



Exova Catalyst, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL

T: 0800 328 1821 (or + 44 161 432 3286 from overseas)

E: toby.campbell@exova.com

Your Exova Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

VIP Polymers Ltd

Installation Name & Address

VIP Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7EB

PPC Permit: B11/94

Stack Reference

Stack 8 - Panstone 6C, 6D, 6E & 6F

Dates of the Monitoring Campaign

16th November 2016

Job Reference Number

CAT-3047

Report Written by

Harpreet Badwal
Team Leader
MCERTS Level 2
MM 03 149
TE1 TE2 TE3 TE4

Report Approved by

Derek Myers
Team Leader
MCERTS Level 2
MM 02 115
TE1 TE2 TE3 TE4

Report Date

1st December 2016

Version

Version 1

Signature of Report Approver



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Executive Summary

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MONITORING OBJECTIVES

VIP Polymers Ltd, Huntingdon
Stack 8 - Panstone 6C, 6D, 6E & 6F
16th November 2016

Overall Aim of the Monitoring Campaign

Exova Catalyst were commissioned by VIP Polymers Ltd to carry out stack emissions testing on the Stack 8 - Panstone 6C, 6D, 6E & 6F at Huntingdon.

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter | Total VOCs (as Carbon) |

Executive Summary

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MONITORING RESULTS

VIP Polymers Ltd, Huntingdon
 Stack 8 - Panstone 6C, 6D, 6E & 6F
 16th November 2016

where MU = Measurement Uncertainty associated with the Result

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.18	0.37	10	g/hr	1.3	2.6	-
Total VOCs (as Carbon)	¹ mg/m ³	0.44	0.56	-	g/hr	3.1	4.0	-
Water Vapour	% v/v	0.31	0.04					
Stack Gas Temperature	°C	19.6						
Stack Gas Velocity	m/s	10.7	0.24					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	7597	383					
Volumetric Flow Rate (REF)	¹ m ³ /hr	7055	356					

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.



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MONITORING DATE(S) & TIMES

VIP Polymers Ltd, Huntingdon
Stack 8 - Panstone 6C, 6D, 6E & 6F
16th November 2016

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m³	0.18	g/hr	1.3	16/11/2016	11:31 - 11:51, 11:53 - 12:13	40
Total VOCs (as Carbon)	R1	mg/m³	0.44	g/hr	3.1	16/11/2016	11:31 - 12:11	40
Velocity & Volumetric Flow Rate	R1					16/11/2016	11:10 - 11:20	

All results are expressed at the respective reference conditions.



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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon
Stack 8 - Panstone 6C, 6D, 6E & 6F
16th November 2016

Standard Operating Conditions

Parameter	Value
Process Status	Compression Moulding Operational
Capacity (of 100%) and Tonnes / Hour	Normal Operation
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Rubber Products
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon
 Stack 8 - Panstone 6C, 6D, 6E & 6F
 16th November 2016

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	ISO 17025 Testing	Testing Lab	Analytical Procedure	Analytical Technique	ISO 17025 Analysis	Analysis Lab		
Total Particulate Matter	EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.18 mg/m³
Water Vapour	EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.32 mg/m³
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	Yes	CAT	Pitot Tube and Thermocouple				Yes	1.2 m/s

ANALYSIS LABORATORIES

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

Exova Catalyst (CAT)	ISO 17025 Accreditation Number: 4279
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SUMMARY OF SAMPLING DEVIATIONS

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

Executive Summary

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SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.50
Width	m	-
Area	m ²	0.20
Port Depth	cm	5
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	30.1		> 5 Pa	Yes
Mean Velocity	m/s	10.7		-	-
Lowest Gas Velocity	m/s	5.95		-	-
Highest Gas Velocity	m/s	13.7		-	-
Ratio of Above	: 1	2.31		< 3 : 1	Yes
Maximum Angle of Swirl	°	10		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

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PLANT PHOTOS

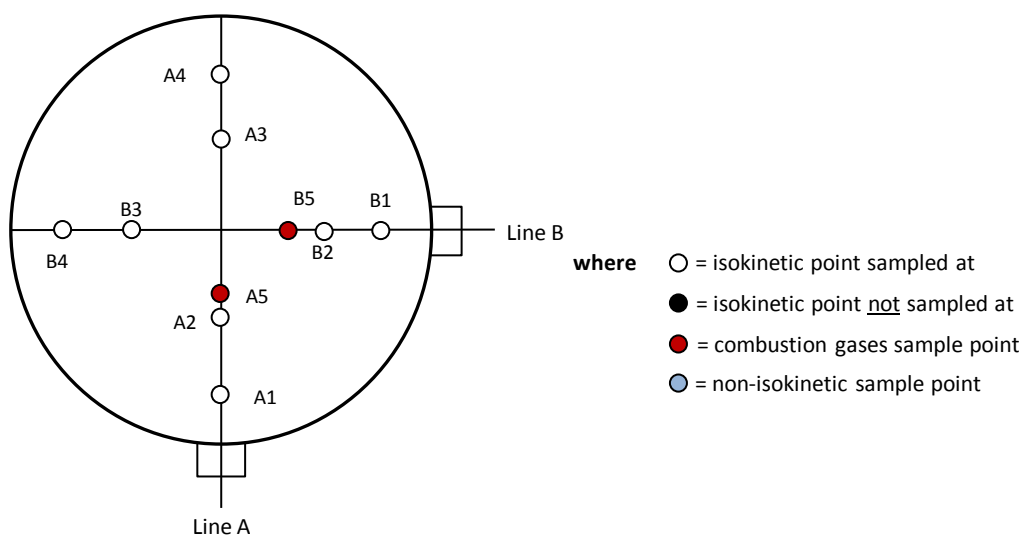
Photo 1



Photo 2



SAMPLE POINTS





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	Harpreet Badwal	MCERTS Level 2	MM 03 149	TE1 TE2 TE3 TE4
Team Leader	Phil Waters	MCERTS Level 2	MM 04 527	TE1 TE2 TE3 TE4

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM (1)	CAT 7.57	Horiba PG-350E	-	Digital Manometer (1)	CAT 3.142
Control Box DGM (2)	-	Horiba PG-250	-	Digital Manometer (2)	CAT 3.144
Box Thermocouples (1)	CAT 3.146	Servomex 4900	-	Digital Temperature Meter	-
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	CAT 14.84
Umbilical (1)	CAT 3.146	ABB AO2020-URAS26	-	Barometer	CAT 13.40
Umbilical (2)	-	Servomex 5200MP	-	Stack Thermocouple (1)	CAT 4.844
Oven Box (1)	-	Ankersmid APS 313	-	Stack Thermocouple (2)	CAT 4.789
Oven Box (2)	-	Gasmet DX4000	-	Stack Thermocouple (3)	CAT 4.013
Heated Probe (1)	CAT 5.126	Gasmet Sampling System	-	1m Heated Line (1)	-
Heated Probe (2)	CAT 5.127	Bernath 3006 FID	CAT 8.31	1m Heated Line (2)	-
Heated Probe (3)	CAT 5.128	M&C PSS	CAT 12.107	1m Heated Line (3)	-
S-Pitot (1)	CAT 21S.57	Mass Flow Controller (1)	CAT 6.61	5m Heated Line (1)	-
S-Pitot (2)	CAT 21P.38	Mass Flow Controller (2)	CAT 6.62	15m Heated Line (1)	-
L-Pitot	-	Mass View (1)	-	20m Heated Line (1)	CAT 20.116
Site Balance	CAT 17.33	Mass View (2)	-	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.33 a & b	Hioki 5043 (V)	CAT 11.69	Dual Channel Heater Controller	-
Last Impinger Arm	-	Easylogger EN-EL-12 Bit	-	Single Channel Heater Controller	CAT 20.116
Callipers	CAT 23.40	Bioaerosols Temperature Logger	-	Laboratory Balance	CAT 1.18 / 1.18a
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.45

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	EN 13284-1	CAT-TP-01
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	0.50
Stack Width, W	m	-
Stack Area, A	m ²	0.20
Average Stack Gas Temperature, T _a	°C	19.9
Average Stack Gas Pressure	Pa	103.8
Average Stack Static Pressure, P _{static}	kPa	0.113
Average Barometric Pressure, P _b	kPa	100.8
Average Pitot Tube Calibration Coefficient, C _p	-	0.84

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.74	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.89	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.31	0.0031	18.02	0.8037	0.00251

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	1.286
Dry Density (Actual), P _{Actual}	kg/m ³	1.195
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.194

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)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	19.9	0.0
Total Pressure	kPa	100.9	101.3
Moisture	%	0.31	0.31

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	7597
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	7055
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	7033
Gas Volumetric Flowrate REF ¹	m ³ /hr	7055

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

(1 of 1)

Parameter	Units	Value
Date of Survey	-	16/11/2016
Time of Survey	-	11:10 - 11:20
Atmospheric Pressure	kPa	100.8
Average Stack Static Pressure	Pa	113
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with KIMO MP 210 (500Pa)	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C _p	-	0.84
Number of Lines Available	-	2
Number of Lines Used	-	2

Sampling Line A							Sampling Line B				
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °
STATIC (Units: Pa)		110.5					115.6				
Mean		99.4	19.8	1.194	10.61		108.2	20.0	1.193	10.88	
1	0.03	130.7	19.0	1.197	12.37	10.0	109.8	20.0	1.193	11.36	10.0
2	0.13	64.6	20.0	1.193	8.71	9.0	30.1	20.0	1.193	5.95	10.0
3	0.38	61.8	20.0	1.193	8.52	9.0	132.4	20.0	1.193	12.47	9.0
4	0.47	140.6	20.0	1.193	12.85	10.0	160.6	20.0	1.193	13.74	8.0

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	$u(\Delta p_i)$	2.011	Pa
- Resolution	$u(res)$	0.00087	
- Calibration	$u(cal)$	1.122	
- Drift	$u(drift)$	0.083	
- Lack of Fit	$u(fit)$	1.838	
- Overall corrections to dynamic measurements	$u(C_f)$	3.045	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00003	-
- $\varphi_{O_2,w}$	-	20.735	
- $\varphi_{CO_2,w}$	-	0.060	
- Oxygen, dry	$u(\phi_{O_2,d})$	0.637	
- Carbon Dioxide, dry	$u(\phi_{CO_2,d})$	0.002	
- Water Vapour	$u(\phi_{H_2O})$	0.016	
- Oxygen, wet	$u(\phi_{O_2,w})$	0.635	
- Carbon Dioxide, wet	$u(\phi_{CO_2,w})$	0.002	
Standard uncertainty associated with the stack temperature	$u(T_c)$	1.494	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.698	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	1.422	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00644	-
Standard uncertainty associated with the local velocities	$u(v_i)$	0.169	Pa
Standard uncertainty associated with the mean velocity	$u(\bar{v})$	0.122	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	0.238	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	2.22	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV,w)$	382.9	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00066	
- $u^2(qV,w)$	-	38163	
- $u(qV,w)$	-	195.4	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV,w)$	5.04	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 8 - Panstone 6C, 6D, 6E & 6F

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.18		0.18
Uncertainty	±mg/m ³	0.37		0.37
Mass Emission	g/hr	1.3		1.3
Uncertainty	±g/hr	2.6		2.6

NOTE: Where the maximum Blank concentration is higher than the Sample concentration, the maximum Blank concentration has been reported.

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.31		0.31
Uncertainty	±% v/v	0.04		0.04

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.18		0.18

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value	
Standard	EN 13284-1	
Technical Procedure	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Glass Fibre	
Number of Sampling Lines Used	2/2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	8/8	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1, A2, A3, A4, B1, B2, B3 & B4	

Reference Conditions

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

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P _b	mmHg	756.0	
Stack static pressure, P _{static}	mmH ₂ O	11.3	
P _s = (P _b + (P _{static} / 13.6))	mmHg	756.8	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	0.8	
Total mass collected in impingers (silica trap)	g	1.1	
Total mass of liquid collected, V _{lc}	g	1.9	
V _{wstd} = (0.001246)(V _{lc})	m ³	0.0024	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V _m	m ³	0.8334	
Gas meter correction factor, Y _d	-	0.9640	
Average dry gas meter temperature, T _m	°C	17.1	
Average pressure drop across orifice, ΔH	mmH ₂ O	44.3	
V _{mstd} = ((0.3592)(V _m)(P _b + (ΔH/13.6))(Y _d)) / (T _m + 273)	m ³	0.7552	
Moisture content, B_{wv} & R_{wv}			
B _{wv} = V _{wstd} / (V _{mstd} + V _{wstd})	m ³	0.0031	
B _{wv} as a percentage	% v/v	0.31	
Reported Water Vapour, checked with Tables in EN 14790, R _{wv}	% v/v	0.31	
Volume of gas metered wet, V_{mstw}			
V _{mstw} = (V _{mstd})(100/(100 - R _{wv}))	m ³	0.7576	
Volume of gas metered at Oxygen Reference Conditions, V_{mstd@X%O₂} & V_{mstw@X%O₂}			
IED & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet (O _{2REFw}) = (21 - REF%O ₂) / (21 - ACT%O _{2w})	-	N/A	
O ₂ Reference Factor dry (O _{2REFd}) = (21 - REF%O ₂) / (21 - ACT%O _{2d})	-	N/A	
V _{mstw@X%oxygen} = (V _{mstw}) / (O _{2REFw})	m ³	N/A	
V _{mstd@X%oxygen} = (V _{mstd}) / (O _{2REFd})	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
M _d = 0.44(%CO ₂)+0.32(%O ₂)+0.28(%N ₂)	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
M _s = M _d (1 - (R _{wv} /100)) + 18(R _{wv} /100)	g/gmol	28.81	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K _p	-	34.97	
Velocity pressure coefficient, C _p	-	0.84	
Average of velocity heads, ΔP _{avg}	mmH ₂ O	11.03	
Average square root of velocity heads, √ΔP	√mmH ₂ O	3.32	
Average stack gas temperature, T _s	°C	19.6	
V _s = ((K _p)(C _p)(√ΔP)(√T _s + 273)) / (√(M _s)(P _s))	m/s	11.33	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO₂}), Dry@O_{2REF} (Q_{stdO₂})			
Area of stack, A _s	m ²	0.20	
Q _a = (60)(A _s)(V _s)	m ³ /min	133.5	
Conversion factor (K/mm.Hg), C _f	-	0.3592	
Q _{stw} = ((Q _a)(P _s)(C _f)) / ((T _s + 273))	m ³ /min	124.0	
Q _{std} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273))	m ³ /min	123.6	
Q _{stwO₂} = ((Q _a)(P _s)(C _f)) / ((T _s + 273)) / (O _{2REFw})	m ³ /min	N/A	
Q _{stdO₂} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273)) / (O _{2REFd})	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D _n	mm	6.04	
Nozzle area, A _n	mm ²	28.69	
Total sampling time, q	min	40	
%I = (4.6398E ⁶)(T _s +273)(V _{mstd}) / (P _s)(V _s)(A _n)(q)(1 - (R _{wv} /100))	%	104.6	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	11:31 - 11:51, 11:53 - 12:13	
Sampling Dates	-	16/11/2016	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.7576	
Filter I.D. Number	-	47-37372	
Start Filter Mass	g	0.15023	
End Filter Mass	g	0.15019	
Total Mass on Filter	g	-0.00004	
Probe Rinse I.D. Number	-	PR-47-37372	
Start Probe Rinse Mass	g	2.97509	
End Probe Rinse Mass	g	2.97515	
Total Mass in Probe Rinse	g	0.00005	
Total Mass Collected	mg	0.01	
Calculated Concentration	mg/m ³	0.01	
Balance Uncertainty / LOD	mg/m ³	0.18	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	16/11/2016	
Average Volume Sampled (REF)	m ³	0.7576	
Filter I.D. Number	-	47-37474	
Start Filter Mass	g	0.14926	
End Filter Mass	g	0.14919	
Total Mass on Filter	g	-0.00007	
Probe Rinse I.D. Number	-	PR-47-37474	
Start Probe Rinse Mass	g	2.92453	
End Probe Rinse Mass	g	2.92456	
Total Mass in Probe Rinse	g	0.00003	
Total Mass Collected	mg	-0.04	
Calculated Concentration	mg/m ³	-0.06	
Balance Uncertainty / LOD	mg/m ³	0.18	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

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Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	20.08	
Pre-Sampling Leak Rate	l/min	0.03	
Post-Sampling Leak Rate	l/min	0.04	
Allowable Leak Rate	l/min	0.40	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	12.5	
Allowable MU	%	20	
MU Acceptable	%	Yes	

Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	104.6	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.25	
Overall Weighing Uncertainty	± mg/m ³	0.33	
ELV [Daily ELV for IED]	mg/m ³	10.00	
Allowable Weighing Uncertainty	mg/m ³	0.50	
Weighing Uncertainty Acceptable	-	Yes	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	20	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	18.00	
Pre-Sampling Leak Rate	l/min	0.02	
Post-Sampling Leak Rate	l/min	0.03	
Allowable Leak Rate	l/min	0.36	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m ³	1.0	
Blank Acceptable	-	Yes	

Acetone / Water Rinse Blank	Units	Blank
Acetone / Water Rinse Value	mg/l	2.7
Allowable Blank	mg/l	10
Blank Acceptable	-	Yes

Method Deviations

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

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	0.8334		uV _m	m ³	0.0167	
Sampled Gas Temperature	T _m	290.1		uT _m	K	2.0	
Sampled Gas Pressure	p _m	100.9		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.20		uL	%	-	
Mass of Particulate	m	0.14		um	mg	0.14	
Uncollected Mass	UCM	-0.04		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.69		≤1%
Sampled Gas Pressure	%	0.50		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.20		≤2%
Mass of Particulate	%	1.85		<5% of ELV
Uncollected Mass	%	-		-

Uncertainty in Measurement Units					Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V _m	m ³	0.7552		0.24	
Leak	L	mg/m ³	0.0002		1.00	
Mass of Particulate	L _r	mg	0.140		1.32	
Uncollected Mass	UCM	mg	-0.03		1.32	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.005	
Leak	mg/m ³	0.0002	
Mass of Particulate	mg/m ³	0.1848	
Uncollected Mass	mg/m ³	-0.0330	

Oxygen Correction Part of MU Budget			
Measured Quantities	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	0.19	
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.37	
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.37	
Reported Uncertainty	mg/m ³	0.37	
Expanded uncertainty (95% confidence), without Oxygen Correction	%	199.2	
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	199.2	
Reported Uncertainty	%	199.2	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 8 - Panstone 6C, 6D, 6E & 6F

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.44		0.44
Uncertainty	±mg/m ³	0.56		0.56
Mass Emission	g/hr	3.1		3.1
Uncertainty	±g/hr	4.0		4.0

General Sampling Information

Parameter	Value
Standard	EN 12619:2013
Technical Procedure	CAT-TP-20
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Type	Propane In Synthetic Air (5 Grade)
Span Gas Reference Number	CYL 1.0245a
Span Gas Expiry Date	10/09/2021
Span Gas Start Pressure (bar)	160
Gas Cylinder Concentration (ppm)	80.1
Span Gas Set Point (ppm)	80.10
Span Gas Uncertainty (%)	N/A
Zero Gas Type	Synthetic Air (5 Grade)
Number of Sampling Lines Used	1/1
Number of Sampling Points Used	1/1
Sample Point I.D.'s	A5 & B5

FORMAT: Number Used / Number Required

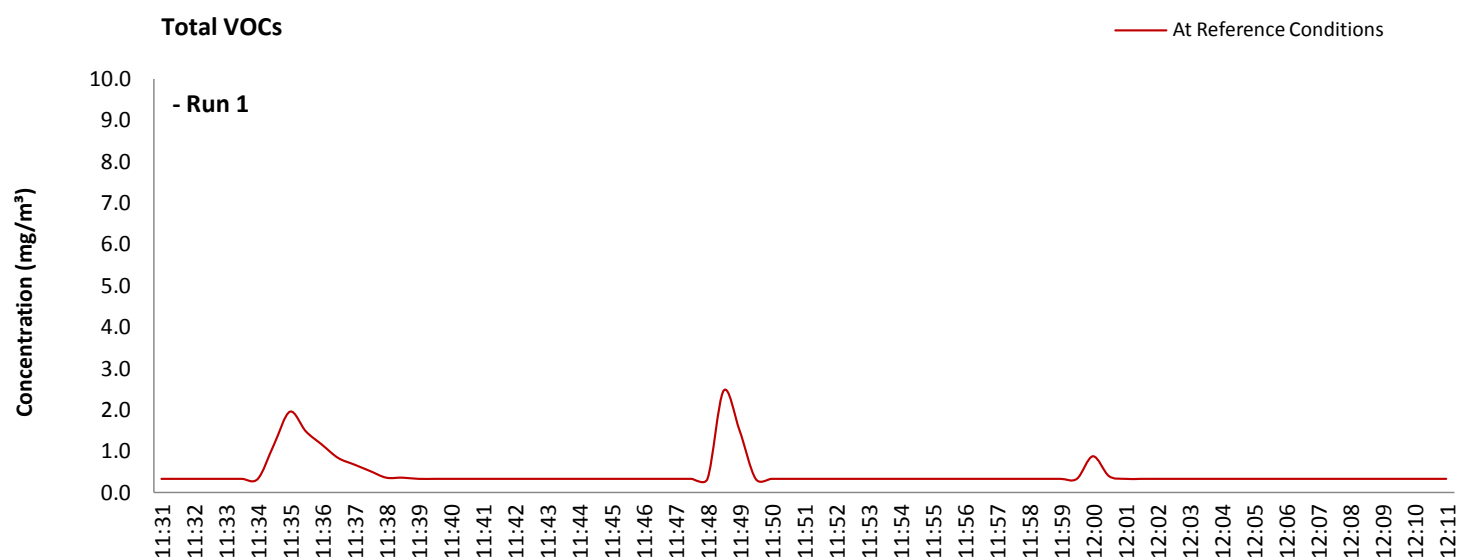
FORMAT: Number Used / Number Required

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	-	11:31 - 12:11	
Sampling Dates	-	16/11/2016	
Instrument Range	ppm	100	
Span Gas Value	ppm	80.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.20	
	Zero Down Sampling Line (Post)	ppm	0.00	
	Zero Drift	ppm	-0.20	
	Allowable Zero Drift	± ppm	4.01	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	80.20	
	Span Down Sampling Line (Post)	ppm	79.80	
	Span Drift	ppm	-0.40	
	Allowable Span Drift	± ppm	4.01	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	7 - 14	

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)
TGN M2 Allowable MU	15.0		%
Measured concentration	0.44		mg/m ³ (STP, dry)
Range Used	100.0		ppm
Range Used [A]	160.6		mg/m ³
Cal gas conc.	80.1		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.	128.7		mg/m ³

Performance characteristics	RUN 1		Units
Response time	45		seconds
Number of readings in measurement	40		-
Repeatability at zero	2.00		% full scale
Repeatability at span level	0.00		% full scale
Deviation from linearity	0.07		% of value
Zero drift	-0.25		% full scale
Span drift	-0.50		% full scale
Volume or pressure flow dependence	1.60		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	1.40		% full scale/10K
Combined interference	0.45		% range
Dependence on voltage	0.50		% full scale/10V
Losses in the line (leak)	0.00		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m ³
Standard deviation of repeatability at span level	0.00		mg/m ³
Lack of fit	0.01		mg/m ³
Drift	-0.19		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)	0.00		mg/m ³
Uncertainty of calibration gas	0.01		mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		0.44	mg/m ³
Expanded uncertainty		0.29	mg/m ³
Expanded uncertainty	k = 1.96	0.56	mg/m ³
Uncertainty corrected to std conds. (O ₂)		0.56	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	127.90	% 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 in M2	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 in M2	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). Ref EA TGN M2.



Exova Catalyst, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL
T: 0800 328 1821 (or + 44 161 432 3286 from overseas)
E: toby.campbell@exova.com
Your Exova Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by
VIP Polymers Ltd

Installation Name & Address

VIP Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7EB

PPC Permit: B11/94

Stack Reference

Stack 9 - Terenzio 3A, 3B & Cooling Table

Dates of the Monitoring Campaign

16th November 2016

Job Reference Number

CAT-3047

Report Written by

Harpreet Badwal
Team Leader
MCERTS Level 2
MM 03 149
TE1 TE2 TE3 TE4

Report Approved by

Derek Myers
Team Leader
MCERTS Level 2
MM 02 115
TE1 TE2 TE3 TE4

Report Date

1st December 2016

Version

Version 1

Signature of Report Approver



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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

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Executive Summary

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MONITORING OBJECTIVES

VIP Polymers Ltd, Huntingdon
Stack 9 - Terenzio 3A, 3B & Cooling Table
16th November 2016

Overall Aim of the Monitoring Campaign

Exova Catalyst were commissioned by VIP Polymers Ltd to carry out stack emissions testing on the Stack 9 - Terenzio 3A, 3B & Cooling Table at Huntingdon.

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter | Total VOCs (as Carbon) |

Executive Summary

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MONITORING RESULTS

VIP Polymers Ltd, Huntingdon
Stack 9 - Terenzio 3A, 3B & Cooling Table
16th November 2016

where MU = Measurement Uncertainty associated with the Result

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.14	0.50	10	g/hr	0.95	3.3	-
Total VOCs (as Carbon)	¹ mg/m ³	0.36	0.56	-	g/hr	2.4	3.8	-
Water Vapour	% v/v	0.16	0.03					
Stack Gas Temperature	°C	19.8						
Stack Gas Velocity	m/s	10.2	0.49					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	7222	475					
Volumetric Flow Rate (REF)	¹ m ³ /hr	6711	441					

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

VIP Polymers Ltd, Huntingdon
Stack 9 - Terenzio 3A, 3B & Cooling Table
16th November 2016

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m ³	0.14	g/hr	0.95	16/11/2016	12:30 - 12:50, 12:52 - 13:12	40
Total VOCs (as Carbon)	R1	mg/m ³	0.36	g/hr	2.4	16/11/2016	12:30 - 13:10	40
Velocity & Volumetric Flow Rate	R1					16/11/2016	13:00 - 13:10	

All results are expressed at the respective reference conditions.



Executive Summary
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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon
Stack 9 - Terenzio 3A, 3B & Cooling Table
16th November 2016

Standard Operating Conditions

Parameter	Value
Process Status	Compression Moulding Operational
Capacity (of 100%) and Tonnes / Hour	Normal Operation
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Rubber Products
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon
Stack 9 - Terenzio 3A, 3B & Cooling Table
16th November 2016

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	ISO 17025 Testing	Testing Lab	Analytical Procedure	Analytical Technique	ISO 17025 Analysis	Analysis Lab		
Total Particulate Matter	EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.14 mg/m ³
Water Vapour	EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.32 mg/m ³
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	Yes	CAT	Pitot Tube and Thermocouple				Yes	1.2 m/s

ANALYSIS LABORATORIES

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

Exova Catalyst (CAT)	ISO 17025 Accreditation Number: 4279
----------------------	--------------------------------------

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	1	Ratio highest to lowest velocities > 5 : 1.
Total Particulate Matter	1	Lowest differential pressure < 5 Pa.

Executive Summary

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SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.50
Width	m	-
Area	m ²	0.20
Port Depth	cm	5
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	1.0		> 5 Pa	No
Mean Velocity	m/s	10.22		-	-
Lowest Gas Velocity	m/s	1.08		-	-
Highest Gas Velocity	m/s	16.52		-	-
Ratio of Above	: 1	15.24		< 3 : 1	No
Maximum Angle of Swirl	°	2		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

Executive Summary

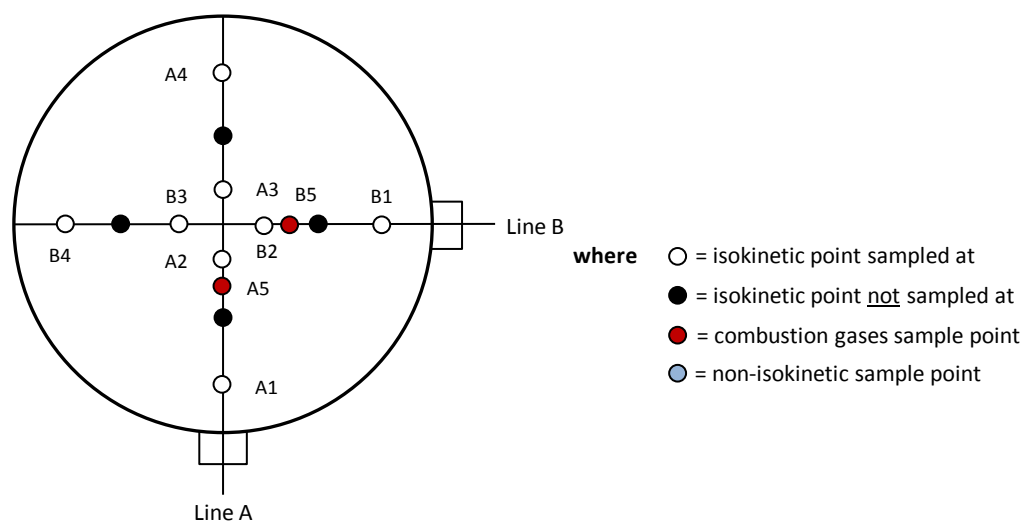
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PLANT PHOTOS

Photo 1



SAMPLE POINTS





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	Harpreet Badwal	MCERTS Level 2	MM 03 149	TE1 TE2 TE3 TE4
Team Leader	Phil Waters	MCERTS Level 2	MM 04 527	TE1 TE2 TE3 TE4

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM (1)	CAT 7.57	Horiba PG-350E	-	Digital Manometer (1)	CAT 3.142
Control Box DGM (2)	-	Horiba PG-250	-	Digital Manometer (2)	CAT 3.144
Box Thermocouples (1)	CAT 3.146	Servomex 4900	-	Digital Temperature Meter	-
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	CAT 14.84
Umbilical (1)	CAT 3.146	ABB AO2020-URAS26	-	Barometer	CAT 13.40
Umbilical (2)	-	Servomex 5200MP	-	Stack Thermocouple (1)	CAT 4.844
Oven Box (1)	-	Ankersmid APS 313	-	Stack Thermocouple (2)	CAT 4.789
Oven Box (2)	-	Gasmet DX4000	-	Stack Thermocouple (3)	CAT 4.013
Heated Probe (1)	CAT 5.126	Gasmet Sampling System	-	1m Heated Line (1)	-
Heated Probe (2)	CAT 5.127	Bernath 3006 FID	CAT 8.31	1m Heated Line (2)	-
Heated Probe (3)	CAT 5.128	M&C PSS	CAT 12.107	1m Heated Line (3)	-
S-Pitot (1)	CAT 21S.57	Mass Flow Controller (1)	CAT 6.61	5m Heated Line (1)	-
S-Pitot (2)	CAT 21P.38	Mass Flow Controller (2)	CAT 6.62	15m Heated Line (1)	-
L-Pitot	-	Mass View (1)	-	20m Heated Line (1)	CAT 20.116
Site Balance	CAT 17.33	Mass View (2)	-	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.33 a & b	Hioki 5043 (V)	CAT 11.69	Dual Channel Heater Controller	-
Last Impinger Arm	-	Easylogger EN-EL-12 Bit	-	Single Channel Heater Controller	CAT 20.116
Callipers	CAT 23.40	Bioaerosols Temperature Logger	-	Laboratory Balance	CAT 1.18 / 1.18a
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.45

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	EN 13284-1	CAT-TP-01
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	0.50
Stack Width, W	m	-
Stack Area, A	m ²	0.20
Average Stack Gas Temperature, T _a	°C	19.8
Average Stack Gas Pressure	Pa	123.1
Average Stack Static Pressure, P _{static}	kPa	0.144
Average Barometric Pressure, P _b	kPa	100.8
Average Pitot Tube Calibration Coefficient, C _p	-	0.84

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.77	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	79.01	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.16	0.0016	18.02	0.8037	0.00131

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	1.286
Dry Density (Actual), P _{Actual}	kg/m ³	1.196
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.195

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)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	19.8	0.0
Total Pressure	kPa	100.9	101.3
Moisture	%	0.16	0.16

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	7222
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	6711
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	6700
Gas Volumetric Flowrate REF ¹	m ³ /hr	6711

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

(1 of 1)

Parameter	Units	Value
Date of Survey	-	16/11/2016
Time of Survey	-	13:00 - 13:10
Atmospheric Pressure	kPa	100.8
Average Stack Static Pressure	Pa	144
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with KIMO MP 210 (500Pa)	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C _p	-	0.84
Number of Lines Available	-	2
Number of Lines Used	-	2

Sampling Line A							Sampling Line B				
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °
STATIC (Units: Pa)		138.0					149.0				
Mean		149.5	19.5	1.196	12.41		96.8	20.0	1.194	8.02	
1	0.03	17.5	19.0	1.199	4.52	1.0	152.6	20.0	1.194	13.38	1.0
2	0.13	218.7	19.0	1.199	16.00	1.0	1.0	20.0	1.194	1.08	0.0
3	0.38	190.3	20.0	1.194	14.95	2.0	1.0	20.0	1.194	1.08	1.0
4	0.47	171.4	20.0	1.194	14.19	1.0	232.4	20.0	1.194	16.52	1.0

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	$u(\Delta p_i)$	2.291	Pa
- Resolution	$u(res)$	0.00087	
- Calibration	$u(cal)$	1.578	
- Drift	$u(drift)$	0.083	
- Lack of Fit	$u(fit)$	2.585	
- Overall corrections to dynamic measurements	$u(C_f)$	4.247	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00003	-
- $\phi_{O_2,w}$	-	20.766	
- $\phi_{CO_2,w}$	-	0.060	
- Oxygen, dry	$u(\phi_{O_2,d})$	0.637	
- Carbon Dioxide, dry	$u(\phi_{CO_2,d})$	0.002	
- Water Vapour	$u(\phi_{H_2O})$	0.008	
- Oxygen, wet	$u(\phi_{O_2,w})$	0.636	
- Carbon Dioxide, wet	$u(\phi_{CO_2,w})$	0.002	
Standard uncertainty associated with the stack temperature	$u(T_c)$	1.494	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.700	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	1.620	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00644	-
Standard uncertainty associated with the local velocities	$u(v_i)$	0.462	Pa
Standard uncertainty associated with the mean velocity	$u(\bar{v})$	0.248	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	0.487	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	4.77	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV,w)$	474.7	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00112	
- $u^2(qV,w)$	-	58660	
- $u(qV,w)$	-	242.2	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV,w)$	6.57	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 9 - Terenzio 3A, 3B & Cooling Table

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.14		0.14
Uncertainty	±mg/m ³	0.50		0.50
Mass Emission	g/hr	0.95		0.95
Uncertainty	±g/hr	3.3		3.3

NOTE: Where the maximum Blank concentration is higher than the Sample concentration, the maximum Blank concentration has been reported.

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.16		0.16
Uncertainty	±% v/v	0.03		0.03

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.14		0.14

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value
Standard	EN 13284-1
Technical Procedure	CAT-TP-01
Probe Material	Titanium
Filter Housing Material	Titanium
Positioning of Filter	In Stack
Filter Size and Material	47mm Glass Fibre
Number of Sampling Lines Used	2/2
Number of Sampling Points Used	8/8
Sample Point I.D.'s	A1, A2, A3, A4, B1, B2, B3 & B4

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

Reference Conditions

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

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	756.0	
Stack static pressure, P_{static}	mmH ₂ O	14.1	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	757.0	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	0.5	
Total mass collected in impingers (silica trap)	g	0.8	
Total mass of liquid collected, V_{lc}	g	1.3	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0016	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.0876	
Gas meter correction factor, Y_d	-	0.9640	
Average dry gas meter temperature, T_m	°C	16.8	
Average pressure drop across orifice, ΔH	mmH ₂ O	72.8	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.9896	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0016	
B_{wo} as a percentage	% v/v	0.16	
Reported Water Vapour, checked with Tables in EN 14790, R_{wv}	% v/v	0.16	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.9912	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
IED & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.82	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K_p	-	34.97	
Velocity pressure coefficient, C_p	-	0.84	
Average of velocity heads, ΔP_{avg}	mmH ₂ O	18.10	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	4.25	
Average stack gas temperature, T_s	°C	19.8	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (V(M_s)(P_s))$	m/s	14.51	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})			
Area of stack, A_s	m ²	0.20	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	171.0	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	158.8	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	158.5	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273) / (O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	6.04	
Nozzle area, A_n	mm ²	28.69	
Total sampling time, q	min	40	
$\%I = (4.6398E^6)(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	106.8	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	12:30 - 12:50, 12:52 - 13:12	
Sampling Dates	-	16/11/2016	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.9912	
Filter I.D. Number	-	47-37475	
Start Filter Mass	g	0.14854	
End Filter Mass	g	0.14856	
Total Mass on Filter	g	0.00002	
Probe Rinse I.D. Number	-	PR-47-37475	
Start Probe Rinse Mass	g	3.06209	
End Probe Rinse Mass	g	3.06214	
Total Mass in Probe Rinse	g	0.00005	
Total Mass Collected	mg	0.07	
Calculated Concentration	mg/m ³	0.07	
Balance Uncertainty / LOD	mg/m ³	0.14	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	16/11/2016	
Average Volume Sampled (REF)	m ³	0.9912	
Filter I.D. Number	-	47-37614	
Start Filter Mass	g	0.14744	
End Filter Mass	g	0.14742	
Total Mass on Filter	g	-0.00002	
Probe Rinse I.D. Number	-	PR-47-37614	
Start Probe Rinse Mass	g	2.91713	
End Probe Rinse Mass	g	2.91714	
Total Mass in Probe Rinse	g	0.00001	
Total Mass Collected	mg	-0.01	
Calculated Concentration	mg/m ³	-0.01	
Balance Uncertainty / LOD	mg/m ³	0.14	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	26.21	
Pre-Sampling Leak Rate	l/min	0.03	
Post-Sampling Leak Rate	l/min	0.04	
Allowable Leak Rate	l/min	0.52	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	17.4	
Allowable MU	%	20	
MU Acceptable	%	Yes	

Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	106.8	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.25	
Overall Weighing Uncertainty	± mg/m ³	0.25	
ELV [Daily ELV for IED]	mg/m ³	10.00	
Allowable Weighing Uncertainty	mg/m ³	0.50	
Weighing Uncertainty Acceptable	-	Yes	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	20	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	



APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

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Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	18.00	
Pre-Sampling Leak Rate	l/min	0.02	
Post-Sampling Leak Rate	l/min	0.03	
Allowable Leak Rate	l/min	0.36	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m ³	1.0	
Blank Acceptable	-	Yes	

Acetone / Water Rinse Blank	Units	Blank
Acetone / Water Rinse Value	mg/l	2.7
Allowable Blank	mg/l	10
Blank Acceptable	-	Yes

Method Deviations

Nature of Deviation	Run Number	
	1	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)		
Ratio highest to lowest velocities > 5 : 1.	x	
Lowest differential pressure < 5 Pa.	x	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	1.0876		uV _m	m ³	0.0218	
Sampled Gas Temperature	T _m	289.8		uT _m	K	2.0	
Sampled Gas Pressure	p _m	100.9		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.15		uL	%	-	
Mass of Particulate	m	0.14		um	mg	0.14	
Uncollected Mass	UCM	-0.01		uUCM	mg	-	

Uncertainty as a Percentage				Requirement of Standard
Measured Quantities	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.69		≤1%
Sampled Gas Pressure	%	0.50		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.15		≤2%
Mass of Particulate	%	1.41		<5% of ELV
Uncollected Mass	%	-		-

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	0.9896	0.14	
Leak	L	mg/m ³	0.000	1.00	
Mass of Particulate	L _r	mg	0.140	1.01	
Uncollected Mass	UCM	mg	0.00	1.01	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.004	
Leak	mg/m ³	0.0001	
Mass of Particulate	mg/m ³	0.1412	
Uncollected Mass	mg/m ³	-0.0039	

Oxygen Correction Part of MU Budget			
Measured Quantities	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	0.14	
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.28	
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.50	
Reported Uncertainty	mg/m ³	0.50	
Expanded uncertainty (95% confidence), without Oxygen Correction	%	196.1	
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	353.0	
Reported Uncertainty	%	353.0	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 9 - Terenzio 3A, 3B & Cooling Table

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.36		0.36
Uncertainty	±mg/m ³	0.56		0.56
Mass Emission	g/hr	2.4		2.4
Uncertainty	±g/hr	3.8		3.8

General Sampling Information

Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	CAT-TP-20	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	CYL 1.0245a	
Span Gas Expiry Date	10/09/2021	
Span Gas Start Pressure (bar)	160	
Gas Cylinder Concentration (ppm)	80.1	
Span Gas Set Point (ppm)	80.10	
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	A5 & B5	

Reference Conditions

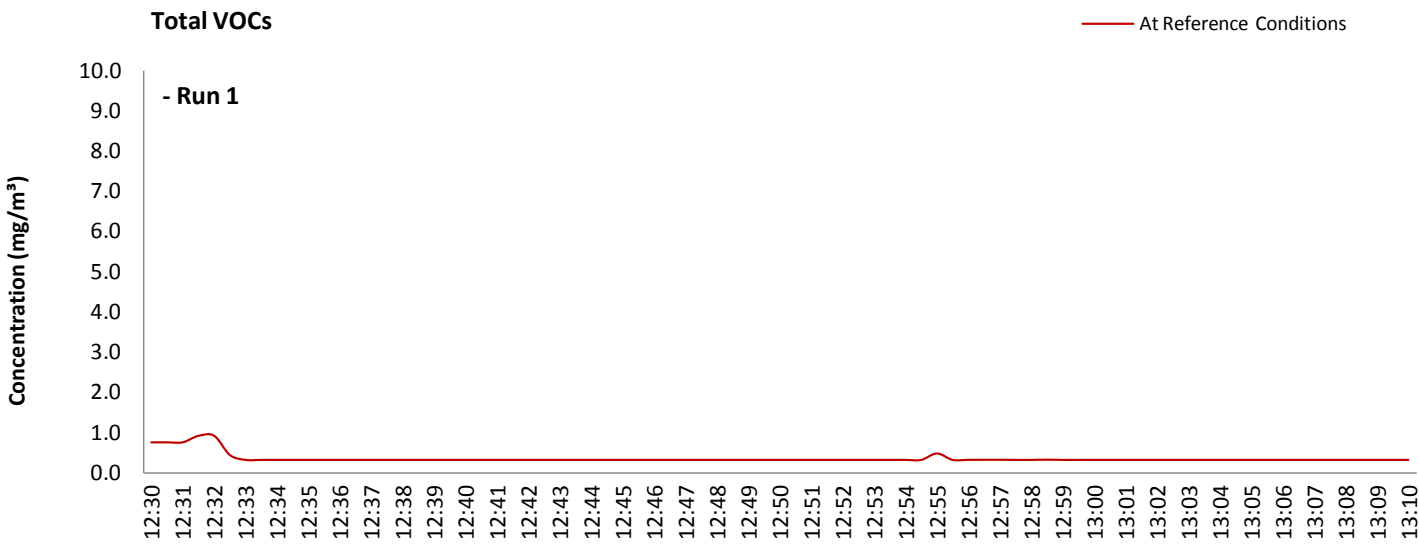
Reference Conditions are: 273K, 101.3kPa, without correction for water vapour content.



APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	12:30 - 13:10	
Sampling Dates	-	16/11/2016	
Instrument Range	ppm	100	
Span Gas Value	ppm	80.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.20	
	Zero Down Sampling Line (Post)	ppm	0.00	
	Zero Drift	ppm	-0.20	
	Allowable Zero Drift	± ppm	4.01	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	80.20	
	Span Down Sampling Line (Post)	ppm	79.80	
	Span Drift	ppm	-0.40	
	Allowable Span Drift	± ppm	4.01	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	6 - 14	

Method Deviations

Nature of Deviation	Run Number	
	1	
(x = deviation applies to the associated run)		
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)
TGN M2 Allowable MU	15.0	%
Measured concentration	0.36	mg/m ³ (STP, dry)
Range Used	100.0	ppm
Range Used [A]	160.6	mg/m ³
Cal gas conc.	80.1	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.	128.7	mg/m ³

Performance characteristics	RUN 1	Units
Response time	45	seconds
Number of readings in measurement	40	-
Repeatability at zero	2.00	% full scale
Repeatability at span level	0.00	% full scale
Deviation from linearity	0.07	% of value
Zero drift	-0.25	% full scale
Span drift	-0.50	% full scale
Volume or pressure flow dependence	1.60	% of full scale
Atmospheric pressure dependence	0.30	% of value/kPa
Ambient temperature dependence	1.40	% full scale/10K
Combined interference	0.45	% range
Dependence on voltage	0.50	% full scale/10V
Losses in the line (leak)	0.00	% of value
Uncertainty of calibration gas	2.00	% of value

Performance characteristic	RUN 1	Units
Standard deviation of repeatability at zero	use rep at span	mg/m ³
Standard deviation of repeatability at span level	0.00	mg/m ³
Lack of fit	0.01	mg/m ³
Drift	-0.19	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)	0.00	mg/m ³
Uncertainty of calibration gas	0.00	mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		0.36	mg/m ³
Expanded uncertainty	k = 1.96	0.29	mg/m ³
Expanded uncertainty		0.56	mg/m ³
Uncertainty corrected to std conds. (O ₂)		0.56	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	157.47	% 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 in M2	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 in M2	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). Ref EA TGN M2.



Exova Catalyst, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL

T: 0800 328 1821 (or + 44 161 432 3286 from overseas)

E: toby.campbell@exova.com

Your Exova Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

VIP Polymers Ltd

Installation Name & Address

VIP Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7EB

PPC Permit: B11/94

Stack Reference

Stack 11 - Strip Press and Cooling Booth

Dates of the Monitoring Campaign

16th November 2016

Job Reference Number

CAT-3047

Report Written by

Harpreet Badwal
Team Leader
MCERTS Level 2
MM 03 149
TE1 TE2 TE3 TE4

Report Approved by

Derek Myers
Team Leader
MCERTS Level 2
MM 02 115
TE1 TE2 TE3 TE4

Report Date

1st December 2016

Version

Version 1

Signature of Report Approver



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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

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Executive Summary

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MONITORING OBJECTIVES

VIP Polymers Ltd, Huntingdon
Stack 11 - Strip Press and Cooling Booth
16th November 2016

Overall Aim of the Monitoring Campaign

Exova Catalyst were commissioned by VIP Polymers Ltd to carry out stack emissions testing on the Stack 11 - Strip Press and Cooling Booth at Huntingdon.

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter | Total VOCs (as Carbon) |

Executive Summary

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MONITORING RESULTS

VIP Polymers Ltd, Huntingdon
 Stack 11 - Strip Press and Cooling Booth
 16th November 2016

where MU = Measurement Uncertainty associated with the Result

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.17	0.33	10	g/hr	2.9	5.6	-
Total VOCs (as Carbon)	¹ mg/m ³	0.41	0.56	-	g/hr	7.1	9.7	-
Water Vapour	% v/v	0.10	0.03					
Stack Gas Temperature	°C	20.0						
Stack Gas Velocity	m/s	11.7	0.20					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	18571	900					
Volumetric Flow Rate (REF)	¹ m ³ /hr	17243	835					

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

VIP Polymers Ltd, Huntingdon
Stack 11 - Strip Press and Cooling Booth
16th November 2016

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m ³	0.17	g/hr	2.9	16/11/2016	13:43 - 14:03, 14:05 - 14:25	40
Total VOCs (as Carbon)	R1	mg/m ³	0.41	g/hr	7.1	16/11/2016	13:43 - 14:23	40
Velocity & Volumetric Flow Rate	R1					16/11/2016	13:41 - 13:51	

All results are expressed at the respective reference conditions.



Executive Summary
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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon
Stack 11 - Strip Press and Cooling Booth
16th November 2016

Standard Operating Conditions

Parameter	Value
Process Status	Compression Press Operational
Capacity (of 100%) and Tonnes / Hour	Normal Operation
Continuous or Batch Process	Batch 15 - 20 min cycle
Feedstock (if applicable)	Rubber Products
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon
Stack 11 - Strip Press and Cooling Booth
16th November 2016

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	ISO 17025 Testing	Testing Lab	Analytical Procedure	Analytical Technique	ISO 17025 Analysis	Analysis Lab		
Total Particulate Matter	EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.17 mg/m ³
Water Vapour	EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.32 mg/m ³
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	Yes	CAT	Pitot Tube and Thermocouple				Yes	1.2 m/s

ANALYSIS LABORATORIES

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

Exova Catalyst (CAT)	ISO 17025 Accreditation Number: 4279
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SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Water Vapour	1	The measurement uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.

Executive Summary

(Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.75
Width	m	-
Area	m ²	0.44
Port Depth	cm	5
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	76.0		> 5 Pa	Yes
Mean Velocity	m/s	11.7		-	-
Lowest Gas Velocity	m/s	9.44		-	-
Highest Gas Velocity	m/s	13.2		-	-
Ratio of Above	: 1	1.40		< 3 : 1	Yes
Maximum Angle of Swirl	°	0		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

Executive Summary

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PLANT PHOTOS

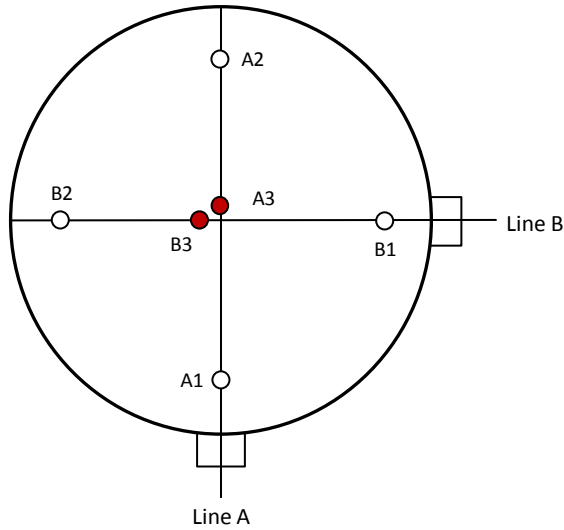
Photo 1



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	Harpreet Badwal	MCERTS Level 2	MM 03 149	TE1 TE2 TE3 TE4
Team Leader	Phil Waters	MCERTS Level 2	MM 04 527	TE1 TE2 TE3 TE4

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM (1)	CAT 7.57	Horiba PG-350E	-	Digital Manometer (1)	CAT 3.142
Control Box DGM (2)	-	Horiba PG-250	-	Digital Manometer (2)	CAT 3.144
Box Thermocouples (1)	CAT 3.146	Servomex 4900	-	Digital Temperature Meter	-
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	CAT 14.84
Umbilical (1)	CAT 3.146	ABB AO2020-URAS26	-	Barometer	CAT 13.40
Umbilical (2)	-	Servomex 5200MP	-	Stack Thermocouple (1)	CAT 4.844
Oven Box (1)	-	Ankersmid APS 313	-	Stack Thermocouple (2)	CAT 4.789
Oven Box (2)	-	Gasmet DX4000	-	Stack Thermocouple (3)	CAT 4.013
Heated Probe (1)	CAT 5.126	Gasmet Sampling System	-	1m Heated Line (1)	-
Heated Probe (2)	CAT 5.127	Bernath 3006 FID	CAT 8.31	1m Heated Line (2)	-
Heated Probe (3)	CAT 5.128	M&C PSS	CAT 12.107	1m Heated Line (3)	-
S-Pitot (1)	CAT 21S.57	Mass Flow Controller (1)	CAT 6.61	5m Heated Line (1)	-
S-Pitot (2)	CAT 21P.38	Mass Flow Controller (2)	CAT 6.62	15m Heated Line (1)	-
L-Pitot	-	Mass View (1)	-	20m Heated Line (1)	CAT 20.116
Site Balance	CAT 17.33	Mass View (2)	-	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.33 a & b	Hioki 5043 (V)	CAT 11.69	Dual Channel Heater Controller	-
Last Impinger Arm	-	Easylogger EN-EL-12 Bit	-	Single Channel Heater Controller	CAT 20.116
Callipers	CAT 23.40	Bioaerosols Temperature Logger	-	Laboratory Balance	CAT 1.18 / 1.18a
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.45

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	EN 13284-1	CAT-TP-01
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	0.75
Stack Width, W	m	-
Stack Area, A	m ²	0.44
Average Stack Gas Temperature, T _a	°C	20.0
Average Stack Gas Pressure	Pa	118.3
Average Stack Static Pressure, P _{static}	kPa	0.147
Average Barometric Pressure, P _b	kPa	100.8
Average Pitot Tube Calibration Coefficient, C _p	-	0.84

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.78	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	79.06	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.10	0.0010	18.02	0.8037	0.00083

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	1.287
Dry Density (Actual), P _{Actual}	kg/m ³	1.195
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.195

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	20.0	0.0
Total Pressure	kPa	100.9	101.3
Moisture	%	0.10	0.10

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	18571
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	17243
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	17225
Gas Volumetric Flowrate REF ¹	m ³ /hr	17243

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

(1 of 1)

Parameter	Units	Value
Date of Survey	-	16/11/2016
Time of Survey	-	13:41 - 13:51
Atmospheric Pressure	kPa	100.8
Average Stack Static Pressure	Pa	147
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with KIMO MP 210 (500Pa)	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C _p	-	0.84
Number of Lines Available	-	2
Number of Lines Used	-	2

Sampling Line A							Sampling Line B				
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °
STATIC (Units: Pa)		139.0					154.0				
Mean		112.0	20.0	1.195	11.31		124.5	20.0	1.195	12.04	
1	0.11	76.0	20.0	1.195	9.44	0.0	102.0	20.0	1.195	10.94	0.0
2	0.64	148.0	20.0	1.195	13.18	0.0	147.0	20.0	1.195	13.13	0.0

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	$u(\Delta p_i)$	2.219	Pa
- Resolution	$u(res)$	0.00087	
- Calibration	$u(cal)$	1.456	
- Drift	$u(drift)$	0.083	
- Lack of Fit	$u(fit)$	2.385	
- Overall corrections to dynamic measurements	$u(C_f)$	3.925	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00003	-
- $\varphi_{O_2,w}$	-	20.778	
- $\varphi_{CO_2,w}$	-	0.060	
- Oxygen, dry	$u(\phi_{O_2,d})$	0.637	
- Carbon Dioxide, dry	$u(\phi_{CO_2,d})$	0.002	
- Water Vapour	$u(\phi_{H_2O})$	0.005	
- Oxygen, wet	$u(\phi_{O_2,w})$	0.636	
- Carbon Dioxide, wet	$u(\phi_{CO_2,w})$	0.002	
Standard uncertainty associated with the stack temperature	$u(T_c)$	1.495	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.699	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	1.569	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00644	-
Standard uncertainty associated with the local velocities	$u(v_i)$	0.143	Pa
Standard uncertainty associated with the mean velocity	$u(\bar{v})$	0.103	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	0.202	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	1.73	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV,w)$	899.8	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00061	
- $u^2(qV,w)$	-	210744	
- $u(qV,w)$	-	459.1	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV,w)$	4.85	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 11 - Strip Press and Cooling Booth

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.17		0.17
Uncertainty	±mg/m ³	0.33		0.33
Mass Emission	g/hr	2.9		2.9
Uncertainty	±g/hr	5.6		5.6

NOTE: Where the maximum Blank concentration is higher than the Sample concentration, the maximum Blank concentration has been reported.

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.10		0.10
Uncertainty	±% v/v	0.03		0.03

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.17		0.17

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value	
Standard	EN 13284-1	
Technical Procedure	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Glass Fibre	
Number of Sampling Lines Used	2/2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	4/4	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1, A2, B1 & B2	

Reference Conditions

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

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P _b	mmHg	756.0	
Stack static pressure, P _{static}	mmH ₂ O	14.2	
P _s = (P _b + (P _{static} / 13.6))	mmHg	757.0	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	0.8	
Total mass collected in impingers (silica trap)	g	-0.1	
Total mass of liquid collected, V _{lc}	g	0.7	
V _{wstd} = (0.001246)(V _{lc})	m ³	0.0009	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V _m	m ³	0.9256	
Gas meter correction factor, Y _d	-	0.9640	
Average dry gas meter temperature, T _m	°C	16.8	
Average pressure drop across orifice, ΔH	mmH ₂ O	53.8	
V _{mstd} = ((0.3592)(V _m)(P _b + (ΔH/13.6))(Y _d)) / (T _m + 273)	m ³	0.8406	
Moisture content, B_{wo} & R_{wv}			
B _{wo} = V _{wstd} / (V _{mstd} + V _{wstd})	m ³	0.0010	
B _{wo} as a percentage	% v/v	0.10	
Reported Water Vapour, checked with Tables in EN 14790, R _{wv}	% v/v	0.10	
Volume of gas metered wet, V_{mstw}			
V _{mstw} = (V _{mstd})(100/(100 - R _{wv}))	m ³	0.8415	
Volume of gas metered at Oxygen Reference Conditions, V_{mstd@X%O₂} & V_{mstw@X%O₂}			
IED & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet (O _{2REFw}) = (21 - REF%O ₂) / (21 - ACT%O _{2w})	-	N/A	
O ₂ Reference Factor dry (O _{2REFd}) = (21 - REF%O ₂) / (21 - ACT%O _{2d})	-	N/A	
V _{mstw@X%oxygen} = (V _{mstw}) / (O _{2REFw})	m ³	N/A	
V _{mstd@X%oxygen} = (V _{mstd}) / (O _{2REFd})	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
M _d = 0.44(%CO ₂)+0.32(%O ₂)+0.28(%N ₂)	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
M _s = M _d (1 - (R _{wv} /100)) + 18(R _{wv} /100)	g/gmol	28.83	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K _p	-	34.97	
Velocity pressure coefficient, C _p	-	0.84	
Average of velocity heads, ΔP _{avg}	mmH ₂ O	13.56	
Average square root of velocity heads, √ΔP	√mmH ₂ O	3.68	
Average stack gas temperature, T _s	°C	20.0	
V _s = ((K _p)(C _p)(√ΔP)(√T _s + 273)) / (√(M _s)(P _s))	m/s	12.56	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO₂}), Dry@O_{2REF} (Q_{stdO₂})			
Area of stack, A _s	m ²	0.44	
Q _a = (60)(A _s)(V _s)	m ³ /min	333.1	
Conversion factor (K/mm.Hg), C _f	-	0.3592	
Q _{stw} = ((Q _a)(P _s)(C _f)) / ((T _s + 273)	m ³ /min	309.1	
Q _{std} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273)	m ³ /min	308.8	
Q _{stwO₂} = ((Q _a)(P _s)(C _f)) / ((T _s + 273) / (O _{2REFw}))	m ³ /min	N/A	
Q _{stdO₂} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273) / (O _{2REFd}))	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D _n	mm	6.04	
Nozzle area, A _n	mm ²	28.69	
Total sampling time, q	min	40	
%I = (4.6398E ⁶)(T _s +273)(V _{mstd}) / (P _s)(V _s)(A _n)(q)(1 - (R _{wv} /100))	%	104.8	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	13:43 - 14:03, 14:05 - 14:25	
Sampling Dates	-	16/11/2016	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.8415	
Filter I.D. Number	-	47-37374	
Start Filter Mass	g	0.15003	
End Filter Mass	g	0.14997	
Total Mass on Filter	g	-0.00006	
Probe Rinse I.D. Number	-	PR-47-37374	
Start Probe Rinse Mass	g	2.96462	
End Probe Rinse Mass	g	2.96462	
Total Mass in Probe Rinse	g	0.00001	
Total Mass Collected	mg	-0.06	
Calculated Concentration	mg/m ³	-0.07	
Balance Uncertainty / LOD	mg/m ³	0.17	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	16/11/2016	
Average Volume Sampled (REF)	m ³	0.8415	
Filter I.D. Number	-	47-37373	
Start Filter Mass	g	0.14659	
End Filter Mass	g	0.14660	
Total Mass on Filter	g	0.00001	
Probe Rinse I.D. Number	-	PR-47-37373	
Start Probe Rinse Mass	g	2.83183	
End Probe Rinse Mass	g	2.83184	
Total Mass in Probe Rinse	g	0.00001	
Total Mass Collected	mg	0.02	
Calculated Concentration	mg/m ³	0.02	
Balance Uncertainty / LOD	mg/m ³	0.17	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	22.31	
Pre-Sampling Leak Rate	l/min	0.03	
Post-Sampling Leak Rate	l/min	0.04	
Allowable Leak Rate	l/min	0.45	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	31.2	
Allowable MU	%	20	
MU Acceptable	%	No	

Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	104.8	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.25	
Overall Weighing Uncertainty	± mg/m ³	0.30	
ELV [Daily ELV for IED]	mg/m ³	10.00	
Allowable Weighing Uncertainty	mg/m ³	0.50	
Weighing Uncertainty Acceptable	-	Yes	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	20	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	18.00	
Pre-Sampling Leak Rate	l/min	0.02	
Post-Sampling Leak Rate	l/min	0.03	
Allowable Leak Rate	l/min	0.36	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m ³	1.0	
Blank Acceptable	-	Yes	

Acetone / Water Rinse Blank	Units	Blank
Acetone / Water Rinse Value	mg/l	2.7
Allowable Blank	mg/l	10
Blank Acceptable	-	Yes

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
The measurement uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.	w	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	0.9256		uV _m	m ³	0.0185	
Sampled Gas Temperature	T _m	289.8		uT _m	K	2.0	
Sampled Gas Pressure	p _m	100.9		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.18		uL	%	-	
Mass of Particulate	m	0.14		um	mg	0.14	
Uncollected Mass	UCM	0.02		uUCM	mg	-	

Uncertainty as a Percentage				Requirement of Standard
Measured Quantities	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.69		≤1%
Sampled Gas Pressure	%	0.50		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.18		≤2%
Mass of Particulate	%	1.66		<5% of ELV
Uncollected Mass	%	-		-

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	0.8406	0.20	
Leak	L	mg/m ³	0.000	1.00	
Mass of Particulate	L _r	mg	0.140	1.19	
Uncollected Mass	UCM	mg	0.01	1.19	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.004	
Leak	mg/m ³	0.0002	
Mass of Particulate	mg/m ³	0.1664	
Uncollected Mass	mg/m ³	0.0137	

Oxygen Correction Part of MU Budget			
Measured Quantities	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	0.17	
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.33	
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.33	
Reported Uncertainty	mg/m ³	0.33	
Expanded uncertainty (95% confidence), without Oxygen Correction	%	196.7	
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	196.7	
Reported Uncertainty	%	196.7	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 11 - Strip Press and Cooling Booth

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.41		0.41
Uncertainty	±mg/m ³	0.56		0.56
Mass Emission	g/hr	7.1		7.1
Uncertainty	±g/hr	9.7		9.7

General Sampling Information

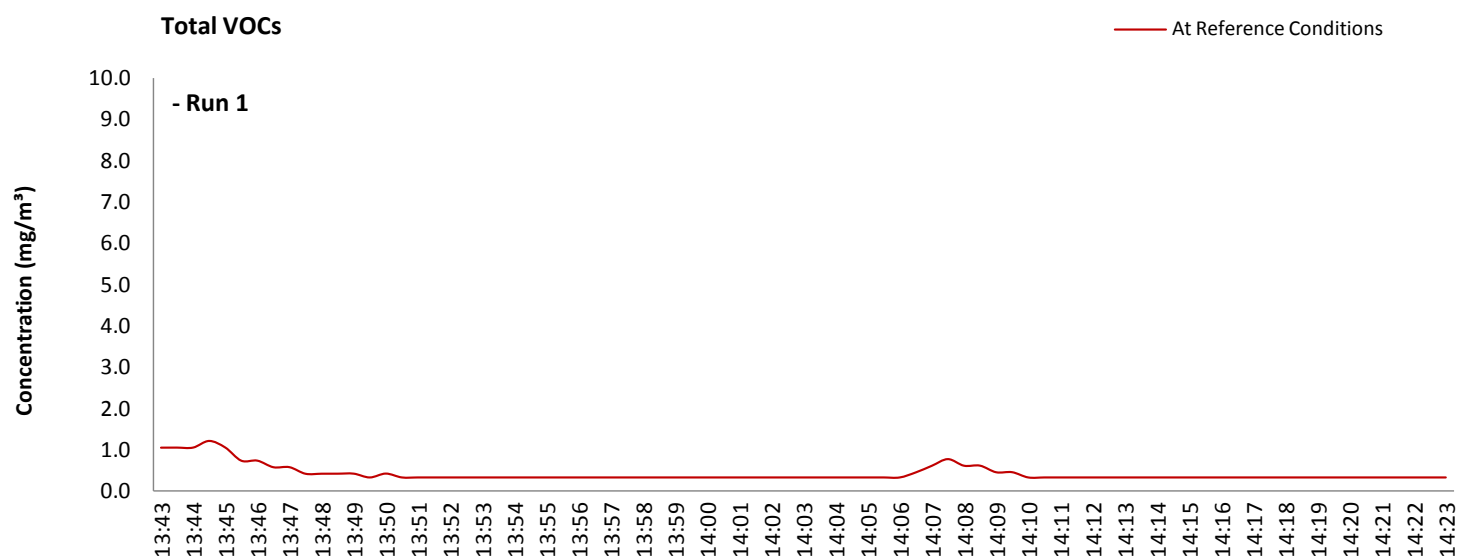
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	CAT-TP-20	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	CYL 1.0245a	
Span Gas Expiry Date	10/09/2021	
Span Gas Start Pressure (bar)	160	
Gas Cylinder Concentration (ppm)	80.1	
Span Gas Set Point (ppm)	80.10	
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	A3 & B3	

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	-	13:43 - 14:23	
Sampling Dates	-	16/11/2016	
Instrument Range	ppm	100	
Span Gas Value	ppm	80.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.20	
	Zero Down Sampling Line (Post)	ppm	0.00	
	Zero Drift	ppm	-0.20	
	Allowable Zero Drift	± ppm	4.01	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	80.20	
	Span Down Sampling Line (Post)	ppm	79.80	
	Span Drift	ppm	-0.40	
	Allowable Span Drift	± ppm	4.01	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	6 - 14	

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)
TGN M2 Allowable MU	15.0		%
Measured concentration	0.41		mg/m ³ (STP, dry)
Range Used	100.0		ppm
Range Used [A]	160.6		mg/m ³
Cal gas conc.	80.1		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.	128.7		mg/m ³

Performance characteristics	RUN 1		Units
Response time	45		seconds
Number of readings in measurement	40		-
Repeatability at zero	2.00		% full scale
Repeatability at span level	0.00		% full scale
Deviation from linearity	0.07		% of value
Zero drift	-0.25		% full scale
Span drift	-0.50		% full scale
Volume or pressure flow dependence	1.60		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	1.40		% full scale/10K
Combined interference	0.45		% range
Dependence on voltage	0.50		% full scale/10V
Losses in the line (leak)	0.00		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m ³
Standard deviation of repeatability at span level	0.00		mg/m ³
Lack of fit	0.01		mg/m ³
Drift	-0.19		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)	0.00		mg/m ³
Uncertainty of calibration gas	0.00		mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		0.41	mg/m ³
Expanded uncertainty		0.29	mg/m ³
Expanded uncertainty	k = 1.96	0.56	mg/m ³
Uncertainty corrected to std conds. (O ₂)		0.56	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	136.59	% 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 in M2	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 in M2	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). Ref EA TGN M2.



Exova Catalyst, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL

T: 0800 328 1821 (or + 44 161 432 3286 from overseas)

E: toby.campbell@exova.com

Your Exova Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

VIP Polymers Ltd

Installation Name & Address

VIP Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7EB

PPC Permit: B11/94

Stack Reference

Stack 24 - The Cooling Booth on Desma 14

Dates of the Monitoring Campaign

16th November 2016

Job Reference Number

CAT-3047

Report Written by

Harpreet Badwal
Team Leader
MCERTS Level 2
MM 03 149
TE1 TE2 TE3 TE4

Report Approved by

Derek Myers
Team Leader
MCERTS Level 2
MM 02 115
TE1 TE2 TE3 TE4

Report Date

1st December 2016

Version

Version 1

Signature of Report Approver



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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

Opinions and interpretations expressed herein are outside the scope of Exova Catalyst's ISO 17025 accreditation.

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Executive Summary

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MONITORING OBJECTIVES

VIP Polymers Ltd, Huntingdon
Stack 24 - The Cooling Booth on Desma 14
16th November 2016

Overall Aim of the Monitoring Campaign

Exova Catalyst were commissioned by VIP Polymers Ltd to carry out stack emissions testing on the Stack 24 - The Cooling Booth on Desma 14 at Huntingdon.

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter | Total VOCs (as Carbon) |

Executive Summary

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MONITORING RESULTS

VIP Polymers Ltd, Huntingdon
 Stack 24 - The Cooling Booth on Desma 14
 16th November 2016

where MU = Measurement Uncertainty associated with the Result

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter ¹	mg/m ³	0.74	0.26	10	g/hr	1.0	0.35	-
Total VOCs (as Carbon) ¹	mg/m ³	1.5	0.43	-	g/hr	2.0	0.59	-
Water Vapour	% v/v	0.1	0.02					
Stack Gas Temperature	°C	15.8						
Stack Gas Velocity	m/s	5.6	0.29					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	1431	98.2					
Volumetric Flow Rate (REF) ¹	m ³ /hr	1347	92.4					

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

VIP Polymers Ltd, Huntingdon
Stack 24 - The Cooling Booth on Desma 14
16th November 2016

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m ³	0.74	g/hr	1.0	16/11/2016	15:41 - 16:21	40
Total VOCs (as Carbon)	R1	mg/m ³	1.5	g/hr	2.0	16/11/2016	15:41 - 16:21	40
Velocity & Volumetric Flow Rate	R1					16/11/2016	15:13 - 15:23	

All results are expressed at the respective reference conditions.



Executive Summary
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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon
Stack 24 - The Cooling Booth on Desma 14
16th November 2016

Standard Operating Conditions

Parameter	Value
Process Status	Injection Press Operational
Capacity (of 100%) and Tonnes / Hour	Normal Operation
Continuous or Batch Process	Batch 3 - 4 min cycle
Feedstock (if applicable)	Rubber Products
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon
 Stack 24 - The Cooling Booth on Desma 14
 16th November 2016

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	ISO 17025 Testing	Testing Lab	Analytical Procedure	Analytical Technique	ISO 17025 Analysis	Analysis Lab		
Total Particulate Matter	EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.13 mg/m³
Water Vapour	EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.32 mg/m³
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	Yes	CAT	Pitot Tube and Thermocouple				Yes	1.2 m/s

ANALYSIS LABORATORIES

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

Exova Catalyst (CAT)	ISO 17025 Accreditation Number: 4279
----------------------	--------------------------------------

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Water Vapour	1	The measurement uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.

Executive Summary

(Page 6 of 7)

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

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	27.3		> 5 Pa	Yes
Mean Velocity	m/s	5.62		-	-
Lowest Gas Velocity	m/s	5.62		-	-
Highest Gas Velocity	m/s	5.62		-	-
Ratio of Above	: 1	1.00		< 3 : 1	Yes
Maximum Angle of Swirl	°	0		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

Executive Summary

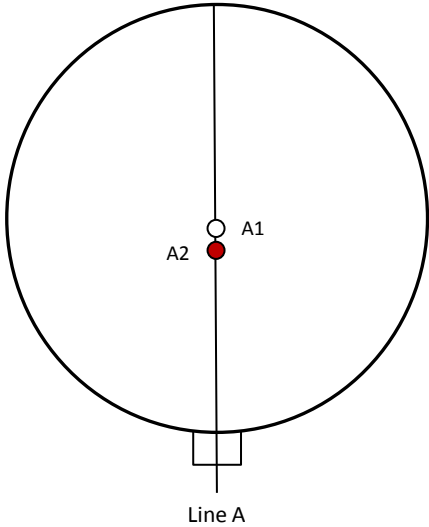
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PLANT PHOTOS

Photo 1



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	Harpreet Badwal	MCERTS Level 2	MM 03 149	TE1 TE2 TE3 TE4
Team Leader	Phil Waters	MCERTS Level 2	MM 04 527	TE1 TE2 TE3 TE4

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM (1)	CAT 7.57	Horiba PG-350E	-	Digital Manometer (1)	CAT 3.142
Control Box DGM (2)	-	Horiba PG-250	-	Digital Manometer (2)	CAT 3.144
Box Thermocouples (1)	CAT 3.146	Servomex 4900	-	Digital Temperature Meter	-
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	CAT 14.84
Umbilical (1)	CAT 3.146	ABB AO2020-URAS26	-	Barometer	CAT 13.40
Umbilical (2)	-	Servomex 5200MP	-	Stack Thermocouple (1)	CAT 4.844
Oven Box (1)	-	Ankersmid APS 313	-	Stack Thermocouple (2)	CAT 4.789
Oven Box (2)	-	Gasmet DX4000	-	Stack Thermocouple (3)	CAT 4.013
Heated Probe (1)	CAT 5.126	Gasmet Sampling System	-	1m Heated Line (1)	-
Heated Probe (2)	CAT 5.127	Bernath 3006 FID	CAT 8.31	1m Heated Line (2)	-
Heated Probe (3)	CAT 5.128	M&C PSS	CAT 12.107	1m Heated Line (3)	-
S-Pitot (1)	CAT 21S.57	Mass Flow Controller (1)	CAT 6.61	5m Heated Line (1)	-
S-Pitot (2)	CAT 21P.38	Mass Flow Controller (2)	CAT 6.62	15m Heated Line (1)	-
L-Pitot	-	Mass View (1)	-	20m Heated Line (1)	CAT 20.116
Site Balance	CAT 17.33	Mass View (2)	-	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.33 a & b	Hioki 5043 (V)	CAT 11.69	Dual Channel Heater Controller	-
Last Impinger Arm	-	Easylogger EN-EL-12 Bit	-	Single Channel Heater Controller	CAT 20.116
Callipers	CAT 23.40	Bioaerosols Temperature Logger	-	Laboratory Balance	CAT 1.18 / 1.18a
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.45

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	EN 13284-1	CAT-TP-01
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	15.0
Average Stack Gas Pressure	Pa	27.3
Average Stack Static Pressure, P _{static}	kPa	0.018
Average Barometric Pressure, P _b	kPa	100.6
Average Pitot Tube Calibration Coefficient, C _p	-	0.84

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.78	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	79.07	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.09	0.0009	18.02	0.8037	0.00072

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	1.287
Dry Density (Actual), P _{Actual}	kg/m ³	1.212
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.212

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)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	15.0	0.0
Total Pressure	kPa	100.6	101.3
Moisture	%	0.09	0.09

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	1431
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	1347
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	1346
Gas Volumetric Flowrate REF ¹	m ³ /hr	1347

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

Parameter	Units	Value
Date of Survey	-	16/11/2016
Time of Survey	-	15:13 - 15:23
Atmospheric Pressure	kPa	100.6
Average Stack Static Pressure	Pa	18
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with KIMO MP 210 (500Pa)	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C _p	-	0.84
Number of Lines Available	-	1
Number of Lines Used	-	1

Sampling Line A						
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m³	Velocity m/s	Swirl °
STATIC (Units: Pa)		17.5				
Mean		27.3	15.0	1.212	5.62	
1	0.15	27.3	15.0	1.212	5.62	0.0

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	$u(\Delta p_i)$	1.086	Pa
- Resolution	$u(res)$	0.00087	
- Calibration	$u(cal)$	0.078	
- Drift	$u(drift)$	0.083	
- Lack of Fit	$u(fit)$	0.018	
- Overall corrections to dynamic measurements	$u(C_f)$	0.179	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00003	-
- $\varphi_{O_2,w}$	-	20.781	
- $\varphi_{CO_2,w}$	-	0.060	
- Oxygen, dry	$u(\phi_{O_2,d})$	0.637	
- Carbon Dioxide, dry	$u(\phi_{CO_2,d})$	0.002	
- Water Vapour	$u(\phi_{H_2O})$	0.005	
- Oxygen, wet	$u(\phi_{O_2,w})$	0.636	
- Carbon Dioxide, wet	$u(\phi_{CO_2,w})$	0.002	
Standard uncertainty associated with the stack temperature	$u(T_c)$	1.469	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.695	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	1.086	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00653	-
Standard uncertainty associated with the local velocities	$u(v_i)$	0.148	Pa
Standard uncertainty associated with the mean velocity	$u(\bar{v})$	0.148	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	0.290	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	5.16	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV,w)$	98.2	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00123	
- $u^2(qV,w)$	-	2508	
- $u(qV,w)$	-	50.1	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV,w)$	6.86	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 24 - The Cooling Booth on Desma 14

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.74		0.74
Uncertainty	±mg/m ³	0.26		0.26
Mass Emission	g/hr	1.0		1.0
Uncertainty	±g/hr	0.35		0.35

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.09		0.09
Uncertainty	±% v/v	0.02		0.02

Blank Runs

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

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value	
Standard	EN 13284-1	
Technical Procedure	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Glass Fibre	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

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

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P _b	mmHg	754.5	
Stack static pressure, P _{static}	mmH ₂ O	1.8	
P _s = (P _b + (P _{static} / 13.6))	mmHg	754.6	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	0.7	
Total mass collected in impingers (silica trap)	g	0.1	
Total mass of liquid collected, V _{lc}	g	0.8	
V _{wstd} = (0.001246)(V _{lc})	m ³	0.0010	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V _m	m ³	1.2044	
Gas meter correction factor, Y _d	-	0.9640	
Average dry gas meter temperature, T _m	°C	13.4	
Average pressure drop across orifice, ΔH	mmH ₂ O	90.1	
V _{mstd} = ((0.3592)(V _m)(P _b + (ΔH/13.6))(Y _d)) / (T _m + 273)	m ³	1.1084	
Moisture content, B_{wo} & R_{wv}			
B _{wo} = V _{wstd} / (V _{mstd} + V _{wstd})	m ³	0.0009	
B _{wo} as a percentage	% v/v	0.09	
Reported Water Vapour, checked with Tables in EN 14790, R _{wv}	% v/v	0.09	
Volume of gas metered wet, V_{mstw}			
V _{mstw} = (V _{mstd})(100/(100 - R _{wv}))	m ³	1.1094	
Volume of gas metered at Oxygen Reference Conditions, V_{mstd@X%O₂} & V_{mstw@X%O₂}			
IED & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet (O _{2REFw}) = (21 - REF%O ₂) / (21 - ACT%O _{2w})	-	N/A	
O ₂ Reference Factor dry (O _{2REFd}) = (21 - REF%O ₂) / (21 - ACT%O _{2d})	-	N/A	
V _{mstw@X%oxygen} = (V _{mstw}) / (O _{2REFw})	m ³	N/A	
V _{mstd@X%oxygen} = (V _{mstd}) / (O _{2REFd})	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
M _d = 0.44(%CO ₂)+0.32(%O ₂)+0.28(%N ₂)	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
M _s = M _d (1 - (R _{wv} /100)) + 18(R _{wv} /100)	g/gmol	28.83	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K _p	-	34.97	
Velocity pressure coefficient, C _p	-	0.84	
Average of velocity heads, ΔP _{avg}	mmH ₂ O	3.00	
Average square root of velocity heads, √ΔP	√mmH ₂ O	1.73	
Average stack gas temperature, T _s	°C	15.8	
V _s = ((K _p)(C _p)(√ΔP)(√T _s + 273)) / (√(M _s)(P _s))	m/s	5.88	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO₂}), Dry@O_{2REF} (Q_{stdO₂})			
Area of stack, A _s	m ²	0.07	
Q _a = (60)(A _s)(V _s)	m ³ /min	24.9	
Conversion factor (K/mm.Hg), C _f	-	0.3592	
Q _{stw} = ((Q _a)(P _s)(C _f)) / ((T _s + 273))	m ³ /min	23.4	
Q _{std} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273))	m ³ /min	23.4	
Q _{stwO₂} = ((Q _a)(P _s)(C _f)) / ((T _s + 273)) / (O _{2REFw})	m ³ /min	N/A	
Q _{stdO₂} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273)) / (O _{2REFd})	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D _n	mm	10.01	
Nozzle area, A _n	mm ²	78.65	
Total sampling time, q	min	40	
%I = (4.6398E ⁶)(T _s +273)(V _{mstd}) / (P _s)(V _s)(A _n)(q)(1 - (R _{wv} /100))	%	106.6	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	15:41 - 16:21	
Sampling Dates	-	16/11/2016	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.1094	
Filter I.D. Number	-	47-37444	
Start Filter Mass	g	0.14904	
End Filter Mass	g	0.14955	
Total Mass on Filter	g	0.00051	
Probe Rinse I.D. Number	-	PR-47-37444	
Start Probe Rinse Mass	g	2.88266	
End Probe Rinse Mass	g	2.88297	
Total Mass in Probe Rinse	g	0.00031	
Total Mass Collected	mg	0.82	
Calculated Concentration	mg/m ³	0.74	
Balance Uncertainty / LOD	mg/m ³	0.13	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	16/11/2016	
Average Volume Sampled (REF)	m ³	1.1094	
Filter I.D. Number	-	47-37616	
Start Filter Mass	g	0.14640	
End Filter Mass	g	0.14633	
Total Mass on Filter	g	-0.00007	
Probe Rinse I.D. Number	-	PR-47-37616	
Start Probe Rinse Mass	g	2.90264	
End Probe Rinse Mass	g	2.90265	
Total Mass in Probe Rinse	g	0.00000	
Total Mass Collected	mg	-0.06	
Calculated Concentration	mg/m ³	-0.06	
Balance Uncertainty / LOD	mg/m ³	0.13	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	29.03	
Pre-Sampling Leak Rate	l/min	0.03	
Post-Sampling Leak Rate	l/min	0.04	
Allowable Leak Rate	l/min	0.58	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	27.4	
Allowable MU	%	20	
MU Acceptable	%	No	

Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	106.6	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.25	
Overall Weighing Uncertainty	± mg/m ³	0.23	
ELV [Daily ELV for IED]	mg/m ³	10.00	
Allowable Weighing Uncertainty	mg/m ³	0.50	
Weighing Uncertainty Acceptable	-	Yes	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	16	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	18.00	
Pre-Sampling Leak Rate	l/min	0.02	
Post-Sampling Leak Rate	l/min	0.03	
Allowable Leak Rate	l/min	0.36	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m ³	1.0	
Blank Acceptable	-	Yes	

Acetone / Water Rinse Blank	Units	Blank
Acetone / Water Rinse Value	mg/l	2.7
Allowable Blank	mg/l	10
Blank Acceptable	-	Yes

Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1
The measurement uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.	w

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	1.2044		uV _m	m ³	0.0241	
Sampled Gas Temperature	T _m	286.4		uT _m	K	2.0	
Sampled Gas Pressure	p _m	100.6		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.14		uL	%	-	
Mass of Particulate	m	0.82		um	mg	0.14	
Uncollected Mass	UCM	-0.06		uUCM	mg	-	

Uncertainty as a Percentage			
Measured Quantities	Units	Run 1	Requirement of Standard
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.70	≤1%
Sampled Gas Pressure	%	0.50	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	0.14	≤2%
Mass of Particulate	%	1.26	<5% of ELV
Uncollected Mass	%	-	-

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	1.1084	0.67	
Leak	L	mg/m ³	0.001	1.00	
Mass of Particulate	L _r	mg	0.823	0.90	
Uncollected Mass	UCM	mg	-0.04	0.90	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.019	
Leak	mg/m ³	0.0006	
Mass of Particulate	mg/m ³	0.1262	
Uncollected Mass	mg/m ³	-0.0330	

Oxygen Correction Part of MU Budget			
Measured Quantities	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	0.13	
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.26	
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.26	
Reported Uncertainty	mg/m ³	0.26	
Expanded uncertainty (95% confidence), without Oxygen Correction	%	34.8	
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	34.8	
Reported Uncertainty	%	34.8	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 24 - The Cooling Booth on Desma 14

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.5		1.5
Uncertainty	±mg/m ³	0.43		0.43
Mass Emission	g/hr	2.0		2.0
Uncertainty	±g/hr	0.59		0.59

General Sampling Information

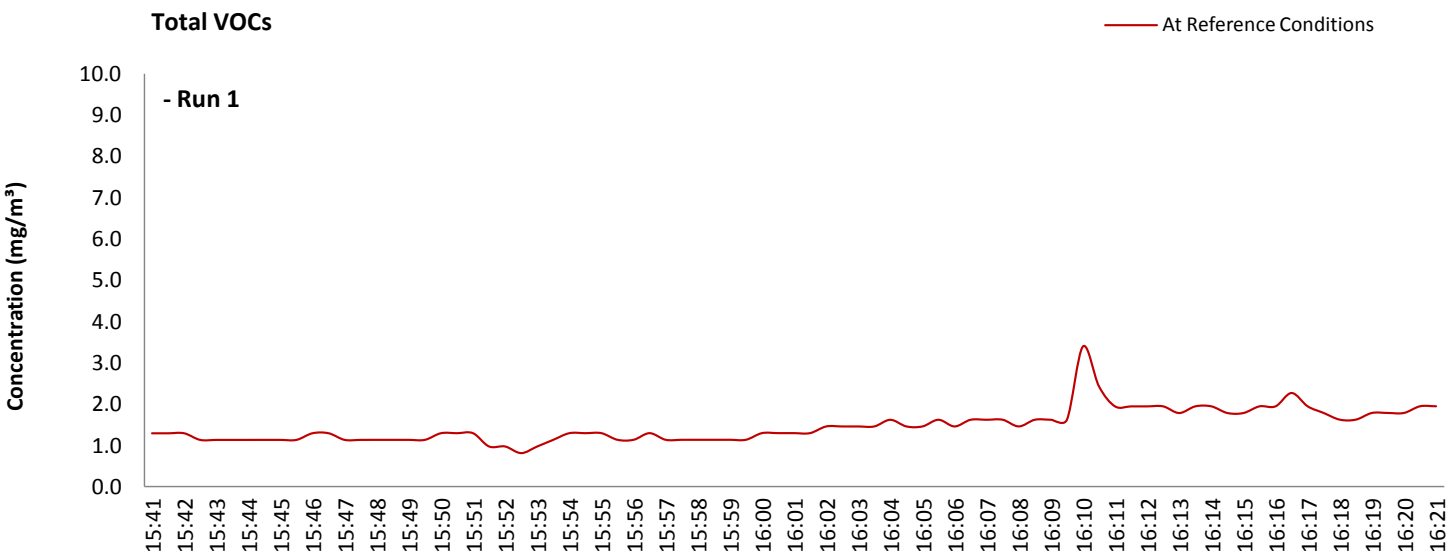
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	CAT-TP-20	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	CYL 1.0245a	
Span Gas Expiry Date	10/09/2021	
Span Gas Start Pressure (bar)	160	
Gas Cylinder Concentration (ppm)	80.1	
Span Gas Set Point (ppm)	80.10	
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	A2	

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	-	15:41 - 16:21	
Sampling Dates	-	16/11/2016	
Instrument Range	ppm	100	
Span Gas Value	ppm	80.1	

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	0.00	
	Allowable Zero Drift	± ppm	4.01	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	80.20	
	Span Down Sampling Line (Post)	ppm	79.60	
	Span Drift	ppm	-0.60	
	Allowable Span Drift	± ppm	4.01	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	6 - 14	

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)
TGN M2 Allowable MU	15.0		%
Measured concentration	1.47		mg/m ³ (STP, dry)
Range Used	100.0		ppm
Range Used [A]	160.6		mg/m ³
Cal gas conc.	80.1		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.	128.7		mg/m ³

Performance characteristics	RUN 1		Units
Response time	45		seconds
Number of readings in measurement	40		-
Repeatability at zero	2.00		% full scale
Repeatability at span level	0.00		% full scale
Deviation from linearity	0.07		% of value
Zero drift	0.00		% full scale
Span drift	-0.75		% full scale
Volume or pressure flow dependence	1.60		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	1.40		% full scale/10K
Combined interference	0.45		% range
Dependence on voltage	0.50		% full scale/10V
Losses in the line (leak)	0.00		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m ³
Standard deviation of repeatability at span level	0.00		mg/m ³
Lack of fit	0.01		mg/m ³
Drift	-0.01		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)	0.00		mg/m ³
Uncertainty of calibration gas	0.02		mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		1.47	mg/m ³
Expanded uncertainty		0.22	mg/m ³
Expanded uncertainty	k = 1.96	0.43	mg/m ³
Uncertainty corrected to std conds. (O ₂)		0.43	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	29.18	% 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 in M2	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 in M2	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). Ref EA TGN M2.



Exova Catalyst, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL

T: 0800 328 1821 (or + 44 161 432 3286 from overseas)

E: toby.campbell@exova.com

Your Exova Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

VIP Polymers Ltd

Installation Name & Address

VIP Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7EB

PPC Permit: B11/94

Stack Reference

Stack 25 - The Cooling Booth on Desma 15

Dates of the Monitoring Campaign

17th November 2016

Job Reference Number

CAT-3047

Report Written by

Harpreet Badwal
Team Leader
MCERTS Level 2
MM 03 149
TE1 TE2 TE3 TE4

Report Approved by

Derek Myers
Team Leader
MCERTS Level 2
MM 02 115
TE1 TE2 TE3 TE4

Report Date

1st December 2016

Version

Version 1

Signature of Report Approver



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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

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Executive Summary

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MONITORING OBJECTIVES

VIP Polymers Ltd, Huntingdon
Stack 25 - The Cooling Booth on Desma 15
17th November 2016

Overall Aim of the Monitoring Campaign

Exova Catalyst were commissioned by VIP Polymers Ltd to carry out stack emissions testing on the Stack 25 - The Cooling Booth on Desma 15 at Huntingdon.

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter | Total VOCs (as Carbon) |

Executive Summary (Page 2 of 7)

MONITORING RESULTS

VIP Polymers Ltd, Huntingdon
Stack 25 - The Cooling Booth on Desma 15
17th November 2016

where MU = Measurement Uncertainty associated with the Result

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.14	0.27	10	g/hr	0.32	0.63	-
Total VOCs (as Carbon)	¹ mg/m ³	2.4	0.70	-	g/hr	5.5	1.6	-
Water Vapour	% v/v	0.07	0.03					
Stack Gas Temperature	°C	15.8						
Stack Gas Velocity	m/s	8.5	0.32					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	2462	145					
Volumetric Flow Rate (REF)	¹ m ³ /hr	2300	135					

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

VIP Polymers Ltd, Huntingdon
Stack 25 - The Cooling Booth on Desma 15
17th November 2016

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m ³	0.14	g/hr	0.32	17/11/2016	09:38 - 10:18	40
Total VOCs (as Carbon)	R1	mg/m ³	2.4	g/hr	5.5	17/11/2016	09:38 - 10:18	40
Velocity & Volumetric Flow Rate	R1					17/11/2016	08:52 - 09:02	

All results are expressed at the respective reference conditions.



Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon
Stack 25 - The Cooling Booth on Desma 15
17th November 2016

Standard Operating Conditions

Parameter	Value
Process Status	Injection Press Operational
Capacity (of 100%) and Tonnes / Hour	Normal Operation
Continuous or Batch Process	Batch 3 - 4 min cycle
Feedstock (if applicable)	Rubber Products
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon
 Stack 25 - The Cooling Booth on Desma 15
 17th November 2016

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	ISO 17025 Testing	Testing Lab	Analytical Procedure	Analytical Technique	ISO 17025 Analysis	Analysis Lab		
Total Particulate Matter	EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.14 mg/m³
Water Vapour	EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.32 mg/m³
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	Yes	CAT	Pitot Tube and Thermocouple				Yes	1.2 m/s

ANALYSIS LABORATORIES

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

Exova Catalyst (CAT)	ISO 17025 Accreditation Number: 4279
----------------------	--------------------------------------

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Water Vapour	1	The measurement uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.

Executive Summary

(Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.32
Width	m	-
Area	m ²	0.08
Port Depth	cm	5
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	62.0		> 5 Pa	Yes
Mean Velocity	m/s	8.50		-	-
Lowest Gas Velocity	m/s	8.50		-	-
Highest Gas Velocity	m/s	8.50		-	-
Ratio of Above	: 1	1.00		< 3 : 1	Yes
Maximum Angle of Swirl	°	0		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

Executive Summary

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PLANT PHOTOS

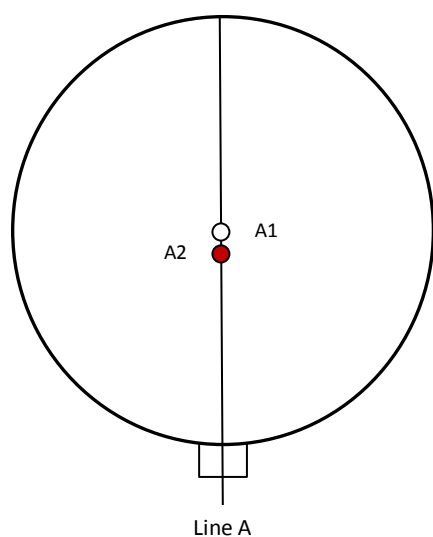
Photo 1



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	Harpreet Badwal	MCERTS Level 2	MM 03 149	TE1 TE2 TE3 TE4
Team Leader	Phil Waters	MCERTS Level 2	MM 04 527	TE1 TE2 TE3 TE4

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM (1)	CAT 7.57	Horiba PG-350E	-	Digital Manometer (1)	CAT 3.142
Control Box DGM (2)	-	Horiba PG-250	-	Digital Manometer (2)	CAT 3.144
Box Thermocouples (1)	CAT 3.146	Servomex 4900	-	Digital Temperature Meter	-
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	CAT 14.84
Umbilical (1)	CAT 3.146	ABB AO2020-URAS26	-	Barometer	CAT 13.40
Umbilical (2)	-	Servomex 5200MP	-	Stack Thermocouple (1)	CAT 4.844
Oven Box (1)	-	Ankersmid APS 313	-	Stack Thermocouple (2)	CAT 4.789
Oven Box (2)	-	Gasmet DX4000	-	Stack Thermocouple (3)	CAT 4.013
Heated Probe (1)	CAT 5.126	Gasmet Sampling System	-	1m Heated Line (1)	-
Heated Probe (2)	CAT 5.127	Bernath 3006 FID	CAT 8.31	1m Heated Line (2)	-
Heated Probe (3)	CAT 5.128	M&C PSS	CAT 12.107	1m Heated Line (3)	-
S-Pitot (1)	CAT 21S.57	Mass Flow Controller (1)	CAT 6.61	5m Heated Line (1)	-
S-Pitot (2)	CAT 21P.38	Mass Flow Controller (2)	CAT 6.62	15m Heated Line (1)	-
L-Pitot	-	Mass View (1)	-	20m Heated Line (1)	CAT 20.116
Site Balance	CAT 17.33	Mass View (2)	-	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.33 a & b	Hioki 5043 (V)	CAT 11.69	Dual Channel Heater Controller	-
Last Impinger Arm	-	Easylogger EN-EL-12 Bit	-	Single Channel Heater Controller	CAT 20.116
Callipers	CAT 23.40	Bioaerosols Temperature Logger	-	Laboratory Balance	CAT 1.18 / 1.18a
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.45

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	EN 13284-1	CAT-TP-01
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	0.32
Stack Width, W	m	-
Stack Area, A	m ²	0.08
Average Stack Gas Temperature, T _a	°C	15.0
Average Stack Gas Pressure	Pa	62.0
Average Stack Static Pressure, P _{static}	kPa	0.040
Average Barometric Pressure, P _b	kPa	99.8
Average Pitot Tube Calibration Coefficient, C _p	-	0.84

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.78	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	79.08	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.07	0.0007	18.02	0.8037	0.00059

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	1.287
Dry Density (Actual), P _{Actual}	kg/m ³	1.203
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.202

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)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	15.0	0.0
Total Pressure	kPa	99.8	101.3
Moisture	%	0.07	0.07

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	2462
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	2300
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	2299
Gas Volumetric Flowrate REF ¹	m ³ /hr	2300

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

(1 of 1)

Parameter	Units	Value
Date of Survey	-	17/11/2016
Time of Survey	-	08:52 - 09:02
Atmospheric Pressure	kPa	99.8
Average Stack Static Pressure	Pa	40
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with KIMO MP 210 (500Pa)	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C _p	-	0.84
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)		40.0				
Mean		62.0	15.0	1.202	8.50	
1	0.16	62.0	15.0	1.202	8.50	0.0

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	$u(\Delta p_i)$	1.255	Pa
- Resolution	$u(res)$	0.00087	
- Calibration	$u(cal)$	0.400	
- Drift	$u(drift)$	0.083	
- Lack of Fit	$u(fit)$	0.091	
- Overall corrections to dynamic measurements	$u(C_f)$	0.575	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00003	-
- $\varphi_{O_2,w}$	-	20.785	
- $\varphi_{CO_2,w}$	-	0.060	
- Oxygen, dry	$u(\phi_{O_2,d})$	0.637	
- Carbon Dioxide, dry	$u(\phi_{CO_2,d})$	0.002	
- Water Vapour	$u(\phi_{H_2O})$	0.004	
- Oxygen, wet	$u(\phi_{O_2,w})$	0.636	
- Carbon Dioxide, wet	$u(\phi_{CO_2,w})$	0.002	
Standard uncertainty associated with the stack temperature	$u(T_c)$	1.469	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.697	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	1.255	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00649	-
Standard uncertainty associated with the local velocities	$u(v_i)$	0.162	Pa
Standard uncertainty associated with the mean velocity	$u(\bar{v})$	0.162	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	0.318	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	3.74	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV,w)$	144.6	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00090	
- $u^2(qV,w)$	-	5440	
- $u(qV,w)$	-	73.8	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV,w)$	5.87	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 25 - The Cooling Booth on Desma 15

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.14		0.14
Uncertainty	±mg/m ³	0.27		0.27
Mass Emission	g/hr	0.32		0.32
Uncertainty	±g/hr	0.63		0.63

NOTE: Where the maximum Blank concentration is higher than the Sample concentration, the maximum Blank concentration has been reported.

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.07		0.07
Uncertainty	±% v/v	0.03		0.03

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.14		0.14

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value	
Standard	EN 13284-1	
Technical Procedure	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Glass Fibre	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

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

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	748.5	
Stack static pressure, P_{static}	mmH ₂ O	4.1	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	748.8	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	0.4	
Total mass collected in impingers (silica trap)	g	0.2	
Total mass of liquid collected, V_{lc}	g	0.6	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0007	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.0898	
Gas meter correction factor, Y_d	-	0.9640	
Average dry gas meter temperature, T_m	°C	8.8	
Average pressure drop across orifice, ΔH	mmH ₂ O	74.1	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.0098	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0007	
B_{wo} as a percentage	% v/v	0.07	
Reported Water Vapour, checked with Tables in EN 14790, R_{wv}	% v/v	0.07	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.0106	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
IED & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.83	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K_p	-	34.97	
Velocity pressure coefficient, C_p	-	0.84	
Average of velocity heads, ΔP_{avg}	mmH ₂ O	6.13	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	2.47	
Average stack gas temperature, T_s	°C	15.8	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (\sqrt{M_s}(P_s))$	m/s	8.43	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})			
Area of stack, A_s	m ²	0.08	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	40.7	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	37.9	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	37.9	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273) / (O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	8.01	
Nozzle area, A_n	mm ²	50.36	
Total sampling time, q	min	40	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	106.5	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	09:38 - 10:18	
Sampling Dates	-	17/11/2016	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.0106	
Filter I.D. Number	-	47-37615	
Start Filter Mass	g	0.14842	
End Filter Mass	g	0.14836	
Total Mass on Filter	g	-0.00006	
Probe Rinse I.D. Number	-	PR-47-37615	
Start Probe Rinse Mass	g	3.04859	
End Probe Rinse Mass	g	3.04861	
Total Mass in Probe Rinse	g	0.00002	
Total Mass Collected	mg	-0.04	
Calculated Concentration	mg/m ³	-0.04	
Balance Uncertainty / LOD	mg/m ³	0.14	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	17/11/2016	
Average Volume Sampled (REF)	m ³	1.0106	
Filter I.D. Number	-	47-37416	
Start Filter Mass	g	0.14920	
End Filter Mass	g	0.14918	
Total Mass on Filter	g	-0.00002	
Probe Rinse I.D. Number	-	PR-47-37416	
Start Probe Rinse Mass	g	3.06404	
End Probe Rinse Mass	g	3.06404	
Total Mass in Probe Rinse	g	0.00000	
Total Mass Collected	mg	-0.02	
Calculated Concentration	mg/m ³	-0.02	
Balance Uncertainty / LOD	mg/m ³	0.14	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

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Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	26.26	
Pre-Sampling Leak Rate	l/min	0.03	
Post-Sampling Leak Rate	l/min	0.04	
Allowable Leak Rate	l/min	0.53	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	36.3	
Allowable MU	%	20	
MU Acceptable	%	No	

Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	106.5	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.25	
Overall Weighing Uncertainty	± mg/m ³	0.25	
ELV [Daily ELV for IED]	mg/m ³	10.00	
Allowable Weighing Uncertainty	mg/m ³	0.50	
Weighing Uncertainty Acceptable	-	Yes	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	16	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	18.00	
Pre-Sampling Leak Rate	l/min	0.02	
Post-Sampling Leak Rate	l/min	0.03	
Allowable Leak Rate	l/min	0.36	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m ³	1.0	
Blank Acceptable	-	Yes	

Acetone / Water Rinse Blank	Units	Blank
Acetone / Water Rinse Value	mg/l	2.7
Allowable Blank	mg/l	10
Blank Acceptable	-	Yes

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
The measurement uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.	w	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	1.0898		uV _m	m ³	0.0218	
Sampled Gas Temperature	T _m	281.8		uT _m	K	2.0	
Sampled Gas Pressure	p _m	99.8		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.15		uL	%	-	
Mass of Particulate	m	0.14		um	mg	0.14	
Uncollected Mass	UCM	-0.02		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.71		≤1%
Sampled Gas Pressure	%	0.50		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.15		≤2%
Mass of Particulate	%	1.39		<5% of ELV
Uncollected Mass	%	-		-

Uncertainty in Measurement Units					Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V _m	m ³	1.0098		0.14	
Leak	L	mg/m ³	0.000		1.00	
Mass of Particulate	L _r	mg	0.140		0.99	
Uncollected Mass	UCM	mg	-0.01		0.99	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.004	
Leak	mg/m ³	0.0001	
Mass of Particulate	mg/m ³	0.1385	
Uncollected Mass	mg/m ³	-0.0114	

Oxygen Correction Part of MU Budget			
Measured Quantities	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	0.14	
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.27	
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.27	
Reported Uncertainty	mg/m ³	0.27	
Expanded uncertainty (95% confidence), without Oxygen Correction	%	196.7	
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	196.7	
Reported Uncertainty	%	196.7	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 25 - The Cooling Booth on Desma 15

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	2.4		2.4
Uncertainty	±mg/m ³	0.70		0.70
Mass Emission	g/hr	5.5		5.5
Uncertainty	±g/hr	1.6		1.6

General Sampling Information

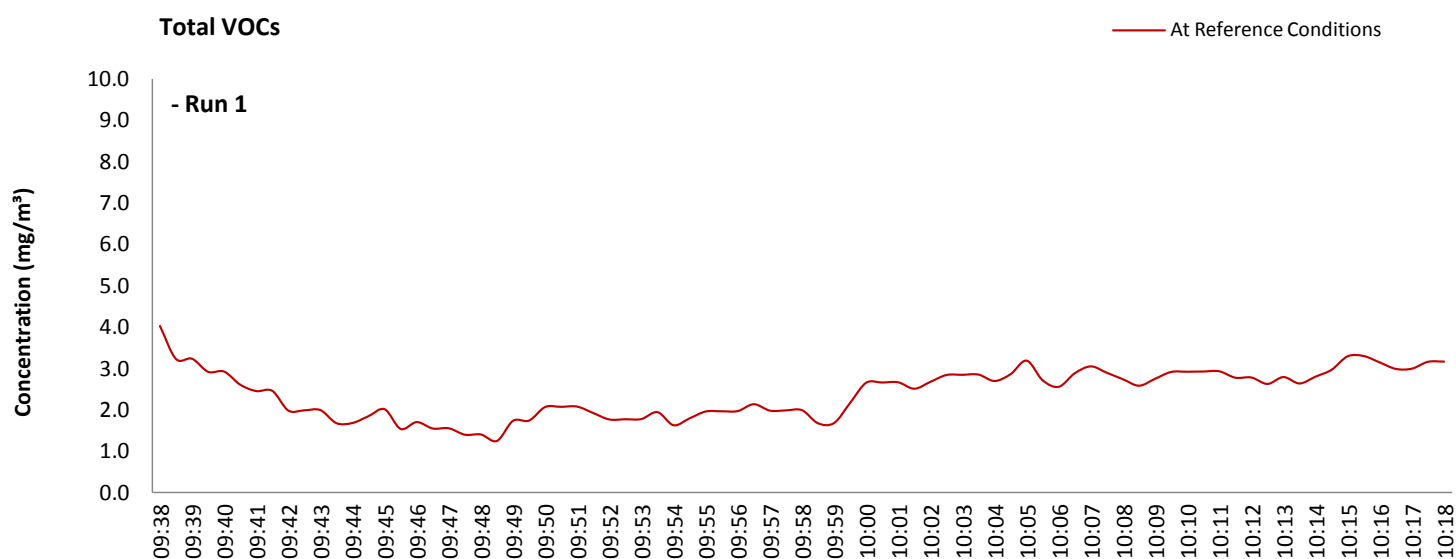
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	CAT-TP-20	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	CYL 1.0245a	
Span Gas Expiry Date	10/09/2021	
Span Gas Start Pressure (bar)	160	
Gas Cylinder Concentration (ppm)	80.1	
Span Gas Set Point (ppm)	80.10	
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	A2	

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	-	09:38 - 10:18	
Sampling Dates	-	17/11/2016	
Instrument Range	ppm	100	
Span Gas Value	ppm	80.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.10	
	Zero Down Sampling Line (Post)	ppm	-0.20	
	Zero Drift	ppm	-0.30	
	Allowable Zero Drift	± ppm	4.01	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	80.00	
	Span Down Sampling Line (Post)	ppm	79.70	
	Span Drift	ppm	-0.30	
	Allowable Span Drift	± ppm	4.01	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	5 - 14	

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)
TGN M2 Allowable MU	15.0		%
Measured concentration	2.41		mg/m ³ (STP, dry)
Range Used	100.0		ppm
Range Used [A]	160.6		mg/m ³
Cal gas conc.	80.1		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.	128.7		mg/m ³

Performance characteristics	RUN 1		Units
Response time	45		seconds
Number of readings in measurement	40		-
Repeatability at zero	2.00		% full scale
Repeatability at span level	0.00		% full scale
Deviation from linearity	0.07		% of value
Zero drift	-0.38		% full scale
Span drift	-0.37		% full scale
Volume or pressure flow dependence	1.60		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	1.40		% full scale/10K
Combined interference	0.45		% range
Dependence on voltage	0.50		% full scale/10V
Losses in the line (leak)	0.12		% 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	0.01		mg/m ³
Drift	-0.28		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)	0.00		mg/m ³
Uncertainty of calibration gas	0.03		mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		2.41	mg/m ³
Expanded uncertainty		0.36	mg/m ³
Expanded uncertainty	k = 1.96	0.70	mg/m ³
Uncertainty corrected to std conds. (O ₂)		0.70	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	29.20	% 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 in M2	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 in M2	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). Ref EA TGN M2.



Exova Catalyst, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL

T: 0800 328 1821 (or + 44 161 432 3286 from overseas)

E: toby.campbell@exova.com

Your Exova Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

VIP Polymers Ltd

Installation Name & Address

VIP Polymers Ltd

15 Windover Road

Huntingdon

Cambridgeshire

PE29 7EB

PPC Permit: B11/94

Stack Reference

Stack 44 - Carbon Black

Dates of the Monitoring Campaign

17th November 2016

Job Reference Number

CAT-3047

Report Written by

Harpreet Badwal

Team Leader

MCERTS Level 2

MM 03 149

TE1 TE2 TE3 TE4

Report Approved by

Derek Myers

Team Leader

MCERTS Level 2

MM 02 115

TE1 TE2 TE3 TE4

Report Date

1st December 2016

Version

Version 1

Signature of Report Approver



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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

Opinions and interpretations expressed herein are outside the scope of Exova Catalyst's ISO 17025 accreditation.

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Executive Summary

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MONITORING OBJECTIVES

VIP Polymers Ltd, Huntingdon
Stack 44 - Carbon Black
17th November 2016

Overall Aim of the Monitoring Campaign

Exova Catalyst were commissioned by VIP Polymers Ltd to carry out stack emissions testing on the Stack 44 - Carbon Black at Huntingdon.

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter | Total VOCs (as Carbon) |

Executive Summary

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MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack 44 - Carbon Black

17th November 2016

where MU = Measurement Uncertainty associated with the Result

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.19	0.41	10	g/hr	1.6	3.4	-
Total VOCs (as Carbon)	¹ mg/m ³	4.9	0.46	-	g/hr	41.1	5.6	-
Water Vapour	% v/v	0.09	0.02					
Stack Gas Temperature	°C	18.0						
Stack Gas Velocity	m/s	16.7	1.5					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	9155	901					
Volumetric Flow Rate (REF)	¹ m ³ /hr	8389	825					

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

VIP Polymers Ltd, Huntingdon
Stack 44 - Carbon Black
17th November 2016

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m ³	0.19	g/hr	1.6	17/11/2016	15:54 - 16:34	40
Total VOCs (as Carbon)	R1	mg/m ³	4.9	g/hr	41.1	17/11/2016	15:54 - 16:34	40
Velocity & Volumetric Flow Rate	R1					17/11/2016	15:35 - 15:45	

All results are expressed at the respective reference conditions.

Executive Summary
(Page 4 of 7)

PROCESS DETAILS

VIP Polymers Ltd, Huntingdon
Stack 44 - Carbon Black
17th November 2016

Standard Operating Conditions

Parameter	Value
Process Status	Raw Product Mixing Operational
Capacity (of 100%) and Tonnes / Hour	Normal Operation
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Carbon Black, Natural Rubber, Synthetic Rubber & Chemicals
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary (Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon
Stack 44 - Carbon Black
17th November 2016

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	ISO 17025 Testing	Testing Lab	Analytical Procedure	Analytical Technique	ISO 17025 Analysis	Analysis Lab		
Total Particulate Matter	EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.12 mg/m ³
Water Vapour	EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.32 mg/m ³
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	Yes	CAT	Pitot Tube and Thermocouple				Yes	1.8 m/s

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

Exova Catalyst (CAT)	ISO 17025 Accreditation Number: 4279
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SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Water Vapour	1	The measurement uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.
Total Particulate Matter	1	One out of two sampling lines was used due to sampling location restrictions, however the number of sample points used on the available line were increased to the minimum required by the Standard

Executive Summary

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SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.44
Width	m	-
Area	m ²	0.15
Port Depth	cm	8
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	216		> 5 Pa	Yes
Mean Velocity	m/s	16.7		-	-
Lowest Gas Velocity	m/s	16.0		-	-
Highest Gas Velocity	m/s	17.4		-	-
Ratio of Above	: 1	1.09		< 3 : 1	Yes
Maximum Angle of Swirl	°	0		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

Executive Summary

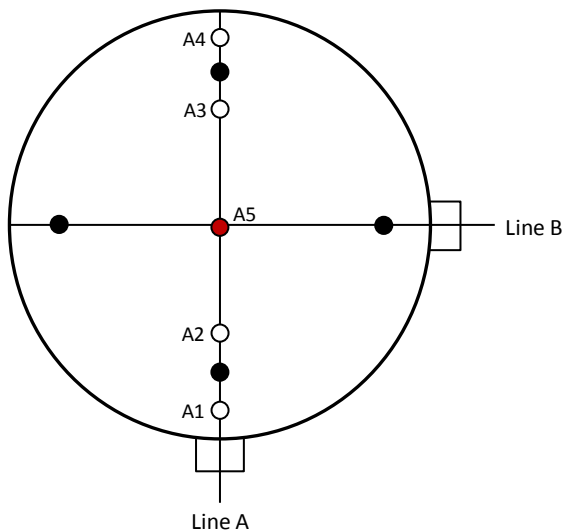
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PLANT PHOTOS

Photo 1



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	Harpreet Badwal	MCERTS Level 2	MM 03 149	TE1 TE2 TE3 TE4
Team Leader	Phil Waters	MCERTS Level 2	MM 04 527	TE1 TE2 TE3 TE4

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM (1)	CAT 7.57	Horiba PG-350E	-	Digital Manometer (1)	CAT 3.142
Control Box DGM (2)	-	Horiba PG-250	-	Digital Manometer (2)	CAT 3.144
Box Thermocouples (1)	CAT 3.146	Servomex 4900	-	Digital Temperature Meter	-
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	CAT 14.84
Umbilical (1)	CAT 3.146	ABB AO2020-URAS26	-	Barometer	CAT 13.40
Umbilical (2)	-	Servomex 5200MP	-	Stack Thermocouple (1)	CAT 4.844
Oven Box (1)	-	Ankersmid APS 313	-	Stack Thermocouple (2)	CAT 4.789
Oven Box (2)	-	Gasmet DX4000	-	Stack Thermocouple (3)	CAT 4.013
Heated Probe (1)	CAT 5.126	Gasmet Sampling System	-	1m Heated Line (1)	-
Heated Probe (2)	CAT 5.127	Bernath 3006 FID	CAT 8.31	1m Heated Line (2)	-
Heated Probe (3)	CAT 5.128	M&C PSS	CAT 12.107	1m Heated Line (3)	-
S-Pitot (1)	CAT 21S.57	Mass Flow Controller (1)	CAT 6.61	5m Heated Line (1)	-
S-Pitot (2)	CAT 21P.38	Mass Flow Controller (2)	CAT 6.62	15m Heated Line (1)	-
L-Pitot	-	Mass View (1)	-	20m Heated Line (1)	CAT 20.116
Site Balance	CAT 17.33	Mass View (2)	-	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.33 a & b	Hioki 5043 (V)	CAT 11.69	Dual Channel Heater Controller	-
Last Impinger Arm	-	Easylogger EN-EL-12 Bit	-	Single Channel Heater Controller	CAT 20.116
Callipers	CAT 23.40	Bioaerosols Temperature Logger	-	Laboratory Balance	CAT 1.18 / 1.18a
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.45

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	EN 13284-1	CAT-TP-01
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	0.44
Stack Width, W	m	-
Stack Area, A	m ²	0.15
Average Stack Gas Temperature, T _a	°C	18.0
Average Stack Gas Pressure	mmH ₂ O	24.0
Average Stack Static Pressure, P _{static}	kPa	0.245
Average Barometric Pressure, P _b	kPa	98.7
Average Pitot Tube Calibration Coefficient, C _p	-	0.84

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.78	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	79.07	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.09	0.0009	18.02	0.8037	0.00071

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	1.287
Dry Density (Actual), P _{Actual}	kg/m ³	1.180
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.179

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	18.0	0.0
Total Pressure	kPa	98.9	101.3
Moisture	%	0.09	0.09

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	9155
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	8389
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	8381
Gas Volumetric Flowrate REF ¹	m ³ /hr	8389

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

(1 of 1)

Parameter	Units	Value
Date of Survey	-	17/11/2016
Time of Survey	-	15:35 - 15:45
Atmospheric Pressure	kPa	98.7
Average Stack Static Pressure	Pa	245
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with Liquid Incline Manometer	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C _p	-	0.84
Number of Lines Available	-	2
Number of Lines Used	-	1

Sampling Line A						
Traverse Point	Depth m	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °
STATIC (Units: Pa)		245.0				
Mean		24.0	18.0	1.179	16.72	
1	0.03	22.0	18.0	1.179	16.02	0.0
2	0.11	24.0	18.0	1.179	16.73	0.0
3	0.33	24.0	18.0	1.179	16.73	0.0
4	0.41	26.0	18.0	1.179	17.41	0.0

Sampling Line B - CEM's Probe inserted in Port				
ΔP	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °

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	$u(\Delta p_i)$	4.114	Pa
- Resolution	$u(res)$	0.52154	
- Calibration	$u(cal)$	5.768	
- Drift	$u(drift)$	1.096	
- Lack of Fit	$u(fit)$	8.537	
- Overall corrections to dynamic measurements	$u(C_f)$	15.922	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00003	-
- $\varphi_{O_2,w}$	-	20.782	
- $\varphi_{CO_2,w}$	-	0.060	
- Oxygen, dry	$u(\phi_{O_2,d})$	0.637	
- Carbon Dioxide, dry	$u(\phi_{CO_2,d})$	0.002	
- Water Vapour	$u(\phi_{H_2O})$	0.004	
- Oxygen, wet	$u(\phi_{O_2,w})$	0.636	
- Carbon Dioxide, wet	$u(\phi_{CO_2,w})$	0.002	
Standard uncertainty associated with the stack temperature	$u(T_c)$	1.485	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.740	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	4.114	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00637	-
Standard uncertainty associated with the local velocities	$u(v_i)$	1.449	Pa
Standard uncertainty associated with the mean velocity	$u(\underline{v})$	0.745	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	1.461	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	8.73	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV,w)$	900.6	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00252	
- $u^2(qV,w)$	-	211142	
- $u(qV,w)$	-	459.5	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV,w)$	9.84	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 44 - Carbon Black

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.19		0.19
Uncertainty	±mg/m ³	0.41		0.41
Mass Emission	g/hr	1.6		1.6
Uncertainty	±g/hr	3.4		3.4

NOTE: Where the maximum Blank concentration is higher than the Sample concentration, the maximum Blank concentration has been reported.

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.09		0.09
Uncertainty	±% v/v	0.02		0.02

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.19		0.19

General Sampling Information

Parameter	Value	
Standard	EN 13284-1	
Technical Procedure	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Glass Fibre	
Number of Sampling Lines Used	1/2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	4/4	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1, A2, A3 & A4	

Reference Conditions

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

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P _b	mmHg	740.3	
Stack static pressure, P _{static}	mmH ₂ O	25.0	
P _s = (P _b + (P _{static} / 13.6))	mmHg	742.1	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-0.3	
Total mass collected in impingers (silica trap)	g	1.1	
Total mass of liquid collected, V _{lc}	g	0.8	
V _{wstd} = (0.001246)(V _{lc})	m ³	0.0010	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V _m	m ³	1.2472	
Gas meter correction factor, Y _d	-	0.9640	
Average dry gas meter temperature, T _m	°C	12.1	
Average pressure drop across orifice, ΔH	mmH ₂ O	94.3	
V _{mstd} = ((0.3592)(V _m)(P _b + (ΔH/13.6))(Y _d)) / (T _m + 273)	m ³	1.1317	
Moisture content, B_{wo} & R_{wv}			
B _{wo} = V _{wstd} / (V _{mstd} + V _{wstd})	m ³	0.0009	
B _{wo} as a percentage	% v/v	0.09	
Reported Water Vapour, checked with Tables in EN 14790, R _{wv}	% v/v	0.09	
Volume of gas metered wet, V_{mstw}			
V _{mstw} = (V _{mstd})(100/(100 - R _{wv}))	m ³	1.1327	
Volume of gas metered at Oxygen Reference Conditions, V_{mstd@X%O₂} & V_{mstw@X%O₂}			
IED & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet (O _{2REFw}) = (21 - REF%O ₂) / (21 - ACT%O _{2w})	-	N/A	
O ₂ Reference Factor dry (O _{2REFd}) = (21 - REF%O ₂) / (21 - ACT%O _{2d})	-	N/A	
V _{mstw@X%oxygen} = (V _{mstw}) / (O _{2REFw})	m ³	N/A	
V _{mstd@X%oxygen} = (V _{mstd}) / (O _{2REFd})	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
M _d = 0.44(%CO ₂)+0.32(%O ₂)+0.28(%N ₂)	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
M _s = M _d (1 - (R _{wv} /100)) + 18(R _{wv} /100)	g/gmol	28.83	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K _p	-	34.97	
Velocity pressure coefficient, C _p	-	0.84	
Average of velocity heads, ΔP _{avg}	mmH ₂ O	23.83	
Average square root of velocity heads, √ΔP	√mmH ₂ O	4.88	
Average stack gas temperature, T _s	°C	18.0	
V _s = ((K _p)(C _p)(√ΔP)(√T _s + 273)) / (√(M _s)(P _s))	m/s	16.76	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO₂}), Dry@O_{2REF} (Q_{stdO₂})			
Area of stack, A _s	m ²	0.15	
Q _a = (60)(A _s)(V _s)	m ³ /min	152.9	
Conversion factor (K/mm.Hg), C _f	-	0.3592	
Q _{stw} = ((Q _a)(P _s)(C _f)) / ((T _s + 273)	m ³ /min	140.1	
Q _{std} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273)	m ³ /min	140.0	
Q _{stwO₂} = ((Q _a)(P _s)(C _f)) / ((T _s + 273) / (O _{2REFw}))	m ³ /min	N/A	
Q _{stdO₂} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273) / (O _{2REFd}))	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D _n	mm	6.04	
Nozzle area, A _n	mm ²	28.69	
Total sampling time, q	min	40	
%I = (4.6398E ⁶)(T _s +273)(V _{mstd}) / (P _s)(V _s)(A _n)(q)(1 - (R _{wv} /100))	%	107.2	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	15:54 - 16:34	
Sampling Dates	-	17/11/2016	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.1327	
Filter I.D. Number	-	47-37263	
Start Filter Mass	g	0.14758	
End Filter Mass	g	0.14772	
Total Mass on Filter	g	0.00014	
Probe Rinse I.D. Number	-	PR-47-37263	
Start Probe Rinse Mass	g	3.07150	
End Probe Rinse Mass	g	3.07153	
Total Mass in Probe Rinse	g	0.00003	
Total Mass Collected	mg	0.17	
Calculated Concentration	mg/m ³	0.15	
Balance Uncertainty / LOD	mg/m ³	0.12	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	17/11/2016	
Average Volume Sampled (REF)	m ³	1.1327	
Filter I.D. Number	-	47-37264	
Start Filter Mass	g	0.14856	
End Filter Mass	g	0.14872	
Total Mass on Filter	g	0.00016	
Probe Rinse I.D. Number	-	PR-47-37264	
Start Probe Rinse Mass	g	3.09013	
End Probe Rinse Mass	g	3.09018	
Total Mass in Probe Rinse	g	0.00005	
Total Mass Collected	mg	0.21	
Calculated Concentration	mg/m ³	0.19	
Balance Uncertainty / LOD	mg/m ³	0.12	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	30.06	
Pre-Sampling Leak Rate	l/min	0.03	
Post-Sampling Leak Rate	l/min	0.04	
Allowable Leak Rate	l/min	0.60	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	27.4	
Allowable MU	%	20	
MU Acceptable	%	No	

Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	107.2	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.25	
Overall Weighing Uncertainty	± mg/m ³	0.22	
ELV [Daily ELV for IED]	mg/m ³	10.00	
Allowable Weighing Uncertainty	mg/m ³	0.50	
Weighing Uncertainty Acceptable	-	Yes	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	18	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	18.00	
Pre-Sampling Leak Rate	l/min	0.02	
Post-Sampling Leak Rate	l/min	0.03	
Allowable Leak Rate	l/min	0.36	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m ³	1.0	
Blank Acceptable	-	Yes	

Acetone / Water Rinse Blank	Units	Blank
Acetone / Water Rinse Value	mg/l	2.7
Allowable Blank	mg/l	10
Blank Acceptable	-	Yes

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
The measurement uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.	w	
One out of two sampling lines was used due to sampling location restrictions, however the number of sample points used on the available line were increased to the minimum required by the Standard	x	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	1.2472		uV _m	m ³	0.0249	
Sampled Gas Temperature	T _m	285.1		uT _m	K	2.0	
Sampled Gas Pressure	p _m	99.0		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.13		uL	%	-	
Mass of Particulate	m	0.17		um	mg	0.14	
Uncollected Mass	UCM	0.21		uUCM	mg	-	

Uncertainty as a Percentage				Requirement of Standard
Measured Quantities	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.70		≤1%
Sampled Gas Pressure	%	0.51		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.13		≤2%
Mass of Particulate	%	1.55		<5% of ELV
Uncollected Mass	%	-		-

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	1.1317	0.17	
Leak	L	mg/m ³	0.0001	1.00	
Mass of Particulate	L _r	mg	0.170	1.11	
Uncollected Mass	UCM	mg	0.12	1.11	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.005	
Leak	mg/m ³	0.0001	
Mass of Particulate	mg/m ³	0.1551	
Uncollected Mass	mg/m ³	0.1365	

Oxygen Correction Part of MU Budget			
Measured Quantities	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	0.21	
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.41	
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.41	
Reported Uncertainty	mg/m ³	0.41	
Expanded uncertainty (95% confidence), without Oxygen Correction	%	215.0	
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	215.0	
Reported Uncertainty	%	215.0	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 44 - Carbon Black

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	4.9		4.9
Uncertainty	±mg/m ³	0.46		0.46
Mass Emission	g/hr	41.1		41.1
Uncertainty	±g/hr	5.6		5.6

General Sampling Information

Parameter	Value
Standard	EN 12619:2013
Technical Procedure	CAT-TP-20
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Type	Propane In Synthetic Air (5 Grade)
Span Gas Reference Number	CYL 1.0245a
Span Gas Expiry Date	10/09/2021
Span Gas Start Pressure (bar)	140
Gas Cylinder Concentration (ppm)	80.1
Span Gas Set Point (ppm)	80.10
Span Gas Uncertainty (%)	N/A
Zero Gas Type	Synthetic Air (5 Grade)
Number of Sampling Lines Used	1/1
Number of Sampling Points Used	1/1
Sample Point I.D.'s	A5

FORMAT: Number Used / Number Required

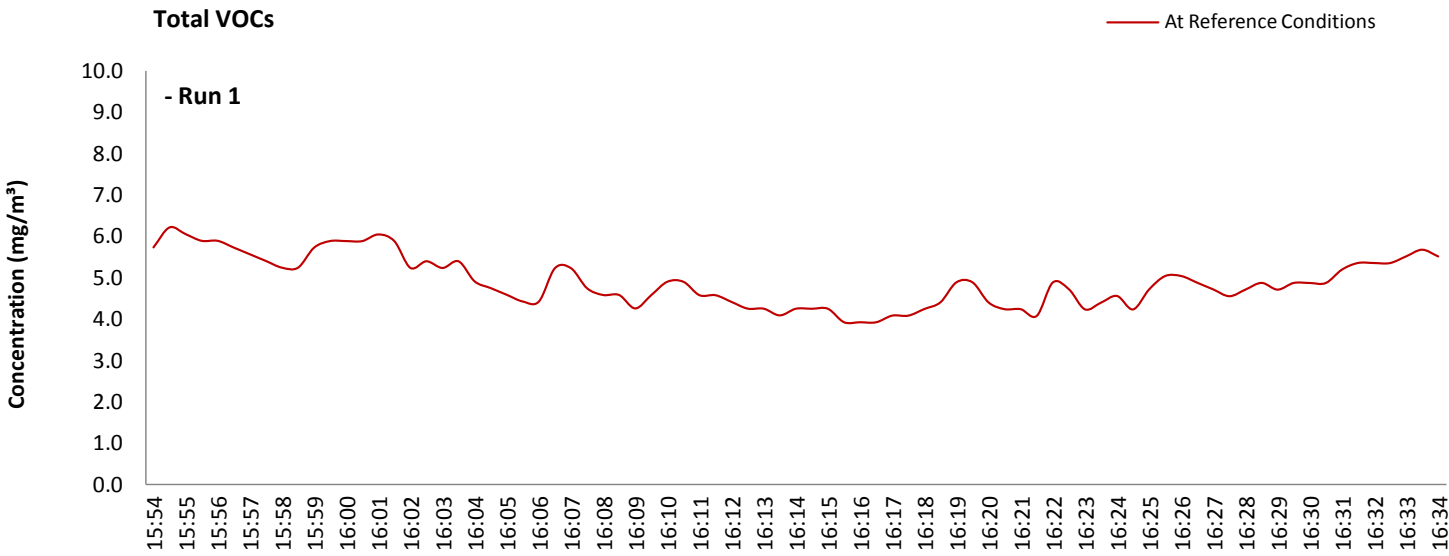
FORMAT: Number Used / Number Required

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	-	15:54 - 16:34	
Sampling Dates	-	17/11/2016	
Instrument Range	ppm	100	
Span Gas Value	ppm	80.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.10	
	Zero Down Sampling Line (Post)	ppm	0.20	
	Zero Drift	ppm	0.10	
	Allowable Zero Drift	± ppm	4.01	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	80.20	
	Span Down Sampling Line (Post)	ppm	79.70	
	Span Drift	ppm	-0.50	
	Allowable Span Drift	± ppm	4.01	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	5 - 14	

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)
TGN M2 Allowable MU	15.0		%
Measured concentration	4.90		mg/m ³ (STP, dry)
Range Used	100.0		ppm
Range Used [A]	160.6		mg/m ³
Cal gas conc.	80.1		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.	128.7		mg/m ³

Performance characteristics	RUN 1		Units
Response time	45		seconds
Number of readings in measurement	40		-
Repeatability at zero	2.00		% full scale
Repeatability at span level	0.00		% full scale
Deviation from linearity	0.07		% of value
Zero drift	0.12		% full scale
Span drift	-0.62		% full scale
Volume or pressure flow dependence	1.60		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	1.40		% full scale/10K
Combined interference	0.45		% range
Dependence on voltage	0.50		% full scale/10V
Losses in the line (leak)	0.00		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m ³
Standard deviation of repeatability at span level	0.00		mg/m ³
Lack of fit	0.01		mg/m ³
Drift	0.07		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)	0.00		mg/m ³
Uncertainty of calibration gas	0.06		mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		4.90	mg/m ³
Expanded uncertainty		0.24	mg/m ³
Expanded uncertainty	k = 1.96	0.46	mg/m ³
Uncertainty corrected to std conds. (O ₂)		0.46	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	9.48	% 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 in M2	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 in M2	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). Ref EA TGN M2.



Exova Catalyst, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL

T: 0800 328 1821 (or + 44 161 432 3286 from overseas)

E: toby.campbell@exova.com

Your Exova Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

VIP Polymers Ltd

Installation Name & Address

VIP Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7EB

PPC Permit: B11/94

Stack Reference

Stack 46 - Spray Booth

Dates of the Monitoring Campaign

17th November 2016

Job Reference Number

CAT-3047

Report Written by

Harpreet Badwal
Team Leader
MCERTS Level 2
MM 03 149
TE1 TE2 TE3 TE4

Report Approved by

Derek Myers
Team Leader
MCERTS Level 2
MM 02 115
TE1 TE2 TE3 TE4

Report Date

1st December 2016

Version

Version 1

Signature of Report Approver



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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

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Executive Summary

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MONITORING OBJECTIVES

VIP Polymers Ltd, Huntingdon
Stack 46 - Spray Booth
17th November 2016

Overall Aim of the Monitoring Campaign

Exova Catalyst were commissioned by VIP Polymers Ltd to carry out stack emissions testing on the Stack 46 - Spray Booth at Huntingdon.

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter | Total VOCs (as Carbon) |



Executive Summary
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MONITORING RESULTS

VIP Polymers Ltd, Huntingdon
Stack 46 - Spray Booth
17th November 2016

where MU = Measurement Uncertainty associated with the Result

Concentration					Mass Emission			
Parameter	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.30	0.39	10	g/hr	2.6	3.3	-
Total VOCs (as Carbon)	¹ mg/m ³	49.9	1.6	-	g/hr	429	25.3	-
Water Vapour	% v/v	0.19	0.04					
Stack Gas Temperature	°C	18.8						
Stack Gas Velocity	m/s	6.6	0.14					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	9373	469					
Volumetric Flow Rate (REF)	¹ m ³ /hr	8597	430					

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

VIP Polymers Ltd, Huntingdon
Stack 46 - Spray Booth
17th November 2016

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m³	0.30	g/hr	2.6	17/11/2016	12:20 - 12:40, 12:42 - 13:02	40
Total VOCs (as Carbon)	R1	mg/m³	49.9	g/hr	429	17/11/2016	12:20 - 13:00	40
Velocity & Volumetric Flow Rate	R1					17/11/2016	12:05 - 12:15	

All results are expressed at the respective reference conditions.



Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon
Stack 46 - Spray Booth
17th November 2016

Standard Operating Conditions

Parameter	Value
Process Status	Paint Application Operational
Capacity (of 100%) and Tonnes / Hour	Normal Operation
Continuous or Batch Process	Batch
Feedstock (if applicable)	Paint + Thinners
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon
 Stack 46 - Spray Booth
 17th November 2016

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	ISO 17025 Testing	Testing Lab	Analytical Procedure	Analytical Technique	ISO 17025 Analysis	Analysis Lab		
Total Particulate Matter	EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.19 mg/m³
Water Vapour	EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.32 mg/m³
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	Yes	CAT	Pitot Tube and Thermocouple				Yes	1.2 m/s

ANALYSIS LABORATORIES

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

Exova Catalyst (CAT)	ISO 17025 Accreditation Number: 4279
----------------------	--------------------------------------

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Water Vapour	1	The measurement uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.

Executive Summary

(Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.71
Width	m	-
Area	m ²	0.40
Port Depth	cm	5
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	30.0		> 5 Pa	Yes
Mean Velocity	m/s	6.58		-	-
Lowest Gas Velocity	m/s	5.97		-	-
Highest Gas Velocity	m/s	6.90		-	-
Ratio of Above	: 1	1.16		< 3 : 1	Yes
Maximum Angle of Swirl	°	0		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

Executive Summary

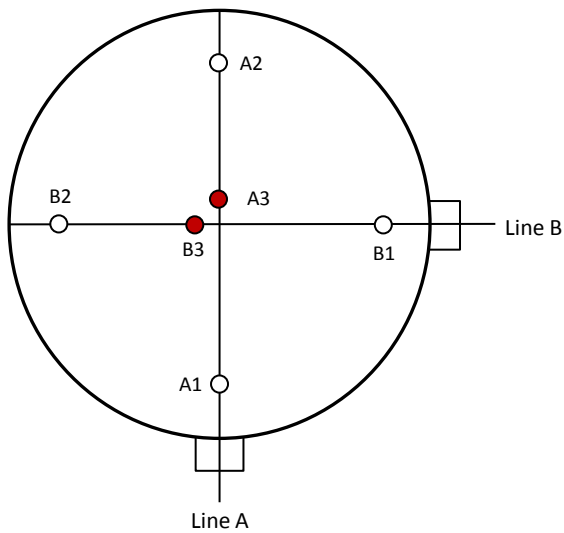
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PLANT PHOTOS

Photo 1



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	Harpreet Badwal	MCERTS Level 2	MM 03 149	TE1 TE2 TE3 TE4
Team Leader	Phil Waters	MCERTS Level 2	MM 04 527	TE1 TE2 TE3 TE4

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM (1)	CAT 7.57	Horiba PG-350E	-	Digital Manometer (1)	CAT 3.142
Control Box DGM (2)	-	Horiba PG-250	-	Digital Manometer (2)	CAT 3.144
Box Thermocouples (1)	CAT 3.146	Servomex 4900	-	Digital Temperature Meter	-
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	CAT 14.84
Umbilical (1)	CAT 3.146	ABB AO2020-URAS26	-	Barometer	CAT 13.40
Umbilical (2)	-	Servomex 5200MP	-	Stack Thermocouple (1)	CAT 4.844
Oven Box (1)	-	Ankersmid APS 313	-	Stack Thermocouple (2)	CAT 4.789
Oven Box (2)	-	Gasmet DX4000	-	Stack Thermocouple (3)	CAT 4.013
Heated Probe (1)	CAT 5.126	Gasmet Sampling System	-	1m Heated Line (1)	-
Heated Probe (2)	CAT 5.127	Bernath 3006 FID	CAT 8.31	1m Heated Line (2)	-
Heated Probe (3)	CAT 5.128	M&C PSS	CAT 12.107	1m Heated Line (3)	-
S-Pitot (1)	CAT 21S.57	Mass Flow Controller (1)	CAT 6.61	5m Heated Line (1)	-
S-Pitot (2)	CAT 21P.38	Mass Flow Controller (2)	CAT 6.62	15m Heated Line (1)	-
L-Pitot	-	Mass View (1)	-	20m Heated Line (1)	CAT 20.116
Site Balance	CAT 17.33	Mass View (2)	-	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.33 a & b	Hioki 5043 (V)	CAT 11.69	Dual Channel Heater Controller	-
Last Impinger Arm	-	Easylogger EN-EL-12 Bit	-	Single Channel Heater Controller	CAT 20.116
Callipers	CAT 23.40	Bioaerosols Temperature Logger	-	Laboratory Balance	CAT 1.18 / 1.18a
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.45

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	EN 13284-1	CAT-TP-01
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	0.71
Stack Width, W	m	-
Stack Area, A	m ²	0.40
Average Stack Gas Temperature, T _a	°C	18.3
Average Stack Gas Pressure	Pa	36.5
Average Stack Static Pressure, P _{static}	kPa	0.025
Average Barometric Pressure, P _b	kPa	99.1
Average Pitot Tube Calibration Coefficient, C _p	-	0.84

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.76	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.99	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.19	0.0019	18.02	0.8037	0.00149

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	1.286
Dry Density (Actual), P _{Actual}	kg/m ³	1.181
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.180

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)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	18.3	0.0
Total Pressure	kPa	99.1	101.3
Moisture	%	0.19	0.19

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	9373
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	8597
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	8581
Gas Volumetric Flowrate REF ¹	m ³ /hr	8597

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

(1 of 1)

Parameter	Units	Value
Date of Survey	-	17/11/2016
Time of Survey	-	12:05 - 12:15
Atmospheric Pressure	kPa	99.1
Average Stack Static Pressure	Pa	25
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	No
Device Used	S-Type Pitot with KIMO MP 210 (500Pa)	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C _p	-	0.84
Number of Lines Available	-	2
Number of Lines Used	-	2

Sampling Line A							Sampling Line B				
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °
STATIC (Units: Pa)		25.0					25.0				
Mean		33.0	18.0	1.181	6.25		40.0	18.5	1.179	6.90	
1	0.10	30.0	18.0	1.181	5.97	0.0	40.0	18.0	1.181	6.89	0.0
2	0.61	36.0	18.0	1.181	6.54	0.0	40.0	19.0	1.177	6.90	0.0

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	$u(\Delta p_i)$	1.120	Pa
- Resolution	$u(res)$	0.00087	
- Calibration	$u(cal)$	0.139	
- Drift	$u(drift)$	0.083	
- Lack of Fit	$u(fit)$	0.031	
- Overall corrections to dynamic measurements	$u(C_f)$	0.254	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00003	-
- $\varphi_{O_2,w}$	-	20.761	
- $\varphi_{CO_2,w}$	-	0.060	
- Oxygen, dry	$u(\phi_{O_2,d})$	0.637	
- Carbon Dioxide, dry	$u(\phi_{CO_2,d})$	0.002	
- Water Vapour	$u(\phi_{H_2O})$	0.009	
- Oxygen, wet	$u(\phi_{O_2,w})$	0.636	
- Carbon Dioxide, wet	$u(\phi_{CO_2,w})$	0.002	
Standard uncertainty associated with the stack temperature	$u(T_c)$	1.486	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.694	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	0.792	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00637	-
Standard uncertainty associated with the local velocities	$u(v_i)$	0.114	Pa
Standard uncertainty associated with the mean velocity	$u(\bar{v})$	0.072	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	0.140	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	2.14	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV,w)$	469.2	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00065	
- $u^2(qV,w)$	-	57296	
- $u(qV,w)$	-	239.4	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV,w)$	5.01	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 46 - Spray Booth

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.30		0.30
Uncertainty	±mg/m ³	0.39		0.39
Mass Emission	g/hr	2.6		2.6
Uncertainty	±g/hr	3.3		3.3

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.19		0.19
Uncertainty	±% v/v	0.04		0.04

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.19		0.19

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value	
Standard	EN 13284-1	
Technical Procedure	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Glass Fibre	
Number of Sampling Lines Used	2/2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	4/4	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1, A2, B1 & B2	

Reference Conditions

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

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P _b	mmHg	743.3	
Stack static pressure, P _{static}	mmH ₂ O	2.5	
P _s = (P _b + (P _{static} / 13.6))	mmHg	743.4	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-3.5	
Total mass collected in impingers (silica trap)	g	4.6	
Total mass of liquid collected, V _{lc}	g	1.1	
V _{wstd} = (0.001246)(V _{lc})	m ³	0.0014	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V _m	m ³	0.8175	
Gas meter correction factor, Y _d	-	0.9640	
Average dry gas meter temperature, T _m	°C	13.5	
Average pressure drop across orifice, ΔH	mmH ₂ O	44.0	
V _{mstd} = ((0.3592)(V _m)(P _b + (ΔH/13.6))(Y _d)) / (T _m + 273)	m ³	0.7376	
Moisture content, B_{wo} & R_{wv}			
B _{wo} = V _{wstd} / (V _{mstd} + V _{wstd})	m ³	0.0019	
B _{wo} as a percentage	% v/v	0.19	
Reported Water Vapour, checked with Tables in EN 14790, R _{wv}	% v/v	0.19	
Volume of gas metered wet, V_{mstw}			
V _{mstw} = (V _{mstd})(100/(100 - R _{wv}))	m ³	0.7389	
Volume of gas metered at Oxygen Reference Conditions, V_{mstd@X%O₂} & V_{mstw@X%O₂}			
IED & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet (O _{2REFw}) = (21 - REF%O ₂) / (21 - ACT%O _{2w})	-	N/A	
O ₂ Reference Factor dry (O _{2REFd}) = (21 - REF%O ₂) / (21 - ACT%O _{2d})	-	N/A	
V _{mstw@X%oxygen} = (V _{mstw}) / (O _{2REFw})	m ³	N/A	
V _{mstd@X%oxygen} = (V _{mstd}) / (O _{2REFd})	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
M _d = 0.44(%CO ₂)+0.32(%O ₂)+0.28(%N ₂)	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
M _s = M _d (1 - (R _{wv} /100)) + 18(R _{wv} /100)	g/gmol	28.82	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K _p	-	34.97	
Velocity pressure coefficient, C _p	-	0.84	
Average of velocity heads, ΔP _{avg}	mmH ₂ O	3.65	
Average square root of velocity heads, √ΔP	√mmH ₂ O	1.91	
Average stack gas temperature, T _s	°C	18.8	
V _s = ((K _p)(C _p)(√ΔP)(√T _s + 273)) / (√(M _s)(P _s))	m/s	6.56	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO₂}), Dry@O_{2REF} (Q_{stdO₂})			
Area of stack, A _s	m ²	0.40	
Q _a = (60)(A _s)(V _s)	m ³ /min	156.0	
Conversion factor (K/mm.Hg), C _f	-	0.3592	
Q _{stw} = ((Q _a)(P _s)(C _f)) / ((T _s + 273)	m ³ /min	142.7	
Q _{std} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273)	m ³ /min	142.5	
Q _{stwO₂} = ((Q _a)(P _s)(C _f)) / ((T _s + 273) / (O _{2REFw}))	m ³ /min	N/A	
Q _{stdO₂} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273) / (O _{2REFd}))	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D _n	mm	8.00	
Nozzle area, A _n	mm ²	50.23	
Total sampling time, q	min	40	
%I = (4.6398E ⁶)(T _s +273)(V _{mstd}) / (P _s)(V _s)(A _n)(q)(1 - (R _{wv} /100))	%	102.0	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	12:20 - 12:40, 12:42 - 13:02	
Sampling Dates	-	17/11/2016	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.7389	
Filter I.D. Number	-	47-37417	
Start Filter Mass	g	0.14693	
End Filter Mass	g	0.14703	
Total Mass on Filter	g	0.00010	
Probe Rinse I.D. Number	-	PR-47-37417	
Start Probe Rinse Mass	g	2.89779	
End Probe Rinse Mass	g	2.89791	
Total Mass in Probe Rinse	g	0.00012	
Total Mass Collected	mg	0.22	
Calculated Concentration	mg/m ³	0.30	
Balance Uncertainty / LOD	mg/m ³	0.19	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	17/11/2016	
Average Volume Sampled (REF)	m ³	0.7389	
Filter I.D. Number	-	47-37238	
Start Filter Mass	g	0.14694	
End Filter Mass	g	0.14686	
Total Mass on Filter	g	-0.00007	
Probe Rinse I.D. Number	-	PR-47-37238	
Start Probe Rinse Mass	g	2.93046	
End Probe Rinse Mass	g	2.93046	
Total Mass in Probe Rinse	g	0.00000	
Total Mass Collected	mg	-0.07	
Calculated Concentration	mg/m ³	-0.10	
Balance Uncertainty / LOD	mg/m ³	0.19	



APPENDIX 2



TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	19.70	
Pre-Sampling Leak Rate	l/min	0.03	
Post-Sampling Leak Rate	l/min	0.04	
Allowable Leak Rate	l/min	0.39	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	20.3	
Allowable MU	%	20	
MU Acceptable	%	No	

Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	102.0	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.25	
Overall Weighing Uncertainty	± mg/m ³	0.34	
ELV [Daily ELV for IED]	mg/m ³	10.00	
Allowable Weighing Uncertainty	mg/m ³	0.50	
Weighing Uncertainty Acceptable	-	Yes	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	19	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	18.00	
Pre-Sampling Leak Rate	l/min	0.02	
Post-Sampling Leak Rate	l/min	0.03	
Allowable Leak Rate	l/min	0.36	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m ³	1.0	
Blank Acceptable	-	Yes	

Acetone / Water Rinse Blank	Units	Blank
Acetone / Water Rinse Value	mg/l	2.7
Allowable Blank	mg/l	10
Blank Acceptable	-	Yes

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
The measurement uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.	w	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	0.8175		uV _m	m ³	0.0164	
Sampled Gas Temperature	T _m	286.5		uT _m	K	2.0	
Sampled Gas Pressure	p _m	99.1		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.20		uL	%	-	
Mass of Particulate	m	0.22		um	mg	0.14	
Uncollected Mass	UCM	-0.07		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.70		≤1%
Sampled Gas Pressure	%	0.50		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.20		≤2%
Mass of Particulate	%	1.89		<5% of ELV
Uncollected Mass	%	-		-

Uncertainty in Measurement Units					Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V _m	m ³	0.7376		0.41	
Leak	L	mg/m ³	0.0004		1.00	
Mass of Particulate	L _r	mg	0.223		1.35	
Uncollected Mass	UCM	mg	-0.04		1.35	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.008	
Leak	mg/m ³	0.0004	
Mass of Particulate	mg/m ³	0.1895	
Uncollected Mass	mg/m ³	-0.0573	

Oxygen Correction Part of MU Budget			
Measured Quantities	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	0.20	
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.39	
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.39	
Reported Uncertainty	mg/m ³	0.39	
Expanded uncertainty (95% confidence), without Oxygen Correction	%	128.5	
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	128.5	
Reported Uncertainty	%	128.5	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 46 - Spray Booth

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	49.9		49.9
Uncertainty	±mg/m ³	1.6		1.6
Mass Emission	g/hr	429		429
Uncertainty	±g/hr	25.3		25.3

General Sampling Information

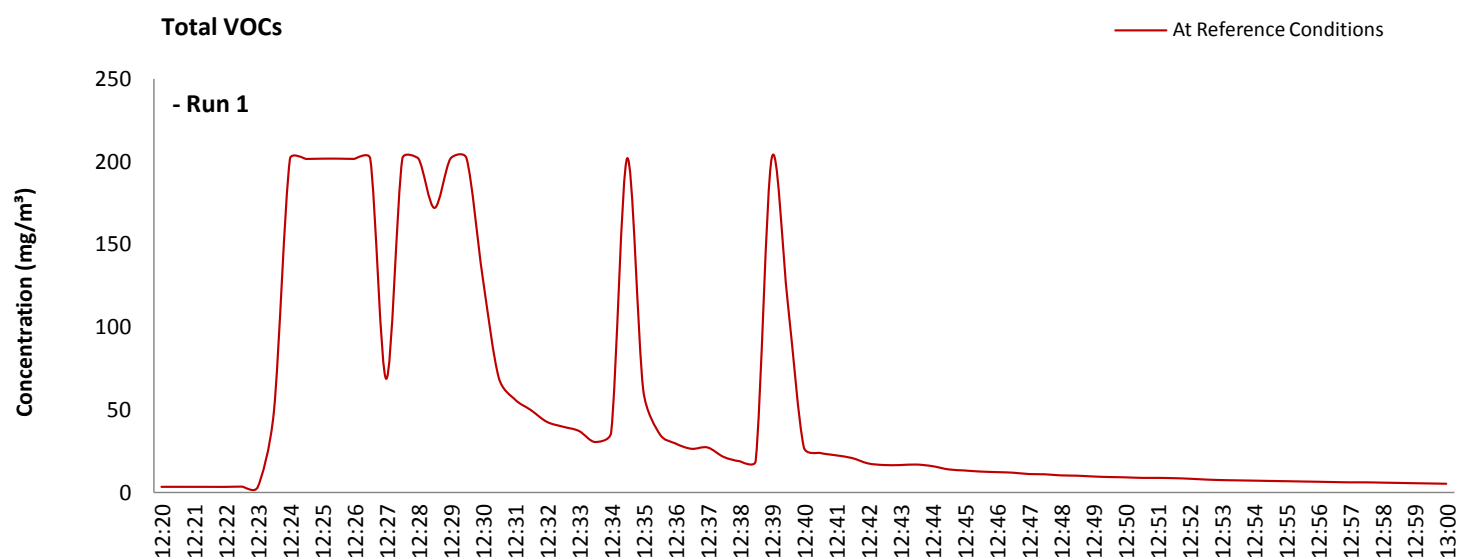
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	CAT-TP-20	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	CYL 1.0245a	
Span Gas Expiry Date	10/09/2021	
Span Gas Start Pressure (bar)	140	
Gas Cylinder Concentration (ppm)	80.1	
Span Gas Set Point (ppm)	80.10	
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	A3 & B3	

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	-	12:20 - 13:00	
Sampling Dates	-	17/11/2016	
Instrument Range	ppm	100	
Span Gas Value	ppm	80.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.20	
	Zero Down Sampling Line (Post)	ppm	0.90	
	Zero Drift	ppm	0.70	
	Allowable Zero Drift	± ppm	4.01	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	80.00	
	Span Down Sampling Line (Post)	ppm	79.60	
	Span Drift	ppm	-0.40	
	Allowable Span Drift	± ppm	4.01	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	5 - 14	

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)
TGN M2 Allowable MU	15.0		%
Measured concentration	49.98		mg/m ³ (STP, dry)
Range Used	100.0		ppm
Range Used [A]	160.6		mg/m ³
Cal gas conc.	80.1		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.	128.7		mg/m ³

Performance characteristics	RUN 1		Units
Response time	45		seconds
Number of readings in measurement	40		-
Repeatability at zero	2.00		% full scale
Repeatability at span level	0.00		% full scale
Deviation from linearity	0.07		% of value
Zero drift	0.88		% full scale
Span drift	-0.50		% full scale
Volume or pressure flow dependence	1.60		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	1.40		% full scale/10K
Combined interference	0.45		% range
Dependence on voltage	0.50		% full scale/10V
Losses in the line (leak)	0.12		% 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	0.01		mg/m ³
Drift	0.51		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)	0.04		mg/m ³
Uncertainty of calibration gas	0.58		mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		49.98	mg/m ³
Expanded uncertainty		0.80	mg/m ³
Expanded uncertainty	k = 1.96	1.56	mg/m ³
Uncertainty corrected to std conds. (O ₂)		1.56	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	3.13	% 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 in M2	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 in M2	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). Ref EA TGN M2.