³)	512.50

Performance Characteristic		Specification	Uncertainty	
Response Time (seconds)	33	<200s		
Logger Sampling Interval (seconds)	15			
Measurement Period (minutes)	120			
Number of Readings in Measurements	480			
Standard dev Repeat @ Zero	0.04	≤±1.0% Range	u _{r0}	N/A
Standard dev Repeat @ Span	0.08	≤±2.0% Range	u _{rs}	0.00
Deviation from Linearity (±)	0.02	≤±2.0% Range	u _{fit}	0.06
Zero Drift (During Measurement)	0.06	% full scale	u _{odr}	0.06
Span Drift (During Measurement)	0.77	% full scale		
Losses in the Line (Leak)	0.19	<2% of value	u _{leak}	0.02
Sensitivity to Atmospheric Pressure	0.1	<1.5% of the certification range	u _{apres}	0.00
Sensitivity to Sample Gas Flow	0.1	<1.0% of the certification range	u _{spres}	0.00
Sensitivity to Ambient Temp @ Span	1.53	<3.0% of the certification range	u _{temp}	0.00
Sensitivity to Ambient Temp @ Zero	0.04	<3.0% of the certification range		0.00
Sensitivity to Electric Voltage	-0.23	<2.0% of the certification range	u _{volt}	0.00
Cross Sensitivity (Interferents)	0.00	<4% of the certification range	u _{int}	0.00
Uncertainty of calibration gas	1	<2% of value	u _{calib}	0.09
Uncertainty in Factor	0.00		u _f	0.00
Measurement Uncertainty				
Combined Uncertainty (mg/m ³)	0.12			
Coverage Factor k	2			
Expanded uncertainty (mg/m ³)	0.24			
Expanded uncertainty to std conditions (mg/m ³)	0.24			
Expanded Uncertainty (% ELV)	0.24			
Expanded uncertainty (mg/m³)	0.24			
Expanded uncertainty (% Value)	1.61			
Requirement in standard is for uncertainty to be < ±10% at ELV at standard conditions				

Uncertainty Budget for Carbon monoxide

Document Reference ANC417 H	Issue No: 10	Page 1 of 1
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Client	Viscose Closures	Date	07/10/2021
Emission Point ID	Thermal oxidiser	Sample Number	100161/10

Measured CO concentration (mg/m³)	0.29	Calibration Value (mg/m³)	127.00
ELV	100	Scale used (mg/m³)	250.00

Performance Characteristic		Specification	Uncertainty	
Response Time (seconds)	28	<200s		
Logger Sampling Interval (seconds)	15			
Measurement Period (minutes)	120			
Number of Readings in Measurements	480			
Standard dev Repeat @ Zero	0.16	≤±1.0% Range	u _{ro}	N/A
Standard dev Repeat @ Span	0.35	≤±2.0% Range	u _{rs}	0.02
Deviation from Linearity (±)	0.02	≤±2.0% Range	u _{fit}	0.03
Zero Drift (During Measurement)	0.10	% full scale	u _{odr}	0.06
Span Drift (During Measurement)	0.49	% full scale		
Losses in the Line (Leak)	0.00	<2% of value	u _{leak}	0.00
Sensitivity to Atmospheric Pressure	0.22	<1.5% of the certification range	u _{apres}	0.00
Sensitivity to Sample Gas Flow	0.1	<1.0% of the certification range	u _{spres}	0.00
Sensitivity to Ambient Temp @ Span	2	<3.0% of the certification range	u _{temp}	0.00
Sensitivity to Ambient Temp @ Zero	-0.2	<3.0% of the certification range		0.00
Sensitivity to Electric Voltage	-0.35	<2.0% of the certification range	u _{volt}	0.00
Cross Sensitivity (Interferents)	0.53	<4% of the certification range	u _{int}	0.00
Uncertainty of calibration gas	2	<2% of value	u _{calib}	0.00
Uncertainty in Factor	0.00		u _f	0.00
Measurement Uncertainty				
Combined Uncertainty (mg/m ³)	0.07			
Coverage Factor k	2			
Expanded uncertainty (mg/m ³)	0.13			
Expanded uncertainty to std conditions (mg/m ³)	0.13			
Expanded Uncertainty (% ELV)	0.13			
Expanded uncertainty (mg/m³)	0.13			
Expanded uncertainty (% Value)	45.83			
Requirement in standard is for uncertainty to be < ±6% at ELV at standard conditions				

APPENDIX 6

(Sub-contracted laboratory results)

(17 Pages)



Certificate of Analysis

Report No.: 21-12360-1

Issue No.: 1

Date of Issue 26/10/2021

Customer Details: Anchem Laboratories Ltd, Unit 5A, D'Arcy Business Park, D'Arcy Way, Llandarcy, Neath, SA10 6EJ, Wales

Customer Contact: Philip Ruck

Customer Order No.: 2020/225

Customer Reference: Stack

Quotation Reference: Q21-01410

Description: 9 liquid samples

Date Received: 11/10/2021

Date Started: 12/10/2021

Date Completed: 26/10/2021

Test Methods: Details available on request (refer to SOP code against relevant result/s)

Notes: None



Approved By: Joanne Dewhurst, Operational Manager

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service.

This certificate shall not be reproduced except in full without the prior written approval of the laboratory.

Observations and interpretations are outside of the scope of UKAS accreditation.

Results reported herein relate only to the items supplied to the laboratory for testing.

Results on an Interim Report are not dry-weight corrected.

Where the laboratory is not responsible for the sampling, results apply to the sample(s) as they were received.

The laboratory shall not be responsible for any information that is supplied by the customer that may affect the validity of results.



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Results Summary

Report No.: 21-12360-1

Customer Reference: Stack

Customer Order No: 2020/225

Customer Sample No	100161/01 Impinger 1&2 Solution	100161/04 Impinger 1&2 Solution	100161/01 Impinger 1&2 Blank Solution
RPS Sample No	66958	66959	66960
Sample Matrix	SOLUTION	SOLUTION	SOLUTION
Sampling Date	06/10/2021	06/10/2021	06/10/2021

Determinand	CAS No	Codes	SOP	RL	Units			
volume of sample supplied		U	N/A	n/a	ml	342	462	340
ammonia	7664-41-7	UM	A6	0.1	ug/mL	273	18.8	< 0.1

Results Summary

Report No.: 21-12360-1

Customer Reference: Stack

Customer Order No: 2020/225

Customer Sample No	100161/04 Impinger 1&2 Blank Solution	100161/01 Impinger 3 Solution	100161/04 Impinger 3 Solution
RPS Sample No	66961	66962	66963
Sample Matrix	SOLUTION	SOLUTION	SOLUTION
Sampling Date	06/10/2021	06/10/2021	06/10/2021

Determinand	CAS No	Codes	SOP	RL	Units			
volume of sample supplied		U	N/A	n/a	ml	412	150	150
ammonia	7664-41-7	UM	A6	0.1	ug/mL	< 0.1	< 0.1	< 0.1

Results Summary

Report No.: 21-12360-1

Customer Reference: Stack

Customer Order No: 2020/225

Customer Sample No	100161/01 Impinger 3 Blank Solution	100161/04 Impinger 3 Blank Solution	100161 Blank Absorption Solution
RPS Sample No	66964	66965	66966
Sample Matrix	SOLUTION	SOLUTION	SOLUTION
Sampling Date	06/10/2021	06/10/2021	06/10/2021

Determinand	CAS No	Codes	SOP	RL	Units			
volume of sample supplied		U	N/A	n/a	ml	142	162	222
ammonia	7664-41-7	UM	A6	0.1	ug/mL	< 0.1	< 0.1	< 0.1

Deviating Samples

Report No.: 21-12360-1

Customer Reference: Stack

Customer Order No: 2020/225

Our policy on Deviating Samples has been implemented in accordance with UKAS Policy on Deviating Samples (TPS63).

RPS is not responsible for the integrity of samples as received, unless RPS personnel performed the sampling. Samples submitted may be declared to be deviating.

Where applicable the analysis method remains UKAS accredited, however results reported for a deviating sample may be compromised.

Where no sampling date was supplied, samples have been declared to be deviating. If the date can be supplied, results may be reissued if assessed not deviating.

Where the sample container used was unsuitable or broken, the sample is flagged as deviating and re-sampling/re-submission may be required.

RPS No.	Customer No.	Customer ID	Date Sampled	Containers Received	Deviating	Reason for Deviation
66958	100161/01	Impinger 1&2 Solution	06/10/2021	Container	No	
	100161/04					
66959	100161/01	Impinger 1&2 Solution	06/10/2021	Container	No	
66960	100161/01	Impinger 1&2 Blank Solution	06/10/2021	Container	No	
	100161/04					
66961	100161/01	Impinger 1&2 Blank Solution	06/10/2021	Container	No	
66962	100161/01	Impinger 3 Solution	06/10/2021	Container	No	
66963	100161/01	Impinger 3 Solution	06/10/2021	Container	No	
	100161/04					
66964	100161/01	Impinger 3 Blank Solution	06/10/2021	Container	No	
66965	100161/01	Impinger 3 Blank Solution	06/10/2021	Container	No	
	100161/04					
66966	100161	Absorption Solution	06/10/2021	Container	No	

Report No.: 21-12360-1

Key Code	Description
N	Not Accredited Test
U	UKAS Accredited Test - UKAS accreditation is only implied if the report carries the UKAS logo
UF	UKAS Flexible Scope Test
M	MCERTS Accredited Test - MCERTS accreditation is only implied if the report carries the MCERTS logo
O	Marine Management Organisation (MMO) Validated
SN	Subcontracted to approved laboratory not accredited for the test
SU	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
SIN	Subcontracted to internal RPS Group laboratory not accredited for the test
SIU	Subcontracted to internal RPS Group laboratory UKAS Accredited for the test
SIM	Subcontracted to internal RPS Group laboratory MCERTS/UKAS Accredited for the test
I/S (in results)	Insufficient Sample
U/S (in results)	Unsuitable Sample
S/C (in results)	See Comments
ND (in results)	Not Detected
L (in results)	Result is outside normal limits

Please note that all samples will be destroyed 4 WEEKS after the report has been issued.

Note: Sample retention may be subject to agreement with the customer for particular projects

Certificate Notes	Description
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Report No.: 21-12360-1

Determinand	CAS No	Media	SOP	% Recovery	% Uncertainty
acetaldehyde	75-07-0	tube	A40	98	16.2
benzaldehyde	100-52-7	tube	A40	100	19.4
butyraldehyde	123-72-8	tube	A40	92	11.5
formaldehyde	50-00-0	tube	A40	97	12.8
hexanal	66-25-1	tube	A40	89	11
propionaldehyde	123-38-6	tube	A40	96	12.6
valeraldehyde	110-62-3	tube	A40	93	12.3
ammonia	7664-41-7	sulphuric acid solution	A6	n/a	8.9
chlorine	7782-50-5	sodium hydroxide solution	C27	n/a	15.2
hydrogen bromide	10035-10-6	sulphuric acid solution	C27	n/a	10.9
hydrogen chloride	7647-01-0	deionised water	C27	n/a	7.9
hydrogen chloride	7647-01-0	sulphuric acid solution	C27	n/a	13.3
hydrogen fluoride	7664-3-3	sodium hydroxide solution	C27	n/a	7.9
sulphur dioxide	7446-09-5	hydrogen peroxide solution	C27	n/a	7.7
nitrogen oxide	10102-43-9	potassium permanganate solution	C27	n/a	11.7
particulates	n/a	filter	D9	n/a	12.2
particulates	n/a	wash solution	D9	n/a	14.8
formaldehyde	50-00-0	deionised water	M103	n/a	23.7
2,4- & 2,6-toluene diisocyanate (TDI)	n/a	filter	M119	n/a	8.6
hexamethylene diisocyanate (HDI)	822-06-0	filter	M119	n/a	5.6
methylene diphenyl diisocyanate (MDI)	101-68-8	filter	M119	n/a	11.8
hydrogen sulphide	7783-06-4	zinc acetate solution	M120	n/a	4.2
antimony	7440-36-0	filter	M31	n/a	10.3
arsenic	7440-38-2	filter	M31	n/a	17.1
cadmium	7440-43-9	filter	M31	n/a	12.1
chromium	7440-47-3	filter	M31	n/a	17.1
cobalt	7440-48-4	filter	M31	n/a	13.1
copper	7440-50-8	filter	M31	n/a	14
lead	7439-92-1	filter	M31	n/a	9.8
manganese	7439-96-5	filter	M31	n/a	17.5
nickel	7440-02-0	filter	M31	n/a	14.4
thallium	7440-28-0	filter	M31	n/a	15.3
tin	7440-31-5	filter	M31	n/a	18.5
vanadium	7440-62-2	filter	M31	n/a	12.1
zinc	7440-66-6	filter	M31	n/a	15.2
antimony	7440-36-0	nitric acid wash	M31	n/a	10.3
arsenic	7440-38-2	nitric acid wash	M31	n/a	17.1
cadmium	7440-43-9	nitric acid wash	M31	n/a	12.1
chromium	7440-47-3	nitric acid wash	M31	n/a	17.1
cobalt	7440-48-4	nitric acid wash	M31	n/a	13.1
copper	7440-50-8	nitric acid wash	M31	n/a	14
lead	7439-92-1	nitric acid wash	M31	n/a	9.8
manganese	7439-96-5	nitric acid wash	M31	n/a	17.5
nickel	7440-02-0	nitric acid wash	M31	n/a	14.4
selenium	7782-49-2	nitric acid wash	M31	n/a	15.1
thallium	7440-28-0	nitric acid wash	M31	n/a	15.3
tin	7440-31-5	nitric acid wash	M31	n/a	18.5
vanadium	7440-62-2	nitric acid wash	M31	n/a	12.1
zinc	7440-66-6	nitric acid wash	M31	n/a	15.2
antimony	7440-36-0	nitric/peroxide solution	M31	n/a	5.9
arsenic	7440-38-2	nitric/peroxide solution	M31	n/a	6.8
cadmium	7440-43-9	nitric/peroxide solution	M31	n/a	6.3
chromium	7440-47-3	nitric/peroxide solution	M31	n/a	7.2
cobalt	7440-48-4	nitric/peroxide solution	M31	n/a	5.2
copper	7440-50-8	nitric/peroxide solution	M31	n/a	6.8
lead	7439-92-1	nitric/peroxide solution	M31	n/a	8.6
manganese	7439-96-5	nitric/peroxide solution	M31	n/a	9.6
nickel	7440-02-0	nitric/peroxide solution	M31	n/a	5.5
selenium	7782-49-2	nitric/peroxide solution	M31	n/a	8.7
thallium	7440-28-0	nitric/peroxide solution	M31	n/a	7.7
tin	7440-31-5	nitric/peroxide solution	M31	n/a	5.8
vanadium	7440-62-2	nitric/peroxide solution	M31	n/a	6.7
zinc	7440-66-6	nitric/peroxide solution	M31	n/a	11.9
1,2,4-trimethylbenzene	95-63-6	tube	O8	88	8.1
1,3,5-trimethylbenzene	108-67-8	tube	O8	92	7.7
2-ethyltoluene	611-14-3	tube	O8	91	8.4
3- & 4-ethyltoluene	n/a	tube	O8	91	8.4
benzene	71-43-2	tube	O8	90	13.9
butyl acetate	123-86-4	tube	O8	90	10.3
decane	124-18-5	tube	O8	97	6.7
dichloromethane	75-09-2	tube	O8	88	24
ethyl acetate	141-78-6	tube	O8	n/a	n/a
ethyl benzene	100-41-4	tube	O8	92	9.8
heptane	142-82-5	tube	O8	94	10.5
hexane	110-54-3	tube	O8	n/a	n/a
limonene	138-86-3	tube	O8	93	13
m- & p-xylene	n/a	tube	O8	90	9.3
methyl isobutyl ketone (MIBK)	108-10-1	tube	O8	86	10
methyl tert-butyl ether (MTBE)	1634-04-4	tube	O8	92	15
o-xylene	95-47-6	tube	O8	86	9.9
propylbenzene	103-65-1	tube	O8	92	7.5
tetrachloroethylene	127-18-4	tube	O8	91	9.3
tetrahydrofuran (THF)	109-99-9	tube	O8	87	14.7
toluene	108-88-3	tube	O8	89	10.7
trichloroethylene	79-01-6	tube	O8	91	10.6
m- & p-cresol	n/a	tube	P1	n/a	11
m- & p-xylenol	n/a	tube	P1	n/a	11.9
o-cresol	95-48-7	tube	P1	n/a	10.8
o-xylenol	526-75-0	tube	P1	n/a	12
phenol	108-95-2	tube	P1	n/a	10.4

Certificate of Analysis

Report No.: 21-12366-2

Issue No.: 2

Date of Issue 21/10/2021

Customer Details: Anchem Laboratories Ltd, Unit 5A, D'Arcy Business Park, D'Arcy Way, Llandarcy, Neath, SA10 6EJ, Wales

Customer Contact: Philip Ruck

Customer Order No.: 2020/224

Customer Reference: Stack

Quotation Reference: Q21-01410

Description: 4 liquid samples

Date Received: 11/10/2021

Date Started: 12/10/2021

Date Completed: 15/10/2021

Test Methods: Details available on request (refer to SOP code against relevant result/s)

Notes: This report replaces issue 1 in its entirety



Approved By: Joanne Dewhurst, Operational Manager

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service.

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Observations and interpretations are outside of the scope of UKAS accreditation.

Results reported herein relate only to the items supplied to the laboratory for testing.

Results on an Interim Report are not dry-weight corrected.

Where the laboratory is not responsible for the sampling, results apply to the sample(s) as they were received.

The laboratory shall not be responsible for any information that is supplied by the customer that may affect the validity of results.

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RPS Environmental Management Limited trading as RPS Laboratories. Registered in England No. 01756175.

Unit 12, Waters Edge Business Park, Modwen Road, Salford, M5 3EZ. T +44 161 872 2443

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Results Summary

Report No.: 21-12366-2

Customer Reference: Stack

Customer Order No: 2020/224

Customer Sample No	100161/03 Impinger Solution Blank	100161/06 Impinger Solution Blank	100161/03 Impinger Solution
RPS Sample No	66995	66996	66997
Sample Matrix	SOLUTION	SOLUTION	SOLUTION
Sampling Date	06/10/2021	06/10/2021	06/10/2021

Determinand	CAS No	Codes	SOP	RL	Units			
volume of sample supplied		N	N/A	n/a	ml	32	35	26
hydrogen sulphide	7783-06-4	Y	M120	1	ug/mL	S/C	S/C	3.60

Results Summary

Report No.: 21-12366-2

Customer Reference: Stack

Customer Order No: 2020/224

Customer Sample No	100161/06 Impinger Solution
RPS Sample No	66998
Sample Matrix	SOLUTION
Sampling Date	06/10/2021

Determinand	CAS No	Codes	SOP	RL	Units	
volume of sample supplied		N	N/A	n/a	ml	30
hydrogen sulphide	7783-06-4	Y	M120	1	ug/mL	3.05

Comments

Report No.: 21-12366-2

Customer Reference: Stack

Customer Order No: 2020/224

RPS Sample Number	Customer Number	Sample Comments
66995	Y161/03 Impinger Solution Bl	Hydrogen Sulphide < 1.41ug/ml NB: LOD raised due to dilution of insufficient sample volume
66996	Y161/06 Impinger Solution Bl	Hydrogen Sulphide < 1.29ug/ml NB: LOD raised due to dilution of insufficient sample volume

Deviating Samples

Report No.: 21-12366-2

Customer Reference: Stack

Customer Order No: 2020/224

Our policy on Deviating Samples has been implemented in accordance with UKAS Policy on Deviating Samples (TPS63).

RPS is not responsible for the integrity of samples as received, unless RPS personnel performed the sampling. Samples submitted may be declared to be deviating.

Where applicable the analysis method remains UKAS accredited, however results reported for a deviating sample may be compromised.

Where no sampling date was supplied, samples have been declared to be deviating. If the date can be supplied, results may be reissued if assessed not deviating.

Where the sample container used was unsuitable or broken, the sample is flagged as deviating and re-sampling/re-submission may be required.

RPS No.	Customer No.	Customer ID	Date Sampled	Containers Received	Deviating	Reason for Deviation
66995	100161/03 Impinger Solution Blank		06/10/2021	Container	No	
66996	100161/06 Impinger Solution Blank		06/10/2021	Container	No	
66997	100161/03 Impinger Solution		06/10/2021	Container	No	
66998	100161/06 Impinger Solution		06/10/2021	Container	No	

Report No.: 21-12366-2

Key Code	Description
N	Not Accredited Test
U	UKAS Accredited Test - UKAS accreditation is only implied if the report carries the UKAS logo
UF	UKAS Flexible Scope Test
M	MCERTS Accredited Test - MCERTS accreditation is only implied if the report carries the MCERTS logo
O	Marine Management Organisation (MMO) Validated
SN	Subcontracted to approved laboratory not accredited for the test
SU	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
SIN	Subcontracted to internal RPS Group laboratory not accredited for the test
SIU	Subcontracted to internal RPS Group laboratory UKAS Accredited for the test
SIM	Subcontracted to internal RPS Group laboratory MCERTS/UKAS Accredited for the test
I/S (in results)	Insufficient Sample
U/S (in results)	Unsuitable Sample
S/C (in results)	See Comments
ND (in results)	Not Detected
L (in results)	Result is outside normal limits

Please note that all samples will be destroyed 4 WEEKS after the report has been issued.

Note: Sample retention may be subject to agreement with the customer for particular projects

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Certificate of Analysis

Report No.: 21-12365-2

Issue No.: 2

Date of Issue 03/11/2021

Customer Details: Anchem Laboratories Ltd, Unit 5A, D'Arcy Business Park, D'Arcy Way, Llandarcy, Neath, SA10 6EJ, Wales

Customer Contact: Philip Ruck

Customer Order No.: 2020/223

Customer Reference: Stack

Quotation Reference: Q21-01410

Description: 4 gas samples

Date Received: 11/10/2021

Date Started: 13/10/2021

Date Completed: 25/10/2021

Test Methods: Details available on request (refer to SOP code against relevant result/s)

Notes: This report replaces issue 1 in its entirety



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Results Summary

Report No.: 21-12365-2

Customer Reference: Stack

Customer Order No: 2020/223

Customer Sample No	100161/02 Sample Tube	100161/02 Blank Tube	100161/05 Sample Tube	100161/05 Blank Tube
RPS Sample No	66991	66992	66993	66994
Sample Matrix	TUBE	TUBE	TUBE	TUBE
Sampling Date	06/10/2021	06/10/2021	06/10/2021	06/10/2021

Determinand	CAS No	Codes	SOP	RL	Units				
carbon disulfide FRONT	75-15-0	N	G8	10	ug	465	< 10	209	< 10
carbon disulfide BACK	75-15-0	N	G8	10	ug	138	< 10	168	< 10

Comments

Report No.: 21-12365-2

Customer Reference: Stack

Customer Order No: 2020/223

Job	Description	Document History
21-12365	n/a	References amended.

Deviating Samples

Report No.: 21-12365-2

Customer Reference: Stack

Customer Order No.: 2020/223

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Where no sampling date was supplied, samples have been declared to be deviating. If the date can be supplied, results may be reissued if assessed not deviating.

Where the sample container used was unsuitable or broken, the sample is flagged as deviating and re-sampling/re-submission may be required.

RPS No.	Customer No.	Customer ID	Date Sampled	Containers Received	Deviating	Reason for Deviation
66991	100161/02 Sample Tube		06/10/2021	Container	No	
66992	100161/02 Blank Tube		06/10/2021	Container	No	
66993	100161/05 Sample Tube		06/10/2021	Container	No	
66994	100161/05 Blank Tube		06/10/2021	Container	No	

Report No.: 21-12365-2

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U/S (in results)	Unsuitable Sample
S/C (in results)	See Comments
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Please note that all samples will be destroyed 4 WEEKS after the report has been issued.

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APPENDIX 7

Instrument Analyser Details

(2 Pages)



Principle of Gas Conditioning

The sampling for oxygen & oxides of nitrogen was carried out using a Horiba PG-350 combustion gas analyser fed via a heated sampling system comprising of a sampling probe, 20m sampling line and a MAK 10 gas conditioning system.

A representative sample of gas is extracted from the stack, passed via the heated filter through a heated sampling line (both maintained at a temperature of 180°C) into the gas conditioning system, where the gas is dried by condensation and cooled to below a maximum dew point temperature of 4°C. The conditioned gas (cool & dried) is then passed to the gas analyser for quantification.

Oxides of nitrogen are analysed using a standard technique called Chemiluminescence and during the sampling was set to cover the range 0-250 ppm.



Test Report ALL100161/21/PR-1

Performance Characteristic	Minimum performance characteristic PG350			
	NO _x	CO	O ₂	SO ₂
Response Time (Required)	≤200 s	≤200 s	≤200 s	≤200 s
Results	<50	<50	<40	<60
Detection Limit	≤± 2% Range	≤± 2% Range	≤± 0.2% relative of Range	≤± 2%
Results	<0.1	<0.2	<0.05	<0.15
Lack of Fit (Linearity)	≤± 2% Range	≤± 2% Range	≤± 0.3% volume	≤± 2%
Results	<2 (R ² >0.9996)	<2 (R ² >0.9996)	<2 (R ² >0.9999)	<2 (R ² >0.9996)
Zero Drift	≤± 2% Range/24 hours	≤± 2% Range/24 hours	≤± 0.2% Volume/24 hours	≤± 2%/24 hours
Results	0.03%	0.35%	0.03%	0.14%
Span Drift	≤± 2% Range/24 hours	≤± 2% Range/24 hours	≤± 0.2% Volume/24 hours	≤± 2%/24 hours
Results	0.72%	0.21%	0.03%	0.89%
Sensitivity to Atmos Pressure	≤± 3% Range/2 kPa	≤± 3% Range/2 kPa	≤± 3% of Range for 2 kPa	≤± 3%/2 kPa
Results	≤± 3% Range/2 kPa	≤± 3% Range/2 kPa	≤± 3% of Range for 2 kPa	≤± 3%/2 kPa
Sensitivity to Sample Volume/pressure	-	-	-	≤± 1%
Results	-	-	-	≤± 1%
Sensitivity to ambient temperature	≤± 3% Range/10 K	≤± 3% Range/10 K	≤± 0.3% Volume/10 K	≤± 3% Range/10 K
Results	≤± 3% Range/10 K	≤± 3% Range/10 K	≤± 0.3% Volume/10 K	≤± 3% Range/10 K
Sensitivity to Electric Voltage	≤± 2% Range/10 V	≤± 2% Range/10 V	≤± 0.1% Volume/10 V	≤± 2% Range/10 V
Results	≤± 2% Range/10 V	≤± 2% Range/10 V	≤± 0.1% Volume/10 V	≤± 2% Range/10 V
Interferents	Total ≤± 4% Range	Total ≤± 4% Range	Total ≤± 0.2% Volume	Total ≤± 4%
Results	-0.52%	-0.87%	0%	-1.82%
Converter Efficiency	≥95.0%			
Results	96.30%			
Losses & Leakage in Sampling Line and Conditioning System	≤± 2% of measured value	≤± 2% of measured value	≤± 2.0% relative of the measured value	≤± 5%
Results	<2%	<2%	<2%	<5%
Std Deviation of repeatability in Lab at zero	≤± 1% Range	≤± 1% Range	≤± 0.20% relative of the range	≤± 1%
Results	0.04%	0.16%	0.05%	0.09%
Std Deviation of repeatability in Lab at span level	≤± 2% Range	≤± 2% Range	≤± 0.40% relative of the range	≤± 2%
Results	0.08%	0.35%	0.03%	0.12%



APPENDIX 8

(Annual calibration details & analysis data retained at permanent laboratory)

