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Stack Emissions Testing Report Commissioned by
Chris Wilson Consulting

Installation Name & Address
Aurora Manufacturing Ltd
Unit 4 Bridgewater Business Park
West Bridgewater Business Park
Leigh
Lancashire
WN7 4HB

Stack Reference
Line 4

Dates of the Monitoring Campaign
7th January 2021

Job Reference Number
ERO-2966

Report Written by
Gary Thackray Team Leader MCERTS Level 2 MM 02 078 TE1 TE2 TE3 TE4

Report Approved by
Chris Rhodes Team Leader MCERTS Level 2 MM 02 117 TE1 TE2 TE3 TE4

Report Date
4th February 2021

Version
Version 1

Signature of Report Approver



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Executive Summary

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MONITORING OBJECTIVES

Aurora Manufacturing Ltd, Leigh

Line 4

7th January 2021

Overall Aim of the Monitoring Campaign

Element were commissioned by Chris Wilson Consulting to carry out stack emissions testing for Aurora Manufacturing Ltd on the Line 4 at Leigh.

The aim of the monitoring campaign was to perform testing, as requested by the customer, for a number of prescribed pollutants. There are no emission limits set for any of the pollutants at this time.

Special Requirements

There were no special requirements.

Target Parameters

Cyclopentane , 2-methylpentane , 3-methylpentane , n-hexane , Methylcyclopentane , Cyclohexane , Total VOCs (as Carbon)

Executive Summary

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MONITORING RESULTS

Aurora Manufacturing Ltd, Leigh

Line 4

7th January 2021

where MU = Measurement Uncertainty associated with the Result

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Cyclopentane	¹ mg/m ³	0.31	0.12	-	g/hr	0.52	0.21	-
2-methylpentane	¹ mg/m ³	1.5	0.58	-	g/hr	2.5	1.0	-
3-methylpentane	¹ mg/m ³	1.9	0.77	-	g/hr	3.3	1.3	-
n-hexane	¹ mg/m ³	2.1	0.83	-	g/hr	3.5	1.4	-
Methylcyclopentane	¹ mg/m ³	11.3	4.5	-	g/hr	19.0	7.6	-
Cyclohexane	¹ mg/m ³	2.2	0.85	-	g/hr	3.6	1.4	-
Total VOCs (as Carbon)	¹ mg/m ³	122	3.7	-	g/hr	205	14.2	-
Water Vapour	% v/v	1.9	0.10					
Stack Gas Temperature	°C	17.0						
Stack Gas Velocity	m/s	7.1	0.30					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	1811	113					
Volumetric Flow Rate (REF)	¹ m ³ /hr	1675	104					

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

¹ Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.



Executive Summary

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MONITORING DATE(S) & TIMES

Aurora Manufacturing Ltd, Leigh

Line 4

7th January 2021

Parameter	Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Cyclopentane	R1 mg/m ³	0.31	g/hr	0.5	07/01/2021	10:54 - 11:54	60
2-methylpentane	R1 mg/m ³	1.5	g/hr	2.5	07/01/2021	10:54 - 11:54	60
3-methylpentane	R1 mg/m ³	1.9	g/hr	3.3	07/01/2021	10:54 - 11:54	60
n-hexane	R1 mg/m ³	2.1	g/hr	3.5	07/01/2021	10:54 - 11:54	60
Methylcyclopentane	R1 mg/m ³	11.3	g/hr	19.0	07/01/2021	10:54 - 11:54	60
Cyclohexane	R1 mg/m ³	2.2	g/hr	3.6	07/01/2021	10:54 - 11:54	60
Total VOCs (as Carbon)	R1 mg/m ³	122	g/hr	205	07/01/2021	10:54 - 11:54	60
Water Vapour	R1 % v/v	1.9			07/01/2021	10:54 - 11:54	60
Velocity Traverse	R1				07/01/2021	11:58 - 12:05	

All results are expressed at the respective reference conditions.



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PROCESS DETAILS

Aurora Manufacturing Ltd, Leigh

Line 4

7th January 2021

Standard Operating Conditions

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

MONITORING & ANALYTICAL METHODS

Aurora Manufacturing Ltd, Leigh

Line 4

7th January 2021

Parameter	Monitoring				Analysis				Overall Status	LOD (Average)
	Standard	Technical Procedure	Sampling Status	Testing Lab	Analytical Procedure	Analytical Technique	Analysis Status	Analysis Lab		
Cyclopentane	CEN/TS 13649	CAT-TP-16	MCERTS	EET	M109	GC-MS	None	RPS	None	0.194 mg/m ³
2-methylpentane	CEN/TS 13649	CAT-TP-16	MCERTS	EET	M109	GC-MS	None	RPS	None	0.194 mg/m ³
3-methylpentane	CEN/TS 13649	CAT-TP-16	MCERTS	EET	M109	GC-MS	17025	RPS	17025	0.194 mg/m ³
n-hexane	CEN/TS 13649	CAT-TP-16	MCERTS	EET	M109	GC-MS	None	RPS	None	0.194 mg/m ³
Methylcyclopentane	CEN/TS 13649	CAT-TP-16	MCERTS	EET	M109	GC-MS	None	RPS	None	0.194 mg/m ³
Cyclohexane	CEN/TS 13649	CAT-TP-16	MCERTS	EET	M109	GC-MS	None	RPS	None	0.194 mg/m ³
Water Vapour	EN 14790	CAT-TP-05	MCERTS	EET	CAT-TP-05	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	MCERTS	EET	Flame Ionisation Detection by Sick 3006 FID				MCERTS	0.32 mg/m ³
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	MCERTS	EET	Pitot Tube and Thermocouple				MCERTS	1.2 m/s

ANALYSIS LABORATORIES

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

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

SUMMARY OF SAMPLING DEVIATIONS

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

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.30
Width	m	-
Area	m ²	0.07
Port Depth	cm	0
Orientation of Duct	-	Horizontal
Number of Ports	-	1
Sample Port Size	-	Hole

Location of Sampling Platform

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

Platform Details

EA Technical Guidance Note M1 / EN 15259 Platform Requirements	Value
Sufficient working area to manipulate probe and operate the measuring instruments	Yes
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	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	43.0	> 5 Pa	Yes
Mean Velocity	m/s	7.1	-	-
Lowest Gas Velocity	m/s	7.1	-	-
Highest Gas Velocity	m/s	7.1	-	-
Ratio of Above	: 1	1.0	< 3 : 1	Yes
Maximum Angle of Swirl	°	NM	NM	NM
No Local Negative Flow	-	Yes	-	Yes

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

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PLANT PHOTOS

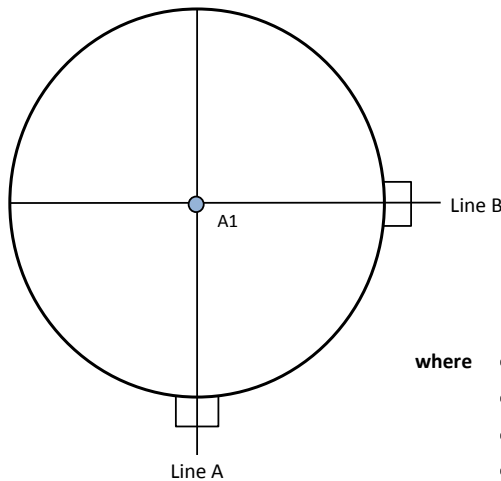
Photo 1



Photo 2



SAMPLE POINTS



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



APPENDICES

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Gary Thackray	MCERTS Level 2	MM 02 078	TE1 TE2 TE3 TE4
Technician	Danny Worthington	MCERTS Level 1	MM 20 1594	None

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM (1)	-	Horiba PG-250 SRM	-	Digital Manometer (1)	CAT 3.154
Control Box DGM (2)	-	Horiba PG-350E	-	Digital Manometer (2)	CAT 3.156
Box Thermocouples (1)	-	Servomex 5200 MP	-	Digital Temperature Meter	CAT 3.154
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	CAT 14.57
Umbilical (1)	-	ABB AO2020-URAS26	-	Barometer	CAT 13.42
Umbilical (2)	-	Testo 350 XL	-	Stack Thermocouple (1)	CAT 4.875
Oven Box (1)	-	JCT JCC P1 Cooler	-	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 8.34	1m Heated Line (2)	-
Heated Probe (3)	-	M&C PSS	CAT 12.110	1m Heated Line (3)	-
S-Pitot (1)	CAT 21s.58	Mass Flow Controller (1)	CAT 6.67	10m Heated Line (1)	CAT 20.120
S-Pitot (2)	-	Mass Flow Controller (2)	CAT 6.68	15m Heated Line (1)	-
L-Pitot	-	Mass View (1)	CAT 25.63	20m Heated Line (1)	-
Site Balance	CAT 17.35	Mass View (2)	CAT 25.64	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.35	Hioki 5043 (V)	CAT 11.74	Dual Channel Heater Controller	-
Last Impinger Arm	-	Easylogger EN-EL-12 Bit	-	Single Channel Heater Controller	CAT 20.120
Callipers	CAT 23.34	Bioaerosols Temperature Logger	-	Laboratory Balance	-
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.01

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Cyclopentane	CEN/TS 13649	CAT-TP-16
2-methylpentane	CEN/TS 13649	CAT-TP-16
3-methylpentane	CEN/TS 13649	CAT-TP-16
n-hexane	CEN/TS 13649	CAT-TP-16
Methylcyclopentane	CEN/TS 13649	CAT-TP-16
Cyclohexane	CEN/TS 13649	CAT-TP-16
Water Vapour	EN 14790	CAT-TP-05
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20
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	0.30
Stack Width, W	m	-
Stack Area, A	m ²	0.07
Average Stack Gas Temperature, T _a	°C	17.0
Average Stack Gas Pressure	Pa	43.0
Average Stack Static Pressure, P _{static}	kPa	0.499
Average Barometric Pressure, P _b	kPa	99.0
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 ρ	Conc kg/m ³ ρ _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.40	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	77.62	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	1.92	0.0192	18.02	0.8037	0.01543

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	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.278
Dry Density (Actual), P _{Actual}	kg/m ³	1.190
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.182

Where: P_{STD} = sum of component concentrations, kg/m³ (not including water vapour)
P_{STW} = sum of all wet concentrations / 100 x density, kg/m³ (including water vapour)
 $P_{Actual} = P_{STD} \times (T_{STP} / (P_{STP})) \times ((P_{static} + P_b) / T_a)$
 $P_{ActualW}$ (at each sampling point) = P_{STW} x (T_s / P_s) x (P_a / T_a)

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	17.0	0.0
Total Pressure	kPa	99.5	101.3
Moisture	%	1.92	1.92

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	1811
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	1675
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	1643
Gas Volumetric Flowrate REF ¹	m ³ /hr	1675



APPENDIX 2



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

(1 of 1)

Parameter	Units	Value
Date of Survey	-	07/01/2021
Time of Survey	-	11:58 - 12:05
Atmospheric Pressure	kPa	99.0
Average Stack Static Pressure	Pa	499
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with KIMO MP 210 (500Pa)	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Horizontal
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)		499.0				
Mean		43.0	17.0	1.182	7.12	
1	0.15	43.0	17.0	1.182	7.12	

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	$u(\Delta p_i)$	1.149	Pa
- Resolution	$u(res)$	0.00087	
- Calibration	$u(cal)$	0.193	
- Drift	$u(drift)$	0.083	
- Lack of Fit	$u(fit)$	0.044	
- Overall corrections to dynamic measurements	$u(C_f)$	0.320	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00003	-
- $\varphi_{O_2,w}$	-	20.401	
- $\varphi_{CO_2,w}$	-	0.059	
- Oxygen, dry	$u(\phi_{O_2,d})$	0.637	
- Carbon Dioxide, dry	$u(\phi_{CO_2,d})$	0.002	
- Water Vapour	$u(\phi_{H_2O})$	0.098	
- Oxygen, wet	$u(\phi_{O_2,w})$	0.625	
- Carbon Dioxide, wet	$u(\phi_{CO_2,w})$	0.002	
Standard uncertainty associated with the stack temperature	$u(T_c)$	1.480	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.696	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	1.149	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00638	-
Standard uncertainty associated with the local velocities	$u(v_i)$	0.155	Pa
Standard uncertainty associated with the mean velocity	$u(\underline{v})$	0.155	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	0.304	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	4.27	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV,w)$	112.7	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00101	
- $u^2(qV,w)$	-	3309	
- $u(qV,w)$	-	57.5	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV,w)$	6.22	%



WATER VAPOUR: RESULTS SUMMARY

Aurora Manufacturing Ltd, Leigh
Line 4

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	% v/v	1.92	1.92
Uncertainty	±% v/v	0.10	0.10

NOTE: Where water droplets are present (See the Quality Assurance page), the Water Vapour concentration as found in Annex A of EN 14790 has been reported instead of the calculated value.

General Sampling Information

Parameter	Value
Standard	EN 14790
Technical Procedure	CAT-TP-05

WATER VAPOUR: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	10:54 - 11:54
Sampling Dates	-	07/01/2021
Sampling Device	-	MFC / MV
Duration	mins	60
Volume Sampled (STP, Dry)	m ³	0.1935
Volume Sampled (STP, Wet)	m ³	0.1973
Sample Flow Rate	l/min	3.22
Liquid Trap Start Mass	g	4348.7
Liquid Trap End Mass	g	4351.3
Silica Trap Start Mass	g	1552.1
Silica Trap End Mass	g	1555.6
Total Mass Of Water Vapour	g	6.1
Calculated Water Vapour	% v/v	3.78

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



WATER VAPOUR: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	3.2
Pre-Sampling Leak Rate	l/min	0.05
Post-Sampling Leak Rate	l/min	0.05
Allowable Leak Rate	l/min	0.06
Leak Test Acceptable	-	Yes

Water Droplets	Units	Run 1
Are Water Droplets Present	-	Yes

Measurement Uncertainty	Units	Run 1
Measurement Uncertainty (MU)	%	5.0
Allowable MU	%	20.0
MU Acceptable	%	Yes

Silica Gel	Units	Run 1
Less than 50% Faded	%	Yes

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

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

WATER VAPOUR: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value		Standard uncertainty		
	Symbol	Run 1	Symbol	Units	Run 1
Sampled Volume (STP)	V _m	0.1935	uV _m	m ³	0.0039
Repeatability of Weighing	R _w	6.10	uR _w	g	0.06
Reading of Balance	R _b	6.10	uR _b	g	0.03
Leak	L	1.55		%	-

Measured Quantities	Uncertainty as a Percentage		Requirement of Standard
	Units	Run 1	
Sampled Volume (STP)	%	2.00	≤2%
Repeatability of Weighing	%	0.98	No Requirement
Reading of Balance	%	0.50	No Requirement
Leak	%	1.55	≤2%

Measured Quantities	Uncertainty in Measurement Units			Sensitivity Coefficient
	Symbol	Units	Run 1	
Sampled Volume (STP)	V _m	m ³	0.1935	19.53
Repeatability of Weighing	R _w	g	6.10	0.62
Reading of Balance	R _b	g	6.10	0.62
Leak	L	% v/v	0.03	1.00

Measured Quantities	Uncertainty in Result	
	Units	Run 1
Sampled Volume (STP)	% v/v	0.076
Repeatability of Weighing	% v/v	0.037
Reading of Balance	% v/v	0.019
Leak	% v/v	0.034

Parameter	Units	Run 1
Combined uncertainty	% v/v	0.09
Expanded uncertainty (95% confidence)	% v/v	0.18
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.18
Uncertainty if Water Droplets are present	% v/v	0.10
Reported Uncertainty	% v/v	0.10
Expanded uncertainty (95% confidence)	%	4.8
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	4.8
Uncertainty if Water Droplets are present	%	5.0
Reported Uncertainty	%	5.0



SPECIATED VOC SCREEN : RESULTS SUMMARY

Aurora Manufacturing Ltd, Leigh
Line 4

Sample Runs

Parameter	Units	Run 1	Mean
Cyclopentane	mg/m ³	0.31	0.31
2-methylpentane	mg/m ³	1.5	1.5
3-methylpentane	mg/m ³	1.9	1.9
n-hexane	mg/m ³	2.1	2.1
Methylcyclopentane	mg/m ³	11.3	11.3
Cyclohexane	mg/m ³	2.2	2.2

General Sampling Information

Parameter	Value
Standard	CEN/TS 13649
Technical Procedure	CAT-TP-16
Name of Analytical Laboratory	RPS
Analytical Laboratory's Procedure	M109
ISO 17025 Accredited Analysis?	See Executive Summary
Date of Sample Analysis	26/01/2021
Probe Material	Titanium
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, without correction for water vapour content.

SPECIATED VOC SCREEN : SAMPLING DETAILS

RUN 1

Parameter	Units	Value
Sampling Times	-	10:54 - 11:54
Sampling Dates	-	07/01/2021
Sampling Device	-	MV
Duration	mins	60
N ₂ to Stack Gas Dilution Ratio	: 1	0
Volume Sampled (REF)	m ³	0.0515

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 %
Cyclopentane	11.0	< 5.0	16.0	5.0	5.0	10.0	0.31	0.31	0.19	100.0
2-methylpentane	71.0	< 5.0	76.0	5.0	5.0	10.0	1.5	1.5	0.19	100.0
3-methylpentane	95.0	< 5.0	100.0	5.0	5.0	10.0	1.9	1.9	0.19	100.0
n-hexane	104.0	< 5.0	109.0	5.0	5.0	10.0	2.1	2.1	0.19	100.0
Methylcyclopentane	578.0	< 5.0	583.0	5.0	5.0	10.0	11.3	11.3	0.19	100.0
Cyclohexane	106.0	< 5.0	111.0	5.0	5.0	10.0	2.2	2.2	0.19	100.0

Reference Conditions are: 273K, 101.3kPa, without correction for water vapour content.

Mass Emission (kg/h)
>0.03239 and <0.03239

SPECIATED VOC SCREEN : SAMPLING DETAILS

BLANK 1

Parameter	Units	Value
Sampling Dates	-	07/01/2021
Sampling Device	-	MV
Average Volume Sampled (REF)	m ³	0.0515

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
Cyclopentane	< 5.0	< 5.0	10.0	< 0.19
2-methylpentane	< 5.0	< 5.0	10.0	< 0.19
3-methylpentane	< 5.0	< 5.0	10.0	< 0.19
n-hexane	< 5.0	< 5.0	10.0	< 0.19
Methylcyclopentane	< 5.0	< 5.0	10.0	< 0.19
Cyclohexane	< 5.0	< 5.0	10.0	< 0.19

Reference Conditions are: 273K, 101.3kPa, without correction for water vapour content.



SPECIATED VOC SCREEN : QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	0.8
Pre-Sampling Leak Rate	l/min	0.00
Post-Sampling Leak Rate	l/min	0.00
Allowable Leak Rate	l/min	0.04
Leak Test Acceptable	-	Yes

Adsorption Efficiency	Units	Run 1
Cyclopentane	%	100.0
2-methylpentane	%	100.0
3-methylpentane	%	100.0
n-hexane	%	100.0
Methylcyclopentane	%	100.0
Cyclohexane	%	100.0
Allowable Adsorption Efficiency	%	95.0
Adsorption Efficiency Acceptable	-	Yes

Temperature at Sample Tubes	Units	Run 1
Temperature	°C	19
Allowable Temperature	°C	40
Temperature Acceptable	-	Yes

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes



SPECIATED VOC SCREEN : QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

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

Validity of Blank vs ELV	Units	Blank 1	Allowed
Allowable for Cyclopentane	mg/m ³	0.2	N/A
Allowable for 2-methylpentane	mg/m ³	0.2	N/A
Allowable for 3-methylpentane	mg/m ³	0.2	N/A
Allowable for n-hexane	mg/m ³	0.2	N/A
Allowable for Methylcyclopentane	mg/m ³	0.2	N/A
Allowable for Cyclohexane	mg/m ³	0.2	N/A

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

SPECIATED VOC SCREEN : MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value		Standard uncertainty		
	Symbol	Run 1	Symbol	Units	Run 1
Sampled Volume (STP)	V _m	0.0505	uV _m	m ³	0.0010
Leak	L	0.00	uL	%	-
Laboratory Result	L _r	20.00	uL _r	%	-

Measured Quantities	Uncertainty as a Percentage		Requirement of Standard
	Units	Run 1	
Sampled Volume (STP)	%	2.00	≤2%
Leak	%	0.00	≤5%
Laboratory Result	%	20.00	No Requirement

Measured Quantities	Uncertainty in Measurement Units			Sensitivity Coefficient
	Symbol	Units	Run 1	
Sampled Volume (STP)	V _m	m ³	0.0505	383.23
Leak	L	mg/m ³	0.0000	1.00
Laboratory Result	L _r	mg/m ³	3.868	1.00

Measured Quantities	Uncertainty in Result	
	Units	Run 1
Sampled Volume (STP)	mg/m ³	0.387
Leak	mg/m ³	0.0000
Laboratory Result	mg/m ³	3.8678

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

Parameter	Units	Run 1
Combined uncertainty	mg/m ³	3.887
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	7.619
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	7.619
Reported Uncertainty	mg/m ³	7.619
Expanded uncertainty (95% confidence), without Oxygen Correction	%	39.4
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	39.4
Reported Uncertainty	%	39.4

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

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Aurora Manufacturing Ltd, Leigh
Line 4

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	122	122
Uncertainty	±mg/m ³	3.7	3.7
Mass Emission	g/hr	205	205
Uncertainty	±g/hr	14.2	14.2

General Sampling Information

Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	CAT-TP-20	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	CYL 1.0386a	
Span Gas Expiry Date	19/11/2024	
Span Gas Start Pressure (bar)	80	
Gas Cylinder Concentration (ppm)	79.97	
Span Gas Set Point (ppm)	79.97	
Span Gas Uncertainty (%)	N/A	
Zero Gas Type	Synthetic Air (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

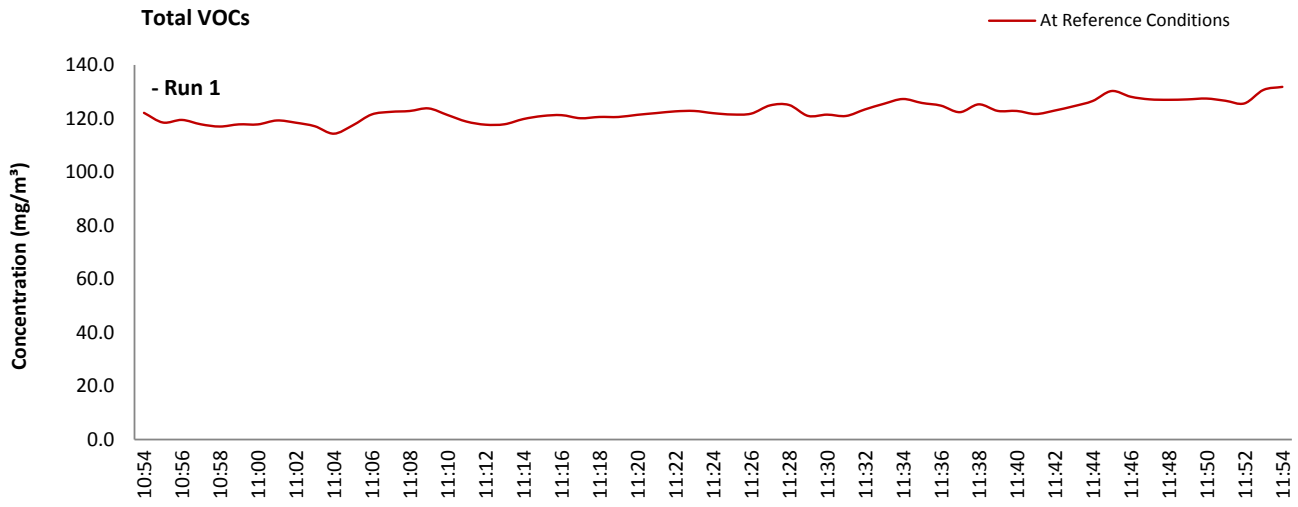
Reference Conditions

Reference Conditions are: 273K, 101.3kPa, without correction for water vapour content.



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	-	10:54 - 11:54
Sampling Dates	-	07/01/2021
Instrument Range	ppm	100
Span Gas Value	ppm	80.0

Quality Assurance

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.20
	Zero Down Sampling Line (Post)	ppm	-0.20
	Zero Drift	ppm	-0.40
	Allowable Zero Drift	± ppm	4.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	78.50
	Span Down Sampling Line (Post)	ppm	79.60
	Span Drift	ppm	1.10
	Allowable Span Drift	± ppm	4.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	14 - 16

Method Deviations

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

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1	Units
Limit value	-	mg/m ³ (REF)
Allowable MU	15.0	%
Measured concentration	124.88	mg/m ³ (STP, dry)
Range Used	100.0	ppm
Range Used [A]	160.6	mg/m ³
Cal gas conc.	80.0	ppm
Conversion	1.61	ppm to mg/m ³
MCERTS Range [B]	15.0	mg/m ³
Lower of [A] or [B]	15.0	mg/m ³
Cal gas conc.	128.4	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	0.83	% of value
Zero drift	-0.51	% full scale
Span drift	1.40	% full scale
Volume or pressure flow dependence	1.60	% of full scale
Atmospheric pressure dependence	0.30	% of value/kPa
Ambient temperature dependence	1.40	% full scale/10K
Combined interference	0.45	% range
Dependence on voltage	0.50	% full scale/10V
Losses in the line (leak)	1.75	% 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	0.00	mg/m ³
Lack of fit	0.07	mg/m ³
Drift	0.00	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)	1.26	mg/m ³
Uncertainty of calibration gas	1.44	mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		124.88	mg/m ³
Expanded uncertainty		1.93	mg/m ³
Expanded uncertainty	k = 1.96	3.78	mg/m ³
Uncertainty corrected to std conds. (O ₂)		3.78	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	3.03	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	N/A	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	N/A	% at ELV
Result of Compliance with Uncertainty Requirement	N/A	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	N/A	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	N/A	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	N/A	% at ELV
Result of Compliance with Uncertainty Requirement	N/A	-

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



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