



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

10th January 2018

Job Reference Number

CAT-3927

Report Written by

Ian Baggley
Team Leader
MCERTS Level 2
MM 05 653
TE1 TE2 TE3 TE4

Report Approved by

Michelle Edwards
Team Leader
MCERTS Level 2
MM 05 659
TE1 TE2 TE3 TE4

Report Date

24th January 2018

Version

Version 1

Signature of Report Approver

A handwritten signature in black ink, appearing to read 'M Edwards', is written over a light grey background within a rectangular box.

CONTENTS

TITLE PAGE

CONTENTS

Summary of Sampling Deviations 2

EXECUTIVE SUMMARY

Monitoring Objectives 3

Monitoring Results 4

Monitoring Dates & Times 5

Process Details 6

Monitoring & Analytical Methods 7

Sampling Location 8

Plant Photos / Sample Points 9

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.

This test report shall not be reproduced, except in full, without the written approval of Exova Catalyst.

Executive Summary

(Page 1 of 7)

MONITORING OBJECTIVES

VIP Polymers Ltd, Huntingdon

Stack 44 - Carbon Black

10th January 2018

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

(Page 2 of 7)

MONITORING RESULTS

VIP Polymers Ltd, Huntingdon
 Stack 44 - Carbon Black
 10th January 2018

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	0.48	10	g/hr	6.6	4.4	-
Total VOCs (as Carbon)	¹ mg/m ³	5.2	1.9	-	g/hr	46.0	17.3	-
Water Vapour	% v/v	0.63	0.05					
Stack Gas Temperature	°C	16.0						
Stack Gas Velocity	m/s	17.4	1.5					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	9518	924					
Volumetric Flow Rate (REF)	¹ m ³ /hr	8906	865					

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

(Page 3 of 7)

MONITORING DATE(S) & TIMES

VIP Polymers Ltd, Huntingdon
 Stack 44 - Carbon Black
 10th January 2018

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m ³	0.74	g/hr	6.6	10/01/2018	09:40 - 10:20	40
Total VOCs (as Carbon)	R1	mg/m ³	5.2	g/hr	46.0	10/01/2018	09:40 - 10:20	40
Velocity & Volumetric Flow Rate	R1					10/01/2018	09:17 - 09:24	

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
10th January 2018

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operation
Capacity (of 100%) and Tonnes / Hour	Full Capacity
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

10th January 2018

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/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	0.21 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
----------------------	--------------------------------------

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	1	In order to maintain isokinetic sampling, a nozzle size smaller than that specified in the Standard was used.
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

(Page 6 of 7)

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

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	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	No

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	255.0		> 5 Pa	Yes
Mean Velocity	m/s	17.39		-	-
Lowest Gas Velocity	m/s	17.06		-	-
Highest Gas Velocity	m/s	17.71		-	-
Ratio of Above	: 1	1.04		< 3 : 1	Yes
Maximum Angle of Swirl	°	4		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

Executive Summary

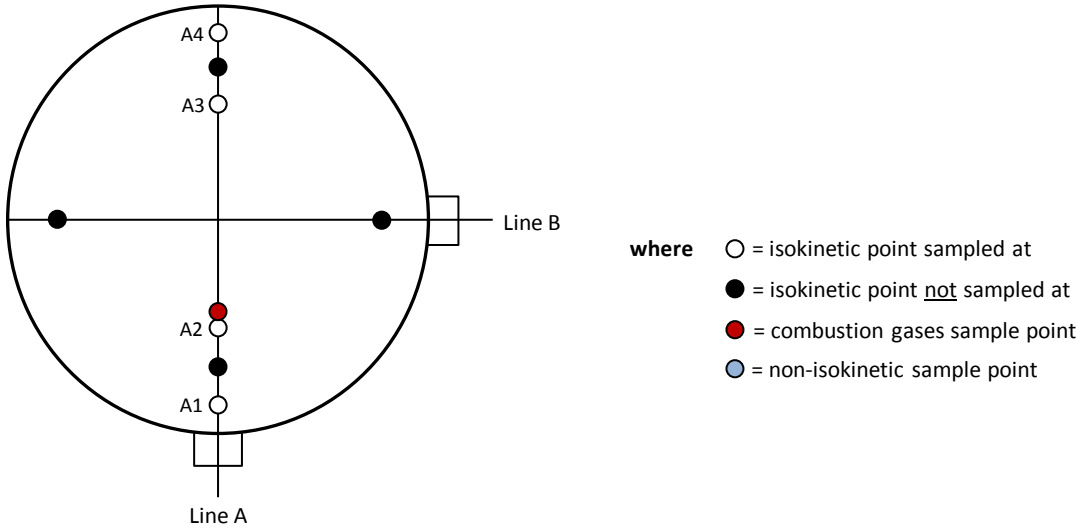
(Page 7 of 7)

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	Ian Baggley	MCERTS Level 2	MM 05 653	TE1 TE2 TE3 TE4
Technician	Gareth Jones	MCERTS Level 1	MM 13 1241	TE1

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 7.5	Horiba PG-250	-	Digital Manometer (1)	CAT 3.125
Control Box DGM (2)	-	Horiba PG-350E	-	Digital Manometer (2)	-
Box Thermocouples (1)	CAT 3.12	Servomex 4900	-	Digital Temperature Meter	CAT 3.125
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	-
Umbilical (1)	CAT 3.12	ABB AO2020-URAS26	-	Barometer	CAT 13.29
Umbilical (2)	-	Testo 350 XL	-	Stack Thermocouple (1)	CAT 4.0018
Oven Box (1)	-	JCT JCC P1 Cooler	-	Stack Thermocouple (2)	-
Oven Box (2)	-	ProtIR 204M	-	Stack Thermocouple (3)	-
Heated Probe (1)	CAT 5.19	Gasmet Sampling System	-	1m Heated Line (1)	-
Heated Probe (2)	CAT 5.20	Bernath 3006 FID	CAT 8.5	1m Heated Line (2)	-
Heated Probe (3)	-	M&C PSS	-	1m Heated Line (3)	-
S-Pitot (1)	CAT 21.S79	Mass Flow Controller (1)	CAT 6.19	5m Heated Line (1)	-
S-Pitot (2)	-	Mass Flow Controller (2)	CAT 6.20	15m Heated Line (1)	CAT 20.89
L-Pitot	-	Mass View (1)	-	20m Heated Line (1)	-
Site Balance	CAT 17.2	Mass View (2)	-	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.2	Easylogger EN-EL-12 Bit	-	Dual Channel Heater Controller	-
Last Impinger Arm	-	Hioki 5043 (V)	CAT 8.40	Single Channel Heater Controller	-
Callipers	CAT 23.7	Bioaerosols Temperature Logger	-	Laboratory Balance	CAT 1.18 / 1.18a
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.26

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	16.0
Average Stack Gas Pressure	mmH ₂ O	27.0
Average Stack Static Pressure, P _{static}	kPa	0.240
Average Barometric Pressure, P _b	kPa	100.1
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

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	20.67	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.64	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.63	0.0063	18.02	0.8037	0.00504

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	1.284
Dry Density (Actual), P _{Actual}	kg/m ³	1.204
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)

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

$P_{ActualW}$ (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	16.0	0.0
Total Pressure	kPa	100.3	101.3
Moisture	%	0.63	0.63

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	9518
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	8906
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	8850
Gas Volumetric Flowrate REF ¹	m ³ /hr	8906

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

(1 of 1)

Parameter	Units	Value
Date of Survey	-	10/01/2018
Time of Survey	-	09:17 - 09:24
Atmospheric Pressure	kPa	100.1
Average Stack Static Pressure	Pa	240
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	-	0.83
Number of Lines Available	-	2
Number of Lines Used	-	1

Sampling Line A							Sampling Line B - Restricted Access				
Traverse Point	Depth m	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °	ΔP	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °
STATIC (Units: Pa)		240.0									
Mean		27.0	16.0	1.202	17.39						
1	0.03	26.0	16.0	1.202	17.06	4.0					
2	0.11	28.0	16.0	1.202	17.71	2.0					
3	0.33	28.0	16.0	1.202	17.71	0.0					
4	0.41	26.0	16.0	1.202	17.06	2.0					

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	$u(\Delta p_i)$	4.552	Pa
- Resolution	$u(res)$	0.52154	
- Calibration	$u(cal)$	7.300	
- Drift	$u(drift)$	1.096	
- Lack of Fit	$u(fit)$	10.804	
- Overall corrections to dynamic measurements	$u(C_f)$	19.722	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00003	-
- $\varphi_{O_2,w}$	-	20.670	
- $\varphi_{CO_2,w}$	-	0.060	
- Oxygen, dry	$u(\phi_{O_2,d})$	0.637	
- Carbon Dioxide, dry	$u(\phi_{CO_2,d})$	0.002	
- Water Vapour	$u(\phi_{H_2O})$	0.032	
- Oxygen, wet	$u(\phi_{O_2,w})$	0.633	
- Carbon Dioxide, wet	$u(\phi_{CO_2,w})$	0.002	
Standard uncertainty associated with the stack temperature	$u(T_c)$	1.474	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.751	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	4.552	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00648	-
Standard uncertainty associated with the local velocities	$u(v_i)$	1.481	Pa
Standard uncertainty associated with the mean velocity	$u(\bar{v})$	0.762	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	1.494	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	8.59	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV,w)$	924.3	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00245	
- $u^2(qV,w)$	-	222388	
- $u(qV,w)$	-	471.6	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV,w)$	9.71	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack 44 - Carbon Black

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.74		0.74
Uncertainty	±mg/m ³	0.48		0.48
Mass Emission	g/hr	6.6		6.6
Uncertainty	±g/hr	4.4		4.4

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.63		0.63
Uncertainty	±% v/v	0.05		0.05

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.20		0.20

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 - 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	750.8	
Stack static pressure, P_{static}	mmH ₂ O	2.9	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	751.0	
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	4.5	
Total mass of liquid collected, V_{lc}	g	3.7	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0046	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.7704	
Gas meter correction factor, Y_d	-	0.9870	
Average dry gas meter temperature, T_m	°C	8.8	
Average pressure drop across orifice, ΔH	mmH ₂ O	40.1	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.7306	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0063	
B_{wo} as a percentage	% v/v	0.63	
Reported Water Vapour, checked with Tables in EN 14790, R_{wv}	% v/v	0.63	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.7353	
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	28.77	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K_p	-	34.97	
Velocity pressure coefficient, C_p	-	0.83	
Average of velocity heads, ΔP_{avg}	mmH ₂ O	26.00	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	5.10	
Average stack gas temperature, T_s	°C	16.0	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (\sqrt{M_s}(P_s))$	m/s	17.12	
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	0.15	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	156.2	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	145.8	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	144.9	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	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	4.96	
Nozzle area, A_n	mm ²	19.32	
Total sampling time, q	min	40	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	99.2	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	09:40 - 10:20	
Sampling Dates	-	10/01/2018	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.7353	
Filter I.D. Number	-	47-48553	
Start Filter Mass	g	0.15724	
End Filter Mass	g	0.15741	
Total Mass on Filter	g	0.00017	
Probe Rinse I.D. Number	-	PR-47-48553	
Start Probe Rinse Mass	g	3.04377	
End Probe Rinse Mass	g	3.04414	
Total Mass in Probe Rinse	g	0.00037	
Total Mass Collected	mg	0.54	
Calculated Concentration	mg/m ³	0.74	
Balance Uncertainty / LOD	mg/m ³	0.19	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	09/01/2018	
Average Volume Sampled (REF)	m ³	0.7353	
Filter I.D. Number	-	47-48552	
Start Filter Mass	g	0.15850	
End Filter Mass	g	0.15846	
Total Mass on Filter	g	-0.00004	
Probe Rinse I.D. Number	-	PR-47-48552	
Start Probe Rinse Mass	g	2.84959	
End Probe Rinse Mass	g	2.84978	
Total Mass in Probe Rinse	g	0.00019	
Total Mass Collected	mg	0.15	
Calculated Concentration	mg/m ³	0.20	
Balance Uncertainty / LOD	mg/m ³	0.19	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	19.01	
Pre-Sampling Leak Rate	l/min	0.14	
Post-Sampling Leak Rate	l/min	0.14	
Allowable Leak Rate	l/min	0.38	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	8.1	
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	%	99.2	
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	0.34	
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	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	20.00	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.12	
Allowable Leak Rate	l/min	0.40	
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	
In order to maintain isokinetic sampling, a nozzle size smaller than that specified in the Standard was used.	x	
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	0.7704		uV _m	m ³	0.0154	
Sampled Gas Temperature	T _m	281.8		uT _m	K	2.0	
Sampled Gas Pressure	p _m	100.1		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.74		uL	%	-	
Mass of Particulate	m	0.54		um	mg	0.14	
Uncollected Mass	UCM	0.15		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	%	0.74		≤2%
Mass of Particulate	%	1.90		<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	0.7306	1.01	
Leak	L	mg/m ³	0.003	1.00	
Mass of Particulate	L _r	mg	0.543	1.36	
Uncollected Mass	UCM	mg	0.09	1.36	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.018	
Leak	mg/m ³	0.0031	
Mass of Particulate	mg/m ³	0.1904	
Uncollected Mass	mg/m ³	0.1178	

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	0.22	
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.44	
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.48	
Reported Uncertainty	mg/m ³	0.48	
Expanded uncertainty (95% confidence), without Oxygen Correction	%	59.6	
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	65.5	
Reported Uncertainty	%	65.5	

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	5.2		5.2
Uncertainty	±mg/m ³	1.9		1.9
Mass Emission	g/hr	46.0		46.0
Uncertainty	±g/hr	17.3		17.3

General Sampling Information

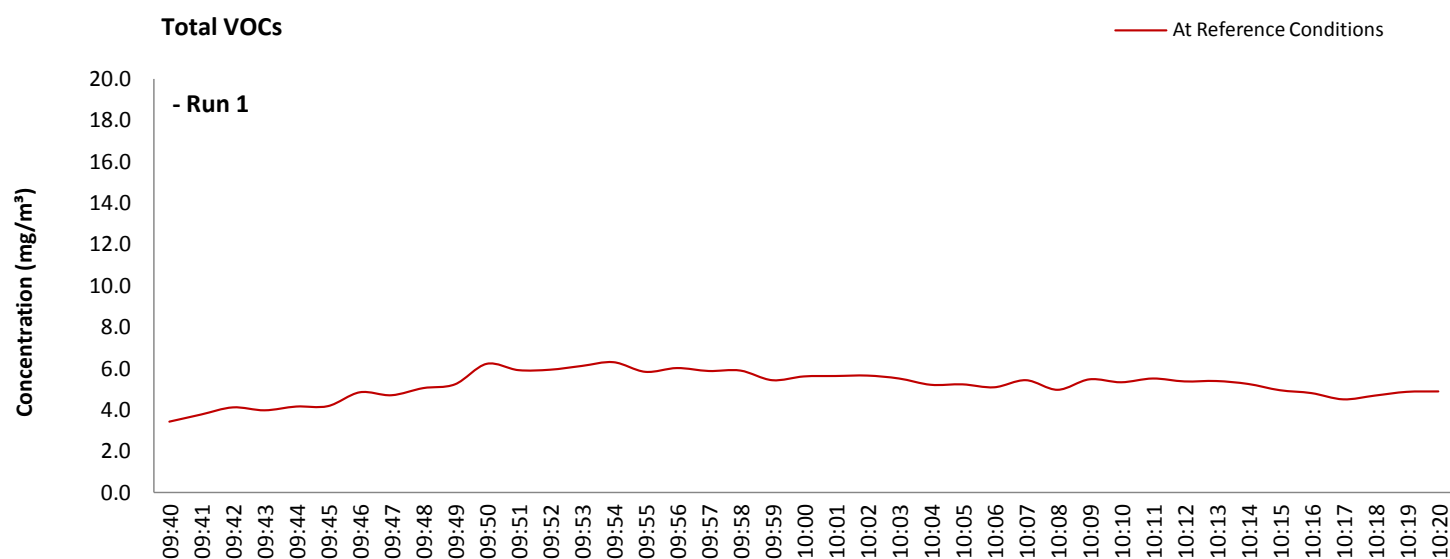
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	CAT-TP-20	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	1.316a	
Span Gas Expiry Date	24/11/2022	
Span Gas Start Pressure (bar)	60	
Gas Cylinder Concentration (ppm)	80.4	
Span Gas Set Point (ppm)	80.40	
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	-	09:40 - 10:20	
Sampling Dates	-	10/01/2018	
Instrument Range	ppm	100	
Span Gas Value	ppm	80.4	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.40	
	Zero Down Sampling Line (Post)	ppm	-0.60	
	Zero Drift	ppm	-1.00	
	Allowable Zero Drift	± ppm	4.02	
	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	79.80	
	Span Drift	ppm	-0.20	
	Allowable Span Drift	± ppm	4.02	
	Span Drift Acceptable	-	Yes	

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

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	5.19		mg/m ³ (STP, dry)
Range Used	100.0		ppm
Range Used [A]	160.6		mg/m ³
Cal gas conc.	80.4		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.	129.1		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	0.20		% of value
Zero drift	-1.25		% full scale
Span drift	-0.25		% 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)	0.50		% 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	0.02		mg/m ³
Drift	-0.94		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)	0.01		mg/m ³
Uncertainty of calibration gas	0.06		mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		5.19	mg/m ³
Expanded uncertainty		0.97	mg/m ³
Expanded uncertainty	k = 1.96	1.89	mg/m ³
Uncertainty corrected to std conds. (O ₂)		1.89	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	36.47	% 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.