

Stack Emissions Testing Summary Sheet

CAT-0810: VIP Polymers Ltd, Huntingdon.

4279

		Particulate Matter		Total VOCs				Test Dates	Flow Rate (REF)	Reference Condition	
Release Point	Units	Result	Limit	Result	Limit				m³/hr		
Stack No. 7	mg/m³	0.70	10	0.21	50				14/09/2011	2712	STP Wet Gas
	g/hr	1.9	-	0.57	-						
Stack No. 8a	mg/m³	0.90	10	0.39	50				14/09/2011	1367	STP Wet Gas
	g/hr	1.2	-	0.53	-						
Stack No. 8b	mg/m³	0.83	10	0.22	50				14/09/2011	1178	STP Wet Gas
	g/hr	0.98	-	0.26	-						
Stack No. 10	mg/m³	2.2	10	0.84	50				14/09/2011	15211	STP Wet Gas
	g/hr	34	-	12.8	-						
Stack No. 11	mg/m³	0.89	10	1.5	50				15/09/2011	16517	STP Wet Gas
	g/hr	14.7	-	24.0	-						
Stack No. 35c	mg/m³	0.99	10	1.7	50				15/09/2011	16620	STP Wet Gas
	g/hr	16.4	-	28.5	-						
Stack No. 35d	mg/m³	1.0	10	2.2	50				15/09/2011	18410	STP Wet Gas
	g/hr	19.1	-	41.0	-						
Stack No. 44	mg/m³	1.3	10	1.4	50				15/09/2011	9424	STP Wet Gas
	g/hr	12.4	-	13.2	-						
Stack No. 46 - Spay Booth	mg/m³	26.0	50	47.8	50				15/09/2011	9880	STP Wet Gas
	g/hr	257	-	472	-						
Standard Reference Method		BS EN 13284-1		BS EN 12619							
Accreditation Status of Test		UKAS & MCERTS		UKAS & MCERTS							

Summary Writer	Scott Pilkington	MCERTS Accreditation	MCERTS Level 2	MCERTS Number	MM 04 501	Report Date	31st October 2011
Summary Approver	James Eldridge	MCERTS Accreditation	MCERTS Level 2	MCERTS Number	MM 05 641	Report Version	Version 2



Stack Emissions Testing Summary Sheet
CAT-0810: VIP Polymers Ltd, Huntingdon.





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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

Dates of the Monitoring Campaign

15th September 2011

Job Reference Number

CAT-0810

Report Written by
Scott Pilkington Team Leader MCERTS Level 2 MM 04 501 TE1 TE2 TE3 TE4

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Report Date
6th October 2011

Version
Version 1

Signature of Report Approver


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Executive Summary

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MONITORING OBJECTIVES

VIP Polymers Ltd, Huntingdon

Stack No. 44

15th September 2011

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 Stack No. 44 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.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary

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MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 44

15th September 2011

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	1.3	0.84	10	g/hr	12.4	7.9	-
Total VOCs (as Carbon)	¹ mg/m ³	1.4	0.15	50	g/hr	13.2	1.4	-
Water Vapour	% v/v	1.7	0.08					
Stack Gas Temperature	°C	20.2						
Stack Gas Velocity	m/s	17.7						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	10139						
Volumetric Flow Rate (REF)	¹ m ³ /hr	9424						

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

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MONITORING DATE(S) & TIMES

VIP Polymers Ltd, Huntingdon

Stack No. 44

15th September 2011

Parameter		Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1	mg/m ³	1.3	15/09/2011	18:30 - 19:30	60
Total VOCs (as Carbon)	Run 1	mg/m ³	1.4	15/09/2011	18:30 - 19:30	60
Velocity & Volumetric Flow Rate	Run 1			15/09/2011	18:12 - 18:23	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. 44

15th September 2011

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	100% of capacity
Continuous or Batch Process	Continuous
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

15th September 2011

	Monitoring				Analysis					
Parameter	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab	MCERTS Testing	LOD (Average)
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-01	Gravimetric	Yes	CAT	Yes	0.12 mg/m³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.21 mg/m³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

Catalyst Environmental Ltd (CAT)	UKAS Accreditation Number: 4279
----------------------------------	---------------------------------

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	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.
Total VOCs (as Carbon)	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	0.45
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)	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	N/A
Safe Access Available	Yes
Easy Access Available	No

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and 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	226	> 5 Pa	Yes
Mean Velocity	m/s	17.7	-	-
Lowest Gas Velocity	m/s	16.2	-	-
Highest Gas Velocity	m/s	19.2	-	-
Ratio of Above	: 1	1.19	< 3 : 1	Yes
Maximum Angle of Swirl	°	8	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

Executive Summary

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PLANT PHOTOS

Photo 1



Photo 2



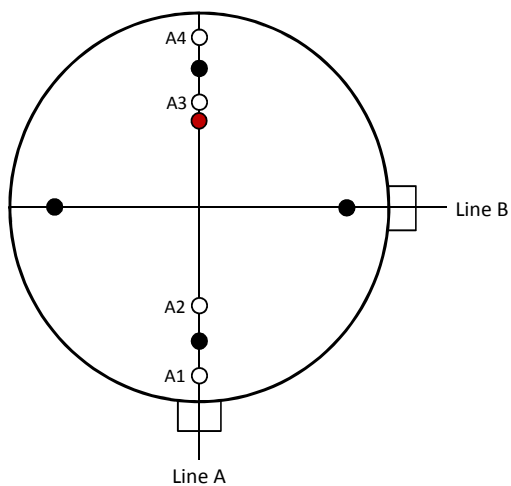
Photo 3



Photo 4



SAMPLE POINTS



where

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

APPENDICES

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Scott Pilkington	MCERTS Level 2	MM 04 501	TE1 TE2 TE3 TE4
Trainee	David Beynon	MCERTS Trainee	MM 11 1138	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 7.20	Horiba PG-250	-	Digital Manometer (1)	CAT 3.32
Box Thermocouples	CAT 3.28	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 7.13	JCT JCC P-1 Cooler	-	Digital Temperature Meter	CAT 3.32
Oven Box	CAT 12.34	5m FT-IR	-	Stopwatch	-
Probe	CAT 5.38	5m FT-IR Sampling System	-	Barometer	CAT 13.12
S-Pitot (1)	CAT 21P.28	Bernath 3006 FID	CAT 8.8	Stack Thermocouple (1)	CAT 4.151
S-Pitot (2)	CAT	Heated Head Filter	CAT 12.31	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.6	1m Heated Line (1)	-
500g Check Weight	CAT 17.12	Mass Flow Controller (2)	CAT 6.5	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.12	Mass View (1)	-	1m Heated Line (3)	-
Last Impinger Arm	-	Mass View (2)	-	5m Heated Line (1)	-
Callipers	CAT 23.12	Easylogger EN-EL-12 Bit	-	15m Heated Line (1)	-
Small DGM	-	-	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	-	-	20m Heated Line (1)	-
Tape Measure	CAT 16.16	-	-		

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

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	20.2
Average Stack Gas Pressure	Pa	272.5
Average Stack Static Pressure, P _{static}	kPa	-0.584
Average Barometric Pressure, P _b	kPa	101.7
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.46	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	77.83	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	1.65	0.0165	18.02	0.8037	0.01329

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	1.196
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.189

Where: P_{STD} = sum of component concentrations, kg/m³ (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m³ (including water vapour)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	20.2	0.0
Total Pressure	kPa	101.1	101.3
Moisture	%	1.65	1.65

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	10139
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	9424
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	9268
Gas Volumetric Flowrate REF ¹	m ³ /hr	9424

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	15/09/2011
Time of Survey	-	18:12 - 18:23
Atmospheric Pressure	kPa	101.7
Stack Static Pressure	Pa	-584
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 (°)	6	6	7	8																

Sampling Line A					
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	227.0	20.2	1.189	16.19
2	0.07	312.0	20.2	1.189	18.98
3	0.11	320.0	20.2	1.189	19.22
4	0.16	292.0	20.2	1.189	18.36
5	0.20	287.0	20.0	1.190	18.19
6	0.25	275.0	20.2	1.189	17.82
7	0.29	269.0	20.2	1.189	17.62
8	0.34	262.0	20.2	1.189	17.39
9	0.38	226.0	20.2	1.189	16.15
10	0.43	255.0	20.2	1.189	17.16
Mean		272.5	20.2	1.189	17.71

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 44

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.3		1.3
Uncertainty	±mg/m ³	0.84		0.84
Mass Emission	g/hr	12.4		12.4
Uncertainty	±g/hr	7.9		7.9

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	1.7		1.7
Uncertainty	±% v/v	0.08		0.08

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.39		0.39

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 / 2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	4 / 4	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1, A2, A3, A4	

Reference Conditions

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

APPENDIX 2

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P _b	mmHg	762.8	
Stack static pressure, P _{static}	mmH ₂ O	-59.6	
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	10.8	
Total mass collected in impingers (silica trap)	g	2.4	
Total mass of liquid collected, V _{lc}	g	13.2	
V _{wstd} = (0.001246)(V _{lc})	m ³	0.0164	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V _m	m ³	0.9788	
Gas meter correction factor, Y _d	-	1.0590	
Average dry gas meter temperature, T _m	°C	18.2	
Average pressure drop across orifice, ΔH	mmH ₂ O	34.0	
V _{mstd} = ((0.3592)(V _m)(P _b + (ΔH/13.6))(Y _d)) / (T _m + 273)	m ³	0.9786	
Moisture content, B_{wv} & R_{wv}			
B _{wv} = V _{wstd} / (V _{mstd} + V _{wstd})	m ³	0.0165	
B _{wv} as a percentage	% v/v	1.65	
Reported Water Vapour, checked with Tables in BS EN 14790, R _{wv}	% v/v	1.65	
Volume of gas metered wet, V_{mstw}			
V _{mstw} = (V _{mstd})(100/(100 - R _{wv}))	m ³	0.9950	
Volume of gas metered at Oxygen Reference Conditions, V_{mstd@X%O₂} & V_{mstw@X%O₂}			
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			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.90	
Total	% v/v	20.96	
N ₂	% v/v	79.04	
M _d = 0.44(%CO ₂)+0.32(%O ₂)+0.28(%N ₂)	g/gmol	28.85	
Molecular weight of stack gas (wet), M_s			
M _s = M _d (1 - (R _{wv} /100)) + 18(R _{wv} /100)	g/gmol	28.67	
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	24.20	
Average square root of velocity heads, √ΔP	√mmH ₂ O	4.92	
Average stack gas temperature, T _s	°C	21.6	
V _s = ((K _p)(C _p)(√ΔP)(√T _s + 273)) / (√(M _s)(P _s))	m/s	16.62	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO₂}), Dry@O_{2REF} (Q_{stdO₂})			
Area of stack, A _s	m ²	0.16	
Q _a = (60)(A _s)(V _s)	m ³ /min	158.6	
Conversion factor (K/mm.Hg), C _f	-	0.3592	
Q _{stw} = ((Q _a)(P _s)(C _f)) / ((T _s + 273))	m ³ /min	146.7	
Q _{std} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273))	m ³ /min	144.3	
Q _{stwO₂} = ((Q _a)(P _s)(C _f)) / ((T _s + 273)(O _{2REFw}))	m ³ /min	N/A	
Q _{stdO₂} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273)(O _{2REFd}))	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D _n	mm	4.73	
Nozzle area, A _n	mm ²	17.57	
Total sampling time, q	min	60	
%I = (4.6398E ⁶)(T _s +273)(V _{mstd}) / (P _s)(V _s)(A _n)(q)(1 - (R _{wv} /100))	%	102.3	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	18:30 - 19:30	
Sampling Dates	-	15/09/2011	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.9950	
Filter I.D. Number	-	47-6657	
Start Filter Mass	g	0.15182	
End Filter Mass	g	0.15178	
Total Mass on Filter	g	-0.00004	
Probe Rinse I.D. Number	-	PR-47-6657	
Start Probe Rinse Mass	g	2.94347	
End Probe Rinse Mass	g	2.94482	
Total Mass in Probe Rinse	g	0.00135	
Total Mass Collected	mg	1.31	
Calculated Concentration	mg/m ³	1.32	
Balance Uncertainty / LOD	mg/m ³	0.12	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	15/09/2011	
Average Volume Sampled (REF)	m ³	0.9950	
Filter I.D. Number	-	47 -6658	
Start Filter Mass	g	0.14998	
End Filter Mass	g	0.15010	
Total Mass on Filter	g	0.00012	
Probe Rinse I.D. Number	-	PR-47 -6658	
Start Probe Rinse Mass	g	2.85279	
End Probe Rinse Mass	g	2.85306	
Total Mass in Probe Rinse	g	0.00027	
Total Mass Collected	mg	0.39	
Calculated Concentration	mg/m ³	0.39	
Balance Uncertainty / LOD	mg/m ³	0.12	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

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Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	17.28	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.12	
Allowable Leak Rate	l/min	0.35	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	5.1	
Allowable MU	%	20	
MU Acceptable	%	Yes	
Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	
Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	102.3	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.12	
Balance Uncertainty	± mg/m ³	0.12	
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	0.12	
20 x Balance Uncertainty	mg	2.40	
Mass Collected	mg	1.31	
Sample Time	mins	60	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	22	
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	20.00	
Pre-Sampling Leak Rate	l/min	0.13	
Post-Sampling Leak Rate	l/min	0.13	
Allowable Leak Rate	l/min	0.40	
Leak Test Acceptable	-	Yes	

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

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

Method Deviations

Nature of Deviation	Run Number	
	1	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)		
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	
In order to maintain isokinetic sampling, a nozzle size smaller than that specified in the Standard was used.	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	0.9788		uV _m	m ³	0.0196	
Sampled Gas Temperature	T _m	291.2		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	0.69		uL	%	-	
Mass of Particulate	m	1.31		um	mg	0.12	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.39		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.69		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.69		≤2%
Mass of Particulate	%	1.21		<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	0.9786		1.35	
Leak	L	mg/m ³	0.005		1.00	
Mass of Particulate	L _r	mg	1.310		1.01	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.23		1.01	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.031	
Leak	mg/m ³	0.0053	
Mass of Particulate	mg/m ³	0.1206	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.2263	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.26	
Expanded uncertainty (95% confidence)	mg/m ³	0.51	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.84	
Reported Uncertainty	mg/m ³	0.84	
Expanded uncertainty (95% confidence)	%	38.5	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	63.5	
Reported Uncertainty	%	63.5	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 44

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.4		1.4
Uncertainty	±mg/m ³	0.15		0.15
Mass Emission	g/hr	13.2		13.2
Uncertainty	±g/hr	1.4		1.4

General Sampling Information

Parameter	Value
Standard	BS EN 12619
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	1.0028
Span Gas Expiry Date	21/05/2013
Span Gas Start Pressure (bar)	150
Gas Cylinder Concentration (ppm)	77.1
Span Gas Uncertainty (%)	2
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A3

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

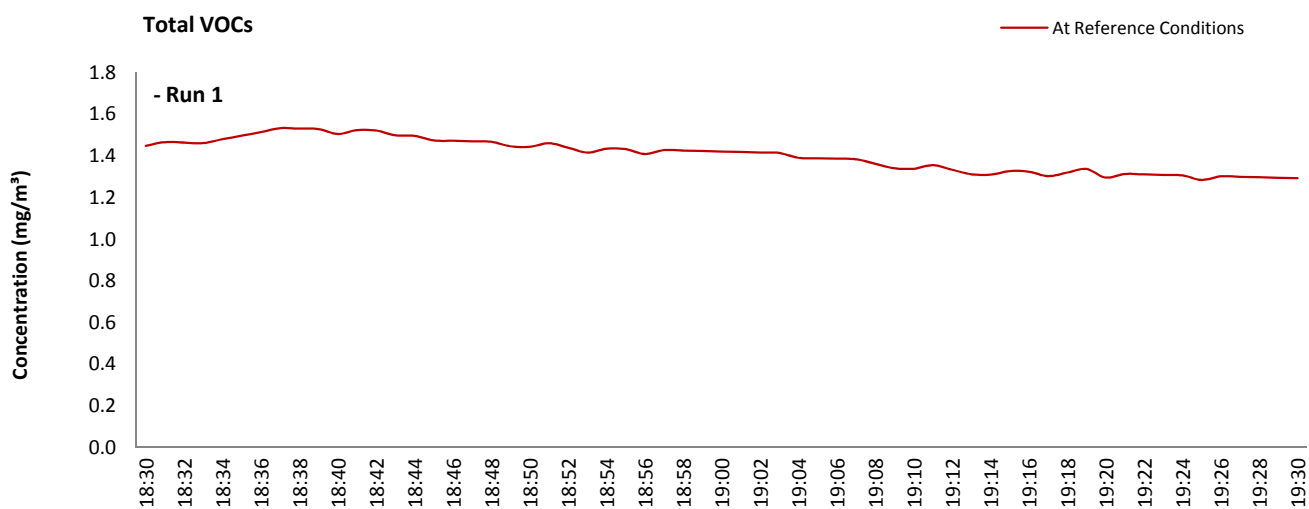
Reference Conditions

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	-	18:30 - 19:30	
Sampling Dates	-	15/09/2011	
Instrument Range	ppm	100	
Span Gas Value	ppm	10.0	

Quality Assurance

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

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	10.00	
	Span Down Sampling Line (Post)	ppm	10.10	
	Span Drift	ppm	0.10	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	8 - 17	

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	0.9		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.016		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.020		
Leak	ppm	0.000		
Calibration Gas Uncertainty	ppm	0.005		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.007		

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)	%	10.5		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	10.5		
Reported Uncertainty	%	10.5		



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. 46 - Spraybooth

Dates of the Monitoring Campaign

15th September 2011

Job Reference Number

CAT-0810

Report Written by
Scott Pilkington Team Leader MCERTS Level 2 MM 04 501 TE1 TE2 TE3 TE4

Report Approved by
James Eldridge Team Leader MCERTS Level 2 MM 05 641 TE1 TE2 TE3 TE4

Report Date
31st October 2011

Version
Version 2

Signature of Report Approver


TITLE PAGE

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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. 46 - Spraybooth
15th September 2011

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. 46 - Spraybooth 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.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary
 (Page 2 of 7)

MONITORING RESULTS

VIP Polymers Ltd, Huntingdon
 Stack No. 46 - Spraybooth
 15th September 2011

Concentration					Mass Emission			
Parameter	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	26.0	1.4	50	g/hr	257	13.8	-
Total VOCs (as Carbon)	¹ mg/m ³	47.8	2.6	50	g/hr	472	25.7	-
Water Vapour	% v/v	4.3	0.21					
Stack Gas Temperature	°C	16.7						
Stack Gas Velocity	m/s	6.7						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	10441						
Volumetric Flow Rate (REF)	¹ m ³ /hr	9880						

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. 46 - Spraybooth
15th September 2011

Parameter		Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1	mg/m³	26.0	15/09/2011	15:10 - 15:40; 15:42 - 16:12	60
Total VOCs (as Carbon)	Run 1	mg/m³	47.8	15/09/2011	15:17 - 16:17	60
Velocity & Volumetric Flow Rate	Run 1			15/09/2011	10:40 -10:51	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

VIP Polymers Ltd, Huntingdon
Stack No. 46 - Spraybooth
15th September 2011

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	Various
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Sprayed Seals
Abatement System	Wet Back Scrubber
Abatement System Running Status	On
Fuel	N/A
Plume Appearance	None Visible

Executive Summary

(Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon
Stack No. 46 - Spraybooth
15th September 2011

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-01	Gravimetric	Yes	CAT	Yes	0.12 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.21 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

Catalyst Environmental Ltd (CAT)	UKAS Accreditation Number: 4279
----------------------------------	---------------------------------

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total VOCs (as Carbon)	1	The measured VOC concentration was >20mg/m ³ (the cut off point for BS EN 12619). Technically, BS EN 13526 should have been selected, but was not as the VOC emissions were anticipated to be <20mg/m ³ .

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.74
Width	m	-
Area	m ²	0.43
Port Depth	cm	4
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

EA Technical Guidance Note M1 / 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	N/A
Safe Access Available	Yes
Easy Access Available	No

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and 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.

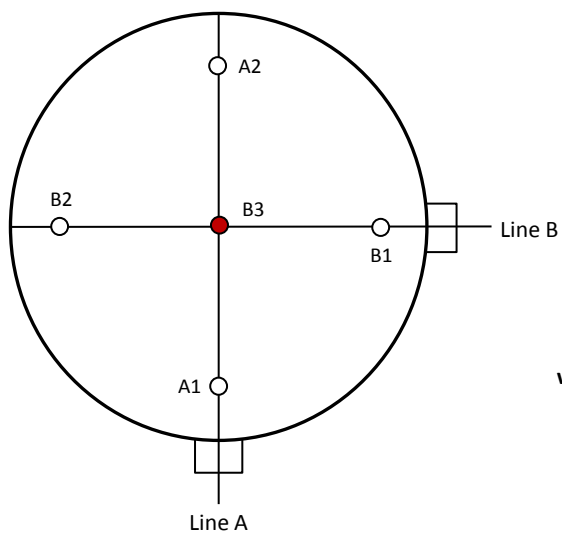
Sampling Plane Validation Criteria (from EA Technical Guidance Document (Monitoring) M1)

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	33.0		> 5 Pa	Yes
Mean Velocity	m/s	6.74		-	-
Lowest Gas Velocity	m/s	6.15		-	-
Highest Gas Velocity	m/s	7.26		-	-
Ratio of Above	: 1	1.18		< 3 : 1	Yes
Maximum Angle of Swirl	°	8		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

PLANT PHOTOS

Due to low light conditions photographs are unavailable

SAMPLE POINTS



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

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Scott Pilkington	MCERTS Level 2	MM 04 501	TE1 TE2 TE3 TE4
Trainee	David Beynon	MCERTS Trainee	MM 11 1138	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 7.20	Horiba PG-250	-	Digital Manometer (1)	CAT 3.32
Box Thermocouples	CAT 3.28	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 7.13	JCT JCC P-1 Cooler	-	Digital Temperature Meter	CAT 3.32
Oven Box	CAT 12.34	5m FT-IR	-	Stopwatch	-
Probe	CAT 5.38	5m FT-IR Sampling System	-	Barometer	CAT 13.12
S-Pitot (1)	CAT 21P.28	Bernath 3006 FID	CAT 8.8	Stack Thermocouple (1)	CAT 4.151
S-Pitot (2)	-	Heated Head Filter	CAT 12.31	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.6	1m Heated Line (1)	-
500g Check Weight	CAT 17.12	Mass Flow Controller (2)	CAT 6.5	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.12	Mass View (1)	-	1m Heated Line (3)	-
Last Impinger Arm	-	Mass View (2)	-	5m Heated Line (1)	-
Callipers	CAT 23.12	Easylogger EN-EL-12 Bit	-	15m Heated Line (1)	-
Small DGM	-	-	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	-	-	20m Heated Line (1)	-
Tape Measure	CAT 16.16	-	-		

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.74
Stack Width, W	m	-
Stack Area, A	m ²	0.43
Average Stack Gas Temperature, T _a	°C	16.7
Average Stack Gas Pressure	Pa	39.8
Average Stack Static Pressure, P _{static}	kPa	0.013
Average Barometric Pressure, P _b	kPa	101.7
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	19.91	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	75.74	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	4.29	0.0429	18.02	0.8037	0.03449

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	1.267
Dry Density (Actual), P _{Actual}	kg/m ³	1.218
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.198

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	16.7	0.0
Total Pressure	kPa	101.7	101.3
Moisture	%	4.29	4.29

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	10441
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	9880
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	9456
Gas Volumetric Flowrate REF ¹	m ³ /hr	9880

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE
(1 of 1)

Parameter	Units	Value
Date of Survey	-	15/09/2011
Time of Survey	-	10:40 -10:51
Atmospheric Pressure	kPa	101.7
Stack Static Pressure	Pa	13
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 (°)	6	6	7	8																

Sampling Line A						Sampling Line B			
Traverse	Depth	ΔP	Temp	Wet Density	Velocity	ΔP	Temp	Wet Density	Velocity
Point	m	Pa	°C	kg/m³	m/s	Pa	°C	kg/m³	m/s
1	0.04	44.0	16.7	1.198	7.10	44.0	16.7	1.198	7.10
2	0.11	40.0	16.7	1.198	6.77	44.0	16.7	1.198	7.10
3	0.19	46.0	16.7	1.198	7.26	44.0	16.7	1.198	7.10
4	0.26	43.0	16.7	1.198	7.02	43.0	16.7	1.198	7.02
5	0.33	40.0	16.7	1.198	6.77	42.0	16.7	1.198	6.94
6	0.41	41.0	16.7	1.198	6.85	39.0	16.7	1.198	6.68
7	0.48	37.0	16.7	1.198	6.51	39.0	16.7	1.198	6.68
8	0.56	38.0	16.7	1.198	6.60	36.0	16.7	1.198	6.42
9	0.63	33.0	16.7	1.198	6.15	35.0	16.7	1.198	6.33
10	0.70	34.0	16.7	1.198	6.24	34.0	16.7	1.198	6.24
Mean		39.6	16.7	1.198	6.73	40.0	16.7	1.198	6.76

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 46 - Spraybooth

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	26.0		26.0
Uncertainty	±mg/m³	1.4		1.4
Mass Emission	g/hr	257		257
Uncertainty	±g/hr	13.8		13.8

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	4.3		4.3
Uncertainty	±% v/v	0.21		0.21

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	0.53		0.53

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, A3, A4	

Reference Conditions

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

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	762.8	
Stack static pressure, P_{static}	mmH ₂ O	0.0	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	762.8	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	25.0	
Total mass collected in impingers (silica trap)	g	10.2	
Total mass of liquid collected, V_{lc}	g	35.2	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0439	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.9902	
Gas meter correction factor, Y_d	-	1.0590	
Average dry gas meter temperature, T_m	°C	21.7	
Average pressure drop across orifice, ΔH	mmH ₂ O	35.1	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.9783	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0429	
B_{wo} as a percentage	% v/v	4.29	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	4.29	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.0222	
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			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.90	
Total	% v/v	20.96	
N ₂	% v/v	79.04	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.85	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.38	
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	6.19	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	2.49	
Average stack gas temperature, T_s	°C	16.0	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (V(M_s)(P_s))$	m/s	8.34	
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	0.43	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	215.4	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	204.2	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	195.4	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	6.73	
Nozzle area, A_n	mm ²	35.58	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	100.9	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	15:10 - 15:40; 15:42 - 16:12	
Sampling Dates	-	15/09/2011	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.0222	
Filter I.D. Number	-	47-6621	
Start Filter Mass	g	0.14948	
End Filter Mass	g	0.17491	
Total Mass on Filter	g	0.02543	
Probe Rinse I.D. Number	-	PR-47-6621	
Start Probe Rinse Mass	g	3.09547	
End Probe Rinse Mass	g	3.09658	
Total Mass in Probe Rinse	g	0.00111	
Total Mass Collected	mg	26.54	
Calculated Concentration	mg/m ³	25.96	
Balance Uncertainty / LOD	mg/m ³	0.12	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	15/09/2011	
Average Volume Sampled (REF)	m ³	1.0222	
Filter I.D. Number	-	47-6620	
Start Filter Mass	g	0.15060	
End Filter Mass	g	0.15071	
Total Mass on Filter	g	0.00011	
Probe Rinse I.D. Number	-	PR-47-6620	
Start Probe Rinse Mass	g	3.20059	
End Probe Rinse Mass	g	3.20102	
Total Mass in Probe Rinse	g	0.00043	
Total Mass Collected	mg	0.54	
Calculated Concentration	mg/m ³	0.53	
Balance Uncertainty / LOD	mg/m ³	0.12	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	17.48	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.12	
Allowable Leak Rate	l/min	0.35	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	4.9	
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	0.12	
Balance Uncertainty	± mg/m ³	0.12	
Daily ELV	mg/m ³	50.00	
Allowable Balance Uncertainty	± mg/m ³	2.50	
Balance Uncertainty Acceptable	-	Yes	

Balance Uncertainty Criteria (2)	Units	Run 1	
Balance Uncertainty	± mg	0.12	
20 x Balance Uncertainty	mg	2.40	
Mass Collected	mg	26.54	
Sample Time	mins	60	
Balance Uncertainty Acceptable	-	N/A	

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

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	20.00	
Pre-Sampling Leak Rate	l/min	0.12	
Post-Sampling Leak Rate	l/min	0.12	
Allowable Leak Rate	l/min	0.40	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m³	5.0	
Blank Acceptable	-	Yes	

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

Method Deviations

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

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	0.9902		uV _m	m ³	0.0198	
Sampled Gas Temperature	T _m	294.7		uT _m	K	2.0	
Sampled Gas Pressure	p _m	101.7		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.69		uL	%	-	
Mass of Particulate	m	26.54		um	mg	0.12	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.54		uUCM	mg	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
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	%	0.69		≤2%
Mass of Particulate	%	0.23		<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	0.9783		26.54	
Leak	L	mg/m ³	0.103		1.00	
Mass of Particulate	L _r	mg	26.540		0.98	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.31		0.98	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.625	
Leak	mg/m ³	0.1029	
Mass of Particulate	mg/m ³	0.1174	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.3050	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.71	
Expanded uncertainty (95% confidence)	mg/m ³	1.40	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	1.40	
Reported Uncertainty	mg/m ³	1.40	
Expanded uncertainty (95% confidence)	%	5.4	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	5.4	
Reported Uncertainty	%	5.4	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 46 - Spraybooth

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	47.8		47.8
Uncertainty	±mg/m ³	2.60		2.60
Mass Emission	g/hr	472		472
Uncertainty	±g/hr	25.7		25.7

General Sampling Information

Parameter	Value
Standard	BS EN 12619
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	1.0028
Span Gas Expiry Date	21/05/2013
Span Gas Start Pressure (bar)	150
Gas Cylinder Concentration (ppm)	77.1
Span Gas Uncertainty (%)	2
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	B3

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

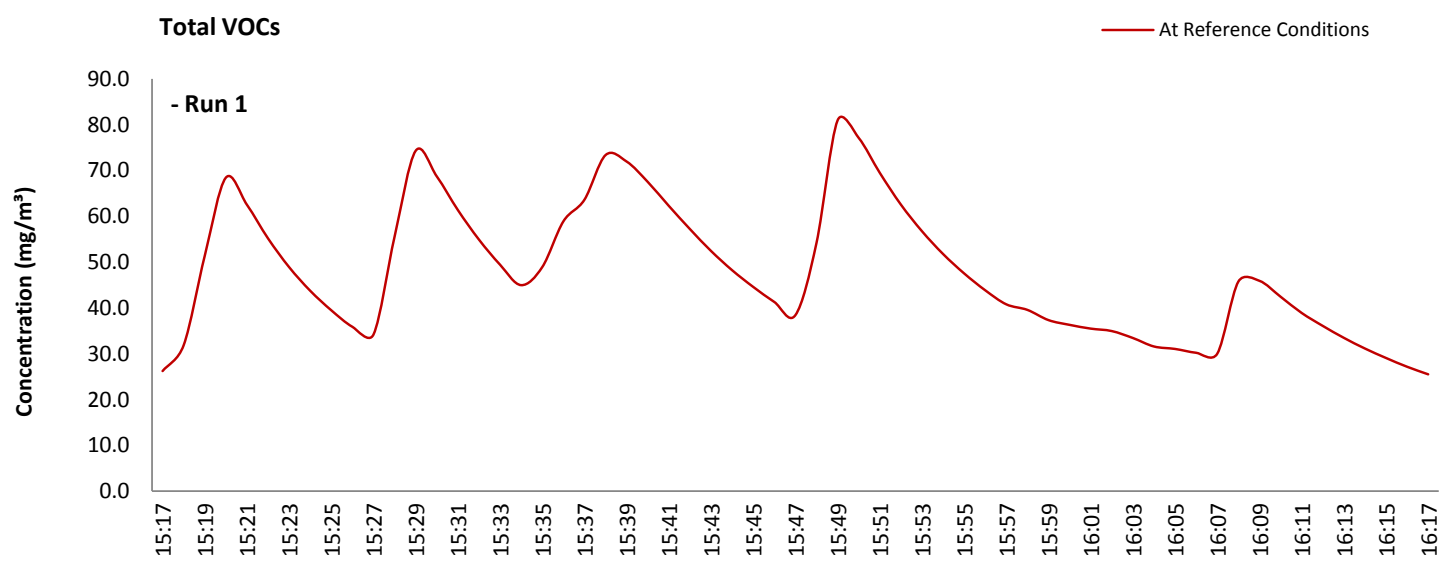
FORMAT: Number Used / Number Required

Reference Conditions

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

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	15:17 - 16:17	
Sampling Dates	-	15/09/2011	
Instrument Range	ppm	100	
Span Gas Value	ppm	10.0	

Quality Assurance

Zero Drift		Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.10	
	Zero Down Sampling Line (Post)	ppm	0.20	
	Zero Drift	ppm	0.10	
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	
Span Drift		Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	10.00	
	Span Down Sampling Line (Post)	ppm	10.10	
	Span Drift	ppm	0.10	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	
Test Conditions		Units	Run 1	
Run Ambient Temperature Range		°C	8 - 17	

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run)	1	
The measured VOC concentration was >20mg/m³ (the cut off point for BS EN 12619). Technically, BS EN 13526 should have been selected, but was not as the VOC emissions were anticipated to be <20mg/m³.	x	

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	29.8		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.016		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.687		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.18		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.24		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.75		
Expanded uncertainty (95% confidence)	ppm	1.47		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	1.62		
Reported Uncertainty	ppm	1.62		
Expanded uncertainty (95% confidence)	%	4.9		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	5.4		
Reported Uncertainty	%	5.4		

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

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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. 7

Dates of the Monitoring Campaign

14th September 2011

Job Reference Number

CAT-0810

Report Written by
Scott Pilkington Team Leader MCERTS Level 2 MM 04 501 TE1 TE2 TE3 TE4

Report Approved by
James Eldridge Team Leader MCERTS Level 2 MM 05 641 TE1 TE2 TE3 TE4

Report Date
6th October 2011

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. 7

14th September 2011

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 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.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary

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MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 7

14th September 2011

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.70	1.18	10	g/hr	1.9	3.2	-
Total VOCs (as Carbon)	¹ mg/m ³	0.21	0.13	50	g/hr	0.57	0.35	-
Water Vapour	% v/v	0.94	0.05					
Stack Gas Temperature	°C	22.5						
Stack Gas Velocity	m/s	11.5						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	2938						
Volumetric Flow Rate (REF)	¹ m ³ /hr	2712						

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 2011

Parameter		Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1	mg/m ³	0.70	14/09/2011	17:17 - 18:17	60
Total VOCs (as Carbon)	Run 1	mg/m ³	0.21	14/07/2011	17:17 - 18:17	60
Velocity & Volumetric Flow Rate	Run 1			14/09/2011	13:45 - 13:50	

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 2011

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	Various
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 2011

	Monitoring				Analysis					
Parameter	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab	MCERTS Testing	LOD (Average)
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-01	Gravimetric	Yes	CAT	Yes	0.09 mg/m³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.21 mg/m³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

Catalyst Environmental Ltd (CAT)	UKAS Accreditation Number: 4279
----------------------------------	---------------------------------

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	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.

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	4
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	N/A
Safe Access Available	Yes
Easy Access Available	No

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and 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	102	> 5 Pa	Yes
Mean Velocity	m/s	11.7	-	-
Lowest Gas Velocity	m/s	10.9	-	-
Highest Gas Velocity	m/s	12.7	-	-
Ratio of Above	: 1	1.17	< 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



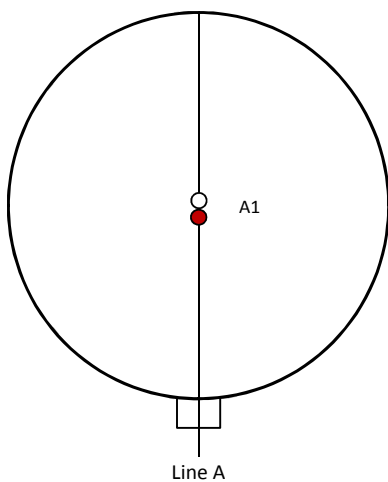
Photo 2



Photo 3



SAMPLE POINTS



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

APPENDICES

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Scott Pilkington	MCERTS Level 2	MM 04 501	TE1 TE2 TE3 TE4
Trainee	David Beynon	MCERTS Trainee	MM 11 1138	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 7.20	Horiba PG-250	-	Digital Manometer (1)	CAT 3.32
Box Thermocouples	CAT 3.28	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 7.13	JCT JCC P-1 Cooler	-	Digital Temperature Meter	CAT 3.32
Oven Box	CAT 12.34	5m FT-IR	-	Stopwatch	-
Probe	CAT 5.38	5m FT-IR Sampling System	-	Barometer	CAT 13.12
S-Pitot (1)	CAT 21P.28	Bernath 3006 FID	CAT 8.8	Stack Thermocouple (1)	CAT 4.151
S-Pitot (2)	-	Heated Head Filter	CAT 12.31	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.6	1m Heated Line (1)	-
500g Check Weight	CAT 17.12	Mass Flow Controller (2)	CAT 6.5	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.12	Mass View (1)	-	1m Heated Line (3)	-
Last Impinger Arm	CAT 4.180	Mass View (2)	-	5m Heated Line (1)	-
Callipers	CAT 23.12	Easylogger EN-EL-12 Bit	-	15m Heated Line (1)	-
Small DGM	-	-	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	-	-	20m Heated Line (1)	CAT 20.32
Tape Measure	CAT 16.16	-	-		

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

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	22.3
Average Stack Gas Pressure	Pa	118.4
Average Stack Static Pressure, P _{static}	kPa	0.001
Average Barometric Pressure, P _b	kPa	101.3
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.60	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.39	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.94	0.0094	18.02	0.8037	0.00758

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	1.283
Dry Density (Actual), P _{Actual}	kg/m ³	1.190
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.186

Where: P_{STD} = sum of component concentrations, kg/m³ (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m³ (including water vapour)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	22.3	0.0
Total Pressure	kPa	101.3	101.3
Moisture	%	0.94	0.94

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	2975
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	2750
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	2724
Gas Volumetric Flowrate REF ¹	m ³ /hr	2750

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	14/09/2011
Time of Survey	-	13:45 - 13:50
Atmospheric Pressure	kPa	101.3
Stack Static Pressure	Pa	1
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 Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	132.0	22.2	1.186	12.36
2	0.05	139.0	22.0	1.187	12.68
3	0.08	134.0	22.2	1.186	12.45
4	0.11	122.0	22.3	1.186	11.88
5	0.14	122.0	22.4	1.185	11.88
6	0.17	107.0	22.3	1.186	11.13
7	0.20	102.0	22.4	1.185	10.87
8	0.23	116.0	22.4	1.185	11.59
9	0.26	103.0	22.4	1.185	10.92
10	0.29	107.0	22.4	1.185	11.13
Mean		118.4	22.3	1.186	11.69

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	0.70		0.70
Uncertainty	±mg/m ³	1.18		1.18
Mass Emission	g/hr	1.9		1.9
Uncertainty	±g/hr	3.2		3.2

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.94		0.94
Uncertainty	±% v/v	0.05		0.05

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.68		0.68

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	759.8	
Stack static pressure, P_{static}	mmH ₂ O	-4.5	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	759.4	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	5.1	
Total mass collected in impingers (silica trap)	g	5.5	
Total mass of liquid collected, V_{lc}	g	10.6	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0132	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.3958	
Gas meter correction factor, Y_d	-	1.0590	
Average dry gas meter temperature, T_m	°C	19.7	
Average pressure drop across orifice, ΔH	mmH ₂ O	67.7	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.3872	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0094	
B_{wo} as a percentage	% v/v	0.94	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.94	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.4004	
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			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.90	
Total	% v/v	20.96	
N ₂	% v/v	79.04	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.85	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.74	
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	11.68	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	3.42	
Average stack gas temperature, T_s	°C	22.5	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (\sqrt{M_s}(P_s))$	m/s	11.54	
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	49.0	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	45.2	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	44.8	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	6.73	
Nozzle area, A_n	mm ²	35.58	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	102.6	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	17:17- 18:17	
Sampling Dates	-	14/09/2011	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.4004	
Filter I.D. Number	-	47-6711	
Start Filter Mass	g	0.15105	
End Filter Mass	g	0.15116	
Total Mass on Filter	g	0.00011	
Probe Rinse I.D. Number	-	PR-47-6711	
Start Probe Rinse Mass	g	2.97859	
End Probe Rinse Mass	g	2.97946	
Total Mass in Probe Rinse	g	0.00087	
Total Mass Collected	mg	0.98	
Calculated Concentration	mg/m ³	0.70	
Balance Uncertainty / LOD	mg/m ³	0.09	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	14/09/2011	
Average Volume Sampled (REF)	m ³	1.4004	
Filter I.D. Number	-	47-6712	
Start Filter Mass	g	0.15267	
End Filter Mass	g	0.15279	
Total Mass on Filter	g	0.00012	
Probe Rinse I.D. Number	-	PR-47-6712	
Start Probe Rinse Mass	g	3.05453	
End Probe Rinse Mass	g	3.05536	
Total Mass in Probe Rinse	g	0.00083	
Total Mass Collected	mg	0.95	
Calculated Concentration	mg/m ³	0.68	
Balance Uncertainty / LOD	mg/m ³	0.09	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	24.64	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.14	
Allowable Leak Rate	l/min	0.49	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	5.2	
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	%	102.6	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.12	
Balance Uncertainty	± mg/m ³	0.09	
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	0.12	
20 x Balance Uncertainty	mg	2.40	
Mass Collected	mg	0.98	
Sample Time	mins	60	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	22	
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	0.05	
Post-Sampling Leak Rate	l/min	0.05	
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	1.3958		uV _m	m ³	0.0279	
Sampled Gas Temperature	T _m	292.7		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	0.57		uL	%	-	
Mass of Particulate	m	0.98		um	mg	0.12	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.95		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	%	0.57		≤2%
Mass of Particulate	%	0.86		<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	1.3872		0.50	
Leak	L	mg/m ³	0.002		1.00	
Mass of Particulate	L _r	mg	0.980		0.71	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.55		0.71	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.017	
Leak	mg/m ³	0.0023	
Mass of Particulate	mg/m ³	0.0857	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.3917	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.40	
Expanded uncertainty (95% confidence)	mg/m ³	0.79	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	1.18	
Reported Uncertainty	mg/m ³	1.18	
Expanded uncertainty (95% confidence)	%	112.4	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	168.6	
Reported Uncertainty	%	168.6	

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	0.21		0.21
Uncertainty	±mg/m ³	0.13		0.13
Mass Emission	g/hr	0.6		0.6
Uncertainty	±g/hr	0.4		0.4

General Sampling Information

Parameter	Value	
Standard	BS EN 12619	
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	1.0028	
Span Gas Expiry Date	21/05/2013	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (ppm)	77.1	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	

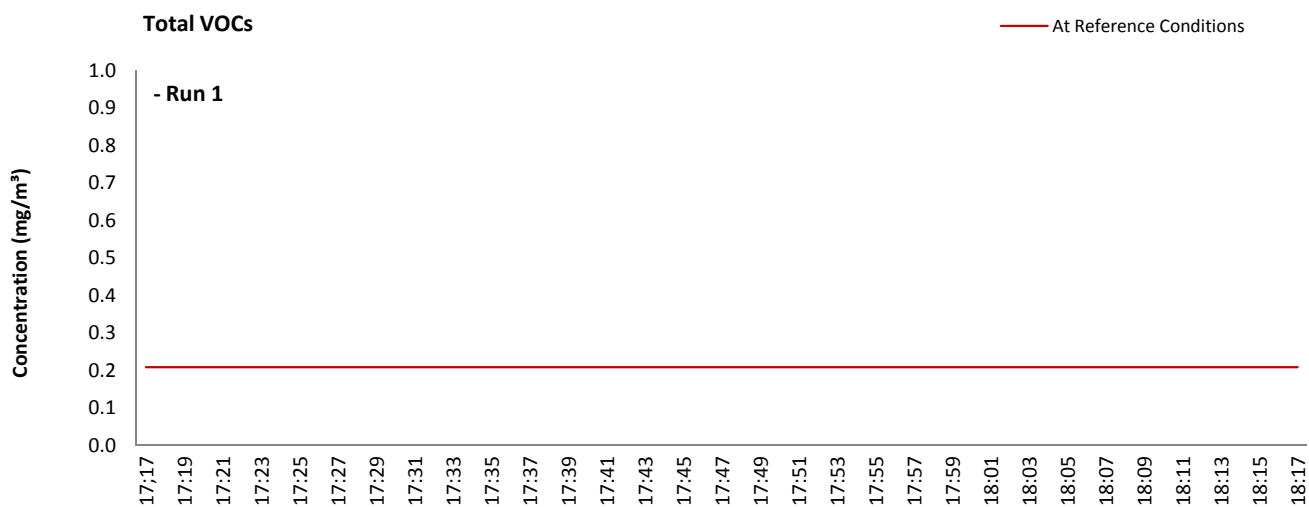
Reference Conditions

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	-	17:17 - 18:17	
Sampling Dates	-	14/09/2011	
Instrument Range	ppm	100	
Span Gas Value	ppm	10.0	

Quality Assurance

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

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	10.00	
	Span Down Sampling Line (Post)	ppm	9.90	
	Span Drift	ppm	-0.10	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	8 - 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	0.1		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.016		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.003		
Leak	ppm	0.000		
Calibration Gas Uncertainty	ppm	0.001		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.001		

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)	%	62.6		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	62.6		
Reported Uncertainty	%	62.6		



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. 8a

Dates of the Monitoring Campaign

14th September 2011

Job Reference Number

CAT-0810

Report Written by
Scott Pilkington Team Leader MCERTS Level 2 MM 04 501 TE1 TE2 TE3 TE4

Report Approved by
James Eldridge Team Leader MCERTS Level 2 MM 05 641 TE1 TE2 TE3 TE4

Report Date
6th October 2011

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. 8a

14th September 2011

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 Stack No. 8a 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.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 8a

14th September 2011

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.90	0.23	10	g/hr	1.2	0.31	-
Total VOCs (as Carbon)	¹ mg/m ³	0.39	0.13	50	g/hr	0.53	0.18	-
Water Vapour	% v/v	0.44	0.03					
Stack Gas Temperature	°C	41.3						
Stack Gas Velocity	m/s	3.5						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	1574						
Volumetric Flow Rate (REF)	¹ m ³ /hr	1367						

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. 8a

14th September 2011

Parameter		Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1	mg/m ³	0.90	14/09/2011	15:56 - 16:56	60
Total VOCs (as Carbon)	Run 1	mg/m ³	0.39	14/09/2011	12:39 - 13:39	60
Velocity & Volumetric Flow Rate	Run 1			14/09/2011	13:45 - 13:50	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. 8a

14th September 2011

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	Various
Continuous or Batch Process	Continuous
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

(Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon

Stack No. 8a

14th September 2011

	Monitoring				Analysis					
Parameter	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab	MCERTS Testing	LOD (Average)
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-01	Gravimetric	Yes	CAT	Yes	0.1 mg/m³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.21 mg/m³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

Catalyst Environmental Ltd (CAT)	UKAS Accreditation Number: 4279
----------------------------------	---------------------------------

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	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.
Total Particulate Matter	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.

Executive Summary

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SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.40
Width	m	-
Area	m ²	0.13
Port Depth	cm	4
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)	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	N/A
Safe Access Available	Yes
Easy Access Available	No

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and 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	8.0	> 5 Pa	Yes
Mean Velocity	m/s	4.33	-	-
Lowest Gas Velocity	m/s	3.13	-	-
Highest Gas Velocity	m/s	5.31	-	-
Ratio of Above	: 1	1.70	< 3 : 1	Yes
Maximum Angle of Swirl	°	2	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

Executive Summary

(Page 7 of 7)

PLANT PHOTOS

Photo 1



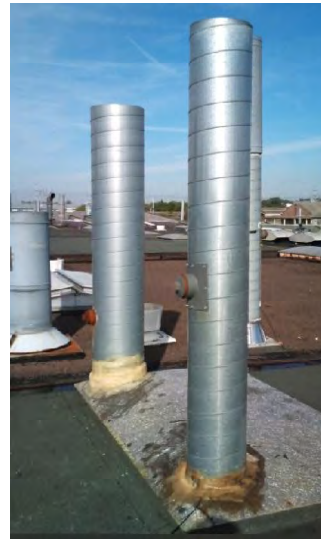
Photo 2



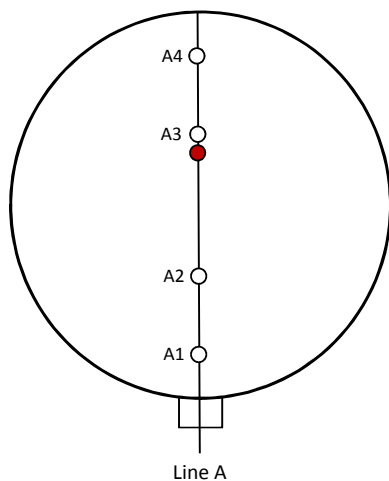
Photo 3



Photo 4



SAMPLE POINTS



where

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

APPENDICES

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Scott Pilkington	MCERTS Level 2	MM 04 501	TE1 TE2 TE3 TE4
Trainee	David Beynon	MCERTS Trainee	MM 11 1138	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 7.20	Horiba PG-250	-	Digital Manometer (1)	CAT 3.32
Box Thermocouples	CAT 3.28	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 7.13	JCT JCC P-1 Cooler	-	Digital Temperature Meter	CAT 3.32
Oven Box	CAT 12.34	5m FT-IR	-	Stopwatch	-
Probe	CAT 5.38	5m FT-IR Sampling System	-	Barometer	CAT 13.12
S-Pitot (1)	CAT 21P.28	Bernath 3006 FID	CAT 8.8	Stack Thermocouple (1)	CAT 4.151
S-Pitot (2)	-	Heated Head Filter	CAT 12.31	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.6	1m Heated Line (1)	-
500g Check Weight	CAT 17.12	Mass Flow Controller (2)	CAT 6.5	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.12	Mass View (1)	-	1m Heated Line (3)	-
Last Impinger Arm	CAT 4.180	Mass View (2)	-	5m Heated Line (1)	-
Callipers	CAT 23.12	Easylogger EN-EL-12 Bit	-	15m Heated Line (1)	-
Small DGM	-	-	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	-	-	20m Heated Line (1)	CAT 20.32
Tape Measure	CAT 16.16	-	-		

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.40
Stack Width, W	m	-
Stack Area, A	m ²	0.13
Average Stack Gas Temperature, T _a	°C	40.3
Average Stack Gas Pressure	Pa	15.7
Average Stack Static Pressure, P _{static}	kPa	0.001
Average Barometric Pressure, P _b	kPa	101.3
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.71	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.80	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.44	0.0044	18.02	0.8037	0.00350

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	1.122
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.120

Where: P_{STD} = sum of component concentrations, kg/m³ (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m³ (including water vapour)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	40.3	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	1959
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	1707
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	1700
Gas Volumetric Flowrate REF ¹	m ³ /hr	1707

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	14/09/2011
Time of Survey	-	13:45 - 13:50
Atmospheric Pressure	kPa	101.3
Stack Static Pressure	Pa	1
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 (°)	2	2	2	2																

Sampling Line A					
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	20.0	40.2	1.120	4.95
2	0.06	23.0	40.2	1.120	5.31
3	0.10	20.0	40.2	1.120	4.95
4	0.14	17.0	40.2	1.120	4.56
5	0.18	18.0	40.2	1.120	4.70
6	0.22	18.0	40.4	1.119	4.70
7	0.26	11.0	40.4	1.119	3.67
8	0.30	8.0	40.4	1.119	3.13
9	0.34	10.0	40.4	1.119	3.50
10	0.38	12.0	40.4	1.119	3.84
Mean		15.7	40.3	1.120	4.33

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 8a

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.90		0.90
Uncertainty	±mg/m ³	0.23		0.23
Mass Emission	g/hr	1.2		1.2
Uncertainty	±g/hr	0.3		0.3

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.44		0.44
Uncertainty	±% v/v	0.03		0.03

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.10		0.10

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	1 / 2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	4 / 4	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1, A2, A3, A4	

Reference Conditions

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

APPENDIX 2

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	759.8	
Stack static pressure, P_{static}	mmH ₂ O	0.0	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	759.8	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	4.3	
Total mass collected in impingers (silica trap)	g	-0.2	
Total mass of liquid collected, V_{lc}	g	4.1	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0051	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.1717	
Gas meter correction factor, Y_d	-	1.0590	
Average dry gas meter temperature, T_m	°C	18.4	
Average pressure drop across orifice, ΔH	mmH ₂ O	48.9	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.1675	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0044	
B_{wo} as a percentage	% v/v	0.44	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.44	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.1726	
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			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.90	
Total	% v/v	20.96	
N ₂	% v/v	79.04	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.85	
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	1.00	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	1.00	
Average stack gas temperature, T_s	°C	41.3	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (\sqrt{M_s}(P_s))$	m/s	3.48	
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	0.13	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	26.2	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	22.8	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	22.7	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	11.66	
Nozzle area, A_n	mm ²	106.79	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	101.0	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	15:56 - 16:56	
Sampling Dates	-	14/09/2011	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.1726	
Filter I.D. Number	-	47-6783	
Start Filter Mass	g	0.15348	
End Filter Mass	g	0.15360	
Total Mass on Filter	g	0.00012	
Probe Rinse I.D. Number	-	PR-47-6783	
Start Probe Rinse Mass	g	3.06407	
End Probe Rinse Mass	g	3.06501	
Total Mass in Probe Rinse	g	0.00094	
Total Mass Collected	mg	1.06	
Calculated Concentration	mg/m ³	0.90	
Balance Uncertainty / LOD	mg/m ³	0.10	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	14/09/2011	
Average Volume Sampled (REF)	m ³	1.1726	
Filter I.D. Number	-	47-6714	
Start Filter Mass	g	0.15064	
End Filter Mass	g	0.15069	
Total Mass on Filter	g	0.00005	
Probe Rinse I.D. Number	-	PR-47-6714	
Start Probe Rinse Mass	g	2.99885	
End Probe Rinse Mass	g	2.99890	
Total Mass in Probe Rinse	g	0.00005	
Total Mass Collected	mg	0.10	
Calculated Concentration	mg/m ³	0.09	
Balance Uncertainty / LOD	mg/m ³	0.10	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	20.68	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.11	
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)	%	6.8	
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	0.12	
Balance Uncertainty	± mg/m ³	0.10	
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	0.12	
20 x Balance Uncertainty	mg	2.40	
Mass Collected	mg	1.06	
Sample Time	mins	60	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	41	
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	20.00	
Pre-Sampling Leak Rate	l/min	0.05	
Post-Sampling Leak Rate	l/min	0.05	
Allowable Leak Rate	l/min	0.40	
Leak Test Acceptable	-	Yes	

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

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

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
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	1.1717		uV _m	m ³	0.0234	
Sampled Gas Temperature	T _m	291.4		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	0.53		uL	%	-	
Mass of Particulate	m	1.06		um	mg	0.12	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.10		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.69		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.53		≤2%
Mass of Particulate	%	1.02		<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	1.1675		0.77	
Leak	L	mg/m ³	0.003		1.00	
Mass of Particulate	L _r	mg	1.060		0.85	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.06		0.85	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.022	
Leak	mg/m ³	0.0028	
Mass of Particulate	mg/m ³	0.1023	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.0492	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.12	
Expanded uncertainty (95% confidence)	mg/m ³	0.23	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.23	
Reported Uncertainty	mg/m ³	0.23	
Expanded uncertainty (95% confidence)	%	25.1	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	25.1	
Reported Uncertainty	%	25.1	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 8a

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.39		0.39
Uncertainty	±mg/m ³	0.13		0.13
Mass Emission	g/hr	0.53		0.53
Uncertainty	±g/hr	0.18		0.18

General Sampling Information

Parameter	Value
Standard	BS EN 12619
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	1.0028
Span Gas Expiry Date	21/05/2013
Span Gas Start Pressure (bar)	150
Gas Cylinder Concentration (ppm)	77.1
Span Gas Uncertainty (%)	2
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A3

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

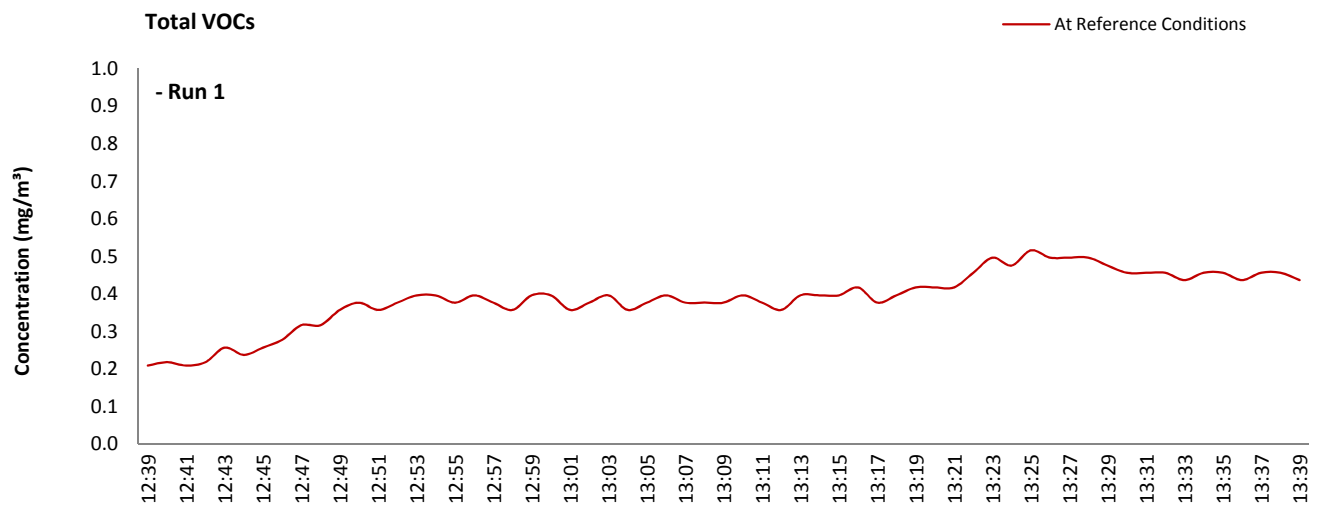
Reference Conditions

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	-	12:39 - 13:39	
Sampling Dates	-	14/09/2011	
Instrument Range	ppm	100	
Span Gas Value	ppm	10.0	

Quality Assurance

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

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	10.00	
	Span Down Sampling Line (Post)	ppm	9.90	
	Span Drift	ppm	-0.10	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	8 - 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	0.24		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.016		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.006		
Leak	ppm	0.000		
Calibration Gas Uncertainty	ppm	0.001		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.002		

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)	%	34.1		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	34.1		
Reported Uncertainty	%	34.1		



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. 8b

Dates of the Monitoring Campaign

14th September 2011

Job Reference Number

CAT-0810

Report Written by
Scott Pilkington Team Leader MCERTS Level 2 MM 04 501 TE1 TE2 TE3 TE4

Report Approved by
James Eldridge Team Leader MCERTS Level 2 MM 05 641 TE1 TE2 TE3 TE4

Report Date
6th October 2011

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. 8b

14th September 2011

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. 8b 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.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 8b

14th September 2011

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.83	0.38	10	g/hr	0.98	0.45	-
Total VOCs (as Carbon)	¹ mg/m ³	0.22	0.13	50	g/hr	0.26	0.15	-
Water Vapour	% v/v	1.0	0.05					
Stack Gas Temperature	°C	21.9						
Stack Gas Velocity	m/s	5.0						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	1273						
Volumetric Flow Rate (REF)	¹ m ³ /hr	1178						

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. 8b

14th September 2011

Parameter		Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1	mg/m ³	0.83	14/09/2011	14:37 - 15:37	60
Total VOCs (as Carbon)	Run 1	mg/m ³	0.22	14/09/2011	14:37 - 15:37	60
Velocity & Volumetric Flow Rate	Run 1			14/09/2011	13:35 - 13:43	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. 8b

14th September 2011

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	Various
Continuous or Batch Process	Continuous
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

(Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon

Stack No. 8b

14th September 2011

	Monitoring				Analysis					
Parameter	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab	MCERTS Testing	LOD (Average)
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-01	Gravimetric	Yes	CAT	Yes	0.1 mg/m³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.21 mg/m³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

Catalyst Environmental Ltd (CAT)	UKAS Accreditation Number: 4279
----------------------------------	---------------------------------

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	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.

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	3
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)	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	N/A
Safe Access Available	Yes
Easy Access Available	No

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and 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	87.0	> 5 Pa	Yes
Mean Velocity	m/s	10.7	-	-
Lowest Gas Velocity	m/s	10.1	-	-
Highest Gas Velocity	m/s	11.4	-	-
Ratio of Above	: 1	1.13	< 3 : 1	Yes
Maximum Angle of Swirl	°	0	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

Executive Summary

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PLANT PHOTOS

Photo 1



Photo 2

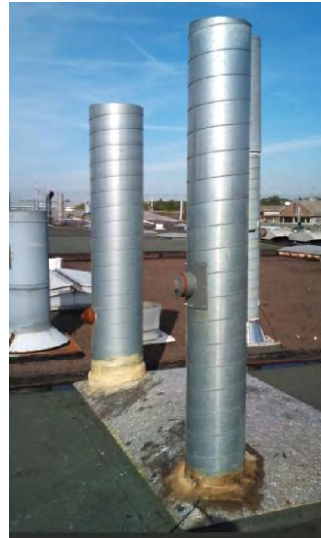
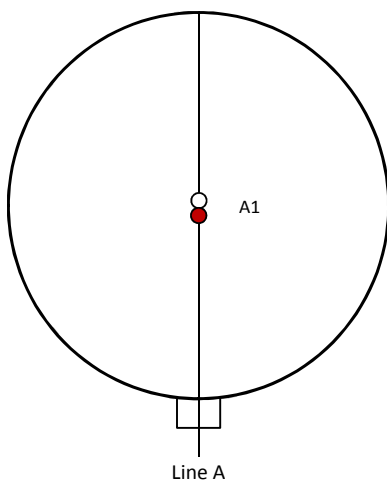


Photo 3



SAMPLE POINTS



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

APPENDICES

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Scott Pilkington	MCERTS Level 2	MM 04 501	TE1 TE2 TE3 TE4
Trainee	David Beynon	MCERTS Trainee	MM 11 1138	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 7.20	Horiba PG-250	-	Digital Manometer (1)	CAT 3.32
Box Thermocouples	CAT 3.28	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 7.13	JCT JCC P-1 Cooler	-	Digital Temperature Meter	CAT 3.32
Oven Box	-	5m FT-IR	-	Stopwatch	-
Probe	CAT 5.38	5m FT-IR Sampling System	-	Barometer	CAT 13.12
S-Pitot (1)	CAT 21P.28	Bernath 3006 FID	CAT 8.8	Stack Thermocouple (1)	CAT 4.151
S-Pitot (2)	-	Heated Head Filter	CAT 12.31	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.6	1m Heated Line (1)	-
500g Check Weight	CAT 17.12	Mass Flow Controller (2)	CAT 6.5	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.12	Mass View (1)	-	1m Heated Line (3)	-
Last Impinger Arm	CAT 4.180	Mass View (2)	-	5m Heated Line (1)	-
Callipers	CAT 23.12	Easylogger EN-EL-12 Bit	-	15m Heated Line (1)	-
Small DGM	-	-	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	-	-	20m Heated Line (1)	-
Tape Measure	CAT 16.16	-	-		

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

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	24.8
Average Stack Gas Pressure	Pa	98.0
Average Stack Static Pressure, P _{static}	kPa	0.022
Average Barometric Pressure, P _b	kPa	101.3
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.59	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.34	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	1.01	0.0101	18.02	0.8037	0.00814

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	1.282
Dry Density (Actual), P _{Actual}	kg/m ³	1.180
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.176

Where: P_{STD} = sum of component concentrations, kg/m³ (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m³ (including water vapour)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	24.8	0.0
Total Pressure	kPa	101.3	101.3
Moisture	%	1.01	1.01

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	2720
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	2494
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	2469
Gas Volumetric Flowrate REF ¹	m ³ /hr	2494

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	14/09/2011
Time of Survey	-	13:35 - 13:43
Atmospheric Pressure	kPa	101.3
Stack Static Pressure	Pa	22
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 Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	88.0	24.8	1.176	10.13
2	0.05	101.0	24.8	1.176	10.86
3	0.08	111.0	24.8	1.176	11.38
4	0.11	110.0	24.8	1.176	11.33
5	0.14	98.0	24.8	1.176	10.69
6	0.17	98.0	24.8	1.176	10.69
7	0.20	97.0	24.8	1.176	10.64
8	0.23	87.0	24.8	1.176	10.08
9	0.26	94.0	24.8	1.176	10.47
10	0.29	96.0	24.8	1.176	10.58
Mean		98.0	24.8	1.176	10.69

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 8b

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.83		0.83
Uncertainty	±mg/m ³	0.38		0.38
Mass Emission	g/hr	0.98		0.98
Uncertainty	±g/hr	0.45		0.45

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	1.01		1.01
Uncertainty	±% v/v	0.05		0.05

Blank Runs

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

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	759.8	
Stack static pressure, P_{static}	mmH ₂ O	0.0	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	759.8	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	8.8	
Total mass collected in impingers (silica trap)	g	1.3	
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	1.2300	
Gas meter correction factor, Y_d	-	1.0590	
Average dry gas meter temperature, T_m	°C	17.5	
Average pressure drop across orifice, ΔH	mmH ₂ O	52.5	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.2299	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0101	
B_{wo} as a percentage	% v/v	1.01	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	1.01	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.2425	
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			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.90	
Total	% v/v	20.96	
N ₂	% v/v	79.04	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.85	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.74	
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	2.20	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	1.48	
Average stack gas temperature, T_s	°C	21.9	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (\sqrt{M_s}(P_s))$	m/s	5.00	
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	21.2	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	19.6	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	19.4	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	9.64	
Nozzle area, A_n	mm ²	73.00	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	102.1	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	14:37 - 15:37	
Sampling Dates	-	14/09/2011	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.2425	
Filter I.D. Number	-	47-6484	
Start Filter Mass	g	0.14648	
End Filter Mass	g	0.14648	
Total Mass on Filter	g	0.00000	
Probe Rinse I.D. Number	-	PR-47-6484	
Start Probe Rinse Mass	g	3.14158	
End Probe Rinse Mass	g	3.14261	
Total Mass in Probe Rinse	g	0.00103	
Total Mass Collected	mg	1.03	
Calculated Concentration	mg/m ³	0.83	
Balance Uncertainty / LOD	mg/m ³	0.10	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	14/09/2011	
Average Volume Sampled (REF)	m ³	1.2425	
Filter I.D. Number	-	47-6489	
Start Filter Mass	g	0.14772	
End Filter Mass	g	0.14769	
Total Mass on Filter	g	-0.00003	
Probe Rinse I.D. Number	-	PR-47-6489	
Start Probe Rinse Mass	g	2.91097	
End Probe Rinse Mass	g	2.91118	
Total Mass in Probe Rinse	g	0.00021	
Total Mass Collected	mg	0.18	
Calculated Concentration	mg/m ³	0.14	
Balance Uncertainty / LOD	mg/m ³	0.10	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	21.71	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.12	
Allowable Leak Rate	l/min	0.43	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	5.2	
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	%	102.1	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.12	
Balance Uncertainty	± mg/m ³	0.10	
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	0.12	
20 x Balance Uncertainty	mg	2.40	
Mass Collected	mg	1.03	
Sample Time	mins	60	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	22	
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	20.00	
Pre-Sampling Leak Rate	l/min	0.05	
Post-Sampling Leak Rate	l/min	0.05	
Allowable Leak Rate	l/min	0.40	
Leak Test Acceptable	-	Yes	

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

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

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
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	1.2300		uV _m	m ³	0.0246	
Sampled Gas Temperature	T _m	290.5		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	0.55		uL	%	-	
Mass of Particulate	m	1.03		um	mg	0.12	
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	%	0.69		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.55		≤2%
Mass of Particulate	%	0.97		<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	1.2299		0.67	
Leak	L	mg/m ³	0.003		1.00	
Mass of Particulate	L _r	mg	1.030		0.80	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.10		0.80	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.020	
Leak	mg/m ³	0.0026	
Mass of Particulate	mg/m ³	0.0966	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.0836	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.13	
Expanded uncertainty (95% confidence)	mg/m ³	0.25	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.38	
Reported Uncertainty	mg/m ³	0.38	
Expanded uncertainty (95% confidence)	%	30.6	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	45.9	
Reported Uncertainty	%	45.9	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 8b

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.22		0.22
Uncertainty	±mg/m ³	0.13		0.13
Mass Emission	g/hr	0.26		0.26
Uncertainty	±g/hr	0.15		0.15

General Sampling Information

Parameter	Value	
Standard	BS EN 12619	
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	1.0028	
Span Gas Expiry Date	21/05/2013	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (ppm)	77.1	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	

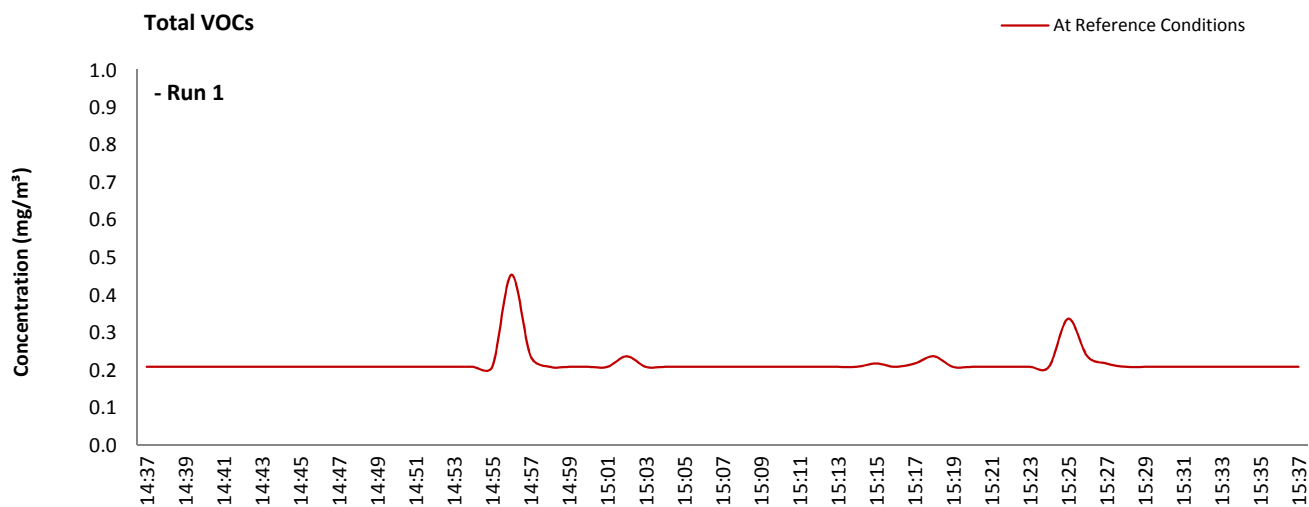
Reference Conditions

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	-	14:37 - 15:37	
Sampling Dates	-	14/09/2011	
Instrument Range	ppm	100	
Span Gas Value	ppm	10.0	

Quality Assurance

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

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	10.00	
	Span Down Sampling Line (Post)	ppm	9.90	
	Span Drift	ppm	-0.10	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	8 -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	0.14		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.016		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.003		
Leak	ppm	0.000		
Calibration Gas Uncertainty	ppm	0.001		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.001		

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)	%	60.2		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	60.2		
Reported Uncertainty	%	60.2		



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. 10

Dates of the Monitoring Campaign
14th September 2011

Job Reference Number
CAT-0810

Report Written by
Scott Pilkington Team Leader MCERTS Level 2 MM 04 501 TE1 TE2 TE3 TE4

Report Approved by
James Eldridge Team Leader MCERTS Level 2 MM 05 641 TE1 TE2 TE3 TE4

Report Date
6th October 2011

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. 10

14th September 2011

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 Stack No. 10 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.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 10

14th September 2011

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	2.2	1.14	10	g/hr	34.0	17.3	-
Total VOCs (as Carbon)	¹ mg/m ³	0.84	0.14	50	g/hr	12.8	2.1	-
Water Vapour	% v/v	1.3	0.07					
Stack Gas Temperature	°C	28.2						
Stack Gas Velocity	m/s	10.5						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	16781						
Volumetric Flow Rate (REF)	¹ m ³ /hr	15211						

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. 10

14th September 2011

Parameter	Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1 mg/m ³	2.23	14/09/2011	13:05 - 13:35: 13:37-14:07	60
Total VOCs (as Carbon)	Run 1 mg/m ³	0.84	14/09/2011	13:05 - 14:05	60
Velocity & Volumetric Flow Rate	Run 1		14/09/2011	12:20 - 12:32	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. 10

14th September 2011

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	Various
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

(Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon

Stack No. 10

14th September 2011

	Monitoring				Analysis					
Parameter	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab	MCERTS Testing	LOD (Average)
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-01	Gravimetric	Yes	CAT	Yes	0.17 mg/m³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.21 mg/m³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

Catalyst Environmental Ltd (CAT)	UKAS Accreditation Number: 4279
----------------------------------	---------------------------------

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	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.

Executive Summary

(Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

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

Location of Sampling Platform

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

Platform Details

EA Technical Guidance Note M1 / 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	N/A
Safe Access Available	Yes
Easy Access Available	No

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and 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	44.0	> 5 Pa	Yes
Mean Velocity	m/s	10.5	-	-
Lowest Gas Velocity	m/s	7.21	-	-
Highest Gas Velocity	m/s	14.8	-	-
Ratio of Above	: 1	2.06	< 3 : 1	Yes
Maximum Angle of Swirl	°	4	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

Executive Summary

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PLANT PHOTOS

Photo 1



Photo 2



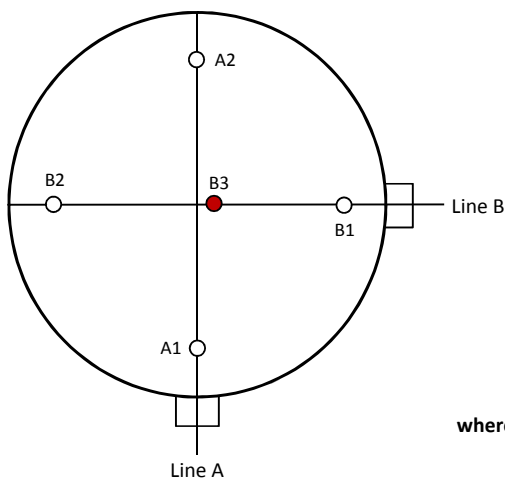
Photo 3



Photo 4



SAMPLE POINTS



where

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

APPENDICES

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Scott Pilkington	MCERTS Level 2	MM 04 501	TE1 TE2 TE3 TE4
Trainee	David Beynon	MCERTS Trainee	MM 11 1138	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 7.20	Horiba PG-250	-	Digital Manometer (1)	CAT 3.32
Box Thermocouples	CAT 3.28	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 7.13	JCT JCC P-1 Cooler	-	Digital Temperature Meter	CAT 3.32
Oven Box	CAT 12.34	5m FT-IR	-	Stopwatch	-
Probe	CAT 5.38	5m FT-IR Sampling System	-	Barometer	CAT 13.12
S-Pitot (1)	CAT 21P.28	Bernath 3006 FID	CAT 8.8	Stack Thermocouple (1)	CAT 4.151
S-Pitot (2)	-	Heated Head Filter	CAT 12.31	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.6	1m Heated Line (1)	-
500g Check Weight	CAT 17.12	Mass Flow Controller (2)	CAT 6.5	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.12	Mass View (1)	-	1m Heated Line (3)	-
Last Impinger Arm	CAT 4.180	Mass View (2)	-	5m Heated Line (1)	-
Callipers	CAT 23.12	Easylogger EN-EL-12 Bit	-	15m Heated Line (1)	-
Small DGM	-	-	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	-	-	20m Heated Line (1)	-
Tape Measure	CAT 16.16	-	-		

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.75
Stack Width, W	m	-
Stack Area, A	m ²	0.44
Average Stack Gas Temperature, T _a	°C	28.2
Average Stack Gas Pressure	Pa	98.1
Average Stack Static Pressure, P _{static}	kPa	0.022
Average Barometric Pressure, P _b	kPa	101.3
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.53	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.13	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	1.28	0.0128	18.02	0.8037	0.01029

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	1.167
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.161

Where: P_{STD} = sum of component concentrations, kg/m³ (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m³ (including water vapour)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	28.2	0.0
Total Pressure	kPa	101.3	101.3
Moisture	%	1.28	1.28

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	16781
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	15211
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	15016
Gas Volumetric Flowrate REF ¹	m ³ /hr	15211

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	14/09/2011
Time of Survey	-	12:20 - 12:32
Atmospheric Pressure	kPa	101.3
Stack Static Pressure	Pa	22
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	3	3	3	2	4	2	2												

Sampling Line A						Sampling Line B				
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	
1	0.04	98.0	28.1	1.162	10.76	99.0	28.2	1.161	10.82	
2	0.11	186.0	28.2	1.161	14.82	144.0	28.3	1.161	13.05	
3	0.19	175.0	28.2	1.161	14.38	134.0	28.1	1.162	12.58	
4	0.26	114.0	28.2	1.161	11.61	133.0	28.3	1.161	12.54	
5	0.34	118.0	28.2	1.161	11.81	44.0	28.2	1.161	7.21	
6	0.41	89.0	28.2	1.161	10.25	56.0	28.2	1.161	8.13	
7	0.49	89.0	28.3	1.161	10.26	66.0	28.2	1.161	8.83	
8	0.56	53.0	28.4	1.161	7.92	76.0	28.3	1.161	9.48	
9	0.64	61.0	28.4	1.161	8.49	87.0	28.3	1.161	10.14	
10	0.71	49.0	28.4	1.161	7.61	90.0	28.2	1.161	10.31	
Mean		103.2	28.3	1.161	10.79	92.9	28.2	1.161	10.31	

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 10

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	2.2		2.2
Uncertainty	±mg/m ³	1.14		1.14
Mass Emission	g/hr	34.0		34.0
Uncertainty	±g/hr	17.3		17.3

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	1.3		1.3
Uncertainty	±% v/v	0.07		0.07

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.60		0.60

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	759.8	
Stack static pressure, P_{static}	mmH ₂ O	2.2	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	759.9	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-9.9	
Total mass collected in impingers (silica trap)	g	17.3	
Total mass of liquid collected, V_{lc}	g	7.4	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0092	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.7101	
Gas meter correction factor, Y_d	-	1.0590	
Average dry gas meter temperature, T_m	°C	16.0	
Average pressure drop across orifice, ΔH	mmH ₂ O	14.8	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.7112	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0128	
B_{wo} as a percentage	% v/v	1.28	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	1.28	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.7205	
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			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.90	
Total	% v/v	20.96	
N ₂	% v/v	79.04	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.85	
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	2.68	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	1.64	
Average stack gas temperature, T_s	°C	28.3	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (\sqrt{M_s}(P_s))$	m/s	5.59	
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	0.44	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	148.1	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	134.2	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	132.5	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	6.72	
Nozzle area, A_n	mm ²	35.51	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	111.3	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	13:05 - 13:35: 13:37- 14:07	
Sampling Dates	-	14/09/2011	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.7205	
Filter I.D. Number	-	47-6781	
Start Filter Mass	g	0.14959	
End Filter Mass	g	0.14996	
Total Mass on Filter	g	0.00037	
Probe Rinse I.D. Number	-	PR-47-6781	
Start Probe Rinse Mass	g	3.01431	
End Probe Rinse Mass	g	3.01555	
Total Mass in Probe Rinse	g	0.00124	
Total Mass Collected	mg	1.61	
Calculated Concentration	mg/m ³	2.23	
Balance Uncertainty / LOD	mg/m ³	0.17	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	14/09/2011	
Average Volume Sampled (REF)	m ³	0.7205	
Filter I.D. Number	-	47-6782	
Start Filter Mass	g	0.15140	
End Filter Mass	g	0.15156	
Total Mass on Filter	g	0.00016	
Probe Rinse I.D. Number	-	PR-47-6782	
Start Probe Rinse Mass	g	3.09289	
End Probe Rinse Mass	g	3.09316	
Total Mass in Probe Rinse	g	0.00027	
Total Mass Collected	mg	0.43	
Calculated Concentration	mg/m ³	0.60	
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	12.53	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.06	
Allowable Leak Rate	l/min	0.25	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	5.5	
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	%	111.3	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.12	
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	0.12	
20 x Balance Uncertainty	mg	2.40	
Mass Collected	mg	1.61	
Sample Time	mins	60	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	28	
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	20.00	
Pre-Sampling Leak Rate	l/min	0.05	
Post-Sampling Leak Rate	l/min	0.05	
Allowable Leak Rate	l/min	0.40	
Leak Test Acceptable	-	Yes	

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

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

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
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	0.7101		uV _m	m ³	0.0142	
Sampled Gas Temperature	T _m	289.0		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	0.48		uL	%	-	
Mass of Particulate	m	1.61		um	mg	0.12	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.43		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.69		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.48		≤2%
Mass of Particulate	%	1.67		<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	0.7112		3.14	
Leak	L	mg/m ³	0.006		1.00	
Mass of Particulate	L _r	mg	1.610		1.39	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.25		1.39	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.053	
Leak	mg/m ³	0.0062	
Mass of Particulate	mg/m ³	0.1666	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.3446	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.39	
Expanded uncertainty (95% confidence)	mg/m ³	0.76	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	1.14	
Reported Uncertainty	mg/m ³	1.14	
Expanded uncertainty (95% confidence)	%	33.9	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	50.8	
Reported Uncertainty	%	50.8	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 10

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.84		0.84
Uncertainty	±mg/m ³	0.14		0.14
Mass Emission	g/hr	12.8		12.8
Uncertainty	±g/hr	2.1		2.1

General Sampling Information

Parameter	Value	
Standard	BS EN 12619	
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	1.0028	
Span Gas Expiry Date	21/05/2013	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (ppm)	77.1	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	B3	

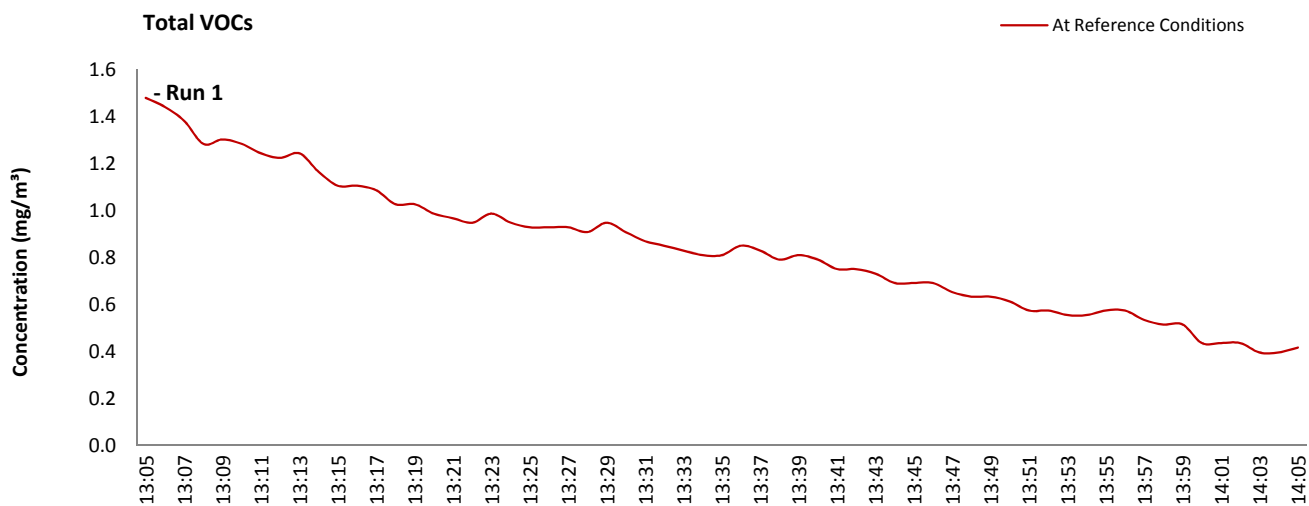
Reference Conditions

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	-	13:05 - 14:05	
Sampling Dates	-	14/09/2011	
Instrument Range	ppm	100	
Span Gas Value	ppm	10.0	

Quality Assurance

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

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	10.00	
	Span Down Sampling Line (Post)	ppm	9.90	
	Span Drift	ppm	-0.10	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	8 -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	0.5		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.016		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.012		
Leak	ppm	0.000		
Calibration Gas Uncertainty	ppm	0.003		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.004		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.04		
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)	%	16.3		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	16.3		
Reported Uncertainty	%	16.3		



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. A11

Dates of the Monitoring Campaign

15th September 2011

Job Reference Number

CAT-0810

Report Written by
Scott Pilkington Team Leader MCERTS Level 2 MM 04 501 TE1 TE2 TE3 TE4

Report Approved by
James Eldridge Team Leader MCERTS Level 2 MM 05 641 TE1 TE2 TE3 TE4

Report Date
6th October 2011

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. A11

15th September 2011

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 Stack No. A11 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.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary

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MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. A11

15th September 2011

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.89	0.28	10	g/hr	14.7	4.6	-
Total VOCs (as Carbon)	¹ mg/m ³	1.5	0.15	50	g/hr	24.0	2.5	-
Water Vapour	% v/v	0.94	0.05					
Stack Gas Temperature	°C	24.8						
Stack Gas Velocity	m/s	11.3						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	17945						
Volumetric Flow Rate (REF)	¹ m ³ /hr	16517						

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

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MONITORING DATE(S) & TIMES

VIP Polymers Ltd, Huntingdon

Stack No. A11

15th September 2011

Parameter		Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1	mg/m ³	0.89	15/09/2011	11:20 - 11:50; 11:52-12:22	60
Total VOCs (as Carbon)	Run 1	mg/m ³	1.5	15/09/2011	11:22 - 12:22	60
Velocity & Volumetric Flow Rate	Run 1			15/09/2011	10:40 -10:51	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. A11

15th September 2011

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	Various
Continuous or Batch Process	Continuous
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. A11

15th September 2011

	Monitoring				Analysis					
Parameter	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab	MCERTS Testing	LOD (Average)
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-01	Gravimetric	Yes	CAT	Yes	0.09 mg/m³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.21 mg/m³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

Catalyst Environmental Ltd (CAT)	UKAS Accreditation Number: 4279
----------------------------------	---------------------------------

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	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.

Executive Summary

(Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.75
Width	m	-
Area	m ²	0.44
Port Depth	cm	4
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	N/A
Safe Access Available	Yes
Easy Access Available	No

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and 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	71.0	> 5 Pa	Yes
Mean Velocity	m/s	11.3	-	-
Lowest Gas Velocity	m/s	9.09	-	-
Highest Gas Velocity	m/s	14.5	-	-
Ratio of Above	: 1	1.60	< 3 : 1	Yes
Maximum Angle of Swirl	°	2	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

Executive Summary

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PLANT PHOTOS

Photo 1



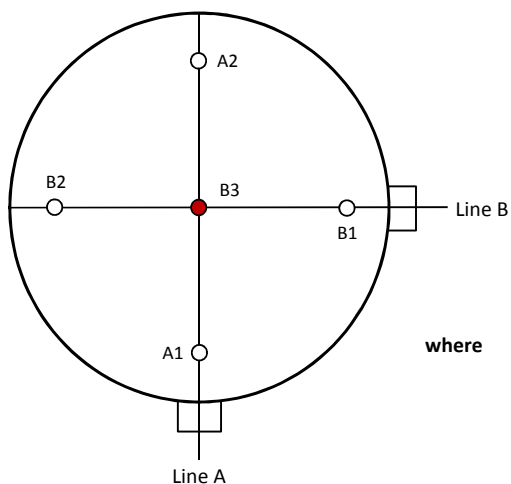
Photo 2



Photo 3



SAMPLE POINTS



where

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

APPENDICES

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Scott Pilkington	MCERTS Level 2	MM 04 501	TE1 TE2 TE3 TE4
Trainee	David Beynon	MCERTS Trainee	MM 11 1138	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 7.20	Horiba PG-250	-	Digital Manometer (1)	CAT 3.32
Box Thermocouples	CAT 3.28	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 7.13	JCT JCC P-1 Cooler	-	Digital Temperature Meter	CAT 3.32
Oven Box	CAT 12.34	5m FT-IR	-	Stopwatch	-
Probe	CAT 5.38	5m FT-IR Sampling System	-	Barometer	CAT 13.12
S-Pitot (1)	CAT 21P.28	Bernath 3006 FID	CAT 8.8	Stack Thermocouple (1)	CAT 4.151
S-Pitot (2)	-	Heated Head Filter	CAT 12.31	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.6	1m Heated Line (1)	-
500g Check Weight	CAT 17.12	Mass Flow Controller (2)	CAT 6.5	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.12	Mass View (1)	-	1m Heated Line (3)	-
Last Impinger Arm	-	Mass View (2)	-	5m Heated Line (1)	-
Callipers	CAT 23.12	Easylogger EN-EL-12 Bit	-	15m Heated Line (1)	-
Small DGM	-	-	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	-	-	20m Heated Line (1)	-
Tape Measure	CAT 16.16	-	-		

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.75
Stack Width, W	m	-
Stack Area, A	m ²	0.44
Average Stack Gas Temperature, T _a	°C	24.8
Average Stack Gas Pressure	Pa	111.5
Average Stack Static Pressure, P _{static}	kPa	0.013
Average Barometric Pressure, P _b	kPa	101.7
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.60	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.40	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.94	0.0094	18.02	0.8037	0.00754

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	1.283
Dry Density (Actual), P _{Actual}	kg/m ³	1.185
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.181

Where: P_{STD} = sum of component concentrations, kg/m³ (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m³ (including water vapour)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	24.8	0.0
Total Pressure	kPa	101.7	101.3
Moisture	%	0.94	0.94

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	17945
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	16517
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	16362
Gas Volumetric Flowrate REF ¹	m ³ /hr	16517

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	15/09/2011
Time of Survey	-	10:40 -10:51
Atmospheric Pressure	kPa	101.7
Stack Static Pressure	Pa	13
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	2	1	2																

Sampling Line A						Sampling Line B				
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	
1	0.04	153.0	24.6	1.181	13.33	129.0	24.6	1.181	12.24	
2	0.11	169.0	24.8	1.181	14.02	124.0	24.8	1.181	12.01	
3	0.19	182.0	24.8	1.181	14.54	144.0	24.8	1.181	12.94	
4	0.26	123.0	24.8	1.181	11.96	136.0	24.8	1.181	12.57	
5	0.34	94.0	24.6	1.181	10.45	102.0	24.8	1.181	10.89	
6	0.41	89.0	24.6	1.181	10.17	92.0	24.8	1.181	10.34	
7	0.49	76.0	24.7	1.181	9.40	84.0	24.8	1.181	9.88	
8	0.56	89.0	24.8	1.181	10.17	91.0	25.0	1.180	10.29	
9	0.64	88.0	24.8	1.181	10.11	96.0	25.1	1.180	10.57	
10	0.71	71.0	25.1	1.180	9.09	98.0	25.2	1.179	10.68	
Mean		113.4	24.8	1.181	11.32	109.6	24.9	1.180	11.24	

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. A11

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.89		0.89
Uncertainty	±mg/m ³	0.28		0.28
Mass Emission	g/hr	14.7		14.7
Uncertainty	±g/hr	4.6		4.6

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.94		0.94
Uncertainty	±% v/v	0.05		0.05

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.09		0.09

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	762.8	
Stack static pressure, P_{static}	mmH ₂ O	1.3	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	762.9	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	6.4	
Total mass collected in impingers (silica trap)	g	4.0	
Total mass of liquid collected, V_{lc}	g	10.4	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0130	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.3848	
Gas meter correction factor, Y_d	-	1.0590	
Average dry gas meter temperature, T_m	°C	22.5	
Average pressure drop across orifice, ΔH	mmH ₂ O	63.0	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.3678	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0094	
B_{wo} as a percentage	% v/v	0.94	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.94	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.3807	
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			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.90	
Total	% v/v	20.96	
N ₂	% v/v	79.04	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.85	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.74	
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	10.75	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	3.28	
Average stack gas temperature, T_s	°C	22.0	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (\sqrt{M_s}(P_s))$	m/s	11.04	
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	0.44	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	292.6	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	271.8	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	269.3	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	6.73	
Nozzle area, A_n	mm ²	35.58	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	105.1	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	11:20 - 11:50; 11:52- 12:22	
Sampling Dates	-	15/09/2011	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.3807	
Filter I.D. Number	-	47-6613	
Start Filter Mass	g	0.15156	
End Filter Mass	g	0.15166	
Total Mass on Filter	g	0.00010	
Probe Rinse I.D. Number	-	PR-47-6613	
Start Probe Rinse Mass	g	2.89233	
End Probe Rinse Mass	g	2.89346	
Total Mass in Probe Rinse	g	0.00113	
Total Mass Collected	mg	1.23	
Calculated Concentration	mg/m ³	0.89	
Balance Uncertainty / LOD	mg/m ³	0.09	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	15/09/2011	
Average Volume Sampled (REF)	m ³	1.3807	
Filter I.D. Number	-	47-6490	
Start Filter Mass	g	0.15119	
End Filter Mass	g	0.15125	
Total Mass on Filter	g	0.00006	
Probe Rinse I.D. Number	-	PR-47-6490	
Start Probe Rinse Mass	g	2.91760	
End Probe Rinse Mass	g	2.91762	
Total Mass in Probe Rinse	g	0.00002	
Total Mass Collected	mg	0.08	
Calculated Concentration	mg/m ³	0.06	
Balance Uncertainty / LOD	mg/m ³	0.09	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	24.44	
Pre-Sampling Leak Rate	l/min	0.12	
Post-Sampling Leak Rate	l/min	0.12	
Allowable Leak Rate	l/min	0.49	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	5.2	
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	%	105.1	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.12	
Balance Uncertainty	± mg/m ³	0.09	
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	0.12	
20 x Balance Uncertainty	mg	2.40	
Mass Collected	mg	1.23	
Sample Time	mins	60	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	22	
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	0.12	
Post-Sampling Leak Rate	l/min	0.12	
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	1.3848		uV _m	m ³	0.0277	
Sampled Gas Temperature	T _m	295.5		uT _m	K	2.0	
Sampled Gas Pressure	p _m	101.7		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.49		uL	%	-	
Mass of Particulate	m	1.23		um	mg	0.12	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.08		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	%	0.49		≤2%
Mass of Particulate	%	0.87		<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	1.3678		0.65	
Leak	L	mg/m ³	0.003		1.00	
Mass of Particulate	L _r	mg	1.230		0.72	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.05		0.72	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.021	
Leak	mg/m ³	0.0025	
Mass of Particulate	mg/m ³	0.0869	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.0335	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.10	
Expanded uncertainty (95% confidence)	mg/m ³	0.19	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.28	
Reported Uncertainty	mg/m ³	0.28	
Expanded uncertainty (95% confidence)	%	21.0	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	31.6	
Reported Uncertainty	%	31.6	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. A11

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.5		1.5
Uncertainty	±mg/m ³	0.15		0.15
Mass Emission	g/hr	24.0		24.0
Uncertainty	±g/hr	2.5		2.5

General Sampling Information

Parameter	Value	
Standard	BS EN 12619	
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	1.0028	
Span Gas Expiry Date	21/05/2013	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (ppm)	77.1	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	B3	

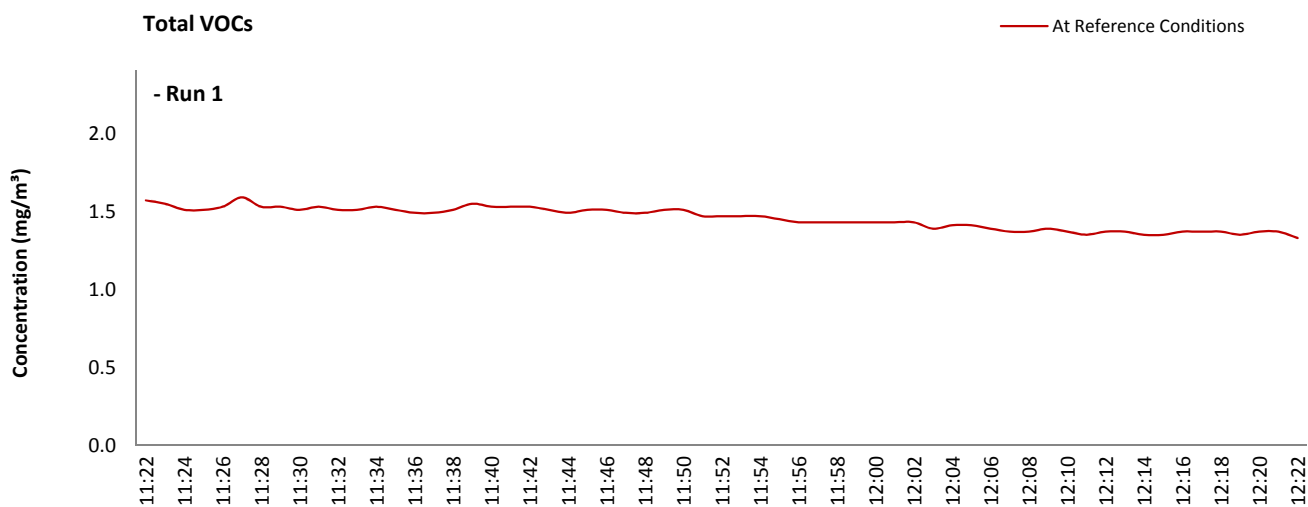
Reference Conditions

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	-	11:22 - 12:22	
Sampling Dates	-	15/09/2011	
Instrument Range	ppm	100	
Span Gas Value	ppm	10.0	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.20	
	Zero Down Sampling Line (Post)	ppm	0.20	
	Zero Drift	ppm	0.00	
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	10.10	
	Span Down Sampling Line (Post)	ppm	10.10	
	Span Drift	ppm	0.00	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	8 -17	

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	0.90		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.016		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.021		
Leak	ppm	0.000		
Calibration Gas Uncertainty	ppm	0.005		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.007		

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)	%	10.2		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	10.2		
Reported Uncertainty	%	10.2		



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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. 35c

Dates of the Monitoring Campaign

15th September 2011

Job Reference Number

CAT-0810

Report Written by
Scott Pilkington Team Leader MCERTS Level 2 MM 04 501 TE1 TE2 TE3 TE4

Report Approved by
James Eldridge Team Leader MCERTS Level 2 MM 05 641 TE1 TE2 TE3 TE4

Report Date
6th October 2011

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. 35c

15th September 2011

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 Stack No. 35c 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.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 35c

15th September 2011

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.99	0.30	10	g/hr	16.4	5.0	-
Total VOCs (as Carbon)	¹ mg/m ³	1.7	0.16	50	g/hr	28.5	2.6	-
Water Vapour	% v/v	1.1	0.06					
Stack Gas Temperature	°C	24.5						
Stack Gas Velocity	m/s	13.8						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	18042						
Volumetric Flow Rate (REF)	¹ m ³ /hr	16620						

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

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MONITORING DATE(S) & TIMES

VIP Polymers Ltd, Huntingdon

Stack No. 35c

15th September 2011

Parameter	Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1 mg/m ³	0.99	15/09/2011	10:05 - 10:35 ; 10:37-11:07	60
Total VOCs (as Carbon)	Run 1 mg/m ³	1.7	15/09/2011	10:05 - 11:05	60
Velocity & Volumetric Flow Rate	Run 1		15/09/2011	09:23 - 09:35	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. 35c

15th September 2011

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	Various
Continuous or Batch Process	Continuous
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

(Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP Polymers Ltd, Huntingdon

Stack No. 35c

15th September 2011

	Monitoring				Analysis					
Parameter	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab	MCERTS Testing	LOD (Average)
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-01	Gravimetric	Yes	CAT	Yes	0.09 mg/m³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.21 mg/m³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

Catalyst Environmental Ltd (CAT)	UKAS Accreditation Number: 4279
----------------------------------	---------------------------------

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	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.

Executive Summary

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SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.68
Width	m	-
Area	m ²	0.36
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	N/A
Safe Access Available	Yes
Easy Access Available	No

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and 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	112	> 5 Pa	Yes
Mean Velocity	m/s	13.8	-	-
Lowest Gas Velocity	m/s	11.4	-	-
Highest Gas Velocity	m/s	15.7	-	-
Ratio of Above	: 1	1.38	< 3 : 1	Yes
Maximum Angle of Swirl	°	2	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

Executive Summary

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PLANT PHOTOS

Photo 1



Photo 2



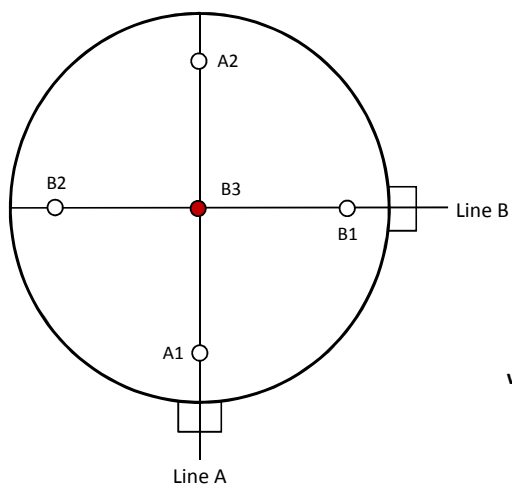
Photo 3



Photo 4



SAMPLE POINTS



where

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

APPENDICES

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Scott Pilkington	MCERTS Level 2	MM 04 501	TE1 TE2 TE3 TE4
Trainee	David Beynon	MCERTS Trainee	MM 11 1138	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 7.20	Horiba PG-250	-	Digital Manometer (1)	CAT 3.32
Box Thermocouples	CAT 3.28	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 7.13	JCT JCC P-1 Cooler	-	Digital Temperature Meter	CAT 3.32
Oven Box	CAT 12.34	5m FT-IR	-	Stopwatch	-
Probe	CAT 5.38	5m FT-IR Sampling System	-	Barometer	CAT 13.12
S-Pitot (1)	CAT 21P.28	Bernath 3006 FID	CAT 8.8	Stack Thermocouple (1)	CAT 4.151
S-Pitot (2)	-	Heated Head Filter	CAT 12.31	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.6	1m Heated Line (1)	-
500g Check Weight	CAT 17.12	Mass Flow Controller (2)	CAT 6.5	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.12	Mass View (1)	-	1m Heated Line (3)	-
Last Impinger Arm	-	Mass View (2)	-	5m Heated Line (1)	-
Callipers	CAT 23.12	Easylogger EN-EL-12 Bit	-	15m Heated Line (1)	-
Small DGM	-	-	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	-	-	20m Heated Line (1)	-
Tape Measure	CAT 16.16	-	-		

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.68
Stack Width, W	m	-
Stack Area, A	m ²	0.36
Average Stack Gas Temperature, T _a	°C	24.5
Average Stack Gas Pressure	Pa	165.1
Average Stack Static Pressure, P _{static}	kPa	0.005
Average Barometric Pressure, P _b	kPa	101.7
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.57	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.28	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	1.09	0.0109	18.02	0.8037	0.00872

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	1.282
Dry Density (Actual), P _{Actual}	kg/m ³	1.186
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.181

Where: P_{STD} = sum of component concentrations, kg/m³ (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m³ (including water vapour)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	24.5	0.0
Total Pressure	kPa	101.7	101.3
Moisture	%	1.09	1.09

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	18042
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	16620
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	16440
Gas Volumetric Flowrate REF ¹	m ³ /hr	16620

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	15/09/2011
Time of Survey	-	09:23 - 09:35
Atmospheric Pressure	kPa	101.7
Stack Static Pressure	Pa	5
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	2	1	2																

Sampling Line A						Sampling Line B				
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	
1	0.03	169.0	24.4	1.182	14.01	169.0	24.5	1.181	14.01	
2	0.10	177.0	24.4	1.182	14.34	213.0	24.5	1.181	15.73	
3	0.17	171.0	24.5	1.181	14.10	199.0	24.5	1.181	15.21	
4	0.24	135.0	24.4	1.182	12.52	193.0	24.5	1.181	14.97	
5	0.31	167.0	24.5	1.181	13.93	179.0	24.5	1.181	14.42	
6	0.37	160.0	24.8	1.180	13.64	184.0	24.5	1.181	14.62	
7	0.44	154.0	24.7	1.180	13.38	194.0	24.5	1.181	15.01	
8	0.51	154.0	24.6	1.181	13.38	196.0	24.6	1.181	15.09	
9	0.58	130.0	24.6	1.181	12.29	114.0	24.6	1.181	11.51	
10	0.65	132.0	24.6	1.181	12.39	112.0	24.6	1.181	11.41	
Mean		154.9	24.6	1.181	13.40	175.3	24.5	1.181	14.20	

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 35c

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.99		0.99
Uncertainty	±mg/m ³	0.30		0.30
Mass Emission	g/hr	16.4		16.4
Uncertainty	±g/hr	5.0		5.0

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	1.1		1.1
Uncertainty	±% v/v	0.06		0.06

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.09		0.09

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	762.8	
Stack static pressure, P_{static}	mmH ₂ O	2.0	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	762.9	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	10.3	
Total mass collected in impingers (silica trap)	g	1.9	
Total mass of liquid collected, V_{lc}	g	12.2	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0152	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.3983	
Gas meter correction factor, Y_d	-	1.0590	
Average dry gas meter temperature, T_m	°C	21.8	
Average pressure drop across orifice, ΔH	mmH ₂ O	65.6	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.3852	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0109	
B_{wo} as a percentage	% v/v	1.09	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	1.09	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.4004	
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			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.90	
Total	% v/v	20.96	
N ₂	% v/v	79.04	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.85	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.73	
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	11.32	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	3.36	
Average stack gas temperature, T_s	°C	24.7	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (\sqrt{M_s}(P_s))$	m/s	11.38	
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	0.36	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	248.0	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	228.3	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	225.8	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	6.73	
Nozzle area, A_n	mm ²	35.58	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	104.4	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	10:05 - 10:35 ; 10:37 - 11:07	
Sampling Dates	-	15/09/2011	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.4004	
Filter I.D. Number	-	47-6710	
Start Filter Mass	g	0.15117	
End Filter Mass	g	0.15135	
Total Mass on Filter	g	0.00018	
Probe Rinse I.D. Number	-	PR-47-6710	
Start Probe Rinse Mass	g	2.92328	
End Probe Rinse Mass	g	2.92448	
Total Mass in Probe Rinse	g	0.00120	
Total Mass Collected	mg	1.38	
Calculated Concentration	mg/m ³	0.99	
Balance Uncertainty / LOD	mg/m ³	0.09	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	15/09/2011	
Average Volume Sampled (REF)	m ³	1.4004	
Filter I.D. Number	-	47-6754	
Start Filter Mass	g	0.15133	
End Filter Mass	g	0.15115	
Total Mass on Filter	g	-0.00018	
Probe Rinse I.D. Number	-	PR-47-6754	
Start Probe Rinse Mass	g	2.86215	
End Probe Rinse Mass	g	2.86221	
Total Mass in Probe Rinse	g	0.00006	
Total Mass Collected	mg	-0.12	
Calculated Concentration	mg/m ³	-0.09	
Balance Uncertainty / LOD	mg/m ³	0.09	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	24.68	
Pre-Sampling Leak Rate	l/min	0.12	
Post-Sampling Leak Rate	l/min	0.12	
Allowable Leak Rate	l/min	0.49	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	5.1	
Allowable MU	%	20	
MU Acceptable	%	Yes	
Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	
Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	104.4	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.12	
Balance Uncertainty	± mg/m ³	0.09	
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	0.12	
20 x Balance Uncertainty	mg	2.40	
Mass Collected	mg	1.38	
Sample Time	mins	60	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	25	
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	0.10	
Post-Sampling Leak Rate	l/min	0.10	
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	1.3983		uV _m	m ³	0.0280	
Sampled Gas Temperature	T _m	294.8		uT _m	K	2.0	
Sampled Gas Pressure	p _m	101.7		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.49		uL	%	-	
Mass of Particulate	m	1.38		um	mg	0.12	
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	%	0.49		≤2%
Mass of Particulate	%	0.86		<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	1.3852	0.71	
Leak	L	mg/m ³	0.003	1.00	
Mass of Particulate	L _r	mg	1.380	0.71	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A	N/A	
Uncollected Mass	UCM	mg	-0.07	0.71	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.024	
Leak	mg/m ³	0.0028	
Mass of Particulate	mg/m ³	0.0857	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	-0.0495	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.10	
Expanded uncertainty (95% confidence)	mg/m ³	0.20	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.30	
Reported Uncertainty	mg/m ³	0.30	
Expanded uncertainty (95% confidence)	%	20.2	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	30.4	
Reported Uncertainty	%	30.4	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 35c

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.7		1.7
Uncertainty	±mg/m ³	0.16		0.16
Mass Emission	g/hr	28.5		28.5
Uncertainty	±g/hr	2.6		2.6

General Sampling Information

Parameter	Value	
Standard	BS EN 12619	
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	1.0028	
Span Gas Expiry Date	21/05/2013	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (ppm)	77.1	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	B3	

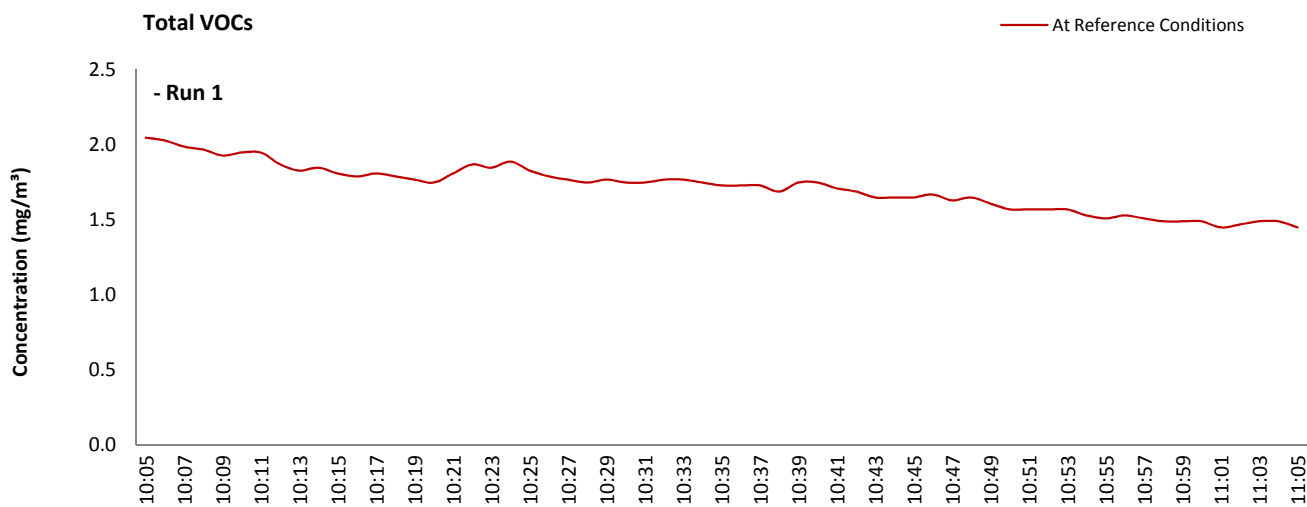
Reference Conditions

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	-	10:05 - 11:05	
Sampling Dates	-	15/09/2011	
Instrument Range	ppm	100	
Span Gas Value	ppm	10.0	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.20	
	Zero Down Sampling Line (Post)	ppm	0.20	
	Zero Drift	ppm	0.00	
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	10.10	
	Span Down Sampling Line (Post)	ppm	10.10	
	Span Drift	ppm	0.00	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	8 -17	

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	1.1		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.016		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.025		
Leak	ppm	0.000		
Calibration Gas Uncertainty	ppm	0.006		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.009		

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)	%	9.1		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	9.1		
Reported Uncertainty	%	9.1		



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. 35d

Dates of the Monitoring Campaign

15th September 2011

Job Reference Number

CAT-0810

Report Written by
Scott Pilkington Team Leader MCERTS Level 2 MM 04 501 TE1 TE2 TE3 TE4

Report Approved by
James Eldridge Team Leader MCERTS Level 2 MM 05 641 TE1 TE2 TE3 TE4

Report Date
6th October 2011

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. 35d

15th September 2011

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 Stack No. 35d 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.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

VIP Polymers Ltd, Huntingdon

Stack No. 35d

15th September 2011

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	1.0	0.65	10	g/hr	19.1	12.0	-
Total VOCs (as Carbon)	¹ mg/m ³	2.2	0.17	50	g/hr	41.0	3.1	-
Water Vapour	% v/v	1.2	0.06					
Stack Gas Temperature	°C	22.4						
Stack Gas Velocity	m/s	15.2						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	19837						
Volumetric Flow Rate (REF)	¹ m ³ /hr	18410						

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. 35d

15th September 2011

Parameter	Units	Concentration	Sampling Date(s)	Sampling Times	Duration (mins)
Total Particulate Matter	Run 1 mg/m ³	1.0	15/09/2011	08:45 - 09:15, 09:16 - 09:46	60
Total VOCs (as Carbon)	Run 1 mg/m ³	2.2	15/09/2011	08:45 - 09:45	60
Velocity & Volumetric Flow Rate	Run 1		15/09/2011	08:10 - 08:23	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

VIP Polymers Ltd, Huntingdon

Stack No. 35d

15th September 2011

Standard Operating Conditions

Parameter	Value
Process Status	Operational
Capacity (of 100%) and Tonnes / Hour	Various
Continuous or Batch Process	Continuous
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. 35d

15th September 2011

	Monitoring				Analysis					
Parameter	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab	MCERTS Testing	LOD (Average)
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-01	Gravimetric	Yes	CAT	Yes	0.09 mg/m³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.10 % v/v
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.21 mg/m³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

Catalyst Environmental Ltd (CAT)	UKAS Accreditation Number: 4279
----------------------------------	---------------------------------

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	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.

Executive Summary

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SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.68
Width	m	-
Area	m ²	0.36
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	N/A
Safe Access Available	Yes
Easy Access Available	No

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and 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	177	> 5 Pa	Yes
Mean Velocity	m/s	15.2	-	-
Lowest Gas Velocity	m/s	14.3	-	-
Highest Gas Velocity	m/s	16.7	-	-
Ratio of Above	: 1	1.17	< 3 : 1	Yes
Maximum Angle of Swirl	°	3	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

Executive Summary

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PLANT PHOTOS

Photo 1



Photo 2



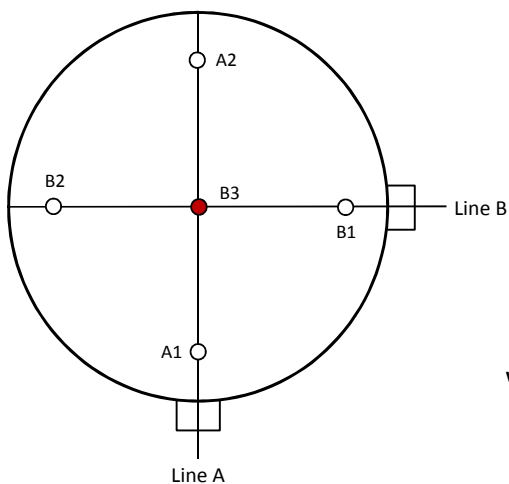
Photo 3



Photo 4



SAMPLE POINTS



where

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

APPENDICES

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Scott Pilkington	MCERTS Level 2	MM 04 501	TE1 TE2 TE3 TE4
Trainee	David Beynon	MCERTS Trainee	MM 11 1138	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 7.20	Horiba PG-250	-	Digital Manometer (1)	CAT 3.32
Box Thermocouples	CAT 3.28	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 7.13	JCT JCC P-1 Cooler	-	Digital Temperature Meter	CAT 3.32
Oven Box	CAT 12.34	5m FT-IR	-	Stopwatch	-
Probe	CAT 5.38	5m FT-IR Sampling System	-	Barometer	CAT 13.12
S-Pitot (1)	CAT 21P.28	Bernath 3006 FID	CAT 8.8	Stack Thermocouple (1)	CAT 4.151
S-Pitot (2)	-	Heated Head Filter	CAT 12.31	Stack Thermocouple (2)	-
L-Pitot	-	Mass Flow Controller (1)	CAT 6.6	1m Heated Line (1)	-
500g Check Weight	CAT 17.12	Mass Flow Controller (2)	CAT 6.5	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.12	Mass View (1)	-	1m Heated Line (3)	-
Last Impinger Arm	-	Mass View (2)	-	5m Heated Line (1)	-
Callipers	CAT 23.12	Easylogger EN-EL-12 Bit	-	15m Heated Line (1)	-
Small DGM	-	-	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	-	-	20m Heated Line (1)	-
Tape Measure	CAT 16.16	-	-		

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 12619	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.68
Stack Width, W	m	-
Stack Area, A	m ²	0.36
Average Stack Gas Temperature, T _a	°C	22.4
Average Stack Gas Pressure	Pa	199.8
Average Stack Static Pressure, P _{static}	kPa	0.020
Average Barometric Pressure, P _b	kPa	101.7
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.56	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.22	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	1.16	0.0116	18.02	0.8037	0.00934

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	1.282
Dry Density (Actual), P _{Actual}	kg/m ³	1.195
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.189

Where: P_{STD} = sum of component concentrations, kg/m³ (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m³ (including water vapour)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	22.4	0.0
Total Pressure	kPa	101.7	101.3
Moisture	%	1.16	1.16

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	19837
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	18410
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	18196
Gas Volumetric Flowrate REF ¹	m ³ /hr	18410

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	15/09/2011
Time of Survey	-	08:10 - 08:23
Atmospheric Pressure	kPa	101.7
Stack Static Pressure	Pa	20
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 (°)	3	3	3	3																

Sampling Line A						Sampling Line B				
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	
1	0.03	212.0	22.2	1.190	15.63	208.0	22.3	1.190	15.49	
2	0.10	242.0	22.3	1.190	16.71	207.0	22.3	1.190	15.45	
3	0.17	216.0	22.5	1.189	15.79	201.0	22.3	1.190	15.23	
4	0.24	194.0	22.4	1.189	14.96	210.0	22.3	1.190	15.56	
5	0.31	188.0	22.4	1.189	14.73	212.0	22.4	1.189	15.64	
6	0.37	181.0	22.5	1.189	14.45	202.0	22.4	1.189	15.27	
7	0.44	190.0	22.4	1.189	14.81	197.0	22.5	1.189	15.08	
8	0.51	202.0	22.3	1.190	15.26	194.0	22.5	1.189	14.96	
9	0.58	182.0	22.3	1.190	14.49	192.0	22.4	1.189	14.88	
10	0.65	177.0	22.3	1.190	14.29	188.0	22.4	1.189	14.73	
Mean		198.4	22.4	1.190	15.11	201.1	22.4	1.189	15.23	

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 35d

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.0		1.0
Uncertainty	±mg/m ³	0.65		0.65
Mass Emission	g/hr	19.1		19.1
Uncertainty	±g/hr	12.0		12.0

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	1.2		1.2
Uncertainty	±% v/v	0.06		0.06

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.35		0.35

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	762.8	
Stack static pressure, P_{static}	mmH ₂ O	2.0	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	762.9	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	7.6	
Total mass collected in impingers (silica trap)	g	5.2	
Total mass of liquid collected, V_{lc}	g	12.8	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0159	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.3523	
Gas meter correction factor, Y_d	-	1.0590	
Average dry gas meter temperature, T_m	°C	18.1	
Average pressure drop across orifice, ΔH	mmH ₂ O	63.3	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.3562	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0116	
B_{wo} as a percentage	% v/v	1.16	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	1.16	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.3721	
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			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.90	
Total	% v/v	20.96	
N ₂	% v/v	79.04	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.85	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.72	
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	10.97	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	3.31	
Average stack gas temperature, T_s	°C	22.3	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (\sqrt{M_s}(P_s))$	m/s	11.16	
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	0.36	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	243.2	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	225.7	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	223.0	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	6.73	
Nozzle area, A_n	mm ²	35.58	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	103.5	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	08:45 - 09:15, 09:16 - 09:46	
Sampling Dates	-	15/09/2011	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.3721	
Filter I.D. Number	-	47-6623	
Start Filter Mass	g	0.15153	
End Filter Mass	g	0.15172	
Total Mass on Filter	g	0.00019	
Probe Rinse I.D. Number	-	PR-47-6623	
Start Probe Rinse Mass	g	3.12607	
End Probe Rinse Mass	g	3.12730	
Total Mass in Probe Rinse	g	0.00123	
Total Mass Collected	mg	1.42	
Calculated Concentration	mg/m ³	1.03	
Balance Uncertainty / LOD	mg/m ³	0.09	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	15/09/2011	
Average Volume Sampled (REF)	m ³	1.3721	
Filter I.D. Number	-	47-6624	
Start Filter Mass	g	0.15057	
End Filter Mass	g	0.15071	
Total Mass on Filter	g	0.00014	
Probe Rinse I.D. Number	-	PR-47-6624	
Start Probe Rinse Mass	g	3.09650	
End Probe Rinse Mass	g	3.09684	
Total Mass in Probe Rinse	g	0.00034	
Total Mass Collected	mg	0.48	
Calculated Concentration	mg/m ³	0.35	
Balance Uncertainty / LOD	mg/m ³	0.09	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	23.87	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.11	
Allowable Leak Rate	l/min	0.48	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	5.0	
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	%	103.5	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.12	
Balance Uncertainty	± mg/m ³	0.09	
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	0.12	
20 x Balance Uncertainty	mg	2.40	
Mass Collected	mg	1.42	
Sample Time	mins	60	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	22	
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	20.00	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.10	
Allowable Leak Rate	l/min	0.40	
Leak Test Acceptable	-	Yes	

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

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

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
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	1.3523		uV _m	m ³	0.0270	
Sampled Gas Temperature	T _m	291.1		uT _m	K	2.0	
Sampled Gas Pressure	p _m	101.7		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.46		uL	%	-	
Mass of Particulate	m	1.42		um	mg	0.12	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.48		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.69		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.46		≤2%
Mass of Particulate	%	0.87		<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	1.3562		0.76	
Leak	L	mg/m ³	0.003		1.00	
Mass of Particulate	L _r	mg	1.420		0.73	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.28		0.73	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.025	
Leak	mg/m ³	0.0028	
Mass of Particulate	mg/m ³	0.0875	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.2020	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.22	
Expanded uncertainty (95% confidence)	mg/m ³	0.43	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.65	
Reported Uncertainty	mg/m ³	0.65	
Expanded uncertainty (95% confidence)	%	41.9	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	62.9	
Reported Uncertainty	%	62.9	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP Polymers Ltd, Huntingdon
Stack No. 35d

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	2.2		2.2
Uncertainty	±mg/m ³	0.17		0.17
Mass Emission	g/hr	41.0		41.0
Uncertainty	±g/hr	3.1		3.1

General Sampling Information

Parameter	Value
Standard	BS EN 12619
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	1.0028
Span Gas Expiry Date	21/05/2013
Span Gas Start Pressure (bar)	150
Gas Cylinder Concentration (ppm)	77.1
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

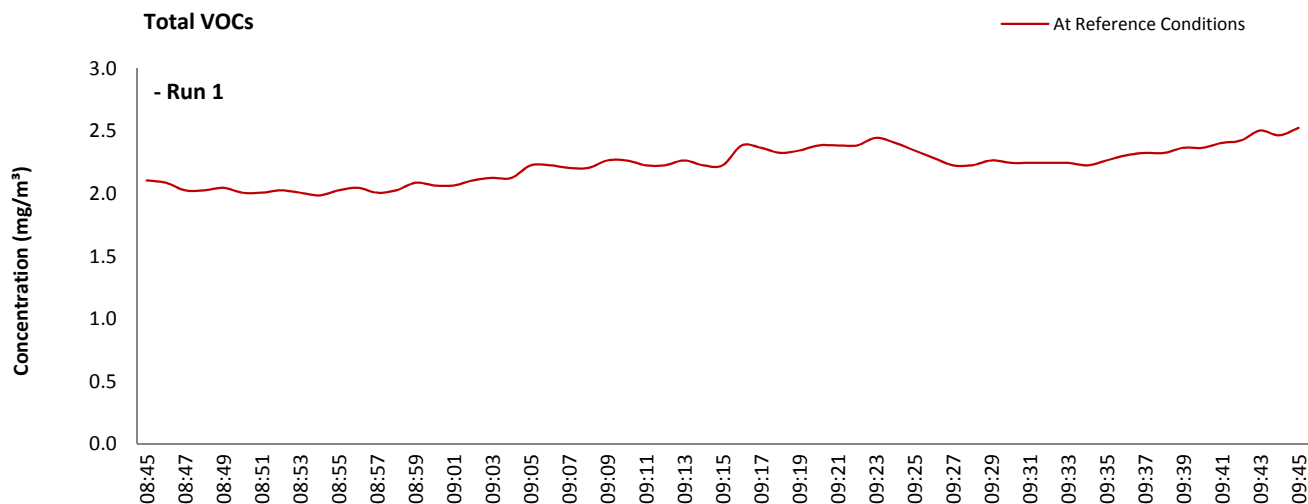
Reference Conditions

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	-	08:45 - 09:45	
Sampling Dates	-	15/09/2011	
Instrument Range	ppm	100	
Span Gas Value	ppm	10.0	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.20	
	Zero Down Sampling Line (Post)	ppm	0.20	
	Zero Drift	ppm	0.00	
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	10.10	
	Span Down Sampling Line (Post)	ppm	10.10	
	Span Drift	ppm	0.00	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	8 - 17	

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	1.4		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.016		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.032		
Leak	ppm	0.000		
Calibration Gas Uncertainty	ppm	0.008		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.011		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.05		
Expanded uncertainty (95% confidence)	ppm	0.11		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.11		
Reported Uncertainty	ppm	0.11		
Expanded uncertainty (95% confidence)	%	7.7		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	7.7		
Reported Uncertainty	%	7.7		