

Stack Emissions Testing Summary Sheet

CAT-0449: VIP Polymers Ltd, Huntingdon

		Particulate Matter		Total VOCs				Test Dates	Flow Rate (REF)	Reference Conditions
Release Point	Units	Result	Limit	Result	Limit				m ³ /hr	
Stack No_7	mg/m ³	0.21	10	0.23	50			14/09/2010	2562	STP Wet Gas
	g/hr	0.54	-	0.59	-					
Stack No_8	mg/m ³	0.37	10	0.77	50			14/09/2010	6395	STP Wet Gas
	g/hr	2.4	-	4.9	-					
Stack No_8c	mg/m ³	0.88	10	0.56	50			14/09/2010	2031	STP Wet Gas
	g/hr	1.8	-	1.1	-					
Stack No_9	mg/m ³	0.52	10	1.6	50			14/09/2010	6069	STP Wet Gas
	g/hr	3.2	-	9.8	-					
Stack No_15	mg/m ³	0.31	10	3.6	50			14/09/2010	1452	STP Wet Gas
	g/hr	0.45	-	5.2	-					
Stack No_41	mg/m ³	0.73	10	1.3	50			13/09/2010	13393	STP Wet Gas
	g/hr	9.8	-	17.6	-					
Stack No_44	mg/m ³	0.39	10	2.1	50			14/09/2010	10161	STP Wet Gas
	g/hr	3.9	-	21.3	-					
Standard Reference Method		BS EN 13284-1		BS EN 13526						
Accreditation Status of Test		UKAS & MCERTS		UKAS & MCERTS						

Summary Writer	Toby Campbell	MCERTS Accreditation	MCERTS Level 2	MCERTS Number	MM 03 155	Report Date	11th October 2010
Summary Approver	Toby Campbell	MCERTS Accreditation	MCERTS Level 2	MCERTS Number	MM 03 155	Report Version	Version 1



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Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: 11/94

Stack Reference

Stack No. 7

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Dates of the Monitoring Campaign

14th September 2010

Job Reference Number

CAT-0449

Report Written by
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Report Approved by
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Report Date
11th October 2010
Version
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Signature of Report Approver


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Executive Summary

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MONITORING OBJECTIVES

VIP Polymers Ltd, Huntingdon

Stack No. 7

14th September 2010

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions testing on the Stack No. 7 by VIP Polymers Ltd 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.

Executive Summary

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MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 7

14th September 2010

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.21	0.69	10	g/hr	0.54	1.8	-
Total VOCs (as Carbon)	¹ mg/m ³	0.23	0.13	50	g/hr	0.59	0.32	-
Water Vapour	% v/v	1.3	0.08					
Stack Gas Temperature	°C	25.7						
Stack Gas Velocity	m/s	11.3						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	2808						
Volumetric Flow Rate (REF)	¹ m ³ /hr	2562						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

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 No. 7

14th September 2010

Parameter		Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1	mg/m ³	0.21	14/09/2010	10:26 - 10:56	30
Total VOCs (as Carbon)	Run 1	mg/m ³	0.23	14/09/2010	10:26 - 10:56	30
Velocity & Volumetric Flow Rate	Run 1			14/09/2010	09:57 - 09:59	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. 7

14th September 2010

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	200 Seals / 6 Hours
Continuous or Batch Process	Batch
Feedstock (if applicable)	Under cured Parts, Viton Seals
Abatement System	None
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	Not Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon

Stack No. 7

14th September 2010

Parameter	Standard	Monitoring			Analysis				MCERTS Testing	LOD (Average)
		Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.19 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.16 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulates , Total VOCs	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	0.30
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 / BS 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 BS EN 15259, and therefore there are no improvement recommendations.

BS EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EA Technical Guidance Document (Monitoring) M1)

Criteria in M1	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	86.3	> 5 Pa	Yes
Mean Velocity	m/s	11.26	-	-
Lowest Gas Velocity	m/s	10.08	-	-
Highest Gas Velocity	m/s	12.20	-	-
Ratio of Above	: 1	1.21	< 3 : 1	Yes
Maximum Angle of Swirl	°	0	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

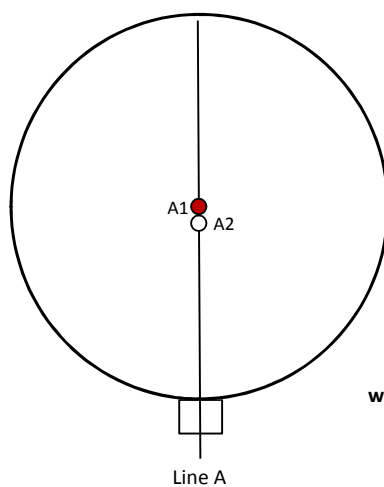
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PLANT PHOTOS



SAMPLE POINTS



where ○ = isokinetic point sampled at
● = isokinetic point not sampled at
● = non-isokinetic / combustion gases sample point

APPENDICES

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APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Brian Jacob
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 06 693
	Technical Endorsements	TE1 TE2 TE3 TE4
Trainee	Name	Robert Sidebotham
	MCERTS Accreditation	MCERTS Trainee
	MCERTS Number	MM 10 1075
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.6	Horiba PG-250	-	Digital Manometer (1)	-
Box Thermocouples	CAT 7.6	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.10	JCT JCC P-1 Cooler	-	Digital Temperature Meter	-
Oven Box	-	5m FT-IR	-	Stopwatch	CAT 14.19
Probe	CAT 5.3	5m FT-IR Sampling System	-	Barometer	CAT 13.9
S-Pitot (1)	CAT 21P.10	Bernath 3006 FID	CAT 8.7	Stack Thermocouple (1)	CAT 140
S-Pitot (2)	-	Heated Head Filter	CAT 12.30	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.3	1m Heated Line (1)	-
500g Check Weight	CAT 17.9	Mass Flow Controller (2)	CAT 6.4	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.9	Easylogger EN-EL-12 Bit	CAT 11.16	1m Heated Line (3)	-
Last Impinger Arm	-			5m Heated Line (1)	-
Callipers	CAT 23.10			15m Heated Line (1)	-
Small DGM	-			15m Heated Line (2)	-
Laboratory Balance	-			20m Heated Line (1)	CAT 20.19
Tape Measure	CAT 16.12				

APPENDIX 2

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	26.6
Average Stack Gas Pressure	mmH ₂ O	11.0
Average Stack Static Pressure, P _{static}	kPa	0.058
Average Barometric Pressure, P _b	kPa	101.1
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	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂	-	20.80	20.54	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	78.14	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	1.26	0.0126	18.02	0.8037	0.0101

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	1.281
Dry Density (Actual), P _{Actual}	kg/m ³	1.171
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.166

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	26.6	0.0
Total Pressure	kPa	101.2	101.3
Moisture	%	1.26	1.26

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	2865
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	2607
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	2575
Gas Volumetric Flowrate REF ¹	m ³ /hr	2607

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	14/09/2010
Time of Survey	-	09:57 - 09:59
Atmospheric Pressure	kPa	101.1
Stack Static Pressure	Pa	58
Type of Pitot Used	-	S-Type Pitot
Are Water Droplets Present?	-	No

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	-	1
Number of Lines Used	-	1

Swirl Point (taken at the sampling points used during testing)																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Angle of Swirl (°)					0															

Sampling Line A					
Traverse Point	Depth m	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	11.4	26.5	1.166	11.47
2	0.05	11.1	26.5	1.166	11.32
3	0.08	10.7	26.6	1.166	11.11
4	0.11	10.4	26.6	1.166	10.96
5	0.14	8.8	26.6	1.166	10.08
6	0.17	10.1	26.5	1.166	10.80
7	0.20	10.6	26.5	1.166	11.06
8	0.23	11.4	26.6	1.166	11.47
9	0.26	12.7	26.6	1.166	12.11
10	0.29	12.9	26.6	1.166	12.20
Mean		11.0	26.6	1.166	11.26

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 7

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.21		0.21
Uncertainty	±mg/m ³	0.69		0.69
Mass Emission	g/hr	0.5		0.5
Uncertainty	±g/hr	1.8		1.8

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	1.26		1.26
Uncertainty	±% v/v	0.08		0.08

Blank Runs

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

General Sampling Information

Parameter	Value	
Standard	BS 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 Quartz 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	A2	

Reference Conditions

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

APPENDIX 2

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	758.3	
Stack static pressure, P_{static}	mmH ₂ O	5.9	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	758.7	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	6.0	
Total mass collected in impingers (silica trap)	g	2.7	
Total mass of liquid collected, V_{lc}	g	8.7	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0108	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.9010	
Gas meter correction factor, Y_d	-	1.0190	
Average dry gas meter temperature, T_m	°C	23.8	
Average pressure drop across orifice, ΔH	mmH ₂ O	89.6	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.8498	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0126	
B_{wo} as a percentage	% v/v	1.26	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	1.26	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.8606	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & 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 (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% 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	28.71	
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	10.53	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	3.25	
Average stack gas temperature, T_s	°C	25.7	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(V_{T_s} + 273)) / (V(M_s)(P_s))$	m/s	11.03	
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	0.07	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	46.8	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	42.7	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	42.2	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	7.78	
Nozzle area, A_n	mm ²	47.55	
Total sampling time, q	min	30	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	99.9	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	10:26 - 10:56	
Sampling Dates	-	14/09/2010	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.8606	
Filter I.D. Number	-	47-3649	
Start Filter Mass	g	0.14922	
End Filter Mass	g	0.14922	
Total Mass on Filter	g	0.00000	
Probe Rinse I.D. Number	-	PR-47-3649	
Start Probe Rinse Mass	g	2.97848	
End Probe Rinse Mass	g	2.97865	
Total Mass in Probe Rinse	g	0.00017	
Total Mass Collected	mg	0.17	
Calculated Concentration	mg/m ³	0.20	
Balance Uncertainty / LOD	mg/m ³	0.19	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	14/09/2010	
Average Volume Sampled (REF)	m ³	0.8606	
Filter I.D. Number	-	47-3541	
Start Filter Mass	g	0.14707	
End Filter Mass	g	0.14709	
Total Mass on Filter	g	0.00002	
Probe Rinse I.D. Number	-	PR-47-3541	
Start Probe Rinse Mass	g	2.89198	
End Probe Rinse Mass	g	2.89214	
Total Mass in Probe Rinse	g	0.00016	
Total Mass Collected	mg	0.18	
Calculated Concentration	mg/m ³	0.21	
Balance Uncertainty / LOD	mg/m ³	0.19	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

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Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	30.60	
Pre-Sampling Leak Rate	l/min	0.26	
Post-Sampling Leak Rate	l/min	0.23	
Allowable Leak Rate	l/min	0.61	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	6.2	
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	%	99.9	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
Balance Uncertainty	± mg/m ³	0.19	
Daily ELV	mg/m ³	10.00	
Allowable Balance Uncertainty	± mg/m ³	0.50	
Balance Uncertainty Acceptable	-	Yes	
Balance Uncertainty Criteria (2)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
20 x Balance Uncertainty	mg	3.20	
Mass Collected	mg	0.17	
Sample Time	mins	30	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	26	
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	25.00	
Pre-Sampling Leak Rate	l/min	0.22	
Post-Sampling Leak Rate	l/min	0.22	
Allowable Leak Rate	l/min	0.50	
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 mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty. This was due to the extremely low level of particulate being emitted from the stack.	x	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	0.9010		uV _m	m ³	0.0180	
Sampled Gas Temperature	T _m	296.8		uT _m	K	2.0	
Sampled Gas Pressure	p _m	101.2		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.75		uL	%	-	
Mass of Particulate	m	0.17		um	mg	0.16	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.18		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.75		≤2%
Mass of Particulate	%	1.97		<5% of ELV
Oxygen Content	%	N/A		≤5%
Uncollected Mass	%	-		-

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	0.8498	0.25	
Leak	L	mg/m ³	0.001	1.00	
Mass of Particulate	L _r	mg	0.170	1.23	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A	N/A	
Uncollected Mass	UCM	mg	0.10	1.23	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.005	
Leak	mg/m ³	0.0009	
Mass of Particulate	mg/m ³	0.1969	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.1279	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.23	
Expanded uncertainty (95% confidence)	mg/m ³	0.46	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.69	
Reported Uncertainty	mg/m ³	0.69	
Expanded uncertainty (95% confidence)	%	220.0	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	330.0	
Reported Uncertainty	%	330.0	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 7

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.23		0.23
Uncertainty	±mg/m ³	0.13		0.13
Mass Emission	g/hr	0.6		0.6
Uncertainty	±g/hr	0.3		0.3

General Sampling Information

Parameter	Value
Standard	BS EN 13526
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 Reference Number	CYL 1.0014
Span Gas Expiry Date	09/03/2012
Span Gas Start Pressure (bar)	120
Gas Cylinder Concentration (ppm)	81.2
Span Gas Uncertainty (%)	2
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A1

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

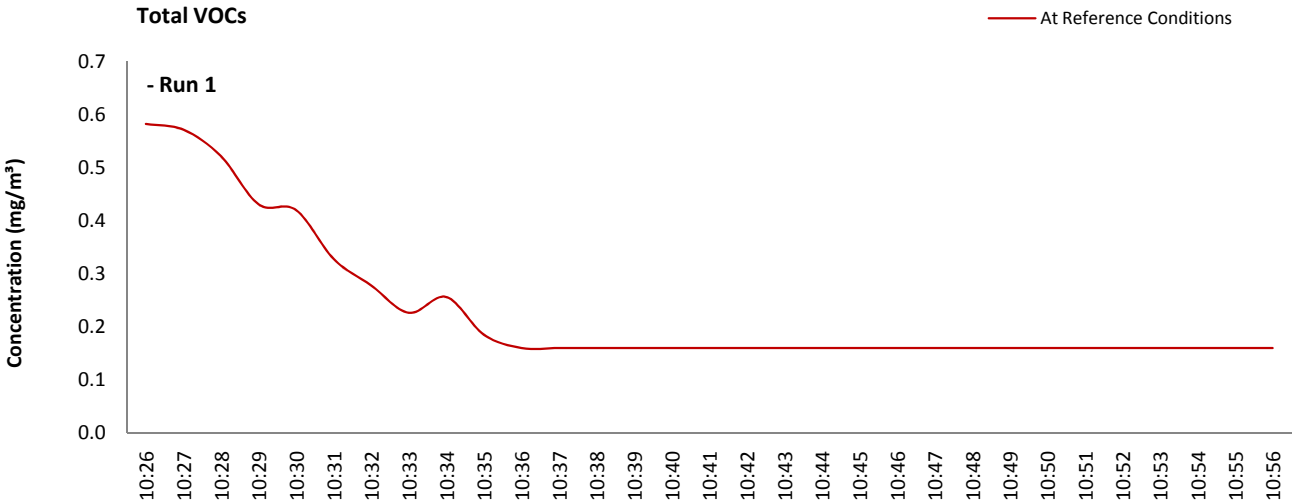
Reference Conditions

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

APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	10:26 - 10:56	
Sampling Dates	-	14/09/2010	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	-0.10	
	Zero Down Sampling Line (Post)	ppm	0.10	
	Zero Drift	ppm	0.20	
CAL 2	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
CAL 3	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	30.60	
	Span Down Sampling Line (Post)	ppm	31.00	
	Span Drift	ppm	0.40	
CAL 2	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
CAL 3	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	15 - 16	

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	100.0		
Measured Reading	ppm	0.1		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.012		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.003		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.00		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.00		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.04		
Expanded uncertainty (95% confidence)	ppm	0.08		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.08		
Reported Uncertainty	ppm	0.08		
Expanded uncertainty (95% confidence)	%	54.5		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	54.5		
Reported Uncertainty	%	54.5		



Air Tech Environmental Consultancy Services

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Your Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: 11/94

Stack Reference

Stack No. 8

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Dates of the Monitoring Campaign

14th September 2010

Job Reference Number

CAT-0449

Report Written by
Robert Haworth Team Leader MCERTS Level 2 MM 07 797 TE1 TE2 & TE4
Report Approved by
Toby Campbell Regional Manager MCERTS Level 2 MM 03 155 TE1 TE2 TE3 TE4
Report Date
11th October 2010
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 No. 8

14th September 2010

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions testing on the Stack No. 8 by VIP Polymers Ltd 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.

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 8

14th September 2010

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.37	1.51	10	g/hr	2.4	9.7	-
Total VOCs (as Carbon)	¹ mg/m ³	0.77	0.13	50	g/hr	4.9	0.8	-
Water Vapour	% v/v	0.34	0.05					
Stack Gas Temperature	°C	26.6						
Stack Gas Velocity	m/s	11.3						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	3515						
Volumetric Flow Rate (REF)	¹ m ³ /hr	6395						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

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 No. 8

14th September 2010

Parameter		Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1	mg/m ³	0.37	14/09/2010	09:39 - 09:55, 09:58 - 10:14	32
Total VOCs (as Carbon)	Run 1	mg/m ³	0.77	14/09/2010	09:39 - 10:14	35
Velocity & Volumetric Flow Rate	Run 1			14/09/2010	08:59 - 09:03	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. 8

14th September 2010

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	200 kg/Hr
Continuous or Batch Process	Batch
Feedstock (if applicable)	Small compression moulding
Abatement System	None
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	Not Visible

Executive Summary

(Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon

Stack No. 8

14th September 2010

Parameter	Standard	Monitoring			Analysis				MCERTS Testing	LOD (Average)
		Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.19 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.16 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	1	Ratio highest to lowest velocities > 5 : 1. The sample points where the angle of swirl was > 15° were omitted from the sampling exercise.

Executive Summary

(Page 6 of 7)

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 / BS 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 does not meet all of the Flow Criteria requirements in the Environment Agency's Technical Guidance Note M1 and BS EN 15259 (see Validation Criteria Table below).

BS EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EA Technical Guidance Document (Monitoring) M1)

Criteria in M1	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	9.8	> 5 Pa	Yes
Mean Velocity	m/s	11.34	-	-
Lowest Gas Velocity	m/s	3.41	-	-
Highest Gas Velocity	m/s	17.34	-	-
Ratio of Above	: 1	5.09	< 3 : 1	No
Maximum Angle of Swirl	°	45	< 15°	No
No Local Negative Flow	-	Yes	-	Yes

Executive Summary

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PLANT PHOTOS

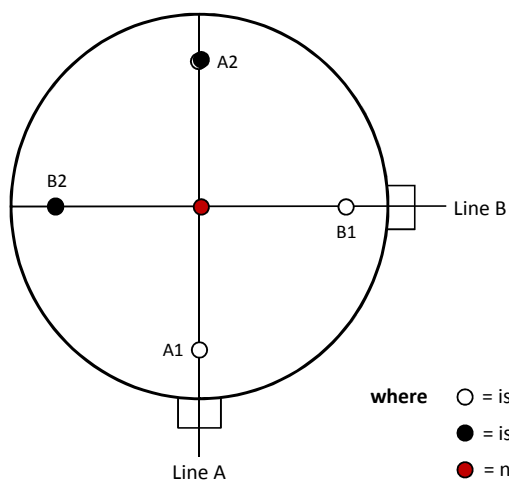
Photo 1



Photo 2



SAMPLE POINTS



where

- = isokinetic point sampled at
- = isokinetic point not sampled at
- = non-isokinetic / combustion gases sample point

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Brian Jacob
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 06 693
	Technical Endorsements	TE1 TE2 TE3 TE4
Trainee	Name	Robert Sidebotham
	MCERTS Accreditation	MCERTS Trainee
	MCERTS Number	MM 10 1075
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.6	Horiba PG-250	-	Digital Manometer (1)	-
Box Thermocouples	CAT 7.6	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.10	JCT JCC P-1 Cooler	-	Digital Temperature Meter	-
Oven Box	-	5m FT-IR	-	Stopwatch	CAT 14.19
Probe	CAT 5.3	5m FT-IR Sampling System	-	Barometer	CAT 13.9
S-Pitot (1)	CAT 21P.10	Bernath 3006 FID	CAT 8.7	Stack Thermocouple (1)	CAT 140
S-Pitot (2)	-	Heated Head Filter	CAT 12.30	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.3	1m Heated Line (1)	-
500g Check Weight	CAT 17.9	Mass Flow Controller (2)	CAT 6.4	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.9	Easylogger EN-EL-12 Bit	CAT 11.16	1m Heated Line (3)	-
Last Impinger Arm	-			5m Heated Line (1)	-
Callipers	CAT 23.10			15m Heated Line (1)	-
Small DGM	-			15m Heated Line (2)	-
Laboratory Balance	-			20m Heated Line (1)	CAT 20.19
Tape Measure	CAT 16.12				

APPENDIX 2

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	29.4
Average Stack Gas Pressure	mmH ₂ O	12.6
Average Stack Static Pressure, P _{static}	kPa	0.064
Average Barometric Pressure, P _b	kPa	101.1
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	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂	-	20.80	20.73	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	78.87	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	0.34	0.0034	18.02	0.8037	0.0028

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	1.160
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.159

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	29.4	0.0
Total Pressure	kPa	101.2	101.3
Moisture	%	0.34	0.34

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	8017
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	7227
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	7202
Gas Volumetric Flowrate REF ¹	m ³ /hr	7227

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	14/09/2010
Time of Survey	-	08:59 - 09:03
Atmospheric Pressure	kPa	101.1
Stack Static Pressure	Pa	64
Type of Pitot Used	-	S-Type Pitot
Are Water Droplets Present?	-	No

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	-	2

Swirl Point (taken at the sampling points used during testing)																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Angle of Swirl (°)	15	40	10	45																

Sampling Line A						Sampling Line B			
Traverse Point	Depth m	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.03	9.9	29.7	1.158	10.73	10.1	29.2	1.160	10.83
2	0.08	6.0	29.5	1.159	8.35	8.8	29.2	1.160	10.10
3	0.13	1.0	29.4	1.159	3.41	8.2	29.3	1.159	9.76
4	0.18	10.6	29.3	1.159	11.09	4.9	29.4	1.159	7.54
5	0.23	18.3	29.9	1.157	14.59	1.5	29.3	1.159	4.17
6	0.28	24.6	29.9	1.157	16.91	3.9	29.4	1.159	6.73
7	0.33	25.9	29.5	1.159	17.34	7.1	29.4	1.159	9.08
8	0.38	23.0	29.3	1.159	16.34	12.5	29.4	1.159	12.05
9	0.43	24.4	29.4	1.159	16.83	18.4	29.3	1.159	14.61
10	0.48	24.2	29.3	1.159	16.76	7.9	29.3	1.159	9.58
Mean		16.8	29.5	1.159	13.24	8.3	29.3	1.159	9.44

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 8

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.37		0.37
Uncertainty	±mg/m ³	1.51		1.51
Mass Emission	g/hr	2.4		2.4
Uncertainty	±g/hr	9.7		9.7

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.34		0.34
Uncertainty	±% v/v	0.05		0.05

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.22		0.22

General Sampling Information

Parameter	Value	
Standard	BS 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 Quartz Fibre	
Number of Sampling Lines Used	2 / 2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	2 / 4	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1 & B1	

Reference Conditions

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

APPENDIX 2

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	758.3	
Stack static pressure, P_{static}	mmH ₂ O	6.5	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	758.7	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-2.3	
Total mass collected in impingers (silica trap)	g	4.6	
Total mass of liquid collected, V_{lc}	g	2.3	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0029	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.8760	
Gas meter correction factor, Y_d	-	1.0190	
Average dry gas meter temperature, T_m	°C	21.6	
Average pressure drop across orifice, ΔH	mmH ₂ O	72.0	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.8310	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0034	
B_{wo} as a percentage	% v/v	0.34	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.34	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.8338	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & 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 (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% 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	28.80	
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	8.56	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	2.93	
Average stack gas temperature, T_s	°C	26.6	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(V_{T_s} + 273)) / (V(M_s)(P_s))$	m/s	9.94	
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	117.2	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	106.6	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	106.2	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	7.78	
Nozzle area, A_n	mm ²	47.55	
Total sampling time, q	min	32	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	101.0	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	09:39 - 09:55, 09:58 - 10:14	
Sampling Dates	-	14/09/2010	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.8338	
Filter I.D. Number	-	47-3626	
Start Filter Mass	g	0.14785	
End Filter Mass	g	0.14798	
Total Mass on Filter	g	0.00013	
Probe Rinse I.D. Number	-	PR-47-3626	
Start Probe Rinse Mass	g	2.85274	
End Probe Rinse Mass	g	2.85292	
Total Mass in Probe Rinse	g	0.00018	
Total Mass Collected	mg	0.31	
Calculated Concentration	mg/m ³	0.37	
Balance Uncertainty / LOD	mg/m ³	0.19	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	13/09/2010	
Average Volume Sampled (REF)	m ³	0.8338	
Filter I.D. Number	-	47-3541	
Start Filter Mass	g	0.14707	
End Filter Mass	g	0.14709	
Total Mass on Filter	g	0.00002	
Probe Rinse I.D. Number	-	PR-47-3541	
Start Probe Rinse Mass	g	2.89198	
End Probe Rinse Mass	g	2.89214	
Total Mass in Probe Rinse	g	0.00016	
Total Mass Collected	mg	0.18	
Calculated Concentration	mg/m ³	0.22	
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	27.90	
Pre-Sampling Leak Rate	l/min	0.20	
Post-Sampling Leak Rate	l/min	0.23	
Allowable Leak Rate	l/min	0.56	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	14.5	
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	%	101.0	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
Balance Uncertainty	± mg/m ³	0.19	
Daily ELV	mg/m ³	10.00	
Allowable Balance Uncertainty	± mg/m ³	0.50	
Balance Uncertainty Acceptable	-	Yes	

Balance Uncertainty Criteria (2)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
20 x Balance Uncertainty	mg	3.20	
Mass Collected	mg	0.31	
Sample Time	mins	32	
Balance Uncertainty Acceptable	-	No	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	27	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	25.00	
Pre-Sampling Leak Rate	l/min	0.22	
Post-Sampling Leak Rate	l/min	0.22	
Allowable Leak Rate	l/min	0.50	
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	
Ratio highest to lowest velocities > 5 : 1.	x	
The sample points where the angle of swirl was > 15° were omitted from the sampling exercise.	x	
The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty. This was due to the extremely low level of particulate being emitted from the stack.	x	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	0.8760		uV _m	m ³	0.0175	
Sampled Gas Temperature	T _m	294.6		uT _m	K	2.0	
Sampled Gas Pressure	p _m	101.2		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.82		uL	%	-	
Mass of Particulate	m	0.31		um	mg	0.16	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.18		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.68		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.82		≤2%
Mass of Particulate	%	1.92		<5% of ELV
Oxygen Content	%	N/A		≤5%
Uncollected Mass	%	-		-

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	0.8310	0.45	
Leak	L	mg/m ³	0.002	1.00	
Mass of Particulate	L _r	mg	0.310	1.20	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A	N/A	
Uncollected Mass	UCM	mg	0.10	1.20	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.009	
Leak	mg/m ³	0.0018	
Mass of Particulate	mg/m ³	0.1919	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.1246	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.23	
Expanded uncertainty (95% confidence)	mg/m ³	0.45	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	1.51	
Reported Uncertainty	mg/m ³	1.51	
Expanded uncertainty (95% confidence)	%	120.7	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	407.5	
Reported Uncertainty	%	407.5	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 8

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.77		0.77
Uncertainty	±mg/m ³	0.13		0.13
Mass Emission	g/hr	4.9		4.9
Uncertainty	±g/hr	0.8		0.8

General Sampling Information

Parameter	Value	
Standard	BS EN 13526	
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 Reference Number	CYL 1.0014	
Span Gas Expiry Date	09/03/2012	
Span Gas Start Pressure (bar)	120	
Gas Cylinder Concentration (ppm)	81.2	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
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	C1	

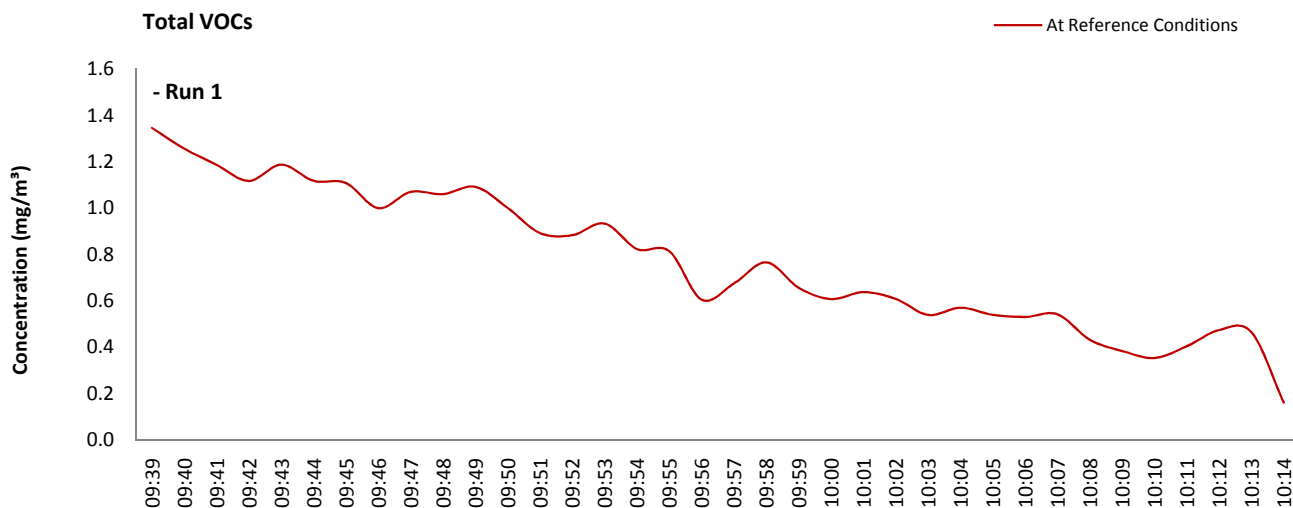
Reference Conditions

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

APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	09:39 - 10:14	
Sampling Dates	-	13/09/2010	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	-0.10	
	Zero Down Sampling Line (Post)	ppm	0.10	
	Zero Drift	ppm	0.20	
CAL 2	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
CAL 3	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	30.60	
	Span Down Sampling Line (Post)	ppm	31.00	
	Span Drift	ppm	0.40	
CAL 2	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
CAL 3	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	15	

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	

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	100.0		
Measured Reading	ppm	0.5		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.012		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.011		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.00		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.00		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.04		
Expanded uncertainty (95% confidence)	ppm	0.08		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.08		
Reported Uncertainty	ppm	0.08		
Expanded uncertainty (95% confidence)	%	17.1		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	17.1		
Reported Uncertainty	%	17.1		



Air Tech Environmental Consultancy Services

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Your Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: 11/94

Stack Reference

Stack No. 8c

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Dates of the Monitoring Campaign

14th September 2010

Job Reference Number

CAT-0449

Report Written by
Robert Haworth Team Leader MCERTS Level 2 MM 07 797 TE1 TE2 & TE4
Report Approved by
Toby Campbell Regional Manager MCERTS Level 2 MM 03 155 TE1 TE2 TE3 TE4
Report Date
11th October 2010
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 No. 8c

14th September 2010

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions testing on the Stack No. 8c by VIP Polymers Ltd 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.

Executive Summary

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MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 8c

14th September 2010

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.88	2.5	10	g/hr	1.8	5.0	-
Total VOCs (as Carbon)	¹ mg/m ³	0.56	0.13	50	g/hr	1.1	0.3	-
Water Vapour	% v/v	0.42	0.09					
Stack Gas Temperature	°C	21.4						
Stack Gas Velocity	m/s	7.1						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	2195						
Volumetric Flow Rate (REF)	¹ m ³ /hr	2031						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

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 No. 8c

14th September 2010

Parameter		Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1	mg/m ³	0.88	14/09/2010	11:12 - 11:42	30
Total VOCs (as Carbon)	Run 1	mg/m ³	0.56	14/09/2010	11:44 - 12:14	30
Velocity & Volumetric Flow Rate	Run 1			14/09/2010	10:32 - 10:34	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. 8c

14th September 2010

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	1 - 200 Kg/Hr
Continuous or Batch Process	Batch
Feedstock (if applicable)	Small Compressions Mouldings
Abatement System	None
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	Not Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon

Stack No. 8c

14th September 2010

Parameter	Standard	Monitoring			Analysis				MCERTS Testing	LOD (Average)
		Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.24 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.16 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	1	Ratio highest to lowest velocities > 5 : 1. The sample points where the angle of swirl was > 15° were omitted from the sampling exercise. Only one sampling line was installed on the stack, however the number of sample points used on the available line were increased to meet the requirements of the Standard.

Executive Summary

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SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.39
Width	m	-
Area	m ²	0.12
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 / BS 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 does not meet all of the Flow Criteria requirements in the Environment Agency's Technical Guidance Note M1 and BS EN 15259 (see Validation Criteria Table below).

BS EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EA Technical Guidance Document (Monitoring) M1)

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	5.9		> 5 Pa	Yes
Mean Velocity	m/s	7.12		-	-
Lowest Gas Velocity	m/s	2.63		-	-
Highest Gas Velocity	m/s	11.71		-	-
Ratio of Above	: 1	4.45		< 3 : 1	No
Maximum Angle of Swirl	°	30		< 15°	No
No Local Negative Flow	-	Yes		-	Yes

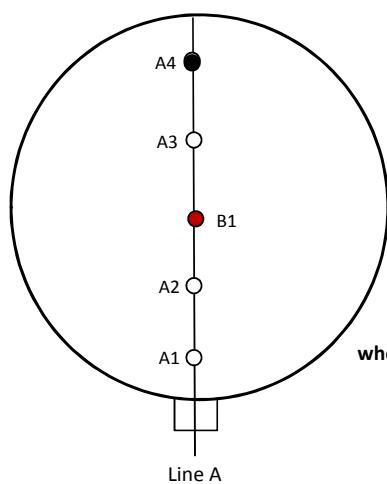
Executive Summary

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PLANT PHOTOS



SAMPLE POINTS



where ○ = isokinetic point sampled at
● = isokinetic point not sampled at
● = non-isokinetic / combustion gases sample point

APPENDICES

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APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Brian Jacob
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 06 693
	Technical Endorsements	TE1 TE2 TE3 TE4
Trainee	Name	Robert Sidebotham
	MCERTS Accreditation	MCERTS Trainee
	MCERTS Number	MM 10 1075
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.6	Horiba PG-250	-	Digital Manometer (1)	-
Box Thermocouples	CAT 7.6	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.10	JCT JCC P-1 Cooler	-	Digital Temperature Meter	-
Oven Box	-	5m FT-IR	-	Stopwatch	CAT 14.19
Probe	CAT 5.3	5m FT-IR Sampling System	-	Barometer	CAT 13.9
S-Pitot (1)	CAT 21P.10	Bernath 3006 FID	CAT 8.7	Stack Thermocouple (1)	CAT 140
S-Pitot (2)	-	Heated Head Filter	CAT 12.30	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.3	1m Heated Line (1)	-
500g Check Weight	CAT 17.9	Mass Flow Controller (2)	CAT 6.4	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.9	Easylogger EN-EL-12 Bit	CAT 11.16	1m Heated Line (3)	-
Last Impinger Arm	-			5m Heated Line (1)	-
Callipers	CAT 23.10			15m Heated Line (1)	-
Small DGM	-			15m Heated Line (2)	-
Laboratory Balance	-			20m Heated Line (1)	CAT 20.19
Tape Measure	CAT 16.12				

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.39
Stack Width, W	m	-
Stack Area, A	m ²	0.12
Average Stack Gas Temperature, T _a	°C	26.7
Average Stack Gas Pressure	mmH ₂ O	5.3
Average Stack Static Pressure, P _{static}	kPa	0.016
Average Barometric Pressure, P _b	kPa	101.1
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	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂	-	20.80	20.71	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	78.80	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	0.42	0.0042	18.02	0.8037	0.0034

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	1.285
Dry Density (Actual), P _{Actual}	kg/m ³	1.171
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.169

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	26.7	0.0
Total Pressure	kPa	101.1	101.3
Moisture	%	0.42	0.42

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	3063
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	2785
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	2773
Gas Volumetric Flowrate REF ¹	m ³ /hr	2785

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	14/09/2010
Time of Survey	-	10:32 - 10:34
Atmospheric Pressure	kPa	101.1
Stack Static Pressure	Pa	16
Type of Pitot Used	-	S-Type Pitot
Are Water Droplets Present?	-	No

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	-	1
Number of Lines Used	-	1

Swirl Point (taken at the sampling points used during testing)																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Angle of Swirl (°)	10	12	15	30																

Sampling Line A					
Traverse Point	Depth m	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	3.8	26.7	1.169	6.62
2	0.06	3.3	26.7	1.169	6.16
3	0.10	1.3	26.6	1.169	3.87
4	0.14	0.6	26.6	1.169	2.63
5	0.18	1.1	26.7	1.169	3.56
6	0.21	3.0	26.7	1.169	5.88
7	0.25	7.4	26.7	1.169	9.23
8	0.29	9.3	26.7	1.169	10.35
9	0.33	10.9	26.7	1.169	11.20
10	0.37	11.9	26.7	1.169	11.71
Mean		5.3	26.7	1.169	7.12

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 8c

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.88		0.88
Uncertainty	±mg/m ³	2.47		2.47
Mass Emission	g/hr	1.8		1.8
Uncertainty	±g/hr	5.0		5.0

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	1.27		1.27
Uncertainty	±% v/v	0.09		0.09

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.49		0.49

General Sampling Information

Parameter	Value	
Standard	BS 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 Quartz Fibre	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	3 / 4	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1, A2, A3	

Reference Conditions

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

APPENDIX 2

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	758.3	
Stack static pressure, P_{static}	mmH ₂ O	1.6	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	758.4	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	2.7	
Total mass collected in impingers (silica trap)	g	4.0	
Total mass of liquid collected, V_{lc}	g	6.7	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0083	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.6910	
Gas meter correction factor, Y_d	-	1.0190	
Average dry gas meter temperature, T_m	°C	24.4	
Average pressure drop across orifice, ΔH	mmH ₂ O	52.6	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.6482	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0127	
B_{wo} as a percentage	% v/v	1.27	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	1.27	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.6566	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & 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 (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% 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	28.70	
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	2.29	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	1.51	
Average stack gas temperature, T_s	°C	21.4	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(V_{T_s} + 273)) / (V(M_s)(P_s))$	m/s	5.10	
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	0.12	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	36.6	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	33.8	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	33.4	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	9.94	
Nozzle area, A_n	mm ²	77.61	
Total sampling time, q	min	30	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	99.5	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	11:12 - 11:42	
Sampling Dates	-	14/09/2010	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.6568	
Filter I.D. Number	-	47-3643	
Start Filter Mass	g	0.14951	
End Filter Mass	g	0.14967	
Total Mass on Filter	g	0.00016	
Probe Rinse I.D. Number	-	PR-47-3643	
Start Probe Rinse Mass	g	3.06380	
End Probe Rinse Mass	g	3.06422	
Total Mass in Probe Rinse	g	0.00042	
Total Mass Collected	mg	0.58	
Calculated Concentration	mg/m ³	0.88	
Balance Uncertainty / LOD	mg/m ³	0.24	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	14/09/2010	
Average Volume Sampled (REF)	m ³	0.6568	
Filter I.D. Number	-	47-3541	
Start Filter Mass	g	0.14951	
End Filter Mass	g	0.14967	
Total Mass on Filter	g	0.00016	
Probe Rinse I.D. Number	-	PR-47-3541	
Start Probe Rinse Mass	g	2.89198	
End Probe Rinse Mass	g	2.89214	
Total Mass in Probe Rinse	g	0.00016	
Total Mass Collected	mg	0.32	
Calculated Concentration	mg/m ³	0.49	
Balance Uncertainty / LOD	mg/m ³	0.24	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	23.47	
Pre-Sampling Leak Rate	l/min	0.26	
Post-Sampling Leak Rate	l/min	0.25	
Allowable Leak Rate	l/min	0.47	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	6.9	
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	%	99.5	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
Balance Uncertainty	± mg/m ³	0.24	
Daily ELV	mg/m ³	10.00	
Allowable Balance Uncertainty	± mg/m ³	0.50	
Balance Uncertainty Acceptable	-	Yes	

Balance Uncertainty Criteria (2)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
20 x Balance Uncertainty	mg	3.20	
Mass Collected	mg	0.58	
Sample Time	mins	30	
Balance Uncertainty Acceptable	-	No	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	21	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	25.00	
Pre-Sampling Leak Rate	l/min	0.22	
Post-Sampling Leak Rate	l/min	0.22	
Allowable Leak Rate	l/min	0.50	
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	
Ratio highest to lowest velocities > 5 : 1.	x	
The sample points where the angle of swirl was > 15° were omitted from the sampling exercise.	x	
Only one sampling line was installed on the stack, however the number of sample points used on the available line were increased to meet the requirements of the Standard.	x	
The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty. This was due to the extremely low level of particulate being emitted from the stack.	x	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	0.6910		uV _m	m ³	0.0138	
Sampled Gas Temperature	T _m	297.4		uT _m	K	2.0	
Sampled Gas Pressure	p _m	101.1		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	1.07		uL	%	-	
Mass of Particulate	m	0.58		um	mg	0.16	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.32		uUCM	mg	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	1.07		≤2%
Mass of Particulate	%	2.44		<5% of ELV
Oxygen Content	%	N/A		≤5%
Uncollected Mass	%	-		-

Measured Quantities	Uncertainty in Measurement Units				Sensitivity Coefficient	
	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V _m	m ³	0.6484		1.36	
Leak	L	mg/m ³	0.005		1.00	
Mass of Particulate	L _r	mg	0.580		1.52	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.18		1.52	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.022	
Leak	mg/m ³	0.0054	
Mass of Particulate	mg/m ³	0.2436	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.2813	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.37	
Expanded uncertainty (95% confidence)	mg/m ³	0.73	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	2.47	
Reported Uncertainty	mg/m ³	2.47	
Expanded uncertainty (95% confidence)	%	82.7	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	279.3	
Reported Uncertainty	%	279.3	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 8c

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.56		0.56
Uncertainty	±mg/m ³	0.13		0.13
Mass Emission	g/hr	1.1		1.1
Uncertainty	±g/hr	0.3		0.3

General Sampling Information

Parameter	Value	
Standard	BS EN 13526	
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 Reference Number	CYL 1.0014	
Span Gas Expiry Date	09/03/2012	
Span Gas Start Pressure (bar)	120	
Gas Cylinder Concentration (ppm)	81.2	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
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	

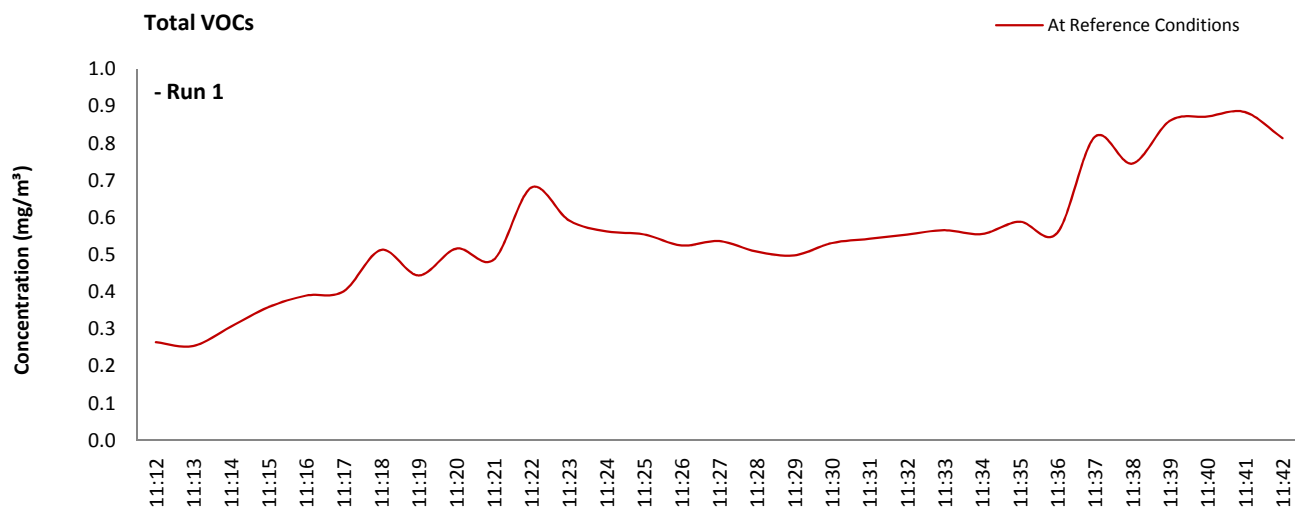
Reference Conditions

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

APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	11:44 - 12:14	
Sampling Dates	-	14/09/2010	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	-0.10	
	Zero Down Sampling Line (Post)	ppm	-0.30	
	Zero Drift	ppm	-0.20	
CAL 2	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
CAL 3	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	30.60	
	Span Down Sampling Line (Post)	ppm	29.50	
	Span Drift	ppm	-1.10	
CAL 2	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
CAL 3	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	15 - 16	

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	100.0		
Measured Reading	ppm	0.3		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.012		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.008		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.00		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.00		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.04		
Expanded uncertainty (95% confidence)	ppm	0.08		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.08		
Reported Uncertainty	ppm	0.08		
Expanded uncertainty (95% confidence)	%	23.2		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	23.2		
Reported Uncertainty	%	23.2		



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Stack Emissions Testing Report Commissioned by
Air Tech Environmental Consultancy Services

Installation Name & Address

VIP Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: 11/94

Stack Reference

Stack No. 9

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Dates of the Monitoring Campaign

14th September 2010

Job Reference Number

CAT-0449

Report Written by
Robert Haworth Team Leader MCERTS Level 2 MM 07 797 TE1 TE2 & TE4
Report Approved by
Toby Campbell Regional Manager MCERTS Level 2 MM 03 155 TE1 TE2 TE3 TE4
Report Date
11th October 2010
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 No. 9

14th September 2010

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions testing on the Stack No. 9 by VIP Polymers Ltd 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.

Executive Summary

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MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 9

14th September 2010

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.52	2.4	10	g/hr	3.2	14.7	-
Total VOCs (as Carbon)	¹ mg/m ³	1.6	0.15	50	g/hr	9.8	0.9	-
Water Vapour	% v/v	1.5	0.09					
Stack Gas Temperature	°C	28.9						
Stack Gas Velocity	m/s	12.2						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	6723						
Volumetric Flow Rate (REF)	¹ m ³ /hr	6069						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

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 No. 9

14th September 2010

Parameter		Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1	mg/m ³	0.52	14/09/2010	08:44 - 09:00, 09:03 - 09:19	32
Total VOCs (as Carbon)	Run 1	mg/m ³	1.6	14/09/2010	08:44 - 09:19	35
Velocity & Volumetric Flow Rate	Run 1			14/09/2010	07:56 - 07:59	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. 9

14th September 2010

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	150 - 250 Kg/hr
Continuous or Batch Process	Batch
Feedstock (if applicable)	Medium Compression Moulding
Abatement System	None
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	Not Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon

Stack No. 9

14th September 2010

Parameter	Standard	Monitoring			Analysis				MCERTS Testing	LOD (Average)
		Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.2 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.16 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	1	Ratio highest to lowest velocities > 5 : 1. The sample points where the angle of swirl was > 15° were omitted from the sampling exercise.

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 / BS 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 does not meet all of the Flow Criteria requirements in the Environment Agency's Technical Guidance Note M1 and BS EN 15259 (see Validation Criteria Table below).

BS EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EA Technical Guidance Document (Monitoring) M1)

Criteria in M1	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	-3.9	> 5 Pa	No
Mean Velocity	m/s	12.15	-	-
Lowest Gas Velocity	m/s	3.58	-	-
Highest Gas Velocity	m/s	16.71	-	-
Ratio of Above	: 1	4.67	< 3 : 1	No
Maximum Angle of Swirl	°	50	< 15°	No
No Local Negative Flow	-	No	-	No

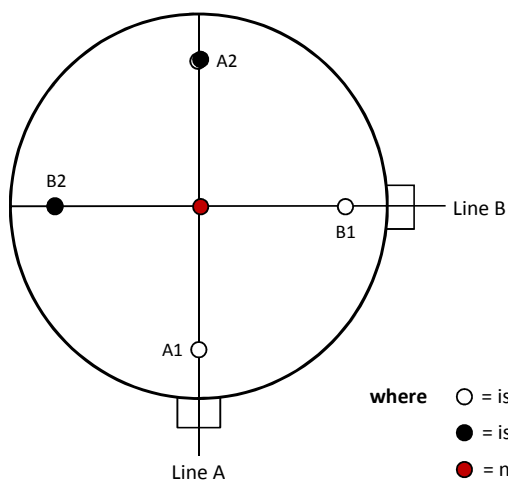
Executive Summary

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PLANT PHOTOS



SAMPLE POINTS



where ○ = isokinetic point sampled at
● = isokinetic point not sampled at
● = non-isokinetic / combustion gases sample point

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Brian Jacob
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 06 693
	Technical Endorsements	TE1 TE2 TE3 TE4
Trainee	Name	Robert Sidebotham
	MCERTS Accreditation	MCERTS Trainee
	MCERTS Number	MM 10 1075
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.6	Horiba PG-250	-	Digital Manometer (1)	-
Box Thermocouples	CAT 7.6	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.10	JCT JCC P-1 Cooler	-	Digital Temperature Meter	-
Oven Box	-	5m FT-IR	-	Stopwatch	CAT 14.19
Probe	CAT 5.3	5m FT-IR Sampling System	-	Barometer	CAT 13.9
S-Pitot (1)	CAT 21P.10	Bernath 3006 FID	CAT 8.7	Stack Thermocouple (1)	CAT 140
S-Pitot (2)	-	Heated Head Filter	CAT 12.30	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.3	1m Heated Line (1)	-
500g Check Weight	CAT 17.9	Mass Flow Controller (2)	CAT 6.4	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.9	Easylogger EN-EL-12 Bit	CAT 11.16	1m Heated Line (3)	-
Last Impinger Arm	-			5m Heated Line (1)	-
Callipers	CAT 23.10			15m Heated Line (1)	-
Small DGM	-			15m Heated Line (2)	-
Laboratory Balance	-			20m Heated Line (1)	CAT 20.19
Tape Measure	CAT 16.12				

APPENDIX 2

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	28.4
Average Stack Gas Pressure	mmH ₂ O	12.8
Average Stack Static Pressure, P _{static}	kPa	0.045
Average Barometric Pressure, P _b	kPa	101.1
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	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂	-	20.80	20.49	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	77.97	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	1.48	0.0148	18.02	0.8037	0.0119

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	1.280
Dry Density (Actual), P _{Actual}	kg/m ³	1.164
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.158

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) = $P_{STW} \times (T_s / P_s) \times (P_a / T_a)$

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	28.4	0.0
Total Pressure	kPa	101.1	101.3
Moisture	%	1.48	1.48

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	8592
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	7770
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	7655
Gas Volumetric Flowrate REF ¹	m ³ /hr	7770

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	14/09/2010
Time of Survey	-	07:56 - 07:59
Atmospheric Pressure	kPa	101.1
Stack Static Pressure	Pa	45
Type of Pitot Used	-	S-Type Pitot
Are Water Droplets Present?	-	No

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	-	2

Swirl Point (taken at the sampling points used during testing)																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Angle of Swirl (°)	15	50	15	45																

Sampling Line A						Sampling Line B			
Traverse Point	Depth m	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.03	10.6	28.2	1.158	11.10	11.0	28.5	1.157	11.31
2	0.08	-0.4	28.3	1.158	-IVE	4.7	28.4	1.158	7.39
3	0.13	1.1	28.3	1.158	3.58	1.7	28.3	1.158	4.44
4	0.18	15.9	28.3	1.158	13.59	-0.4	29.0	1.155	-IVE
5	0.23	19.7	28.3	1.158	15.13	2.1	28.4	1.158	4.94
6	0.28	24.0	28.5	1.157	16.71	15.7	28.4	1.158	13.51
7	0.33	23.0	28.4	1.158	16.35	19.2	28.3	1.158	14.94
8	0.38	22.0	28.5	1.157	15.99	19.5	28.3	1.158	15.05
9	0.43	18.6	28.4	1.158	14.70	18.8	28.4	1.158	14.78
10	0.48	21.1	28.5	1.157	15.66	7.9	28.3	1.158	9.58
Mean		15.6	28.4	1.158	13.65	10.0	28.4	1.158	10.66

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 9

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.52		0.52
Uncertainty	±mg/m ³	2.42		2.42
Mass Emission	g/hr	3.2		3.2
Uncertainty	±g/hr	14.7		14.7

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	1.48		1.48
Uncertainty	±% v/v	0.09		0.09

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.23		0.23

General Sampling Information

Parameter	Value	
Standard	BS 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 Quartz 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, B1	

Reference Conditions

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

APPENDIX 2

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	758.3	
Stack static pressure, P_{static}	mmH ₂ O	4.6	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	758.6	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	3.1	
Total mass collected in impingers (silica trap)	g	6.2	
Total mass of liquid collected, V_{lc}	g	9.3	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0116	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.8070	
Gas meter correction factor, Y_d	-	1.0190	
Average dry gas meter temperature, T_m	°C	19.3	
Average pressure drop across orifice, ΔH	mmH ₂ O	64.1	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.7710	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0148	
B_{wo} as a percentage	% v/v	1.48	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	1.48	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.7826	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & 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 (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% 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	28.68	
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	7.74	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	2.78	
Average stack gas temperature, T_s	°C	28.9	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(V_{T_s} + 273)) / (V(M_s)(P_s))$	m/s	9.51	
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	112.1	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	101.1	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	99.6	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	7.78	
Nozzle area, A_n	mm ²	47.55	
Total sampling time, q	min	32	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	99.9	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	08:44 - 09:00, 09:03 - 09:19	
Sampling Dates	-	14/09/2010	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.7826	
Filter I.D. Number	-	47-3590	
Start Filter Mass	g	0.14869	
End Filter Mass	g	0.14886	
Total Mass on Filter	g	0.00017	
Probe Rinse I.D. Number	-	PR-47-3590	
Start Probe Rinse Mass	g	3.01455	
End Probe Rinse Mass	g	3.01479	
Total Mass in Probe Rinse	g	0.00024	
Total Mass Collected	mg	0.41	
Calculated Concentration	mg/m ³	0.52	
Balance Uncertainty / LOD	mg/m ³	0.20	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	13/09/2010	
Average Volume Sampled (REF)	m ³	0.7826	
Filter I.D. Number	-	47-3541	
Start Filter Mass	g	0.14707	
End Filter Mass	g	0.14709	
Total Mass on Filter	g	0.00002	
Probe Rinse I.D. Number	-	PR-47-3541	
Start Probe Rinse Mass	g	2.89198	
End Probe Rinse Mass	g	2.89214	
Total Mass in Probe Rinse	g	0.00016	
Total Mass Collected	mg	0.18	
Calculated Concentration	mg/m ³	0.23	
Balance Uncertainty / LOD	mg/m ³	0.20	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	25.70	
Pre-Sampling Leak Rate	l/min	0.21	
Post-Sampling Leak Rate	l/min	0.20	
Allowable Leak Rate	l/min	0.51	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	6.0	
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	%	99.9	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
Balance Uncertainty	± mg/m ³	0.20	
Daily ELV	mg/m ³	10.00	
Allowable Balance Uncertainty	± mg/m ³	0.50	
Balance Uncertainty Acceptable	-	Yes	
Balance Uncertainty Criteria (2)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
20 x Balance Uncertainty	mg	3.20	
Mass Collected	mg	0.41	
Sample Time	mins	32	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	29	
Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	25.00	
Pre-Sampling Leak Rate	l/min	0.22	
Post-Sampling Leak Rate	l/min	0.22	
Allowable Leak Rate	l/min	0.50	
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	
Ratio highest to lowest velocities > 5 : 1.	x	
The sample points where the angle of swirl was > 15° were omitted from the sampling exercise.	x	
Non homogenous flow stream.	x	
The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty. This was due to the extremely low level of particulate being emitted from the stack.	x	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	0.8070		uV _m	m ³	0.0161	
Sampled Gas Temperature	T _m	292.3		uT _m	K	2.0	
Sampled Gas Pressure	p _m	101.2		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.78		uL	%	-	
Mass of Particulate	m	0.41		um	mg	0.16	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.18		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.68		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.78		≤2%
Mass of Particulate	%	2.04		<5% of ELV
Oxygen Content	%	N/A		≤5%
Uncollected Mass	%	-		-

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	0.7710	0.68	
Leak	L	mg/m ³	0.002	1.00	
Mass of Particulate	L _r	mg	0.410	1.28	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A	N/A	
Uncollected Mass	UCM	mg	0.10	1.28	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.013	
Leak	mg/m ³	0.0024	
Mass of Particulate	mg/m ³	0.2045	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.1328	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.24	
Expanded uncertainty (95% confidence)	mg/m ³	0.48	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	2.42	
Reported Uncertainty	mg/m ³	2.42	
Expanded uncertainty (95% confidence)	%	91.3	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	462.4	
Reported Uncertainty	%	462.4	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 9

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.61		1.61
Uncertainty	±mg/m ³	0.15		0.15
Mass Emission	g/hr	9.8		9.8
Uncertainty	±g/hr	0.9		0.9

General Sampling Information

Parameter	Value	
Standard	BS EN 13526	
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 Reference Number	CYL 1.0014	
Span Gas Expiry Date	09/03/2012	
Span Gas Start Pressure (bar)	120	
Gas Cylinder Concentration (ppm)	81.2	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
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	

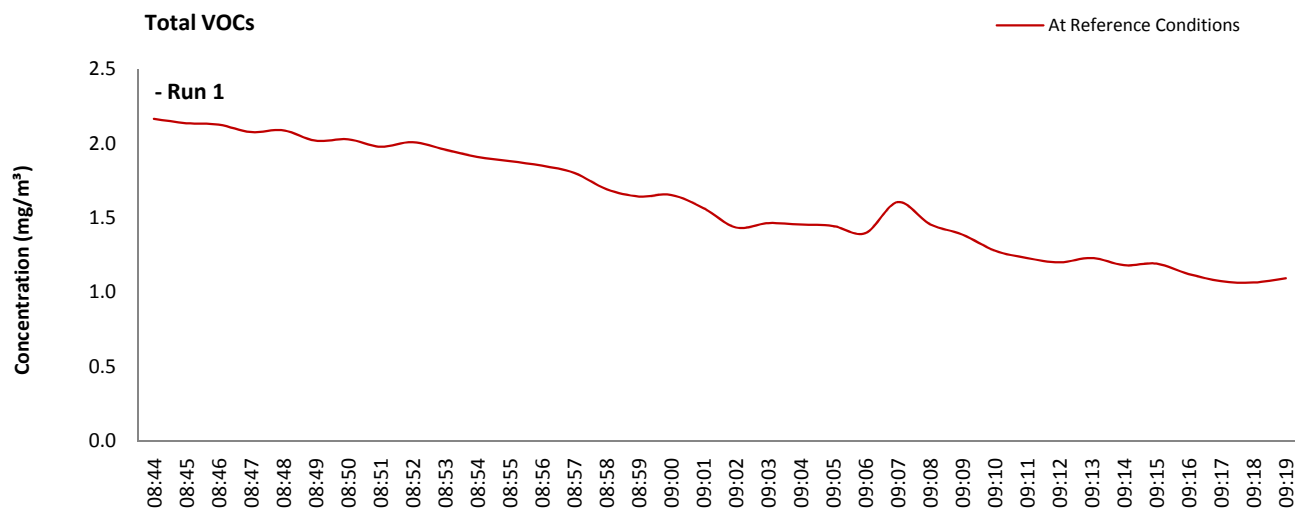
Reference Conditions

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

APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	08:44 - 09:19	
Sampling Dates	-	13/09/2010	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	-0.10	
	Zero Down Sampling Line (Post)	ppm	0.10	
	Zero Drift	ppm	0.20	
CAL 2	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
CAL 3	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	30.60	
	Span Down Sampling Line (Post)	ppm	31.00	
	Span Drift	ppm	0.40	
CAL 2	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
CAL 3	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	15	

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	

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	100.0		
Measured Reading	ppm	1.0		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.012		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.023		
Leak	ppm	0.01		
Calibration Gas Uncertainty	ppm	0.01		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.05		
Expanded uncertainty (95% confidence)	ppm	0.09		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.09		
Reported Uncertainty	ppm	0.09		
Expanded uncertainty (95% confidence)	%	9.4		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	9.4		
Reported Uncertainty	%	9.4		



Air Tech Environmental Consultancy Services

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

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Your Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: 11/94

Stack Reference

Stack No. 15 - Moranes

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Dates of the Monitoring Campaign

14th September 2010

Job Reference Number

CAT-0449

Report Written by
Robert Haworth Team Leader MCERTS Level 2 MM 07 797 TE1 TE2 & TE4
Report Approved by
Toby Campbell Regional Manager MCERTS Level 2 MM 03 155 TE1 TE2 TE3 TE4
Report Date
8th October 2010
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 Catalyst Environmental Ltd's UKAS accreditation.

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Executive Summary

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MONITORING OBJECTIVES

VIP Polymers Ltd, Huntingdon

Stack No. 15 - Moranes

14th September 2010

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions testing on the Stack No. 15 - Moranes by VIP Polymers Ltd 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.

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 15 - Moranes

14th September 2010

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.31	1.10	10	g/hr	0.45	1.6	-
Total VOCs (as Carbon)	¹ mg/m ³	3.6	0.23	50	g/hr	5.2	0.33	-
Water Vapour	% v/v	1.4	0.10					
Stack Gas Temperature	°C	26.8						
Stack Gas Velocity	m/s	4.9						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	1598						
Volumetric Flow Rate (REF)	¹ m ³ /hr	1452						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

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 No. 15 - Moranes

14th September 2010

Parameter		Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1	mg/m ³	0.31	14/09/2010	11:59 - 12:29	30
Total VOCs (as Carbon)	Run 1	mg/m ³	3.6	14/09/2010	11:12 - 11:42	30
Velocity & Volumetric Flow Rate	Run 1			14/09/2010	11:37 - 11:39	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. 15 - Moranes

14th September 2010

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	100 - 180 Kg/hr
Continuous or Batch Process	Batch
Feedstock (if applicable)	Compression Moulding
Abatement System	None
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	Not Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon

Stack No. 15 - Moranes

14th September 2010

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.28 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.16 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	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	0.35
Width	m	-
Area	m ²	0.10
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 / BS 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 BS EN 15259, and therefore there are no improvement recommendations.

BS EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EA Technical Guidance Document (Monitoring) M1)

Criteria in M1	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	15.7	> 5 Pa	Yes
Mean Velocity	m/s	4.94	-	-
Lowest Gas Velocity	m/s	4.30	-	-
Highest Gas Velocity	m/s	6.80	-	-
Ratio of Above	: 1	1.58	< 3 : 1	Yes
Maximum Angle of Swirl	°	5	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

Executive Summary

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PLANT PHOTOS

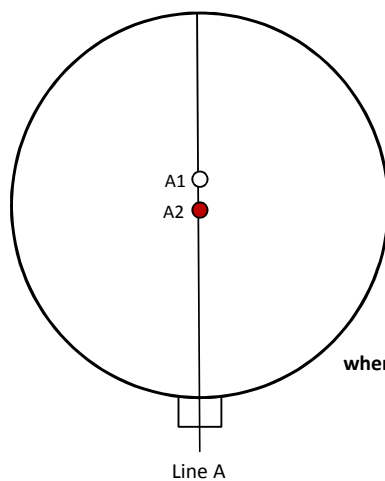
Photo 1



Photo 2



SAMPLE POINTS



where

- = isokinetic point sampled at
- = isokinetic point not sampled at
- = non-isokinetic / combustion gases sample point

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Brian Jacob
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 06 693
	Technical Endorsements	TE1 TE2 TE3 TE4
Trainee	Name	Robert Sidebotham
	MCERTS Accreditation	MCERTS Trainee
	MCERTS Number	MM 10 1075
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.6	Horiba PG-250	-	Digital Manometer (1)	-
Box Thermocouples	CAT 7.6	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.10	JCT JCC P-1 Cooler	-	Digital Temperature Meter	-
Oven Box	-	5m FT-IR	-	Stopwatch	CAT 14.19
Probe	CAT 5.3	5m FT-IR Sampling System	-	Barometer	CAT 13.9
S-Pitot (1)	CAT 21P.10	Bernath 3006 FID	CAT 8.7	Stack Thermocouple (1)	CAT 140
S-Pitot (2)	-	Heated Head Filter	CAT 12.30	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.3	1m Heated Line (1)	-
500g Check Weight	CAT 17.9	Mass Flow Controller (2)	CAT 6.4	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.9	Easylogger EN-EL-12 Bit	CAT 11.16	1m Heated Line (3)	-
Last Impinger Arm	-			5m Heated Line (1)	-
Callipers	CAT 23.10			15m Heated Line (1)	-
Small DGM	-			15m Heated Line (2)	-
Laboratory Balance	-			20m Heated Line (1)	CAT 20.19
Tape Measure	CAT 16.12				

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.35
Stack Width, W	m	-
Stack Area, A	m ²	0.10
Average Stack Gas Temperature, T _a	°C	26.8
Average Stack Gas Pressure	mmH ₂ O	2.2
Average Stack Static Pressure, P _{static}	kPa	0.008
Average Barometric Pressure, P _b	kPa	101.1
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	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂	-	20.80	20.52	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	78.06	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	1.37	0.0137	18.02	0.8037	0.0110

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	1.281
Dry Density (Actual), P _{Actual}	kg/m ³	1.170
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.164

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	26.8	0.0
Total Pressure	kPa	101.1	101.3
Moisture	%	1.37	1.37

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	1711
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	1555
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	1534
Gas Volumetric Flowrate REF ¹	m ³ /hr	1555

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	14/09/2010
Time of Survey	-	11:37 - 11:39
Atmospheric Pressure	kPa	101.1
Stack Static Pressure	Pa	8
Type of Pitot Used	-	S-Type Pitot
Are Water Droplets Present?	-	No

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	-	1
Number of Lines Used	-	1

Swirl Point (taken at the sampling points used during testing)																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Angle of Swirl (°)					5															

Sampling Line A					
Traverse Point	Depth m	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	4.0	26.8	1.164	6.80
2	0.05	2.3	26.8	1.164	5.16
3	0.09	2.3	26.8	1.164	5.16
4	0.12	2.0	26.8	1.164	4.81
5	0.16	1.8	26.8	1.164	4.56
6	0.19	1.6	26.8	1.164	4.30
7	0.23	1.6	26.8	1.164	4.30
8	0.26	1.8	26.8	1.164	4.56
9	0.30	2.0	26.8	1.164	4.81
10	0.33	2.1	26.8	1.164	4.93
Mean		2.2	26.8	1.164	4.94

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 15 - Moranes

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.31		0.31
Uncertainty	±mg/m ³	1.10		1.10
Mass Emission	g/hr	0.5		0.5
Uncertainty	±g/hr	1.6		1.6

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	1.37		1.37
Uncertainty	±% v/v	0.10		0.10

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.31		0.31

General Sampling Information

Parameter	Value	
Standard	BS 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 Quartz 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.

APPENDIX 2

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	758.3	
Stack static pressure, P_{static}	mmH ₂ O	0.8	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	758.3	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	3.4	
Total mass collected in impingers (silica trap)	g	2.9	
Total mass of liquid collected, V_{lc}	g	6.3	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0078	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.6080	
Gas meter correction factor, Y_d	-	1.0190	
Average dry gas meter temperature, T_m	°C	25.8	
Average pressure drop across orifice, ΔH	mmH ₂ O	41.6	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.5671	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0137	
B_{wo} as a percentage	% v/v	1.37	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	1.37	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.5750	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & 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 (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% 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	28.69	
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	1.83	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	1.35	
Average stack gas temperature, T_s	°C	26.8	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(V_{T_s} + 273)) / (V(M_s)(P_s))$	m/s	4.61	
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	0.10	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	26.6	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	24.2	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	23.9	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	9.94	
Nozzle area, A_n	mm ²	77.61	
Total sampling time, q	min	30	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	98.2	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	11:59 - 12:29	
Sampling Dates	-	14/09/2010	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.5750	
Filter I.D. Number	-	47-3642	
Start Filter Mass	g	0.14656	
End Filter Mass	g	0.14640	
Total Mass on Filter	g	-0.00016	
Probe Rinse I.D. Number	-	PR-47-3642	
Start Probe Rinse Mass	g	2.86089	
End Probe Rinse Mass	g	2.86118	
Total Mass in Probe Rinse	g	0.00029	
Total Mass Collected	mg	0.13	
Calculated Concentration	mg/m ³	0.23	
Balance Uncertainty / LOD	mg/m ³	0.28	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	14/09/2010	
Average Volume Sampled (REF)	m ³	0.5750	
Filter I.D. Number	-	47-3541	
Start Filter Mass	g	0.14707	
End Filter Mass	g	0.14709	
Total Mass on Filter	g	0.00002	
Probe Rinse I.D. Number	-	PR-47-3541	
Start Probe Rinse Mass	g	2.89198	
End Probe Rinse Mass	g	2.89214	
Total Mass in Probe Rinse	g	0.00016	
Total Mass Collected	mg	0.18	
Calculated Concentration	mg/m ³	0.31	
Balance Uncertainty / LOD	mg/m ³	0.28	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	20.65	
Pre-Sampling Leak Rate	l/min	0.19	
Post-Sampling Leak Rate	l/min	0.25	
Allowable Leak Rate	l/min	0.41	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	7.2	
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	%	98.2	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
Balance Uncertainty	± mg/m ³	0.28	
Daily ELV	mg/m ³	10.00	
Allowable Balance Uncertainty	± mg/m ³	0.50	
Balance Uncertainty Acceptable	-	Yes	
Balance Uncertainty Criteria (2)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
20 x Balance Uncertainty	mg	3.20	
Mass Collected	mg	0.13	
Sample Time	mins	30	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	27	
Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	25.00	
Pre-Sampling Leak Rate	l/min	0.22	
Post-Sampling Leak Rate	l/min	0.22	
Allowable Leak Rate	l/min	0.50	
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 mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty. This was due to the extremely low level of particulate being emitted from the stack.	x	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	0.6080		uV _m	m ³	0.0122	
Sampled Gas Temperature	T _m	298.8		uT _m	K	2.0	
Sampled Gas Pressure	p _m	101.1		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	1.21		uL	%	-	
Mass of Particulate	m	0.16		um	mg	0.16	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.18		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	1.21		≤2%
Mass of Particulate	%	3.13		<5% of ELV
Oxygen Content	%	N/A		≤5%
Uncollected Mass	%	-		-

Uncertainty in Measurement Units					Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V _m	m ³	0.5671		0.55	
Leak	L	mg/m ³	0.002		1.00	
Mass of Particulate	L _r	mg	0.160		1.96	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.10		1.96	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.008	
Leak	mg/m ³	0.0022	
Mass of Particulate	mg/m ³	0.3131	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.2033	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.37	
Expanded uncertainty (95% confidence)	mg/m ³	0.73	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	1.10	
Reported Uncertainty	mg/m ³	1.10	
Expanded uncertainty (95% confidence)	%	233.8	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	350.7	
Reported Uncertainty	%	350.7	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 15 - Moranes

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	3.61		3.61
Uncertainty	±mg/m ³	0.23		0.23
Mass Emission	g/hr	5.2		5.2
Uncertainty	±g/hr	0.3		0.3

General Sampling Information

Parameter	Value
Standard	BS EN 13526
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 Reference Number	CYL 1.0014
Span Gas Expiry Date	09/03/2012
Span Gas Start Pressure (bar)	120
Gas Cylinder Concentration (ppm)	81.2
Span Gas Uncertainty (%)	2
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A1

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

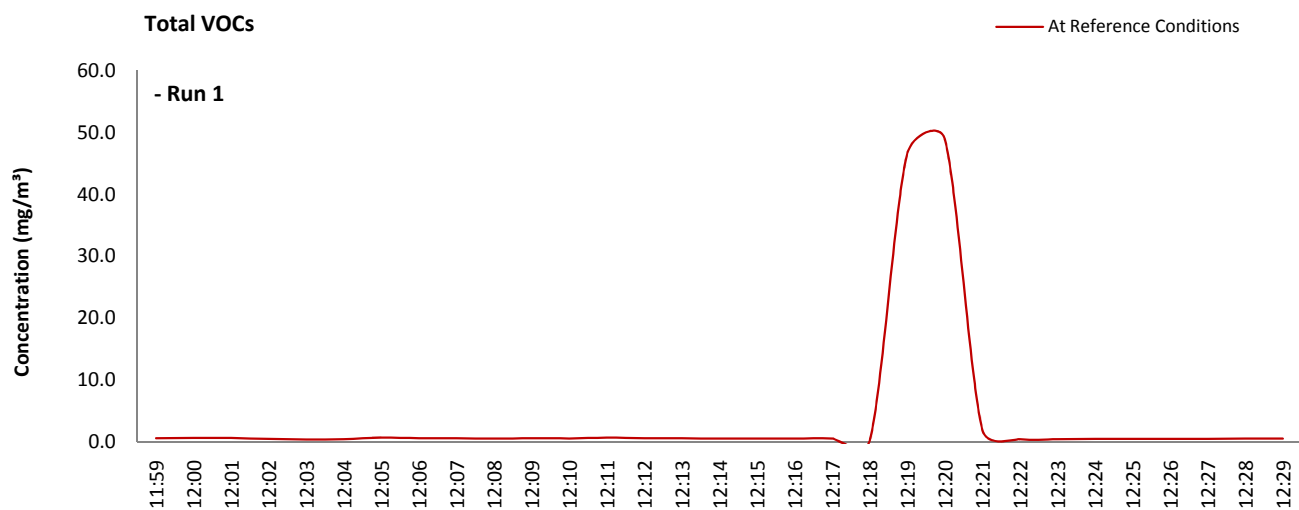
Reference Conditions

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

APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	11:12 - 11:42	
Sampling Dates	-	14/09/2010	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	-0.10	
	Zero Down Sampling Line (Post)	ppm	-0.30	
	Zero Drift	ppm	-0.20	
CAL 2	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
CAL 3	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	30.60	
	Span Down Sampling Line (Post)	ppm	29.50	
	Span Drift	ppm	-1.10	
CAL 2	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
CAL 3	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	16 - 18	

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	

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	100.0		
Measured Reading	ppm	2.2		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.012		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.052		
Leak	ppm	0.02		
Calibration Gas Uncertainty	ppm	0.01		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.02		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.07		
Expanded uncertainty (95% confidence)	ppm	0.14		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.14		
Reported Uncertainty	ppm	0.14		
Expanded uncertainty (95% confidence)	%	6.3		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	6.3		
Reported Uncertainty	%	6.3		

Although measured concentrations greater than the MCERTS Certified range of the analyser (15 mg/m³) were recorded, Catalyst's Internal Annual Systems Checks cover the use of the analyser up to 16061 mg/m³.



Air Tech Environmental Consultancy Services

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

T: 0800 328 1821

E: toby.campbell@cat-env.com

Your Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: 11/94

Stack Reference

Stack No. 41

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Dates of the Monitoring Campaign

13th September 2010

Job Reference Number

CAT-0449

Report Written by
Robert Haworth Team Leader MCERTS Level 2 MM 07 797 TE1 TE2 & TE4
Report Approved by
Toby Campbell Regional Manager MCERTS Level 2 MM 03 155 TE1 TE2 TE3 TE4
Report Date
11th October 2010
Version
Version 1
Signature of Report Approver


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APPENDIX 2 - Raw Data, Sampling Equations & Charts

Opinions and interpretations expressed herein are outside the scope of Catalyst Environmental Ltd's UKAS accreditation.

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Executive Summary

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MONITORING OBJECTIVES

VIP Polymers Ltd, Huntingdon

Stack No. 41

13th September 2010

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions testing on the Stack No. 41 by VIP Polymers Ltd 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.

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 41

13th September 2010

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.73	0.74	10	g/hr	9.8	9.9	-
Total VOCs (as Carbon)	¹ mg/m ³	1.3	0.14	50	g/hr	17.6	1.9	-
Water Vapour	% v/v	1.8	0.11					
Stack Gas Temperature	°C	30.3						
Stack Gas Velocity	m/s	8.4						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	14771						
Volumetric Flow Rate (REF)	¹ m ³ /hr	13393						

NOTE: VOLUMETRIC FLOW RATE 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 No. 41

13th September 2010

Parameter		Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1	mg/m ³	0.73	13/09/2010	16:17 - 16:33, 16:35 - 16:51	32
Total VOCs (as Carbon)	Run 1	mg/m ³	1.3	13/09/2010	16:17 - 16:51	34
Velocity & Volumetric Flow Rate	Run 1			13/09/2010	15:47 - 15:56	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. 41

13th September 2010

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	Full Production
Continuous or Batch Process	Batch
Abatement System Running Status	On
Fuel	N / A
Plume Appearance	Not Visible

Executive Summary

(Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon

Stack No. 41

13th September 2010

Parameter	Standard	Monitoring			Analysis				MCERTS Testing	LOD (Average)
		Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.23 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.16 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter, Total VOCs	1	There are no deviations associated with the sampling employed.

Executive Summary

(Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.79
Width	m	-
Area	m ²	0.49
Port Depth	cm	5
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

EA Technical Guidance Note M1 / BS 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)	No
Platform has chains / self closing gates at top of ladders	No
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

All platforms should be designed in accordance with the requirements in the Environment Agency's Technical Guidance Note M1 and BS EN 15259.

BS EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EA Technical Guidance Document (Monitoring) M1)

Criteria in M1	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	35.3	> 5 Pa	Yes
Mean Velocity	m/s	8.37	-	-
Lowest Gas Velocity	m/s	6.46	-	-
Highest Gas Velocity	m/s	9.70	-	-
Ratio of Above	: 1	1.50	< 3 : 1	Yes
Maximum Angle of Swirl	°	10	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

Executive Summary

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PLANT PHOTOS

Photo 1



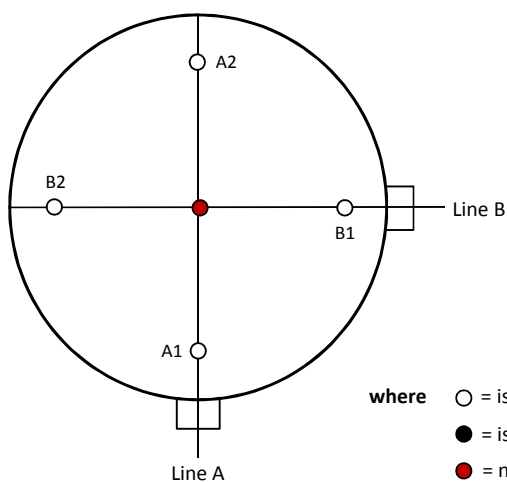
Photo 2



Photo 3



SAMPLE POINTS



where

- = isokinetic point sampled at
- = isokinetic point not sampled at
- = non-isokinetic / combustion gases sample point

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Brian Jacob
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 06 693
	Technical Endorsements	TE1 TE2 TE3 TE4
Trainee	Name	Robert Sidebotham
	MCERTS Accreditation	MCERTS Trainee
	MCERTS Number	MM 10 1075
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.6	Horiba PG-250	-	Digital Manometer (1)	-
Box Thermocouples	CAT 7.6	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.10	JCT JCC P-1 Cooler	-	Digital Temperature Meter	-
Oven Box	-	5m FT-IR	-	Stopwatch	CAT 14.19
Probe	CAT 5.3	5m FT-IR Sampling System	-	Barometer	CAT 13.9
S-Pitot (1)	CAT 21P.10	Bernath 3006 FID	CAT 8.7	Stack Thermocouple (1)	CAT 140
S-Pitot (2)	-	Heated Head Filter	CAT 12.30	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.3	1m Heated Line (1)	-
500g Check Weight	CAT 17.9	Mass Flow Controller (2)	CAT 6.4	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.9	Easylogger EN-EL-12 Bit	CAT 11.16	1m Heated Line (3)	-
Last Impinger Arm	-			5m Heated Line (1)	-
Callipers	CAT 23.10			15m Heated Line (1)	-
Small DGM	-			15m Heated Line (2)	-
Laboratory Balance	-			20m Heated Line (1)	CAT 20.19
Tape Measure	CAT 16.12				

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.79
Stack Width, W	m	-
Stack Area, A	m ²	0.49
Average Stack Gas Temperature, T _a	°C	30.3
Average Stack Gas Pressure	mmH ₂ O	6.1
Average Stack Static Pressure, P _{static}	kPa	0.033
Average Barometric Pressure, P _b	kPa	102.0
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	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂	-	20.80	20.43	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	77.71	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	1.80	0.0180	18.02	0.8037	0.0145

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	1.279
Dry Density (Actual), P _{Actual}	kg/m ³	1.167
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.159

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) = $P_{STW} \times (T_s / P_s) \times (P_a / T_a)$

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	30.3	0.0
Total Pressure	kPa	102.0	101.3
Moisture	%	1.80	1.80

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	14771
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	13393
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	13152
Gas Volumetric Flowrate REF ¹	m ³ /hr	13393

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	13/09/2010
Time of Survey	-	15:47 - 15:56
Atmospheric Pressure	kPa	102.0
Stack Static Pressure	Pa	33
Type of Pitot Used	-	S-Type Pitot
Are Water Droplets Present?	-	No

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	-	2

Swirl Point (taken at the sampling points used during testing)																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Angle of Swirl (°)	2	5	0	10																

Sampling Line A						Sampling Line B				
Traverse Point	Depth m	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s	
1	0.04	4.1	30.2	1.160	6.90	4.1	30.2	1.160	6.90	
2	0.12	6.3	30.3	1.159	8.55	3.6	30.2	1.160	6.46	
3	0.20	7.1	30.3	1.159	9.08	4.3	30.3	1.159	7.07	
4	0.28	6.7	30.3	1.159	8.82	4.3	30.3	1.159	7.07	
5	0.36	6.3	30.4	1.159	8.55	5.3	30.3	1.159	7.84	
6	0.43	7.0	30.3	1.159	9.01	6.1	30.2	1.160	8.41	
7	0.51	7.2	30.3	1.159	9.14	6.3	30.2	1.160	8.55	
8	0.59	7.0	30.3	1.159	9.01	7.2	30.3	1.159	9.14	
9	0.67	5.8	30.3	1.159	8.21	8.1	30.2	1.160	9.70	
10	0.75	7.6	30.2	1.160	9.39	7.9	30.2	1.160	9.58	
Mean		6.5	30.3	1.159	8.67	5.7	30.2	1.159	8.07	

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 41

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.73		0.73
Uncertainty	±mg/m ³	0.74		0.74
Mass Emission	g/hr	9.8		9.8
Uncertainty	±g/hr	9.9		9.9

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	1.80		1.80
Uncertainty	±% v/v	0.11		0.11

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.23		0.23

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	BS 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 Quartz 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.

APPENDIX 2

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	765.0	
Stack static pressure, P_{static}	mmH ₂ O	3.4	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	765.3	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	3.7	
Total mass collected in impingers (silica trap)	g	6.4	
Total mass of liquid collected, V_{lc}	g	10.1	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0126	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.7120	
Gas meter correction factor, Y_d	-	1.0190	
Average dry gas meter temperature, T_m	°C	19.0	
Average pressure drop across orifice, ΔH	mmH ₂ O	49.5	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.6860	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0180	
B_{wo} as a percentage	% v/v	1.80	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	1.80	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.6986	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & 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 (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% 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	28.65	
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	6.03	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	2.45	
Average stack gas temperature, T_s	°C	31.0	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(V_{T_s} + 273)) / (V(M_s)(P_s))$	m/s	8.39	
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	0.49	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	246.8	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	223.1	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	219.1	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	7.78	
Nozzle area, A_n	mm ²	47.55	
Total sampling time, q	min	32	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	100.9	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	16:17 - 16:33, 16:35 - 16:51	
Sampling Dates	-	13/09/2010	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.6986	
Filter I.D. Number	-	47-3593	
Start Filter Mass	g	0.14824	
End Filter Mass	g	0.14818	
Total Mass on Filter	g	-0.00006	
Probe Rinse I.D. Number	-	PR-47-3593	
Start Probe Rinse Mass	g	3.03687	
End Probe Rinse Mass	g	3.03744	
Total Mass in Probe Rinse	g	0.00057	
Total Mass Collected	mg	0.51	
Calculated Concentration	mg/m ³	0.73	
Balance Uncertainty / LOD	mg/m ³	0.23	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	13/09/2010	
Average Volume Sampled (REF)	m ³	0.6986	
Filter I.D. Number	-	47-3592	
Start Filter Mass	g	0.15005	
End Filter Mass	g	0.15007	
Total Mass on Filter	g	0.00002	
Probe Rinse I.D. Number	-	PR-47-3592	
Start Probe Rinse Mass	g	2.85277	
End Probe Rinse Mass	g	2.85287	
Total Mass in Probe Rinse	g	0.00010	
Total Mass Collected	mg	0.12	
Calculated Concentration	mg/m ³	0.17	
Balance Uncertainty / LOD	mg/m ³	0.23	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	22.67	
Pre-Sampling Leak Rate	l/min	0.25	
Post-Sampling Leak Rate	l/min	0.20	
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)	%	5.9	
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	%	100.9	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
Balance Uncertainty	± mg/m ³	0.23	
Daily ELV	mg/m ³	10.00	
Allowable Balance Uncertainty	± mg/m ³	0.50	
Balance Uncertainty Acceptable	-	Yes	
Balance Uncertainty Criteria (2)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
20 x Balance Uncertainty	mg	3.20	
Mass Collected	mg	0.51	
Sample Time	mins	32	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	31	
Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	25.00	
Pre-Sampling Leak Rate	l/min	0.22	
Post-Sampling Leak Rate	l/min	0.22	
Allowable Leak Rate	l/min	0.50	
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 mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty. This was due to the extremely low level of particulate being emitted from the stack.	x	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	0.7120		uV _m	m ³	0.0142	
Sampled Gas Temperature	T _m	292.0		uT _m	K	2.0	
Sampled Gas Pressure	p _m	102.0		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.88		uL	%	-	
Mass of Particulate	m	0.51		um	mg	0.16	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.12		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.68		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.88		≤2%
Mass of Particulate	%	2.29		<5% of ELV
Oxygen Content	%	N/A		≤5%
Uncollected Mass	%	-		-

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	0.6860	1.06	
Leak	L	mg/m ³	0.004	1.00	
Mass of Particulate	L _r	mg	0.510	1.43	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A	N/A	
Uncollected Mass	UCM	mg	0.07	1.43	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.018	
Leak	mg/m ³	0.0037	
Mass of Particulate	mg/m ³	0.2290	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.0992	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.25	
Expanded uncertainty (95% confidence)	mg/m ³	0.49	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.74	
Reported Uncertainty	mg/m ³	0.74	
Expanded uncertainty (95% confidence)	%	67.2	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	100.8	
Reported Uncertainty	%	100.8	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 41

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.31		1.31
Uncertainty	±mg/m ³	0.14		0.14
Mass Emission	g/hr	17.6		17.6
Uncertainty	±g/hr	1.9		1.9

General Sampling Information

Parameter	Value
Standard	BS EN 13526
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 Reference Number	CYL 1.0014
Span Gas Expiry Date	09/03/2012
Span Gas Start Pressure (bar)	120
Gas Cylinder Concentration (ppm)	81.2
Span Gas Uncertainty (%)	2
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A5

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

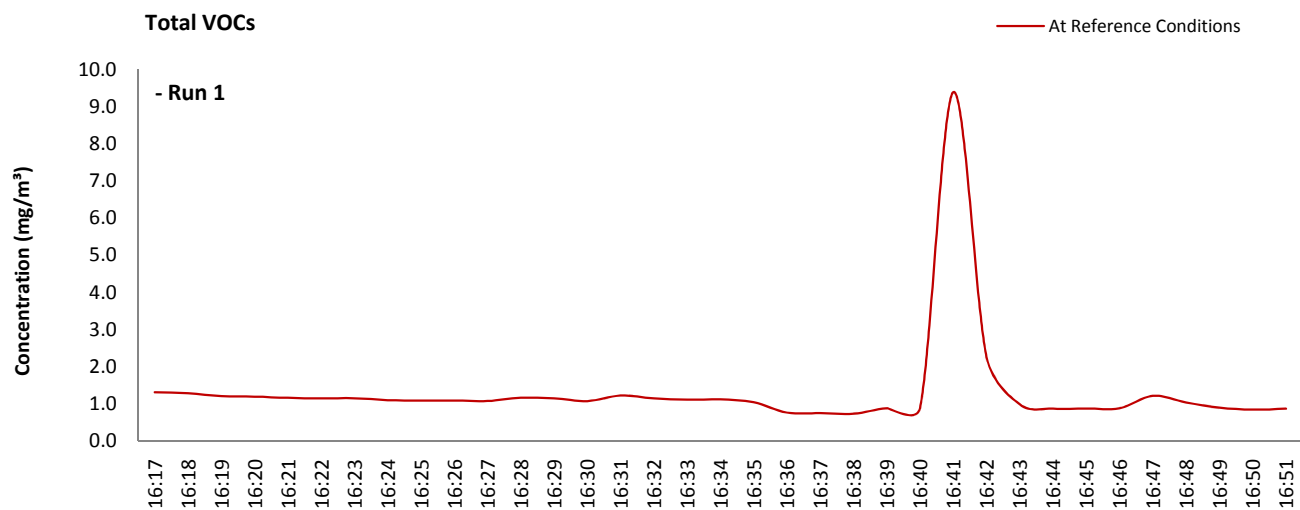
Reference Conditions

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

APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	16:17 - 16:51	
Sampling Dates	-	13/09/2010	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.10	
	Zero Down Sampling Line (Post)	ppm	0.00	
	Zero Drift	ppm	-0.10	
CAL 2	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
CAL 3	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	30.90	
	Span Down Sampling Line (Post)	ppm	29.80	
	Span Drift	ppm	-1.10	
CAL 2	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
CAL 3	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

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

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	100.0		
Measured Reading	ppm	0.8		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.012		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.019		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.00		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.05		
Expanded uncertainty (95% confidence)	ppm	0.09		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.09		
Reported Uncertainty	ppm	0.09		
Expanded uncertainty (95% confidence)	%	10.8		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	10.8		
Reported Uncertainty	%	10.8		



Air Tech Environmental Consultancy Services

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Your Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: 11/94

Stack Reference

Stack No. 44 - Carbon Black

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Dates of the Monitoring Campaign

14th September 2010

Job Reference Number

CAT-0449

Report Written by
Robert Haworth Team Leader MCERTS Level 2 MM 07 797 TE1 TE2 & TE4
Report Approved by
Toby Campbell Regional Manager MCERTS Level 2 MM 03 155 TE1 TE2 TE3 TE4
Report Date
11th October 2010
Version
Version 1
Signature of Report Approver


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APPENDIX 2 - Raw Data, Sampling Equations & Charts

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Executive Summary

(Page 1 of 7)

MONITORING OBJECTIVES

VIP Polymers Ltd, Huntingdon

Stack No. 44 - Carbon Black

14th September 2010

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions testing on the Stack No. 44 - Carbon Black by VIP Polymers Ltd 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.

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 44 - Carbon Black

14th September 2010

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.39	0.40	10	g/hr	3.9	4.1	-
Total VOCs (as Carbon)	¹ mg/m ³	2.1	0.17	50	g/hr	21.3	1.7	-
Water Vapour	% v/v	0.44	0.06					
Stack Gas Temperature	°C	13.1						
Stack Gas Velocity	m/s	18.4						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	11135						
Volumetric Flow Rate (REF)	¹ m ³ /hr	10161						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

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 No. 44 - Carbon Black

14th September 2010

Parameter		Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1	mg/m ³	0.39	14/09/2010	13:47 - 14:19	32
Total VOCs (as Carbon)	Run 1	mg/m ³	2.1	14/09/2010	14:19 - 14:49	30
Velocity & Volumetric Flow Rate	Run 1			14/09/2010	13:19 - 13:20	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. 44 - Carbon Black

14th September 2010

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	100% of capacity
Continuous or Batch Process	Batch
Feedstock (if applicable)	Carbon
Abatement System	Bag Filter
Abatement System Running Status	On
Fuel	N/A
Plume Appearance	Not Visible

Executive Summary

(Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon

Stack No. 44 - Carbon Black

14th September 2010

Parameter	Standard	Monitoring			Analysis				MCERTS Testing	LOD (Average)
		Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.17 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.16 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	1	Only one sampling line could be used as one of the port caps was stuck, however the number of sample points used on the available line were increased to meet the requirements of the Standard.

Executive Summary

(Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.45
Width	m	-
Area	m ²	0.16
Port Depth	cm	5
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 / BS 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 BS EN 15259, and therefore there are no improvement recommendations.

BS EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EA Technical Guidance Document (Monitoring) M1)

Criteria in M1	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	254.0	> 5 Pa	Yes
Mean Velocity	m/s	18.45	-	-
Lowest Gas Velocity	m/s	17.27	-	-
Highest Gas Velocity	m/s	19.55	-	-
Ratio of Above	: 1	1.13	< 3 : 1	Yes
Maximum Angle of Swirl	°	9	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

Executive Summary

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PLANT PHOTOS

Photo 1



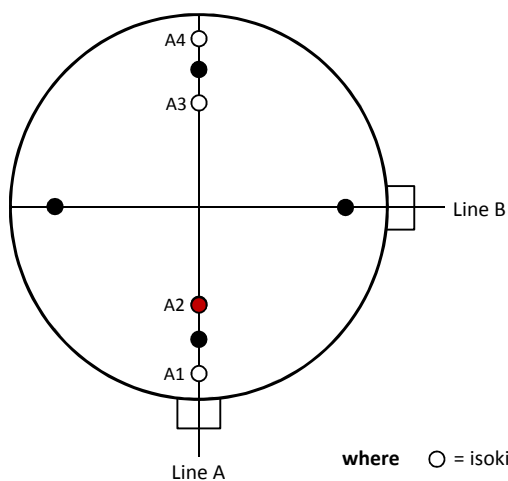
Photo 2



Photo 3



SAMPLE POINTS



where ○ = isokinetic point sampled at
● = isokinetic point not sampled at
● = non-isokinetic / combustion gases sample point

APPENDICES

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APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Brian Jacob
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 06 693
	Technical Endorsements	TE1 TE2 TE3 TE4
Trainee	Name	Robert Sidebotham
	MCERTS Accreditation	MCERTS Trainee
	MCERTS Number	MM 10 1075
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.6	Horiba PG-250	-	Digital Manometer (1)	-
Box Thermocouples	CAT 7.6	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.10	JCT JCC P-1 Cooler	-	Digital Temperature Meter	-
Oven Box	-	5m FT-IR	-	Stopwatch	CAT 14.19
Probe	CAT 5.3	5m FT-IR Sampling System	-	Barometer	CAT 13.9
S-Pitot (1)	CAT 21P.10	Bernath 3006 FID	CAT 8.7	Stack Thermocouple (1)	CAT 140
S-Pitot (2)	-	Heated Head Filter	CAT 12.30	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.3	1m Heated Line (1)	-
500g Check Weight	CAT 17.9	Mass Flow Controller (2)	CAT 6.4	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.9	Easylogger EN-EL-12 Bit	CAT 11.16	1m Heated Line (3)	-
Last Impinger Arm	-			5m Heated Line (1)	-
Callipers	CAT 23.10			15m Heated Line (1)	-
Small DGM	-			15m Heated Line (2)	-
Laboratory Balance	-			20m Heated Line (1)	CAT 20.19
Tape Measure	CAT 16.12				

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.45
Stack Width, W	m	-
Stack Area, A	m ²	0.16
Average Stack Gas Temperature, T _a	°C	27.2
Average Stack Gas Pressure	mmH ₂ O	29.6
Average Stack Static Pressure, P _{static}	kPa	0.210
Average Barometric Pressure, P _b	kPa	101.1
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	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂	-	20.80	20.71	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	78.79	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	0.44	0.0044	18.02	0.8037	0.0035

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	1.285
Dry Density (Actual), P _{Actual}	kg/m ³	1.171
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.169

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	27.2	0.0
Total Pressure	kPa	101.3	101.3
Moisture	%	0.44	0.44

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	10565
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	9609
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	9567
Gas Volumetric Flowrate REF ¹	m ³ /hr	9609

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	14/09/2010
Time of Survey	-	13:19 - 13:20
Atmospheric Pressure	kPa	101.1
Stack Static Pressure	Pa	210
Type of Pitot Used	-	S-Type Pitot
Are Water Droplets Present?	-	No

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	-	1
Number of Lines Used	-	1

Swirl Point (taken at the sampling points used during testing)																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Angle of Swirl (°)	9	9	5	5																

Sampling Line A					
Traverse Point	Depth m	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	30.1	27.2	1.169	18.62
2	0.07	31.4	27.2	1.169	19.01
3	0.11	29.8	27.2	1.169	18.52
4	0.16	31.7	27.2	1.169	19.10
5	0.20	33.2	27.2	1.169	19.55
6	0.25	28.6	27.0	1.170	18.14
7	0.29	28.9	27.2	1.169	18.24
8	0.34	27.5	27.2	1.169	17.79
9	0.38	25.9	27.2	1.169	17.27
10	0.43	28.9	27.2	1.169	18.24
Mean		29.6	27.2	1.169	18.45

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 44 - Carbon Black

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.39		0.39
Uncertainty	±mg/m ³	0.40		0.40
Mass Emission	g/hr	3.9		3.9
Uncertainty	±g/hr	4.1		4.1

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.88		0.88
Uncertainty	±% v/v	0.06		0.06

Blank Runs

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

General Sampling Information

Parameter	Value	
Standard	BS EN 13284-1	
Technical Procedure	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	Out Stack	
Filter Size and Material	47mm Quartz 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.

APPENDIX 2

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	758.3	
Stack static pressure, P_{static}	mmH ₂ O	21.4	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	759.8	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	2.4	
Total mass collected in impingers (silica trap)	g	4.2	
Total mass of liquid collected, V_{lc}	g	6.6	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0082	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.9820	
Gas meter correction factor, Y_d	-	1.0190	
Average dry gas meter temperature, T_m	°C	23.9	
Average pressure drop across orifice, ΔH	mmH ₂ O	94.5	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.9262	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0088	
B_{wo} as a percentage	% v/v	0.88	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.88	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.9345	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & 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 (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% 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	28.75	
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	32.78	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	5.73	
Average stack gas temperature, T_s	°C	26.1	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (\sqrt{M_s}(P_s))$	m/s	19.45	
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	0.16	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	185.6	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	169.3	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	167.9	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	5.94	
Nozzle area, A_n	mm ²	27.68	
Total sampling time, q	min	32	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	99.1	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	13:47 - 14:19	
Sampling Dates	-	14/09/2010	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.9347	
Filter I.D. Number	-	47-3648	
Start Filter Mass	g	0.14900	
End Filter Mass	g	0.14904	
Total Mass on Filter	g	0.00004	
Probe Rinse I.D. Number	-	PR-47-3648	
Start Probe Rinse Mass	g	2.89269	
End Probe Rinse Mass	g	2.89301	
Total Mass in Probe Rinse	g	0.00032	
Total Mass Collected	mg	0.36	
Calculated Concentration	mg/m ³	0.39	
Balance Uncertainty / LOD	mg/m ³	0.17	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	14/09/2010	
Average Volume Sampled (REF)	m ³	0.9347	
Filter I.D. Number	-	47-3644	
Start Filter Mass	g	0.14894	
End Filter Mass	g	0.14895	
Total Mass on Filter	g	0.00001	
Probe Rinse I.D. Number	-	PR-47-3644	
Start Probe Rinse Mass	g	2.92321	
End Probe Rinse Mass	g	2.92338	
Total Mass in Probe Rinse	g	0.00017	
Total Mass Collected	mg	0.18	
Calculated Concentration	mg/m ³	0.19	
Balance Uncertainty / LOD	mg/m ³	0.17	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	31.27	
Pre-Sampling Leak Rate	l/min	0.18	
Post-Sampling Leak Rate	l/min	0.20	
Allowable Leak Rate	l/min	0.63	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	6.9	
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	%	99.1	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
Balance Uncertainty	± mg/m ³	0.17	
Daily ELV	mg/m ³	10.00	
Allowable Balance Uncertainty	± mg/m ³	0.50	
Balance Uncertainty Acceptable	-	Yes	
Balance Uncertainty Criteria (2)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
20 x Balance Uncertainty	mg	3.20	
Mass Collected	mg	0.36	
Sample Time	mins	32	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	#DIV/0!	
Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	25.00	
Pre-Sampling Leak Rate	l/min	0.22	
Post-Sampling Leak Rate	l/min	0.22	
Allowable Leak Rate	l/min	0.50	
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	
Only one sampling line was installed on the stack, however the number of sample points used on the available line were increased to meet the requirements of the Standard.	x	
The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty. This was due to the extremely low level of particulate being emitted from the stack.	x	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	0.9820		uV _m	m ³	0.0196	
Sampled Gas Temperature	T _m	296.9		uT _m	K	2.0	
Sampled Gas Pressure	p _m	101.3		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.64		uL	%	-	
Mass of Particulate	m	0.36		um	mg	0.16	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.18		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.64		≤2%
Mass of Particulate	%	1.71		<5% of ELV
Oxygen Content	%	N/A		≤5%
Uncollected Mass	%	-		-

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V _m	m ³	0.9265	0.42	
Leak	L	mg/m ³	0.001	1.00	
Mass of Particulate	L _r	mg	0.360	1.07	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A	N/A	
Uncollected Mass	UCM	mg	0.10	1.07	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.010	
Leak	mg/m ³	0.0014	
Mass of Particulate	mg/m ³	0.1712	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.1112	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.20	
Expanded uncertainty (95% confidence)	mg/m ³	0.40	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.40	
Reported Uncertainty	mg/m ³	0.40	
Expanded uncertainty (95% confidence)	%	104.0	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	104.0	
Reported Uncertainty	%	104.0	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 44 - Carbon Black

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	2.10		2.10
Uncertainty	±mg/m ³	0.17		0.17
Mass Emission	g/hr	21.3		21.3
Uncertainty	±g/hr	1.7		1.7

General Sampling Information

Parameter	Value	
Standard	BS EN 13526	
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 Reference Number	CYL 1.0014	
Span Gas Expiry Date	09/03/2012	
Span Gas Start Pressure (bar)	120	
Gas Cylinder Concentration (ppm)	81.2	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
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	

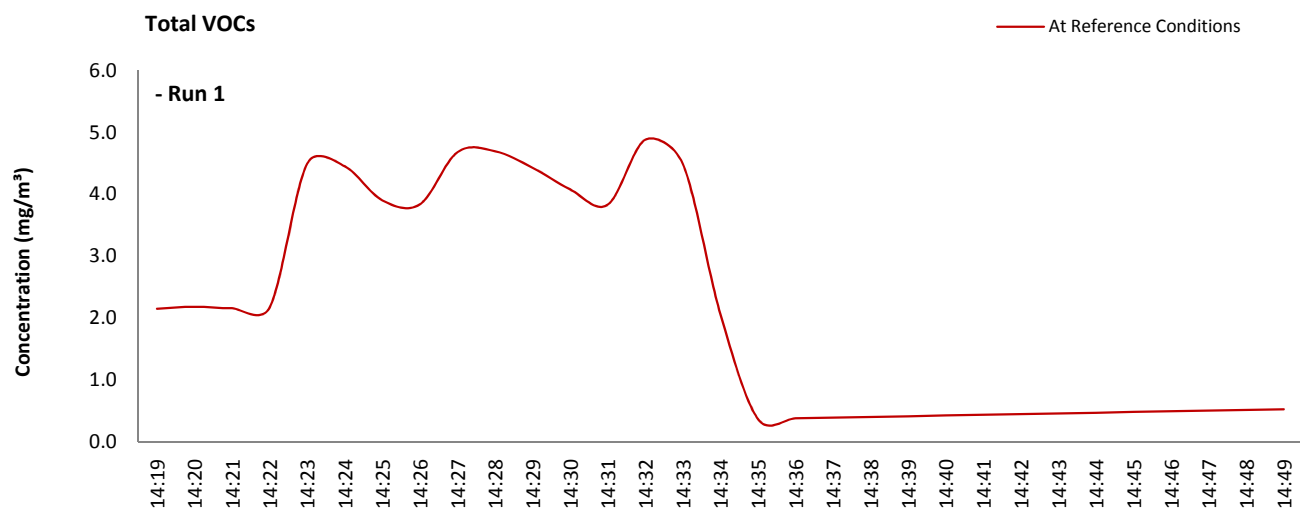
Reference Conditions

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

APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	14:19 - 14:49	
Sampling Dates	-	14/09/2010	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	-0.10	
	Zero Down Sampling Line (Post)	ppm	-0.30	
	Zero Drift	ppm	-0.20	
CAL 2	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
CAL 3	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	30.60	
	Span Down Sampling Line (Post)	ppm	29.50	
	Span Drift	ppm	-1.10	
CAL 2	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
CAL 3	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

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

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	100.0		
Measured Reading	ppm	1.3		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.012		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.030		
Leak	ppm	0.01		
Calibration Gas Uncertainty	ppm	0.01		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.05		
Expanded uncertainty (95% confidence)	ppm	0.10		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.10		
Reported Uncertainty	ppm	0.10		
Expanded uncertainty (95% confidence)	%	8.0		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	8.0		
Reported Uncertainty	%	8.0		



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Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: 11/94

Stack Reference

Stack No. 44 - Carbon Black

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Dates of the Monitoring Campaign

14th September 2010

Job Reference Number

CAT-0449

Report Written by
Robert Haworth Team Leader MCERTS Level 2 MM 07 797 TE1 TE2 & TE4
Report Approved by
Toby Campbell Regional Manager MCERTS Level 2 MM 03 155 TE1 TE2 TE3 TE4
Report Date
11th October 2010
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 No. 44 - Carbon Black

14th September 2010

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions testing on the Stack No. 44 - Carbon Black by VIP Polymers Ltd 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.

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 44 - Carbon Black

14th September 2010

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.39	0.40	10	g/hr	3.9	4.1	-
Total VOCs (as Carbon)	¹ mg/m ³	2.1	0.17	50	g/hr	21.3	1.7	-
Water Vapour	% v/v	0.44	0.06					
Stack Gas Temperature	°C	13.1						
Stack Gas Velocity	m/s	18.4						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	11135						
Volumetric Flow Rate (REF)	¹ m ³ /hr	10161						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

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 No. 44 - Carbon Black

14th September 2010

Parameter		Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1	mg/m ³	0.39	14/09/2010	13:47 - 14:19	32
Total VOCs (as Carbon)	Run 1	mg/m ³	2.1	14/09/2010	14:19 - 14:49	30
Velocity & Volumetric Flow Rate	Run 1			14/09/2010	13:19 - 13:20	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. 44 - Carbon Black

14th September 2010

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	100% of capacity
Continuous or Batch Process	Batch
Feedstock (if applicable)	Carbon
Abatement System	Bag Filter
Abatement System Running Status	On
Fuel	N/A
Plume Appearance	Not Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon

Stack No. 44 - Carbon Black

14th September 2010

Parameter	Standard	Monitoring			Analysis				MCERTS Testing	LOD (Average)
		Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.17 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.16 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	1	Only one sampling line could be used as one of the port caps was stuck, however the number of sample points used on the available line were increased to meet the requirements of the Standard.

Executive Summary

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SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.45
Width	m	-
Area	m ²	0.16
Port Depth	cm	5
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 / BS 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 BS EN 15259, and therefore there are no improvement recommendations.

BS EN 15259 Homogeneity Test Requirements

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

Sampling Plane Validation Criteria (from EA Technical Guidance Document (Monitoring) M1)

Criteria in M1	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	254.0	> 5 Pa	Yes
Mean Velocity	m/s	18.45	-	-
Lowest Gas Velocity	m/s	17.27	-	-
Highest Gas Velocity	m/s	19.55	-	-
Ratio of Above	: 1	1.13	< 3 : 1	Yes
Maximum Angle of Swirl	°	9	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

Executive Summary

(Page 7 of 7)

PLANT PHOTOS

Photo 1



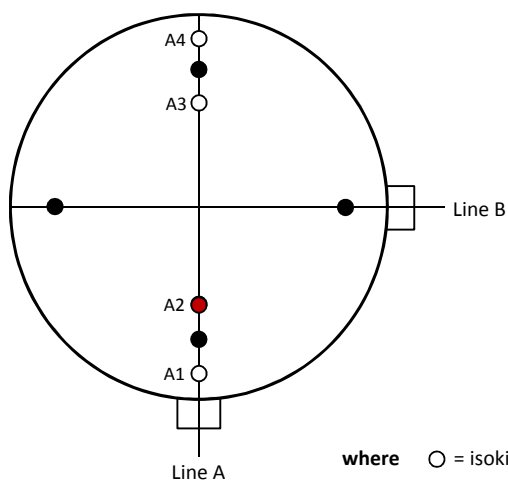
Photo 2



Photo 3



SAMPLE POINTS



where ○ = isokinetic point sampled at
● = isokinetic point not sampled at
● = non-isokinetic / combustion gases sample point

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Brian Jacob
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 06 693
	Technical Endorsements	TE1 TE2 TE3 TE4
Trainee	Name	Robert Sidebotham
	MCERTS Accreditation	MCERTS Trainee
	MCERTS Number	MM 10 1075
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.6	Horiba PG-250	-	Digital Manometer (1)	-
Box Thermocouples	CAT 7.6	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.10	JCT JCC P-1 Cooler	-	Digital Temperature Meter	-
Oven Box	-	5m FT-IR	-	Stopwatch	CAT 14.19
Probe	CAT 5.3	5m FT-IR Sampling System	-	Barometer	CAT 13.9
S-Pitot (1)	CAT 21P.10	Bernath 3006 FID	CAT 8.7	Stack Thermocouple (1)	CAT 140
S-Pitot (2)	-	Heated Head Filter	CAT 12.30	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.3	1m Heated Line (1)	-
500g Check Weight	CAT 17.9	Mass Flow Controller (2)	CAT 6.4	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.9	Easylogger EN-EL-12 Bit	CAT 11.16	1m Heated Line (3)	-
Last Impinger Arm	-			5m Heated Line (1)	-
Callipers	CAT 23.10			15m Heated Line (1)	-
Small DGM	-			15m Heated Line (2)	-
Laboratory Balance	-			20m Heated Line (1)	CAT 20.19
Tape Measure	CAT 16.12				

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.45
Stack Width, W	m	-
Stack Area, A	m ²	0.16
Average Stack Gas Temperature, T _a	°C	27.2
Average Stack Gas Pressure	mmH ₂ O	29.6
Average Stack Static Pressure, P _{static}	kPa	0.210
Average Barometric Pressure, P _b	kPa	101.1
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	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂	-	20.80	20.71	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	78.79	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	0.44	0.0044	18.02	0.8037	0.0035

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	1.285
Dry Density (Actual), P _{Actual}	kg/m ³	1.171
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.169

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) = $P_{STW} \times (T_s / P_s) \times (P_a / T_a)$

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	27.2	0.0
Total Pressure	kPa	101.3	101.3
Moisture	%	0.44	0.44

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	10565
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	9609
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	9567
Gas Volumetric Flowrate REF ¹	m ³ /hr	9609

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	14/09/2010
Time of Survey	-	13:19 - 13:20
Atmospheric Pressure	kPa	101.1
Stack Static Pressure	Pa	210
Type of Pitot Used	-	S-Type Pitot
Are Water Droplets Present?	-	No

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	-	1
Number of Lines Used	-	1

Swirl Point (taken at the sampling points used during testing)																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Angle of Swirl (°)	9	9	5	5																

Sampling Line A					
Traverse Point	Depth m	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	30.1	27.2	1.169	18.62
2	0.07	31.4	27.2	1.169	19.01
3	0.11	29.8	27.2	1.169	18.52
4	0.16	31.7	27.2	1.169	19.10
5	0.20	33.2	27.2	1.169	19.55
6	0.25	28.6	27.0	1.170	18.14
7	0.29	28.9	27.2	1.169	18.24
8	0.34	27.5	27.2	1.169	17.79
9	0.38	25.9	27.2	1.169	17.27
10	0.43	28.9	27.2	1.169	18.24
Mean		29.6	27.2	1.169	18.45

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 44 - Carbon Black

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.39		0.39
Uncertainty	±mg/m ³	0.40		0.40
Mass Emission	g/hr	3.9		3.9
Uncertainty	±g/hr	4.1		4.1

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.88		0.88
Uncertainty	±% v/v	0.06		0.06

Blank Runs

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

General Sampling Information

Parameter	Value	
Standard	BS EN 13284-1	
Technical Procedure	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	Out Stack	
Filter Size and Material	47mm Quartz 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.

APPENDIX 2

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	758.3	
Stack static pressure, P_{static}	mmH ₂ O	21.4	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	759.8	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	2.4	
Total mass collected in impingers (silica trap)	g	4.2	
Total mass of liquid collected, V_{lc}	g	6.6	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0082	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.9820	
Gas meter correction factor, Y_d	-	1.0190	
Average dry gas meter temperature, T_m	°C	23.9	
Average pressure drop across orifice, ΔH	mmH ₂ O	94.5	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.9262	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0088	
B_{wo} as a percentage	% v/v	0.88	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.88	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.9345	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & 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 (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% 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	28.75	
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	32.78	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	5.73	
Average stack gas temperature, T_s	°C	26.1	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (\sqrt{M_s}(P_s))$	m/s	19.45	
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	0.16	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	185.6	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	169.3	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	167.9	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	5.94	
Nozzle area, A_n	mm ²	27.68	
Total sampling time, q	min	32	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	99.1	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	13:47 - 14:19	
Sampling Dates	-	14/09/2010	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.9347	
Filter I.D. Number	-	47-3648	
Start Filter Mass	g	0.14900	
End Filter Mass	g	0.14904	
Total Mass on Filter	g	0.00004	
Probe Rinse I.D. Number	-	PR-47-3648	
Start Probe Rinse Mass	g	2.89269	
End Probe Rinse Mass	g	2.89301	
Total Mass in Probe Rinse	g	0.00032	
Total Mass Collected	mg	0.36	
Calculated Concentration	mg/m ³	0.39	
Balance Uncertainty / LOD	mg/m ³	0.17	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	14/09/2010	
Average Volume Sampled (REF)	m ³	0.9347	
Filter I.D. Number	-	47-3644	
Start Filter Mass	g	0.14894	
End Filter Mass	g	0.14895	
Total Mass on Filter	g	0.00001	
Probe Rinse I.D. Number	-	PR-47-3644	
Start Probe Rinse Mass	g	2.92321	
End Probe Rinse Mass	g	2.92338	
Total Mass in Probe Rinse	g	0.00017	
Total Mass Collected	mg	0.18	
Calculated Concentration	mg/m ³	0.19	
Balance Uncertainty / LOD	mg/m ³	0.17	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	31.27	
Pre-Sampling Leak Rate	l/min	0.18	
Post-Sampling Leak Rate	l/min	0.20	
Allowable Leak Rate	l/min	0.63	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	6.9	
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	%	99.1	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
Balance Uncertainty	± mg/m ³	0.17	
Daily ELV	mg/m ³	10.00	
Allowable Balance Uncertainty	± mg/m ³	0.50	
Balance Uncertainty Acceptable	-	Yes	
Balance Uncertainty Criteria (2)	Units	Run 1	
Balance Uncertainty	± mg	0.16	
20 x Balance Uncertainty	mg	3.20	
Mass Collected	mg	0.36	
Sample Time	mins	32	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	#DIV/0!	
Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	25.00	
Pre-Sampling Leak Rate	l/min	0.22	
Post-Sampling Leak Rate	l/min	0.22	
Allowable Leak Rate	l/min	0.50	
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	
Only one sampling line was installed on the stack, however the number of sample points used on the available line were increased to meet the requirements of the Standard.	x	
The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty. This was due to the extremely low level of particulate being emitted from the stack.	x	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V_m	0.9820		uV_m	m^3	0.0196	
Sampled Gas Temperature	T_m	296.9		uT_m	K	2.0	
Sampled Gas Pressure	p_m	101.3		up_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Leak	L	0.64		uL	%	-	
Mass of Particulate	m	0.36		um	mg	0.16	
Oxygen Content	$O_{2,m}$	N/A		$uO_{2,m}$	% v/v	N/A	
Uncollected Mass	UCM	0.18		$uUCM$	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.64		≤2%
Mass of Particulate	%	1.71		<5% of ELV
Oxygen Content	%	N/A		≤5%
Uncollected Mass	%	-		-

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V_m	m^3	0.9265	0.42	
Leak	L	mg/ m^3	0.001	1.00	
Mass of Particulate	L_r	mg	0.360	1.07	
Factor for O ₂ Correction	$O_{2,m}$	% v/v	N/A	N/A	
Uncollected Mass	UCM	mg	0.10	1.07	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/ m^3	0.010	
Leak	mg/ m^3	0.0014	
Mass of Particulate	mg/ m^3	0.1712	
Factor for O ₂ Correction	mg/ m^3	N/A	
Uncollected Mass	mg/ m^3	0.1112	

Parameter	Units	Run 1	
Combined uncertainty	mg/ m^3	0.20	
Expanded uncertainty (95% confidence)	mg/ m^3	0.40	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/ m^3	0.40	
Reported Uncertainty	mg/ m^3	0.40	
Expanded uncertainty (95% confidence)	%	104.0	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	104.0	
Reported Uncertainty	%	104.0	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 44 - Carbon Black

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	2.10		2.10
Uncertainty	±mg/m ³	0.17		0.17
Mass Emission	g/hr	21.3		21.3
Uncertainty	±g/hr	1.7		1.7

General Sampling Information

Parameter	Value	
Standard	BS EN 13526	
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 Reference Number	CYL 1.0014	
Span Gas Expiry Date	09/03/2012	
Span Gas Start Pressure (bar)	120	
Gas Cylinder Concentration (ppm)	81.2	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
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	

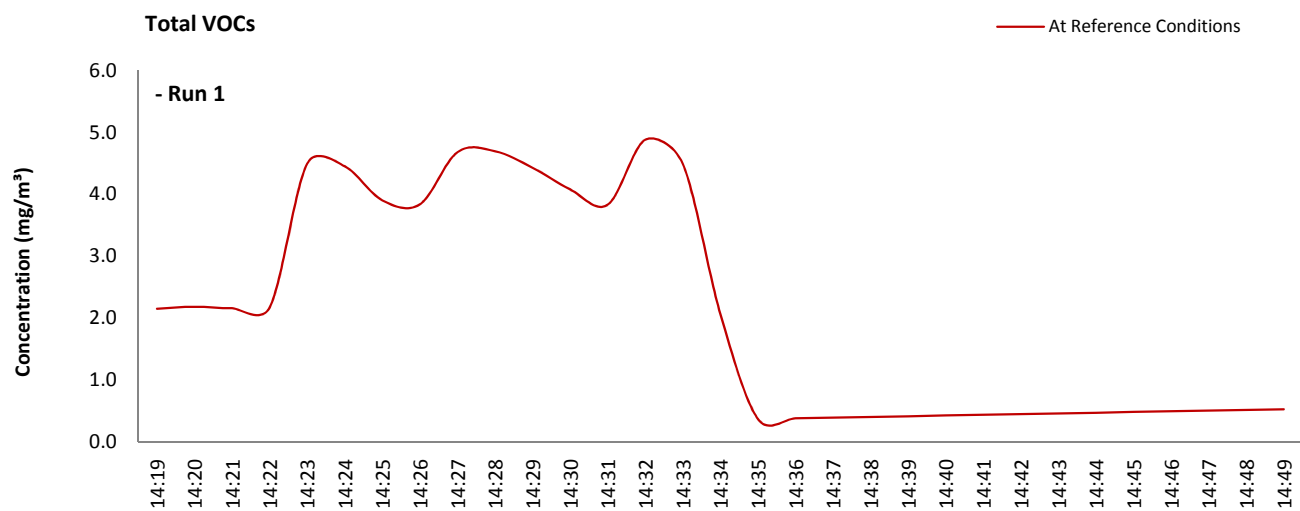
Reference Conditions

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

APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	14:19 - 14:49	
Sampling Dates	-	14/09/2010	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	-0.10	
	Zero Down Sampling Line (Post)	ppm	-0.30	
	Zero Drift	ppm	-0.20	
CAL 2	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
CAL 3	Zero Down Sampling Line (Pre)	ppm		
	Zero Down Sampling Line (Post)	ppm		
	Zero Drift	ppm		
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	30.60	
	Span Down Sampling Line (Post)	ppm	29.50	
	Span Drift	ppm	-1.10	
CAL 2	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
CAL 3	Span Down Sampling Line (Pre)	ppm		
	Span Down Sampling Line (Post)	ppm		
	Span Drift	ppm		
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

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

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	100.0		
Measured Reading	ppm	1.3		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.012		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.030		
Leak	ppm	0.01		
Calibration Gas Uncertainty	ppm	0.01		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.05		
Expanded uncertainty (95% confidence)	ppm	0.10		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.10		
Reported Uncertainty	ppm	0.10		
Expanded uncertainty (95% confidence)	%	8.0		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	8.0		
Reported Uncertainty	%	8.0		