

Stack Emissions Testing Summary Sheet

CAT-0043: VIP-Polymers Ltd, Huntingdon

		Particulate Matter		Total VOCs				Test Dates	Flow Rate (REF)	Reference Conditions
Release Point	Units	Result	Limit	Result	Limit				m³/hr	
7 - Thompson	mg/m³	0.70	10	2.5	50			16/09/2008	2758	STP Wet Gas
	g/hr	1.9	N/A	6.9	N/A					
8A - Press 18	mg/m³	0.45	10	1.8	50			16/09/2008	2521	STP Wet Gas
	g/hr	1.1	N/A	4.5	N/A					
8C - Press 19	mg/m³	0.40	10	3.2	50			16/09/2008	3101	STP Wet Gas
	g/hr	1.2	N/A	9.9	N/A					
25 - Desma 11 Booth	mg/m³	0.62	10	2.2	50			15/09/2008	2546	STP Wet Gas
	g/hr	1.6	N/A	5.5	N/A					
26 - Desma 12 Booth	mg/m³	0.62	10	1.9	50			15/09/2008	2305	STP Wet Gas
	g/hr	1.4	N/A	4.3	N/A					
27 - Desma 16 Booth	mg/m³	0.59	10	1.1	50			15/09/2008	1761	STP Wet Gas
	g/hr	1.0	N/A	1.9	N/A					
35c - MIR	mg/m³	0.42	10	1.9	50			17/09/2008	7504	STP Wet Gas
	g/hr	3.2	N/A	14.3	N/A					
37 - Desma 9 Booth	mg/m³	0.24	10	1.9	50			15/09/2008	1767	STP Wet Gas
	g/hr	0.43	N/A	3.3	N/A					
43 - Mill	mg/m³	2.4	10	5.4	50			16/09/2008	2320	STP Wet Gas
	g/hr	5.6	N/A	12.5	N/A					
44 - Carbon Black	mg/m³	0.80	10	3.1	50			17/09/2008	9934	STP Wet Gas
	g/hr	7.9	N/A	31	N/A					
60 - MIR 1, 5 & 6	mg/m³	0.20	10	2.0	50			16/09/2008	1777	STP Wet Gas
	g/hr	0.35	N/A	3.5	N/A					
Standard Reference Method		BS EN 13284-1		BS EN 13526						
Accreditation Status of Test		UKAS & MCERTS		UKAS & MCERTS						

Summary Writer	Paul Martin	MCERTS Accreditation	MCERTS Level 2	MCERTS Number	MM 04 503	Report Date	26th September 2008
Summary Approver	James Harmer	MCERTS Accreditation	MCERTS Level 2	MCERTS Number	MM 03 156	Report Version	Version 1



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Stack Emissions Testing Report Commissioned by

VIP-Polymers Ltd

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 3DA

PPC Permit: 11/94

Stack Reference

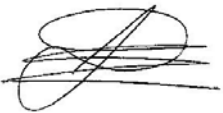
60 - MIR 1, 5 & 6

Dates of the Monitoring Campaign

16th September 2008

Job Reference Number

CAT-0043

Report Written by
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Report Date
25th September 2008
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Executive Summary (Page 1 of 7)

MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

60 - MIR 1, 5 & 6

16th September 2008

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions monitoring on the 60 - MIR 1, 5 & 6 stack by VIP Polymers Ltd at their Plant in Huntingdon.

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

Special Requirements

There were no special requirements.

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MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon

60 - MIR 1, 5 & 6

16th September 2008

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	mg/m ³	0.20	0.76	10	g/hr	0.35	1.3	N/A
Total VOCs (as Carbon)	mg/m ³	2.0	1.6	50	g/hr	3.5	2.8	N/A
Water Vapour	% v/v	0.51	0.04					
Stack Gas Temperature	°C	23.5						
Stack Gas Velocity	m/s	7.5						
Stack Gas Volumetric Flow Rate (ACTUAL)	m ³ /hr	1912						
Stack Gas Volumetric Flow Rate (REF)	m ³ /hr	1777						

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

Executive Summary (Page 3 of 7)

MONITORING DATES & TIMES

VIP-Polymers Ltd, Huntingdon

60 - MIR 1, 5 & 6

16th September 2008

Parameter		Sampling Date/s	Sampling Times	Sampling Duration (mins)
Total Particulate Matter	Run 1	16/09/2008	09:36 - 10:06	30
Total VOCs (as Carbon)	Run 1	16/09/2008	09:36 - 10:06	30
Velocity & Volumetric Flow Rate	Run 1	16/09/2008	09:15 - 09:20	

Executive Summary (Page 4 of 7)

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon

60 - MIR 1, 5 & 6

16th September 2008

Standard Operating Conditions

Parameter	Value
Process Status	Normal
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Rubber
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary (Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon
60 - MIR 1, 5 & 6
16th September 2008

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.13 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.22 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

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.

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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

Sampling Platform

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

M1 Platform Requirements	Value
Minimum Platform Area 5m ²	N/A
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
Obstructions do not hamper insertion of sampling equipment	Yes
Depth of Platform = Minimum of 2m or Probe Length + 1m	Yes

Sampling Location / Platform Improvement Recommendations

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

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

Criteria in M1	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	38.0	> 5 Pa	Yes
Mean Velocity	m/s	7.51	-	-
Lowest Gas Velocity	m/s	6.60	-	-
Highest Gas Velocity	m/s	8.58	-	-
Ratio of Above	: 1	1.30	< 3 : 1	Yes
Maximum Angle of Swirl	°	1	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes
Other Criteria	Units	Traverse	Required	Compliant
Homogeneous Flow Stream	-	Yes	-	-

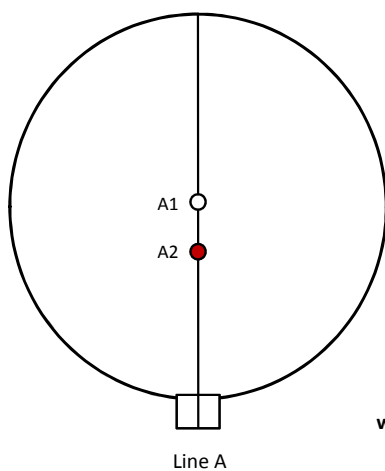
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PLANT PHOTOS

Photo 1



SAMPLE POINTS



where

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

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Paul Martin
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 04 503
	Technical Endorsements	TE1 TE2 TE3 TE4
Technician	Name	Robert Hester
	MCERTS Accreditation	MCERTS Level 1
	MCERTS Number	MM 06 766
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.3
Box Thermocouples	CAT 3.8
Umbilical	CAT 03.08
Oven Box	CAT 12.3
Probe	CAT 5.3
S-Pitot (1)	CAT 21P.3
S-Pitot (2)	CAT 21S.7
L-Pitot	-
500g Check Weight	CAT 17.3
1Kg Check Weight	CAT 17.3
Last Impinger Arm	-
Calipers	CAT 23.3
Small DGM	-
Laboratory Balance	CAT 1.18
Tapemeasure	CAT 16.1

Instrumental Analysers	
Equipment Type	Equipment I.D.
Horiba PG-250 Analyser	-
JCT JCC P-1 Cooler	-
5m FT-IR	-
5m FT-IR Sampling System	-
Bernath 3006 FID	CAT 8.2
Heated Head Filter	-
Mass Flow Controller (1)	CAT 6.5
Mass Flow Controller (2)	CAT 6.6
Easylogger EN-EL-12 Bit	CAT 11.1

Miscellaneous Items	
Equipment Type	Equipment I.D.
Digital Manometer (1)	CAT 3.3
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.3
Stopwatch	CAT 14.7
Protractor	-
Barometer	CAT 13.3
Stack Thermocouple (1)	CAT 4.16
Stack Thermocouple (2)	CAT 4.35
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	CAT 20.3
15m Heated Line (1)	-
15m Heated Line (2)	-
20m Heated Line (1)	-

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details	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	22.8
Average Stack Gas Pressure	Pa	49.5
Average Stack Static Pressure, P _{static}	kPa	-0.050
Average Barometric Pressure, P _b	kPa	102.1
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂	-	20.80	20.69	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.74	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.51	0.0051	18.02	0.8037	0.00411

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	1.197
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.194

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

$P_{STW} = (P_{STD} + p_i \text{ of H}_2\text{O}) / (1 + (p_i \text{ of H}_2\text{O} / 0.8037))$

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	Reference
Temperature	°C	23	0
Total Pressure	kPa	102.1	101.3
Moisture	%	0.5	0.5

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	1912
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	1777
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	1768

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	16/09/2008
Time of Survey	-	09:15 - 09:20
Atmospheric Pressure	kPa	102.1
Stack Static Pressure	Pa	-50
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 (°)	1																			

Sampling Line A					
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	43.0	23.0	1.194	7.03
2	0.05	44.0	22.9	1.194	7.11
3	0.08	50.0	22.9	1.194	7.58
4	0.11	60.0	22.9	1.194	8.30
5	0.14	62.0	22.9	1.194	8.44
6	0.17	64.0	23.0	1.194	8.58
7	0.20	50.0	23.0	1.194	7.58
8	0.23	44.0	23.0	1.194	7.11
9	0.26	38.0	22.4	1.196	6.60
10	0.29	40.0	22.4	1.196	6.77
Mean		49.5	22.8	1.194	7.51

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
60 - MIR 1, 5 & 6

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.20		0.20
Uncertainty	±mg/m ³	0.76		0.76
Mass Emission	g/hr	0.35		0.35
Uncertainty	±g/hr	1.34		1.34

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

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.51		0.51
Uncertainty	±% v/v	0.04		0.04

Blank Runs

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

General Sampling Information

Parameter	Value	
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	FORMAT: Number Used / Number Required
Number of Sampling Points Used	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	765.8	
Stack static pressure, P_{static}	mmH ₂ O	-5.1	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	765.4	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-6.8	
Total mass collected in impingers (silica trap)	g	11.4	
Total mass of liquid collected, V_{lc}	g	4.6	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0057	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.1510	
Gas meter correction factor, Y_d	-	1.0130	
Average dry gas meter temperature, T_m	°C	18.9	
Average pressure drop across orifice, ΔH	mmH ₂ O	152.4	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.1147	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0051	
B_{wo} as a percentage	% v/v	0.51	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.51	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.1204	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.79	
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	6.36	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	2.52	
Average stack gas temperature, T_s	°C	24.2	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (\sqrt{M_s}(P_s))$	m/s	8.50	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} ($Q_{stw@O_2}$), Dry@O_{2REF} ($Q_{std@O_2}$)			
Area of stack, A_s	m ²	0.07	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	36.1	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	33.4	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	33.2	
$Q_{stw@O_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{std@O_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	9.89	
Nozzle area, A_n	mm ²	76.88	
Total sampling time, q	min	30	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	103.0	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	09:36 - 10:06	
Sampling Dates	-	16/09/2008	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.1204	
Filter I.D. Number	-	47-0153	
Start Filter Mass	g	0.15051	
End Filter Mass	g	0.15048	
Total Mass on Filter	g	-0.00003	
Probe Rinse I.D. Number	-	PR-47-0153	
Start Probe Rinse Mass	g	3.84630	
End Probe Rinse Mass	g	3.84648	
Total Mass in Probe Rinse	g	0.00018	
Total Mass Collected	mg	0.15	
Calculated Concentration	mg/m ³	0.13	
Balance Uncertainty / LOD	mg/m ³	0.13	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	16/09/2008	
Average Volume Sampled (REF)	m ³	1.1204	
Filter I.D. Number	-	47-0152	
Start Filter Mass	g	0.15233	
End Filter Mass	g	0.15228	
Total Mass on Filter	g	-0.00005	
Probe Rinse I.D. Number	-	PR-47-0152	
Start Probe Rinse Mass	g	3.62056	
End Probe Rinse Mass	g	3.62083	
Total Mass in Probe Rinse	g	0.00027	
Total Mass Collected	mg	0.22	
Calculated Concentration	mg/m ³	0.20	
Balance Uncertainty / LOD	mg/m ³	0.13	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	38.87	
Pre-Sampling Leak Rate	l/min	0.12	
Post-Sampling Leak Rate	l/min	0.28	
Allowable Leak Rate	l/min	0.78	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	8.4	
Allowable MU	%	20	
MU Acceptable	%	Yes	

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

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	103.0	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.15	
Balance Uncertainty	± mg/m ³	0.13	
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	0.15	
20 x Balance Uncertainty	mg	3.00	
Mass Collected	mg	0.15	
Sample Time	mins	30	
Balance Uncertainty Acceptable	-	No	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	24	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	30.00	
Pre-Sampling Leak Rate	l/min	0.26	
Post-Sampling Leak Rate	l/min	0.26	
Allowable Leak Rate	l/min	0.60	
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.	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	1.1510		uV _m	m ³	0.0230	
Sampled Gas Temperature	T _m	297.2		uT _m	K	2.0	
Sampled Gas Pressure	p _m	103.6		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.72		uL	%	-	
Mass of Particulate	m	0.15		um	mg	0.15	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.22		uUCM	mg	-	

Uncertainty as a Percentage				Requirement of Standard
Measured Quantities	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.72		≤2%
Mass of Particulate	%	1.96		<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	1.1147		0.18	
Leak	L	mg/m ³	0.001		1.00	
Mass of Particulate	L _r	mg	0.150		1.31	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.13		1.31	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.005	
Leak	mg/m ³	0.0008	
Mass of Particulate	mg/m ³	0.1964	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.1663	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.257	
Expanded uncertainty (95% confidence)	mg/m ³	0.504	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.757	
Reported Uncertainty	mg/m ³	0.757	
Expanded uncertainty (95% confidence)	%	256.9	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	385.3	
Reported Uncertainty	%	385.3	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

(CONCURRENT WATER VAPOUR)

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	1.1510		uV _m	m ³	0.023	
Sampled Gas Temperature	T _m	297.2		uT _m	K	2.0	
Sampled Gas Pressure	p _m	103.6		uρ _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Repeatability of Weighing	R _w	4.60		uR _w	g	0.16	
Reading of Balance	R _b	4.60		uR _b	g	0.02	
Leak	L	0.72			%	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Repeatability of Weighing	%	3.48		No Requirement
Reading of Balance	%	0.50		No Requirement
Leak	%	0.72		≤2%

Measured Quantities	Uncertainty in Measurement Units				Sensitivity Coefficient	
	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V _m	m ³	1.1147		0.46	
Repeatability of Weighing	R _w	g	4.60		0.11	
Reading of Balance	R _b	g	4.60		0.11	
Leak	L	% v/v	0.00		1.00	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	% v/v	0.012	
Repeatability of Weighing	% v/v	0.0178	
Reading of Balance	% v/v	0.0026	
Leak	% v/v	0.0021	

Parameter	Units	Run 1	
Combined uncertainty	% v/v	0.02	
Expanded uncertainty (95% confidence)	% v/v	0.04	
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.04	
Uncertainty if Water Droplets are present	% v/v		
Reported Uncertainty	% v/v	0.04	
Expanded uncertainty (95% confidence)	%	8.4	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	8.4	
Uncertainty if Water Droplets are present	%		
Reported Uncertainty	%	8.4	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
60 - MIR 1, 5 & 6

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	2.0		2.0
Uncertainty	±mg/m ³	1.6		1.6
Mass Emission	g/hr	3.5		3.5
Uncertainty	±g/hr	2.8		2.8

General Sampling Information

Parameter	Value	
Probe Material	Stainless Steel	
Filtration Type / Size	0.5µm Stainless Steel	
Heated Head Filter Used	No	
Heated Line Temperature	180°C	
Span Gas Reference Number	CAT 1.003	
Span Gas Expiry Date	01/08/2011	
Span Gas Start Pressure (bar)	190	
Gas Cylinder Concentration (ppm)	79	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	

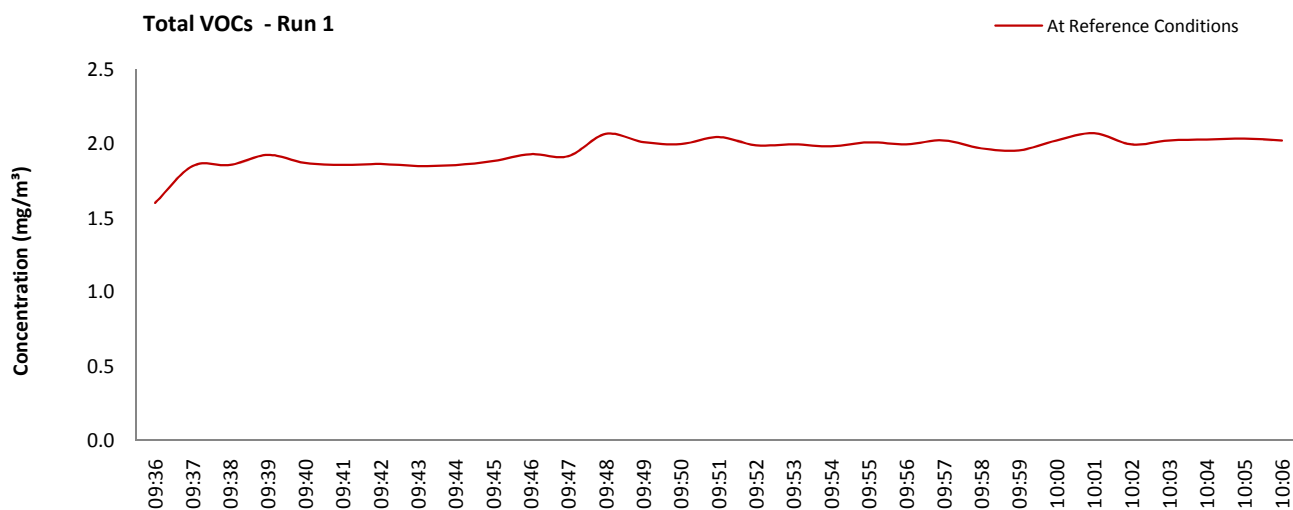
Reference Conditions

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	-	09:36 - 10:06	
Sampling Dates	-	16/09/2008	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

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

Span Drift	Units	Run 1	
Span Down Sampling Line (Pre)	ppm	30.80	
Span Down Sampling Line (Post)	ppm	29.90	
Span Drift	ppm	-0.90	
Allowable Span Drift	± ppm	1.56	
Span Drift Acceptable	-	Yes	

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
Range	ppm	100.0		
Measured Reading	ppm	1.2		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.289		
Temperature Dependent Zero Drift	ppm	0.289		
Temperature Dependent Span Drift	ppm	0.289		
Cross-Sensitivity	ppm	0.028		
Leak	ppm	0.01		
Calibration Gas Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.50		
Expanded uncertainty (95% confidence)	ppm	0.98		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.98		
Reported Uncertainty	ppm	0.98		
Expanded uncertainty (95% confidence)	%	80.9		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	80.9		
Reported Uncertainty	%	80.9		



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Your Catalyst Contact: Stuart Davidson (07957 554 956)

Stack Emissions Testing Report Commissioned by
VIP-Polymers Ltd

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 3DA

PPC Permit: 11/94

Stack Reference

44 - Carbon Black Stack

Dates of the Monitoring Campaign

17th September 2008

Job Reference Number

CAT-0043

Report Written by
Rob Hester Technician MCERTS Level 1 MM 06 766 None
Report Approved by
James Harmer Technical Manager MCERTS Level 2 MM 03 156 TE1 TE2 TE3 TE4
Report Date
25th September 2008
Report Version
Version 1
Signature of Report Approver




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TITLE PAGE

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APPENDICES

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Executive Summary (Page 1 of 7)

MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

44 - Carbon Black Stack

17th September 2008

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions monitoring on the 44 - Carbon Black stack by VIP Polymers Ltd at their Plant in Huntingdon.

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

Special Requirements

There were no special requirements.

Executive Summary (Page 2 of 7)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon

44 - Carbon Black Stack

17th September 2008

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	mg/m ³	0.80	1.4	10	g/hr	7.9	13.5	N/A
Total VOCs (as Carbon)	mg/m ³	3.1	1.6	50	g/hr	31.0	15.7	N/A
Water Vapour	% v/v	0.35	0.04					
Stack Gas Temperature	°C	23.8						
Stack Gas Velocity	m/s	17.9						
Stack Gas Volumetric Flow Rate (ACTUAL)	m ³ /hr	10705						
Stack Gas Volumetric Flow Rate (REF)	m ³ /hr	9934						

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

Executive Summary (Page 3 of 7)

MONITORING DATES & TIMES

VIP-Polymers Ltd, Huntingdon

44 - Carbon Black Stack

17th September 2008

Parameter		Sampling Date/s	Sampling Times	Sampling Duration (mins)
Total Particulate Matter	Run 1	17/09/2008	12:44 - 13:14	30
Total VOCs (as Carbon)	Run 1	17/09/2008	13:05 - 13:35	30
Velocity & Volumetric Flow Rate	Run 1	17/09/2008	11:50 - 11:57	

Executive Summary (Page 4 of 7)

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon

44 - Carbon Black Stack

17th September 2008

Standard Operating Conditions

Parameter	Value
Process Status	Normal
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Rubber
Abatement System	Bag Filter
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary (Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon
44 - Carbon Black Stack
17th September 2008

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.12 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.22 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	1	Only one sampling line was installed on the stack, with only one sampling point being tested due to sampling platform restrictions.
Total Particulate Matter	1	The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty.

Executive Summary (Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.46
Width	m	-
Area	m ²	0.17
Port Depth	cm	4
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Sampling Platform

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

M1 Platform Requirements	Value
Minimum Platform Area 5m ²	No
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
Platform has vertical base boards (approx. 0.25m high)	Yes
Platform has chains / self closing gates at top of ladders	No
Obstructions do not hamper insertion of sampling equipment	Yes
Depth of Platform = Minimum of 2m or Probe Length + 1m	No

Sampling Location / Platform Improvement Recommendations

All sampling locations should be designed in accordance with the normative requirements of the Environment Agency's Technical Guidance Note M1. However, in this instance the sampling location could be easily improved by changing the orientation of the sampling port so that it faced the platform.

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

Criteria in M1	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	190.0	> 5 Pa	Yes
Mean Velocity	m/s	17.89	-	-
Lowest Gas Velocity	m/s	14.78	-	-
Highest Gas Velocity	m/s	20.24	-	-
Ratio of Above	: 1	1.37	< 3 : 1	Yes
Maximum Angle of Swirl	°	0	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes
Other Criteria	Units	Traverse	Required	Compliant
Homogeneous Flow Stream	-	Yes	-	-

Executive Summary (Page 7 of 7)

PLANT PHOTOS

Photo 1



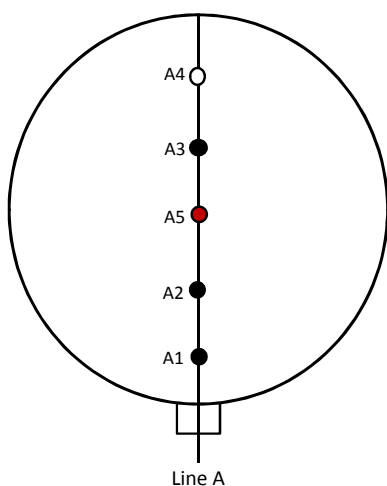
Photo 2



Photo 3



SAMPLE POINTS



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

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Paul Martin
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 04 503
	Technical Endorsements	TE1 TE2 TE3 TE4
Technician	Name	Robert Hester
	MCERTS Accreditation	MCERTS Level 1
	MCERTS Number	MM 06 766
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.3
Box Thermocouples	CAT 3.8
Umbilical	CAT 03.08
Oven Box	CAT 12.3
Probe	CAT 5.3
S-Pitot (1)	CAT 21P.3
S-Pitot (2)	CAT 21S.7
L-Pitot	-
500g Check Weight	CAT 17.3
1Kg Check Weight	CAT 17.3
Last Impinger Arm	-
Calipers	CAT 23.3
Small DGM	-
Laboratory Balance	CAT 1.18
Tapemeasure	CAT 16.1

Instrumental Analysers	
Equipment Type	Equipment I.D.
Horiba PG-250 Analyser	-
JCT JCC P-1 Cooler	-
5m FT-IR	-
5m FT-IR Sampling System	-
Bernath 3006 FID	CAT 8.2
Heated Head Filter	-
Mass Flow Controller (1)	CAT 6.5
Mass Flow Controller (2)	CAT 6.6
Easylogger EN-EL-12 Bit	CAT 11.1

Miscellaneous Items	
Equipment Type	Equipment I.D.
Digital Manometer (1)	CAT 3.3
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.3
Stopwatch	CAT 14.7
Protractor	-
Barometer	CAT 13.3
Stack Thermocouple (1)	CAT 4.16
Stack Thermocouple (2)	CAT 4.35
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	CAT 20.3
15m Heated Line (1)	-
15m Heated Line (2)	-
20m Heated Line (1)	-

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details	Units	Value
Stack Diameter / Depth, D	m	0.46
Stack Width, W	m	-
Stack Area, A	m ²	0.17
Average Stack Gas Temperature, T _a	°C	23.6
Average Stack Gas Pressure	Pa	280.5
Average Stack Static Pressure, P _{static}	kPa	0.139
Average Barometric Pressure, P _b	kPa	102.0
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂	-	20.80	20.73	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.86	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.35	0.0035	18.02	0.8037	0.00280

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P _{STD}	kg/m ³	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.286
Dry Density (Actual), P _{Actual}	kg/m ³	1.195
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.193

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

$P_{STW} = (P_{STD} + p_i \text{ of H}_2\text{O}) / (1 + (p_i \text{ of H}_2\text{O} / 0.8037))$

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	Reference
Temperature	°C	24	0
Total Pressure	kPa	102.1	101.3
Moisture	%	0.3	0.3

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	10705
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	9934
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	9900

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	17/09/2008
Time of Survey	-	11:50 - 11:57
Atmospheric Pressure	kPa	102.0
Stack Static Pressure	Pa	139
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	190.0	23.6	1.193	14.78
2	0.07	235.0	23.8	1.192	16.45
3	0.12	274.0	23.8	1.192	17.76
4	0.16	291.0	23.9	1.192	18.30
5	0.21	313.0	23.8	1.192	18.98
6	0.25	301.0	23.8	1.192	18.61
7	0.30	356.0	23.6	1.193	20.24
8	0.35	317.0	23.5	1.193	19.09
9	0.39	311.0	23.4	1.194	18.91
10	0.44	217.0	22.9	1.196	15.78
Mean		280.5	23.6	1.193	17.89

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
44 - Carbon Black Stack

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.80		0.80
Uncertainty	±mg/m ³	1.4		1.4
Mass Emission	g/hr	7.9		7.9
Uncertainty	±g/hr	13.5		13.5

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.35		0.35
Uncertainty	±% v/v	0.04		0.04

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.77		0.77

General Sampling Information

Parameter	Value	
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	1 / 4	FORMAT: Number Used / Number Required
Sample Point I.D.'s	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	765.0	
Stack static pressure, P _{static}	mmH ₂ O	14.2	
P _s = (P _b + (P _{static} / 13.6))	mmHg	766.0	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-9.6	
Total mass collected in impingers (silica trap)	g	13.0	
Total mass of liquid collected, V _{lc}	g	3.4	
V _{wstd} = (0.001246)(V _{lc})	m ³	0.0042	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V _m	m ³	1.2549	
Gas meter correction factor, Y _d	-	1.0130	
Average dry gas meter temperature, T _m	°C	20.6	
Average pressure drop across orifice, ΔH	mmH ₂ O	181.8	
V _{mstd} = ((0.3592)(V _m)(P _b + (ΔH/13.6))(Y _d)) / (T _m + 273)	m ³	1.2106	
Moisture content, B_{wo} & R_{wv}			
B _{wo} = V _{wstd} / (V _{mstd} + V _{wstd})	m ³	0.0035	
B _{wo} as a percentage	% v/v	0.35	
Reported Water Vapour, checked with Tables in BS EN 14790, R _{wv}	% v/v	0.35	
Volume of gas metered wet, V_{mstw}			
V _{mstw} = (V _{mstd})(100/(100 - R _{wv}))	m ³	1.2149	
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 (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
M _d = 0.44(%CO ₂)+0.32(%O ₂)+0.28(%N ₂)	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
M _s = M _d (1 - (R _{wv} /100)) + 18(R _{wv} /100)	g/gmol	28.80	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K _p	-	34.97	
Velocity pressure coefficient, C _p	-	0.83	
Average of velocity heads, ΔP _{avg}	mmH ₂ O	30.83	
Average square root of velocity heads, √ΔP	√mmH ₂ O	5.55	
Average stack gas temperature, T _s	°C	24.0	
V _s = ((K _p)(C _p)(√ΔP)(√T _s + 273)) / (√(M _s)(P _s))	m/s	18.70	
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	0.17	
Q _a = (60)(A _s)(V _s)	m ³ /min	186.5	
Conversion factor (K/mm.Hg), C _f	-	0.3592	
Q _{stw} = ((Q _a)(P _s)(C _f)) / ((T _s + 273))	m ³ /min	172.8	
Q _{std} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273))	m ³ /min	172.2	
Q _{stwO₂} = ((Q _a)(P _s)(C _f)) / ((T _s + 273)(O _{2REFw}))	m ³ /min	N/A	
Q _{stdO₂} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273)(O _{2REFd}))	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D _n	mm	6.95	
Nozzle area, A _n	mm ²	37.98	
Total sampling time, q	min	30	
%I = (4.6398E ⁶)(T _s +273)(V _{mstd}) / (P _s)(V _s)(A _n)(q)(1 - (R _{wv} /100))	%	102.6	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	12:44 - 13:14	
Sampling Dates	-	17/09/2008	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.2149	
Filter I.D. Number	-	47-0228	
Start Filter Mass	g	0.15141	
End Filter Mass	g	0.15217	
Total Mass on Filter	g	0.00076	
Probe Rinse I.D. Number	-	PR-47-0228	
Start Probe Rinse Mass	g	3.63309	
End Probe Rinse Mass	g	3.63330	
Total Mass in Probe Rinse	g	0.00021	
Total Mass Collected	mg	0.97	
Calculated Concentration	mg/m ³	0.80	
Balance Uncertainty / LOD	mg/m ³	0.12	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	17/09/2008	
Average Volume Sampled (REF)	m ³	1.2149	
Filter I.D. Number	-	47-0222	
Start Filter Mass	g	0.15178	
End Filter Mass	g	0.15200	
Total Mass on Filter	g	0.00022	
Probe Rinse I.D. Number	-	PR-47-0222	
Start Probe Rinse Mass	g	3.44527	
End Probe Rinse Mass	g	3.44599	
Total Mass in Probe Rinse	g	0.00072	
Total Mass Collected	mg	0.94	
Calculated Concentration	mg/m ³	0.77	
Balance Uncertainty / LOD	mg/m ³	0.12	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	42.37	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.26	
Allowable Leak Rate	l/min	0.85	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	10.5	
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	%	102.6	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.15	
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	0.15	
20 x Balance Uncertainty	mg	3.00	
Mass Collected	mg	0.97	
Sample Time	mins	30	
Balance Uncertainty Acceptable	-	No	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	24	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	30.00	
Pre-Sampling Leak Rate	l/min	0.08	
Post-Sampling Leak Rate	l/min	0.10	
Allowable Leak Rate	l/min	0.60	
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, with only one sampling point being tested due to sampling platform restrictions.	x	
The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty.	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	1.2549		uV _m	m ³	0.0251	
Sampled Gas Temperature	T _m	297.0		uT _m	K	2.0	
Sampled Gas Pressure	p _m	103.8		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.61		uL	%	-	
Mass of Particulate	m	0.97		um	mg	0.15	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.94		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.61		≤2%
Mass of Particulate	%	1.23		<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	1.2106		0.66	
Leak	L	mg/m ³	0.003		1.00	
Mass of Particulate	L _r	mg	0.970		0.82	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.54		0.82	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.020	
Leak	mg/m ³	0.0028	
Mass of Particulate	mg/m ³	0.1235	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.4467	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.464	
Expanded uncertainty (95% confidence)	mg/m ³	0.909	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	1.364	
Reported Uncertainty	mg/m ³	1.364	
Expanded uncertainty (95% confidence)	%	113.9	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	170.8	
Reported Uncertainty	%	170.8	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

(CONCURRENT WATER VAPOUR)

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V_m	1.2549		uV_m	m ³	0.0251	
Sampled Gas Temperature	T_m	297.0		uT_m	K	2.0	
Sampled Gas Pressure	p_m	103.8		uP_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Repeatability of Weighing	R_w	3.40		uR_w	g	0.16	
Reading of Balance	R_b	3.40		uR_b	g	0.02	
Leak	L	0.61			%	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Repeatability of Weighing	%	4.71		No Requirement
Reading of Balance	%	0.50		No Requirement
Leak	%	0.61		≤2%

Measured Quantities	Uncertainty in Measurement Units				Sensitivity Coefficient	
	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V_m	m ³	1.2106		0.29	
Repeatability of Weighing	R_w	g	3.40		0.10	
Reading of Balance	R_b	g	3.40		0.10	
Leak	L	% v/v	0.00		1.00	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	% v/v	0.009	
Repeatability of Weighing	% v/v	0.0164	
Reading of Balance	% v/v	0.0017	
Leak	% v/v	0.0012	

Parameter	Units	Run 1	
Combined uncertainty	% v/v	0.02	
Expanded uncertainty (95% confidence)	% v/v	0.04	
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.04	
Uncertainty if Water Droplets are present	% v/v		
Reported Uncertainty	% v/v	0.04	
Expanded uncertainty (95% confidence)	%	10.5	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	10.5	
Uncertainty if Water Droplets are present	%		
Reported Uncertainty	%	10.5	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
44 - Carbon Black Stack

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	3.1		3.1
Uncertainty	±mg/m ³	1.6		1.6
Mass Emission	g/hr	31.0		31.0
Uncertainty	±g/hr	15.7		15.7

General Sampling Information

Parameter	Value
Probe Material	Stainless Steel
Filtration Type / Size	0.5µm Ceramic
Heated Head Filter Used	No
Heated Line Temperature	180°C
Span Gas Reference Number	CAT 1.003
Span Gas Expiry Date	01/08/2011
Span Gas Start Pressure (bar)	185
Gas Cylinder Concentration (ppm)	79
Span Gas Uncertainty (%)	2
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A5

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

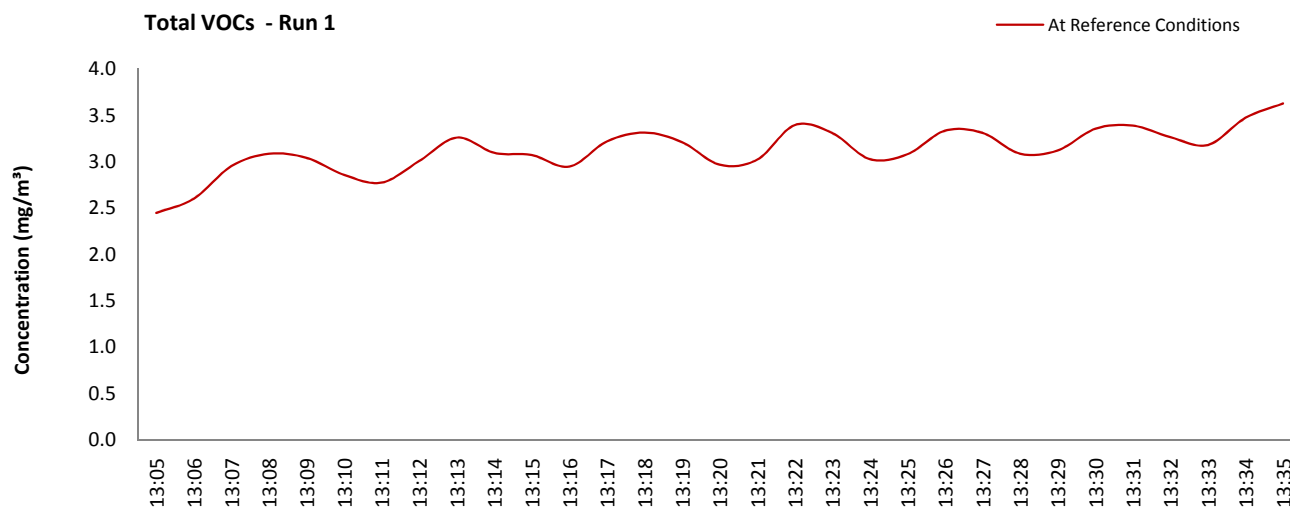
Reference Conditions

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

APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	13:05 - 13:35	
Sampling Dates	-	17/09/2008	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

Zero Drift	Units	Run 1	
Zero Down Sampling Line (Pre)	ppm	0.40	
Zero Down Sampling Line (Post)	ppm	0.10	
Zero Drift	ppm	-0.30	
Allowable Zero Drift	± ppm	1.56	
Zero Drift Acceptable	-	Yes	

Span Drift	Units	Run 1	
Span Down Sampling Line (Pre)	ppm	31.30	
Span Down Sampling Line (Post)	ppm	30.80	
Span Drift	ppm	-0.50	
Allowable Span Drift	± ppm	1.56	
Span Drift Acceptable	-	Yes	

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
Range	ppm	100.0		
Measured Reading	ppm	1.9		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.289		
Temperature Dependent Zero Drift	ppm	0.289		
Temperature Dependent Span Drift	ppm	0.289		
Cross-Sensitivity	ppm	0.045		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.02		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.50		
Expanded uncertainty (95% confidence)	ppm	0.98		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.98		
Reported Uncertainty	ppm	0.98		
Expanded uncertainty (95% confidence)	%	50.7		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	50.7		
Reported Uncertainty	%	50.7		



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Your Catalyst Contact: Stuart Davidson (07957 554 956)

Stack Emissions Testing Report Commissioned by

VIP-Polymers Ltd

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 3DA

PPC Permit: 11/94

Stack Reference

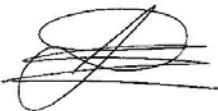
43 - Mill

Dates of the Monitoring Campaign

16th September 2008

Job Reference Number

CAT-0043

Report Written by
Rob Hester Technician MCERTS Level 1 MM 06 766 None
Report Approved by
James Harmer Technical Manager MCERTS Level 2 MM 03 156 TE1 TE2 TE3 TE4
Report Date
25th September 2008
Report Version
Version 1
Signature of Report Approver


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APPENDICES

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Executive Summary (Page 1 of 7)

MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

43 - Mill

16th September 2008

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions monitoring on the 43 - Mill stack by VIP Polymers Ltd at their Plant in Huntingdon.

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

Special Requirements

There were no special requirements.

Executive Summary (Page 2 of 7)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon

43 - Mill

16th September 2008

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	mg/m ³	2.4	0.51	10	g/hr	5.6	1.2	N/A
Total VOCs (as Carbon)	mg/m ³	5.4	1.60	50	g/hr	12.5	3.7	N/A
Water Vapour	% v/v	0.07	0.03					
Stack Gas Temperature	°C	24.7						
Stack Gas Velocity	m/s	3.3						
Stack Gas Volumetric Flow Rate (ACTUAL)	m ³ /hr	2510						
Stack Gas Volumetric Flow Rate (REF)	m ³ /hr	2320						

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

Executive Summary (Page 3 of 7)

MONITORING DATES & TIMES

VIP-Polymers Ltd, Huntingdon

43 - Mill

16th September 2008

Parameter		Sampling Date/s	Sampling Times	Sampling Duration (mins)
Total Particulate Matter	Run 1	16/09/2008	10:44 - 11:06 & 11:53 - 12:04	32
Total VOCs (as Carbon)	Run 1	16/09/2008	11:53 - 12:23	30
Velocity & Volumetric Flow Rate	Run 1	16/09/2008	10:22 - 10:30	

Executive Summary (Page 4 of 7)

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon

43 - Mill

16th September 2008

Standard Operating Conditions

Parameter	Value
Process Status	Normal
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Rubber
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary (Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon
43 - Mill
16th September 2008

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.12 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.22 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Water Vapour	1	The method uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.
Total Particulate Matter	1	The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty.

Executive Summary (Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.52
Width	m	-
Area	m ²	0.21
Port Depth	cm	4
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Sampling Platform

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

M1 Platform Requirements	Value
Minimum Platform Area 5m ²	N/A
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
Obstructions do not hamper insertion of sampling equipment	Yes
Depth of Platform = Minimum of 2m or Probe Length + 1m	Yes

Sampling Location / Platform Improvement Recommendations

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

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

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	5.0		> 5 Pa	Yes
Mean Velocity	m/s	3.28		-	-
Lowest Gas Velocity	m/s	2.40		-	-
Highest Gas Velocity	m/s	3.72		-	-
Ratio of Above	: 1	1.55		< 3 : 1	Yes
Maximum Angle of Swirl	°	9		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes
Other Criteria	Units	Traverse		Required	Compliant
Homogeneous Flow Stream	-	Yes		-	-

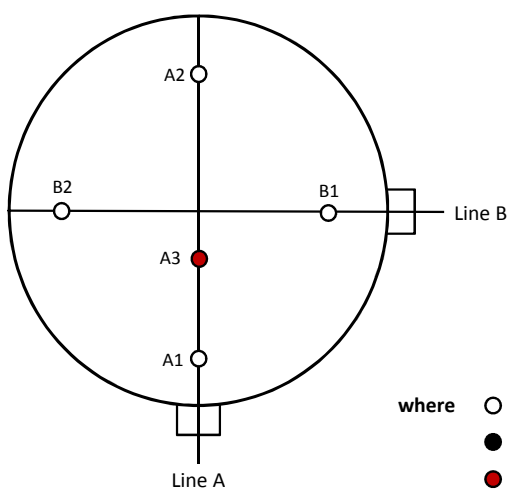
Executive Summary (Page 7 of 7)

PLANT PHOTOS

Photo 1



SAMPLE POINTS



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

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Paul Martin
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 04 503
	Technical Endorsements	TE1 TE2 TE3 TE4
Technician	Name	Robert Hester
	MCERTS Accreditation	MCERTS Level 1
	MCERTS Number	MM 06 766
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.3
Box Thermocouples	CAT 3.8
Umbilical	CAT 03.08
Oven Box	CAT 12.3
Probe	CAT 5.3
S-Pitot (1)	CAT 21P.3
S-Pitot (2)	CAT 21S.7
L-Pitot	-
500g Check Weight	CAT 17.3
1Kg Check Weight	CAT 17.3
Last Impinger Arm	-
Calipers	CAT 23.3
Small DGM	-
Laboratory Balance	CAT 1.18
Tapemeasure	CAT 16.1

Instrumental Analysers	
Equipment Type	Equipment I.D.
Horiba PG-250 Analyser	-
JCT JCC P-1 Cooler	-
5m FT-IR	-
5m FT-IR Sampling System	-
Bernath 3006 FID	CAT 8.2
Heated Head Filter	-
Mass Flow Controller (1)	CAT 6.5
Mass Flow Controller (2)	CAT 6.6
Easylogger EN-EL-12 Bit	CAT 11.1

Miscellaneous Items	
Equipment Type	Equipment I.D.
Digital Manometer (1)	CAT 3.3
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.3
Stopwatch	CAT 14.7
Protractor	-
Barometer	CAT 13.3
Stack Thermocouple (1)	CAT 4.16
Stack Thermocouple (2)	CAT 4.35
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	CAT 20.3
15m Heated Line (1)	-
15m Heated Line (2)	-
20m Heated Line (1)	-

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details	Units	Value
Stack Diameter / Depth, D	m	0.52
Stack Width, W	m	-
Stack Area, A	m ²	0.21
Average Stack Gas Temperature, T _a	°C	24.7
Average Stack Gas Pressure	Pa	9.5
Average Stack Static Pressure, P _{static}	kPa	-0.007
Average Barometric Pressure, P _b	kPa	102.1
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂	-	20.80	20.79	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	79.08	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.07	0.0007	18.02	0.8037	0.00057

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P _{STD}	kg/m ³	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.287
Dry Density (Actual), P _{Actual}	kg/m ³	1.190
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.189

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

$P_{STW} = (P_{STD} + p_i \text{ of H}_2\text{O}) / (1 + (p_i \text{ of H}_2\text{O} / 0.8037))$

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	Reference
Temperature	°C	25	0
Total Pressure	kPa	102.1	101.3
Moisture	%	0.1	0.1

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	2510
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	2320
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	2318

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	16/09/2008
Time of Survey	-	10:22 - 10:30
Atmospheric Pressure	kPa	102.1
Stack Static Pressure	Pa	-7
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	1	9	9																

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	6.0	24.9	1.189	2.63	9.0	24.6	1.190	3.22				
2	0.08	8.0	24.9	1.189	3.04	11.0	24.6	1.190	3.56				
3	0.13	9.0	24.9	1.189	3.22	12.0	24.6	1.190	3.72				
4	0.18	10.0	24.9	1.189	3.40	12.0	24.6	1.190	3.72				
5	0.23	7.0	24.9	1.189	2.84	11.0	24.6	1.190	3.56				
6	0.29	9.0	24.9	1.189	3.22	12.0	24.6	1.190	3.72				
7	0.34	10.0	24.9	1.189	3.40	11.0	24.6	1.190	3.56				
8	0.39	10.0	24.9	1.189	3.40	11.0	24.6	1.190	3.56				
9	0.44	8.0	24.8	1.189	3.04	10.0	24.6	1.190	3.40				
10	0.49	5.0	24.8	1.189	2.40	8.0	24.7	1.189	3.04				
Mean		8.2	24.9	1.189	3.06	10.7	24.6	1.190	3.51				

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
43 - Mill

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	2.4		2.4
Uncertainty	±mg/m ³	0.51		0.51
Mass Emission	g/hr	5.6		5.6
Uncertainty	±g/hr	1.19		1.19

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

Blank Runs

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

General Sampling Information

Parameter	Value	
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	FORMAT: Number Used / Number Required
Number of Sampling Points Used	4	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1, A2, B1 & B2	

Reference Conditions

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

APPENDIX 2

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	765.8	
Stack static pressure, P_{static}	mmH ₂ O	-0.7	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	765.7	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-11.0	
Total mass collected in impingers (silica trap)	g	11.7	
Total mass of liquid collected, V_{lc}	g	0.7	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0009	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.2710	
Gas meter correction factor, Y_d	-	1.0130	
Average dry gas meter temperature, T_m	°C	22.2	
Average pressure drop across orifice, ΔH	mmH ₂ O	164.6	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.2187	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0007	
B_{wo} as a percentage	% v/v	0.07	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.07	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.2196	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.83	
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	24.6	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (\sqrt{M_s}(P_s))$	m/s	3.37	
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	0.21	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	42.9	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	39.7	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	39.7	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	15.98	
Nozzle area, A_n	mm ²	200.50	
Total sampling time, q	min	32	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	101.7	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	10:44 - 11:06 & 11:53 - 12:04	
Sampling Dates	-	16/09/2008	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.2196	
Filter I.D. Number	-	47-0213	
Start Filter Mass	g	0.15048	
End Filter Mass	g	0.15271	
Total Mass on Filter	g	0.00223	
Probe Rinse I.D. Number	-	PR-47-0213	
Start Probe Rinse Mass	g	3.53673	
End Probe Rinse Mass	g	3.53745	
Total Mass in Probe Rinse	g	0.00072	
Total Mass Collected	mg	2.95	
Calculated Concentration	mg/m ³	2.42	
Balance Uncertainty / LOD	mg/m ³	0.12	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	16/09/2008	
Average Volume Sampled (REF)	m ³	1.2196	
Filter I.D. Number	-	47-0154	
Start Filter Mass	g	0.15111	
End Filter Mass	g	0.15094	
Total Mass on Filter	g	-0.00017	
Probe Rinse I.D. Number	-	PR-47-0154	
Start Probe Rinse Mass	g	3.58382	
End Probe Rinse Mass	g	3.58422	
Total Mass in Probe Rinse	g	0.00040	
Total Mass Collected	mg	0.23	
Calculated Concentration	mg/m ³	0.19	
Balance Uncertainty / LOD	mg/m ³	0.12	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	40.24	
Pre-Sampling Leak Rate	l/min	0.30	
Post-Sampling Leak Rate	l/min	0.27	
Allowable Leak Rate	l/min	0.80	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	45.1	
Allowable MU	%	20	
MU Acceptable	%	No	

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

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	101.7	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.15	
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	0.15	
20 x Balance Uncertainty	mg	3.00	
Mass Collected	mg	2.95	
Sample Time	mins	32	
Balance Uncertainty Acceptable	-	No	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	25	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	30.00	
Pre-Sampling Leak Rate	l/min	0.22	
Post-Sampling Leak Rate	l/min	0.28	
Allowable Leak Rate	l/min	0.60	
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 method uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.	wx	
The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty.	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	1.2710		uV_m	m^3	0.0254	
Sampled Gas Temperature	T_m	297.6		uT_m	K	2.0	
Sampled Gas Pressure	p_m	103.7		up_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Leak	L	0.67		uL	%	-	
Mass of Particulate	m	2.95		um	mg	0.15	
Oxygen Content	$O_{2,m}$	N/A		$uO_{2,m}$	% v/v	N/A	
Uncollected Mass	UCM	0.23		$uUCM$	mg	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
Sampled Volume (Actual)	%	2.00		$\leq 2\%$
Sampled Gas Temperature	%	0.67		$\leq 1\%$
Sampled Gas Pressure	%	0.48		$\leq 1\%$
Sampled Gas Humidity	%	1.00		$\leq 1\%$
Leak	%	0.67		$\leq 2\%$
Mass of Particulate	%	1.23		$< 5\%$ of ELV
Oxygen Content	%	N/A		$\leq 5\%$
Uncollected Mass	%	-		-

Measured Quantities	Uncertainty in Measurement Units				Sensitivity Coefficient	
	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V_m	m^3	1.2187		1.98	
Leak	L	mg/ m^3	0.009		1.00	
Mass of Particulate	L_r	mg	2.950		0.82	
Factor for O_2 Correction	$O_{2,m}$	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.13		0.82	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	mg/ m^3	0.059	
Leak	mg/ m^3	0.0094	
Mass of Particulate	mg/ m^3	0.1230	
Factor for O_2 Correction	mg/ m^3	N/A	
Uncollected Mass	mg/ m^3	0.1089	

Parameter	Units	Run 1	
Combined uncertainty	mg/ m^3	0.175	
Expanded uncertainty (95% confidence)	mg/ m^3	0.343	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/ m^3	0.514	
Reported Uncertainty	mg/ m^3	0.514	
Expanded uncertainty (95% confidence)	%	14.2	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	21.3	
Reported Uncertainty	%	21.3	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

(CONCURRENT WATER VAPOUR)

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	1.2710		uV _m	m ³	0.0254	
Sampled Gas Temperature	T _m	297.6		uT _m	K	2.0	
Sampled Gas Pressure	p _m	103.7		uP _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Repeatability of Weighing	R _w	0.70		uR _w	g	0.16	
Reading of Balance	R _b	0.70		uR _b	g	0.00	
Leak	L	0.67			%	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Repeatability of Weighing	%	22.86		No Requirement
Reading of Balance	%	0.50		No Requirement
Leak	%	0.67		≤2%

Measured Quantities	Uncertainty in Measurement Units				Sensitivity Coefficient	
	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V _m	m ³	1.2187		0.06	
Repeatability of Weighing	R _w	g	0.70		0.10	
Reading of Balance	R _b	g	0.70		0.10	
Leak	L	% v/v	0.00		1.00	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	% v/v	0.002	
Repeatability of Weighing	% v/v	0.0163	
Reading of Balance	% v/v	0.0004	
Leak	% v/v	0.0003	

Parameter	Units	Run 1	
Combined uncertainty	% v/v	0.02	
Expanded uncertainty (95% confidence)	% v/v	0.03	
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.03	
Uncertainty if Water Droplets are present	% v/v		
Reported Uncertainty	% v/v	0.03	
Expanded uncertainty (95% confidence)	%	45.1	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	45.1	
Uncertainty if Water Droplets are present	%		
Reported Uncertainty	%	45.1	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
43 - Mill

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	5.4		5.4
Uncertainty	±mg/m ³	1.6		1.6
Mass Emission	g/hr	12.5		12.5
Uncertainty	±g/hr	3.7		3.7

General Sampling Information

Parameter	Value
Probe Material	Stainless Steel
Filtration Type / Size	0.5µm Ceramic
Heated Head Filter Used	No
Heated Line Temperature	180°C
Span Gas Reference Number	CAT 1.003
Span Gas Expiry Date	01/08/2011
Span Gas Start Pressure (bar)	195
Gas Cylinder Concentration (ppm)	79
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

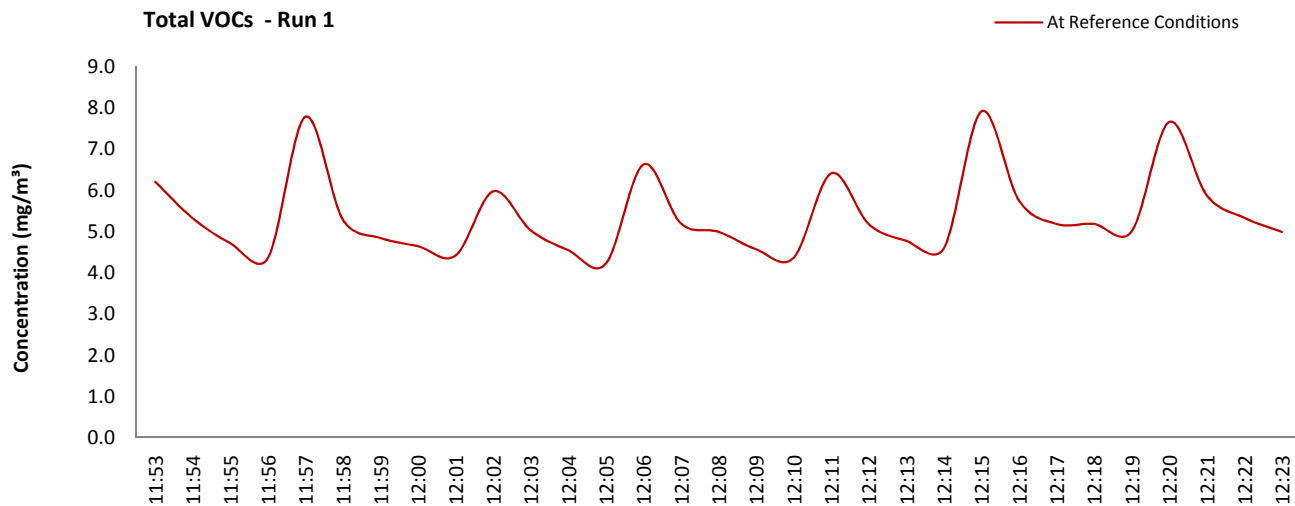
Reference Conditions

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	-	11:53 - 12:23	
Sampling Dates	-	16/09/2008	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

Zero Drift	Units	Run 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	
Span Down Sampling Line (Pre)	ppm	31.00	
Span Down Sampling Line (Post)	ppm	30.40	
Span Drift	ppm	-0.60	
Allowable Span Drift	± ppm	1.56	
Span Drift Acceptable	-	Yes	

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
Range	ppm	100.0		
Measured Reading	ppm	3.3		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.289		
Temperature Dependent Zero Drift	ppm	0.289		
Temperature Dependent Span Drift	ppm	0.289		
Cross-Sensitivity	ppm	0.077		
Leak	ppm	0.01		
Calibration Gas Uncertainty	ppm	0.03		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.51		
Expanded uncertainty (95% confidence)	ppm	0.99		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.99		
Reported Uncertainty	ppm	0.99		
Expanded uncertainty (95% confidence)	%	29.7		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	29.7		
Reported Uncertainty	%	29.7		



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Stack Emissions Testing Report Commissioned by

VIP-Polymers Ltd

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 3DA

PPC Permit: 11/94

Stack Reference

37 - Desma 9 Booth

Dates of the Monitoring Campaign

15th September 2008

Job Reference Number

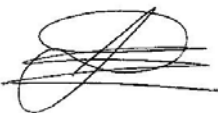
CAT-0043

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Report Date
25th September 2008

Report Version
Version 1

Signature of Report Approver




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APPENDICES

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Executive Summary (Page 1 of 7)

MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

37 - Desma 9 Booth

15th September 2008

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions monitoring on the 37 - Desma 9 Booth by VIP Polymers Ltd at their Plant in Huntingdon.

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

Special Requirements

There were no special requirements.

Executive Summary (Page 2 of 7)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon

37 - Desma 9 Booth

15th September 2008

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	mg/m ³	0.24	0.54	10	g/hr	0.43	0.95	N/A
Total VOCs (as Carbon)	mg/m ³	1.9	1.6	50	g/hr	3.3	2.8	N/A
Water Vapour	% v/v	0.09	0.04					
Stack Gas Temperature	°C	26.4						
Stack Gas Velocity	m/s	7.6						
Stack Gas Volumetric Flow Rate (ACTUAL)	m ³ /hr	1922						
Stack Gas Volumetric Flow Rate (REF)	m ³ /hr	1767						

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

Executive Summary (Page 3 of 7)

MONITORING DATES & TIMES

VIP-Polymers Ltd, Huntingdon

37 - Desma 9 Booth

15th September 2008

Parameter		Sampling Date/s	Sampling Times	Sampling Duration (mins)
Total Particulate Matter	Run 1	15/09/2008	16:47 - 17:17	30
Total VOCs (as Carbon)	Run 1	15/09/2008	16:00 - 16:30	30
Velocity & Volumetric Flow Rate	Run 1	15/09/2008	16:32 - 16:40	

Executive Summary (Page 4 of 7)

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon

37 - Desma 9 Booth

15th September 2008

Standard Operating Conditions

Parameter	Value
Process Status	Normal
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Rubber
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary (Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon
37 - Desma 9 Booth
15th September 2008

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.14 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.22 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Water Vapour	1	The method uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.
Total Particulate	1	The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty.

Executive Summary (Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.30
Width	m	-
Area	m ²	0.07
Port Depth	cm	4
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Sampling Platform

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

M1 Platform Requirements	Value
Minimum Platform Area 5m ²	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
Obstructions do not hamper insertion of sampling equipment	Yes
Depth of Platform = Minimum of 2m or Probe Length + 1m	Yes

Sampling Location / Platform Improvement Recommendations

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

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	7.55	-	-
Lowest Gas Velocity	m/s	6.19	-	-
Highest Gas Velocity	m/s	8.12	-	-
Ratio of Above	: 1	1.31	< 3 : 1	Yes
Maximum Angle of Swirl	°	2	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes
Other Criteria	Units	Traverse	Required	Compliant
Homogeneous Flow Stream	-	Yes	-	-

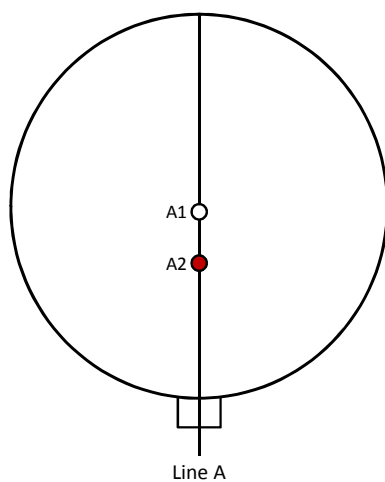
Executive Summary (Page 7 of 7)

PLANT PHOTOS

Photo 1



SAMPLE POINTS



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

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Paul Martin
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 04 503
	Technical Endorsements	TE1 TE2 TE3 TE4
Technician	Name	Robert Hester
	MCERTS Accreditation	MCERTS Level 1
	MCERTS Number	MM 06 766
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.3	Horiba PG-250 Analyser	-	Digital Manometer (1)	CAT 3.3
Box Thermocouples	CAT 3.8	JCT JCC P-1 Cooler	-	Digital Manometer (2)	-
Umbilical	CAT 03.08	5m FT-IR	-	Digital Temperature Meter	CAT 3.3
Oven Box	CAT 12.3	5m FT-IR Sampling System	-	Stopwatch	CAT 14.7
Probe	CAT 5.3	Bernath 3006 FID	CAT 8.2	Protractor	-
S-Pitot (1)	CAT 21P.3	Heated Head Filter	-	Barometer	CAT 13.3
S-Pitot (2)	CAT 21S.7	Mass Flow Controller (1)	CAT 6.5	Stack Thermocouple (1)	CAT 4.16
L-Pitot	-	Mass Flow Controller (2)	CAT 6.6	Stack Thermocouple (2)	CAT 4.35
500g Check Weight	CAT 17.3	Easylogger EN-EL-12 Bit	CAT 11.1	1m Heated Line (1)	-
1Kg Check Weight	CAT 17.3			1m Heated Line (2)	-
Last Impinger Arm	-			1m Heated Line (3)	-
Calipers	CAT 23.3			5m Heated Line (1)	CAT 20.3
Small DGM	-			15m Heated Line (1)	-
Laboratory Balance	CAT 1.18			15m Heated Line (2)	-
Tapemeasure	CAT 16.1			20m Heated Line (1)	-

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details	Units	Value
Stack Diameter / Depth, D	m	0.30
Stack Width, W	m	-
Stack Area, A	m ²	0.07
Average Stack Gas Temperature, T _a	°C	26.1
Average Stack Gas Pressure	Pa	49.4
Average Stack Static Pressure, P _{static}	kPa	-0.040
Average Barometric Pressure, P _b	kPa	102.1
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂	-	20.80	20.78	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	79.07	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.09	0.0009	18.02	0.8037	0.00075

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P _{STD}	kg/m ³	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.287
Dry Density (Actual), P _{Actual}	kg/m ³	1.184
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.183

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

$P_{STW} = (P_{STD} + p_i \text{ of H}_2\text{O}) / (1 + (p_i \text{ of H}_2\text{O} / 0.8037))$

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	Reference
Temperature	°C	26	0
Total Pressure	kPa	102.1	101.3
Moisture	%	0.1	0.1

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	1922
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	1767
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	1765

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	15/09/2008
Time of Survey	-	16:32 - 16:40
Atmospheric Pressure	kPa	102.1
Stack Static Pressure	Pa	-40
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																			

Sampling Line A					
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	33.0	26.5	1.182	6.19
2	0.05	51.0	26.7	1.181	7.70
3	0.08	48.0	26.9	1.180	7.47
4	0.11	51.0	26.9	1.180	7.70
5	0.14	45.0	26.4	1.182	7.23
6	0.17	49.0	26.3	1.183	7.54
7	0.20	56.0	25.7	1.185	8.05
8	0.23	57.0	25.5	1.186	8.12
9	0.26	53.0	25.4	1.186	7.83
10	0.29	51.0	24.9	1.188	7.68
Mean		49.4	26.1	1.183	7.55

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
37 - Desma 9 Booth

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.24		0.24
Uncertainty	±mg/m ³	0.54		0.54
Mass Emission	g/hr	0.43		0.43
Uncertainty	±g/hr	0.95		0.95

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.09		0.09
Uncertainty	±% v/v	0.04		0.04

Blank Runs

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

General Sampling Information

Parameter	Value	
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	FORMAT: Number Used / Number Required
Number of Sampling Points Used	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	765.8	
Stack static pressure, P_{static}	mmH ₂ O	-4.1	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	765.5	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-14.7	
Total mass collected in impingers (silica trap)	g	15.5	
Total mass of liquid collected, V_{lc}	g	0.8	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0010	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.1448	
Gas meter correction factor, Y_d	-	1.0130	
Average dry gas meter temperature, T_m	°C	28.5	
Average pressure drop across orifice, ΔH	mmH ₂ O	144.8	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.0727	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0009	
B_{wo} as a percentage	% v/v	0.09	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.09	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.0737	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.83	
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	5.90	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	2.43	
Average stack gas temperature, T_s	°C	26.7	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (\sqrt{M_s}(P_s))$	m/s	8.22	
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	34.8	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	32.0	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	31.9	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	9.89	
Nozzle area, A_n	mm ²	76.88	
Total sampling time, q	min	30	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	102.9	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	16:47 - 17:17	
Sampling Dates	-	15/09/2008	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.0737	
Filter I.D. Number	-	47-0151	
Start Filter Mass	g	0.15203	
End Filter Mass	g	0.15214	
Total Mass on Filter	g	0.00011	
Probe Rinse I.D. Number	-	PR-47-0151	
Start Probe Rinse Mass	g	3.51162	
End Probe Rinse Mass	g	3.51177	
Total Mass in Probe Rinse	g	0.00015	
Total Mass Collected	mg	0.26	
Calculated Concentration	mg/m ³	0.24	
Balance Uncertainty / LOD	mg/m ³	0.14	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	15/09/2008	
Average Volume Sampled (REF)	m ³	1.0737	
Filter I.D. Number	-	47-0150	
Start Filter Mass	g	0.15107	
End Filter Mass	g	0.15110	
Total Mass on Filter	g	0.00003	
Probe Rinse I.D. Number	-	PR-47-0150	
Start Probe Rinse Mass	g	3.49288	
End Probe Rinse Mass	g	3.49307	
Total Mass in Probe Rinse	g	0.00019	
Total Mass Collected	mg	0.22	
Calculated Concentration	mg/m ³	0.20	
Balance Uncertainty / LOD	mg/m ³	0.14	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	38.66	
Pre-Sampling Leak Rate	l/min	0.18	
Post-Sampling Leak Rate	l/min	0.15	
Allowable Leak Rate	l/min	0.77	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	39.5	
Allowable MU	%	20	
MU Acceptable	%	No	

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

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	102.9	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.15	
Balance Uncertainty	± mg/m ³	0.14	
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	0.15	
20 x Balance Uncertainty	mg	3.00	
Mass Collected	mg	0.26	
Sample Time	mins	30	
Balance Uncertainty Acceptable	-	No	

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

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	30.00	
Pre-Sampling Leak Rate	l/min	0.40	
Post-Sampling Leak Rate	l/min	0.39	
Allowable Leak Rate	l/min	0.60	
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 method uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.	wx	
The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty.	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	1.1448		uV _m	m ³	0.0229	
Sampled Gas Temperature	T _m	299.7		uT _m	K	2.0	
Sampled Gas Pressure	p _m	103.5		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.39		uL	%	-	
Mass of Particulate	m	0.26		um	mg	0.15	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.22		uUCM	mg	-	

Uncertainty as a Percentage				Requirement of Standard
Measured Quantities	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.39		≤2%
Mass of Particulate	%	1.40		<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	1.0727	0.23	
Leak	L	mg/m ³	0.001	1.00	
Mass of Particulate	L _r	mg	0.260	0.93	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A	N/A	
Uncollected Mass	UCM	mg	0.13	0.93	

Uncertainty in Result		
Measured Quantities	Units	Run 1
Sampled Volume (STP)	mg/m ³	0.006
Leak	mg/m ³	0.0005
Mass of Particulate	mg/m ³	0.1397
Factor for O ₂ Correction	mg/m ³	N/A
Uncollected Mass	mg/m ³	0.1183

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.183	
Expanded uncertainty (95% confidence)	mg/m ³	0.359	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.538	
Reported Uncertainty	mg/m ³	0.538	
Expanded uncertainty (95% confidence)	%	148.3	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	222.4	
Reported Uncertainty	%	222.4	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

(CONCURRENT WATER VAPOUR)

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	1.1448		uV _m	m ³	0.0229	
Sampled Gas Temperature	T _m	299.7		uT _m	K	2.0	
Sampled Gas Pressure	p _m	103.5		uP _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Repeatability of Weighing	R _w	0.80		uR _w	g	0.16	
Reading of Balance	R _b	0.80		uR _b	g	0.00	
Leak	L	0.39			%	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Repeatability of Weighing	%	20.00		No Requirement
Reading of Balance	%	0.50		No Requirement
Leak	%	0.39		≤2%

Measured Quantities	Uncertainty in Measurement Units				Sensitivity Coefficient	
	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V _m	m ³	1.0727		0.09	
Repeatability of Weighing	R _w	g	0.80		0.12	
Reading of Balance	R _b	g	0.80		0.12	
Leak	L	% v/v	0.00		1.00	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	% v/v	0.002	
Repeatability of Weighing	% v/v	0.0186	
Reading of Balance	% v/v	0.0005	
Leak	% v/v	0.0002	

Parameter	Units	Run 1	
Combined uncertainty	% v/v	0.02	
Expanded uncertainty (95% confidence)	% v/v	0.04	
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.04	
Uncertainty if Water Droplets are present	% v/v		
Reported Uncertainty	% v/v	0.04	
Expanded uncertainty (95% confidence)	%	39.5	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	39.5	
Uncertainty if Water Droplets are present	%		
Reported Uncertainty	%	39.5	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
37 - Desma 9 Booth

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.9		1.9
Uncertainty	±mg/m ³	1.6		1.6
Mass Emission	g/hr	3.3		3.3
Uncertainty	±g/hr	2.8		2.8

General Sampling Information

Parameter	Value	
Probe Material	Stainless Steel	
Filtration Type / Size	0.5µm Stainless Steel	
Heated Head Filter Used	No	
Heated Line Temperature	180°C	
Span Gas Reference Number	CAT 1.003	
Span Gas Expiry Date	01/08/2011	
Span Gas Start Pressure (bar)	195	
Gas Cylinder Concentration (ppm)	79	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A2	

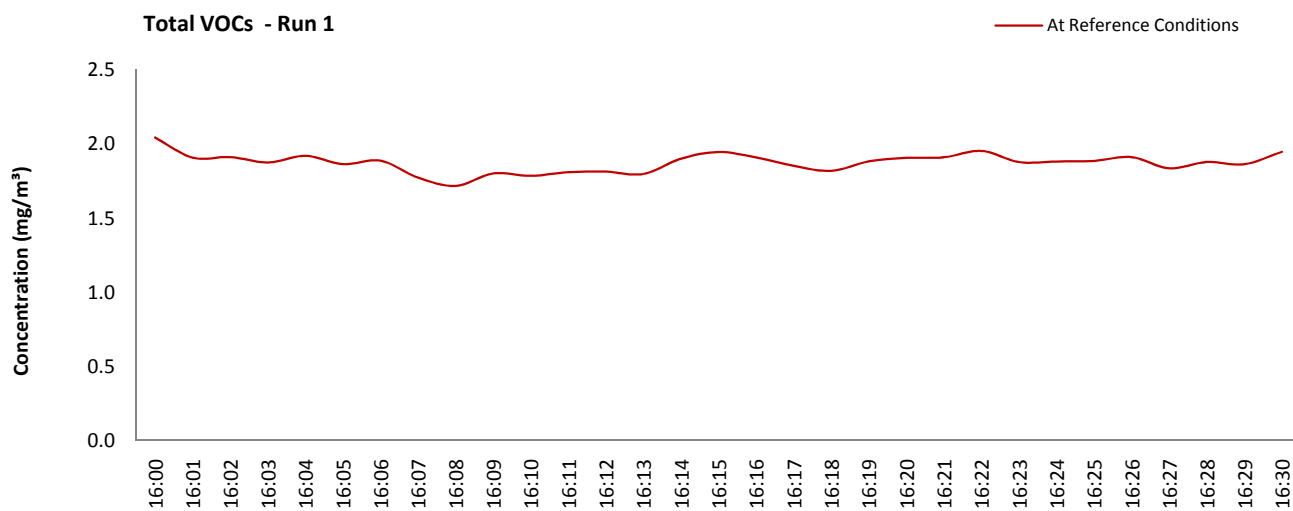
Reference Conditions

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

APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	16:00 - 16:30	
Sampling Dates	-	15/09/2008	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

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

Span Drift	Units	Run 1	
Span Down Sampling Line (Pre)	ppm	31.00	
Span Down Sampling Line (Post)	ppm	30.80	
Span Drift	ppm	-0.20	
Allowable Span Drift	± ppm	1.56	
Span Drift Acceptable	-	Yes	

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
Range	ppm	100.0		
Measured Reading	ppm	1.2		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.289		
Temperature Dependent Zero Drift	ppm	0.289		
Temperature Dependent Span Drift	ppm	0.289		
Cross-Sensitivity	ppm	0.027		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.50		
Expanded uncertainty (95% confidence)	ppm	0.98		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.98		
Reported Uncertainty	ppm	0.98		
Expanded uncertainty (95% confidence)	%	84.3		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	84.3		
Reported Uncertainty	%	84.3		



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Stack Emissions Testing Report Commissioned by
VIP-Polymers Ltd

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 3DA

PPC Permit: 11/94

Stack Reference

35C - MIR

Dates of the Monitoring Campaign

17th September 2008

Job Reference Number

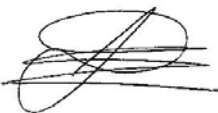
CAT-0043

Report Written by
Rob Hester Technician MCERTS Level 1 MM 06 766 None

Report Approved by
James Harmer Technical Manager MCERTS Level 2 MM 03 156 TE1 TE2 TE3 TE4

Report Date
25th September 2008

Report Version
Version 1

Signature of Report Approver




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APPENDICES

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

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Executive Summary (Page 1 of 7)

MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

35C - MIR

17th September 2008

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions monitoring on the 35C - MIR stack by VIP Polymers Ltd at their Plant in Huntingdon.

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

Special Requirements

There were no special requirements.

Executive Summary (Page 2 of 7)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon

35C - MIR

17th September 2008

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	mg/m ³	0.42	1.1	10	g/hr	3.2	7.9	N/A
Total VOCs (as Carbon)	mg/m ³	1.9	1.6	50	g/hr	14.3	11.8	N/A
Water Vapour	% v/v	0.77	0.05					
Stack Gas Temperature	°C	25.7						
Stack Gas Velocity	m/s	7.0						
Stack Gas Volumetric Flow Rate (ACTUAL)	m ³ /hr	8148						
Stack Gas Volumetric Flow Rate (REF)	m ³ /hr	7504						

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

Executive Summary (Page 3 of 7)

MONITORING DATES & TIMES

VIP-Polymers Ltd, Huntingdon

35C - MIR

17th September 2008

Parameter		Sampling Date/s	Sampling Times	Sampling Duration (mins)
Total Particulate Matter	Run 1	17/09/2008	10:01 - 10:31	30
Total VOCs (as Carbon)	Run 1	17/09/2008	10:01 - 10:31	30
Velocity & Volumetric Flow Rate	Run 1	17/09/2008	09:15 - 09:25	

Executive Summary (Page 4 of 7)

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon

35C - MIR

17th September 2008

Standard Operating Conditions

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

Executive Summary (Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon
35C - MIR
17th September 2008

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.15 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.22 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	1	Lowest differential pressure < 5 Pa.
Total Particulate Matter	1	The sample points where the angle of swirl was > 15° were omitted from the sampling exercise.

Executive Summary (Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.64
Width	m	-
Area	m ²	0.32
Port Depth	cm	4
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Sampling Platform

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

M1 Platform Requirements	Value
Minimum Platform Area 5m ²	N/A
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
Obstructions do not hamper insertion of sampling equipment	Yes
Depth of Platform = Minimum of 2m or Probe Length + 1m	Yes

Sampling Location / Platform Improvement Recommendations

Although the sampling location meets the platform requirements in M1, none of the sampling plane validation criteria were met (see below).

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

Criteria in M1	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	-15.0	> 5 Pa	No
Mean Velocity	m/s	7.03	-	-
Lowest Gas Velocity	m/s	1.53	-	-
Highest Gas Velocity	m/s	13.17	-	-
Ratio of Above	: 1	8.64	< 3 : 1	No
Maximum Angle of Swirl	°	42	< 15°	No
No Local Negative Flow	-	No	-	No
Other Criteria	Units	Traverse	Required	Compliant
Homogeneous Flow Stream	-	No	-	-

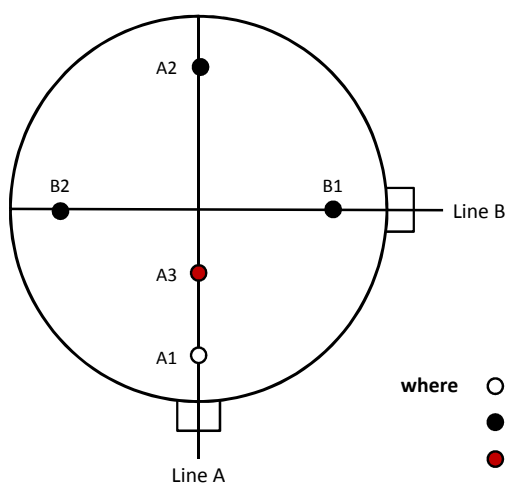
Executive Summary (Page 7 of 7)

PLANT PHOTOS

Photo 1



SAMPLE POINTS



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

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Paul Martin
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 04 503
	Technical Endorsements	TE1 TE2 TE3 TE4
Technician	Name	Robert Hester
	MCERTS Accreditation	MCERTS Level 1
	MCERTS Number	MM 06 766
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.3
Box Thermocouples	CAT 3.8
Umbilical	CAT 03.08
Oven Box	CAT 12.3
Probe	CAT 5.3
S-Pitot (1)	CAT 21P.3
S-Pitot (2)	CAT 21S.7
L-Pitot	-
500g Check Weight	CAT 17.3
1Kg Check Weight	CAT 17.3
Last Impinger Arm	-
Calipers	CAT 23.3
Small DGM	-
Laboratory Balance	CAT 1.18
Tapemeasure	CAT 16.1

Instrumental Analysers	
Equipment Type	Equipment I.D.
Horiba PG-250 Analyser	-
JCT JCC P-1 Cooler	-
5m FT-IR	-
5m FT-IR Sampling System	-
Bernath 3006 FID	CAT 8.2
Heated Head Filter	-
Mass Flow Controller (1)	CAT 6.5
Mass Flow Controller (2)	CAT 6.6
Easylogger EN-EL-12 Bit	CAT 11.1

Miscellaneous Items	
Equipment Type	Equipment I.D.
Digital Manometer (1)	CAT 3.3
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.3
Stopwatch	CAT 14.7
Protractor	-
Barometer	CAT 13.3
Stack Thermocouple (1)	CAT 4.16
Stack Thermocouple (2)	CAT 4.35
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	CAT 20.3
15m Heated Line (1)	-
15m Heated Line (2)	-
20m Heated Line (1)	-

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details	Units	Value
Stack Diameter / Depth, D	m	0.64
Stack Width, W	m	-
Stack Area, A	m ²	0.32
Average Stack Gas Temperature, T _a	°C	25.3
Average Stack Gas Pressure	Pa	44.8
Average Stack Static Pressure, P _{static}	kPa	-0.060
Average Barometric Pressure, P _b	kPa	102.0
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂	-	20.80	20.64	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.53	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.77	0.0077	18.02	0.8037	0.00621

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P _{STD}	kg/m ³	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.284
Dry Density (Actual), P _{Actual}	kg/m ³	1.186
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.182

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

$P_{STW} = (P_{STD} + p_i \text{ of H}_2\text{O}) / (1 + (p_i \text{ of H}_2\text{O} / 0.8037))$

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	Reference
Temperature	°C	25	0
Total Pressure	kPa	101.9	101.3
Moisture	%	0.8	0.8

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	8148
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	7504
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	7446

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	17/09/2008
Time of Survey	-	09:15 - 09:25
Atmospheric Pressure	kPa	102.0
Stack Static Pressure	Pa	-60
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	32	42	38																

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	54.0	25.1	1.183	7.91	-15.0	25.7	1.181	-IVE
2	0.10	30.0	25.3	1.182	5.90	-10.0	25.7	1.181	-IVE
3	0.16	5.0	25.3	1.182	2.41	-12.0	25.8	1.180	-IVE
4	0.22	10.0	25.1	1.183	3.41	2.0	25.9	1.180	1.53
5	0.29	5.0	25.1	1.183	2.41	6.0	26.0	1.179	2.64
6	0.35	44.0	24.9	1.184	7.14	32.0	26.0	1.179	6.10
7	0.42	30.0	24.8	1.184	5.90	28.0	25.8	1.180	5.71
8	0.48	101.0	24.8	1.184	10.82	73.0	25.5	1.181	9.21
9	0.54	120.0	24.4	1.186	11.78	105.0	25.4	1.182	11.04
10	0.61	150.0	24.3	1.186	13.17	138.0	25.2	1.183	12.65
Mean		54.9	24.9	1.184	7.09	34.7	25.7	1.181	6.98

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
35C - MIR

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.42		0.42
Uncertainty	±mg/m ³	1.1		1.1
Mass Emission	g/hr	3.2		3.2
Uncertainty	±g/hr	7.9		7.9

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

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.77		0.77
Uncertainty	±% v/v	0.05		0.05

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.42		0.42

General Sampling Information

Parameter	Value	
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	1 / 4	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	765.0	
Stack static pressure, P_{static}	mmH ₂ O	-6.1	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	764.6	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-6.7	
Total mass collected in impingers (silica trap)	g	13.0	
Total mass of liquid collected, V_{lc}	g	6.3	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0078	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.0450	
Gas meter correction factor, Y_d	-	1.0130	
Average dry gas meter temperature, T_m	°C	18.8	
Average pressure drop across orifice, ΔH	mmH ₂ O	125.4	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.0088	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0077	
B_{wo} as a percentage	% v/v	0.77	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.77	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.0166	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.76	
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	2.50	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	1.58	
Average stack gas temperature, T_s	°C	26.0	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (\sqrt{M_s}(P_s))$	m/s	5.35	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} ($Q_{stw@O_2}$), Dry@O_{2REF} ($Q_{std@O_2}$)			
Area of stack, A_s	m ²	0.32	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	103.3	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	94.9	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	94.2	
$Q_{stw@O_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{std@O_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	11.92	
Nozzle area, A_n	mm ²	111.61	
Total sampling time, q	min	30	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	102.9	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	10:01 - 10:31	
Sampling Dates	-	17/09/2008	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.0166	
Filter I.D. Number	-	47-0221	
Start Filter Mass	g	0.15193	
End Filter Mass	g	0.15228	
Total Mass on Filter	g	0.00035	
Probe Rinse I.D. Number	-	PR-47-0221	
Start Probe Rinse Mass	g	3.62034	
End Probe Rinse Mass	g	3.62040	
Total Mass in Probe Rinse	g	0.00006	
Total Mass Collected	mg	0.41	
Calculated Concentration	mg/m ³	0.40	
Balance Uncertainty / LOD	mg/m ³	0.15	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	17/09/2008	
Average Volume Sampled (REF)	m ³	1.0166	
Filter I.D. Number	-	47-0220	
Start Filter Mass	g	0.15244	
End Filter Mass	g	0.15263	
Total Mass on Filter	g	0.00019	
Probe Rinse I.D. Number	-	PR-47-0220	
Start Probe Rinse Mass	g	3.62322	
End Probe Rinse Mass	g	3.62346	
Total Mass in Probe Rinse	g	0.00024	
Total Mass Collected	mg	0.43	
Calculated Concentration	mg/m ³	0.42	
Balance Uncertainty / LOD	mg/m ³	0.15	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	35.29	
Pre-Sampling Leak Rate	l/min	0.21	
Post-Sampling Leak Rate	l/min	0.28	
Allowable Leak Rate	l/min	0.71	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	7.0	
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	%	102.9	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.15	
Balance Uncertainty	± mg/m ³	0.15	
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	0.15	
20 x Balance Uncertainty	mg	3.00	
Mass Collected	mg	0.41	
Sample Time	mins	30	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	26	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	30.00	
Pre-Sampling Leak Rate	l/min	0.45	
Post-Sampling Leak Rate	l/min	0.44	
Allowable Leak Rate	l/min	0.60	
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	
Lowest differential pressure < 5 Pa.	x	
The sample points where the angle of swirl was > 15° were omitted from the sampling exercise.	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	1.0450		uV_m	m^3	0.0209	
Sampled Gas Temperature	T_m	299.0		uT_m	K	2.0	
Sampled Gas Pressure	p_m	103.2		up_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Leak	L	0.79		uL	%	-	
Mass of Particulate	m	0.41		um	mg	0.15	
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				Requirement of Standard
Measured Quantities	Units	Run 1		
Sampled Volume (Actual)	%	2.00		$\leq 2\%$
Sampled Gas Temperature	%	0.67		$\leq 1\%$
Sampled Gas Pressure	%	0.48		$\leq 1\%$
Sampled Gas Humidity	%	1.00		$\leq 1\%$
Leak	%	0.79		$\leq 2\%$
Mass of Particulate	%	1.55		$< 5\%$ of ELV
Oxygen Content	%	N/A		$\leq 5\%$
Uncollected Mass	%	-		-

Measured Quantities	Uncertainty in Measurement Units				Sensitivity Coefficient	
	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V_m	m^3	1.0088		0.42	
Leak	L	mg/m^3	0.002		1.00	
Mass of Particulate	L_r	mg	0.410		1.03	
Factor for O_2 Correction	$O_{2,m}$	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.25		1.03	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m^3	0.010	
Leak	mg/m^3	0.0019	
Mass of Particulate	mg/m^3	0.1547	
Factor for O_2 Correction	mg/m^3	N/A	
Uncollected Mass	mg/m^3	0.2561	

Parameter	Units	Run 1	
Combined uncertainty	mg/m^3	0.299	
Expanded uncertainty (95% confidence)	mg/m^3	0.587	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m^3	1.056	
Reported Uncertainty	mg/m^3	1.056	
Expanded uncertainty (95% confidence)	%	138.7	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	249.7	
Reported Uncertainty	%	249.7	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

(CONCURRENT WATER VAPOUR)

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	1.0450		uV _m	m ³	0.0209	
Sampled Gas Temperature	T _m	299.0		uT _m	K	2.0	
Sampled Gas Pressure	p _m	103.2		uρ _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Repeatability of Weighing	R _w	6.30		uR _w	g	0.16	
Reading of Balance	R _b	6.30		uR _b	g	0.03	
Leak	L	0.79			%	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Repeatability of Weighing	%	2.54		No Requirement
Reading of Balance	%	0.50		No Requirement
Leak	%	0.79		≤2%

Measured Quantities	Uncertainty in Measurement Units				Sensitivity Coefficient	
	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V _m	m ³	1.0088		0.77	
Repeatability of Weighing	R _w	g	6.30		0.12	
Reading of Balance	R _b	g	6.30		0.12	
Leak	L	% v/v	0.00		1.00	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	% v/v	0.019	
Repeatability of Weighing	% v/v	0.0196	
Reading of Balance	% v/v	0.0039	
Leak	% v/v	0.0035	

Parameter	Units	Run 1	
Combined uncertainty	% v/v	0.03	
Expanded uncertainty (95% confidence)	% v/v	0.05	
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.05	
Uncertainty if Water Droplets are present	% v/v		
Reported Uncertainty	% v/v	0.05	
Expanded uncertainty (95% confidence)	%	7.0	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	7.0	
Uncertainty if Water Droplets are present	%		
Reported Uncertainty	%	7.0	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
35C - MIR

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.9		1.9
Uncertainty	±mg/m ³	1.6		1.6
Mass Emission	g/hr	14.3		14.3
Uncertainty	±g/hr	11.8		11.8

General Sampling Information

Parameter	Value
Probe Material	Stainless Steel
Filtration Type / Size	0.5µm Ceramic
Heated Head Filter Used	No
Heated Line Temperature	180°C
Span Gas Reference Number	CYL 1.003
Span Gas Expiry Date	01/08/2011
Span Gas Start Pressure (bar)	190
Gas Cylinder Concentration (ppm)	79
Span Gas Uncertainty (%)	2
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A2

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

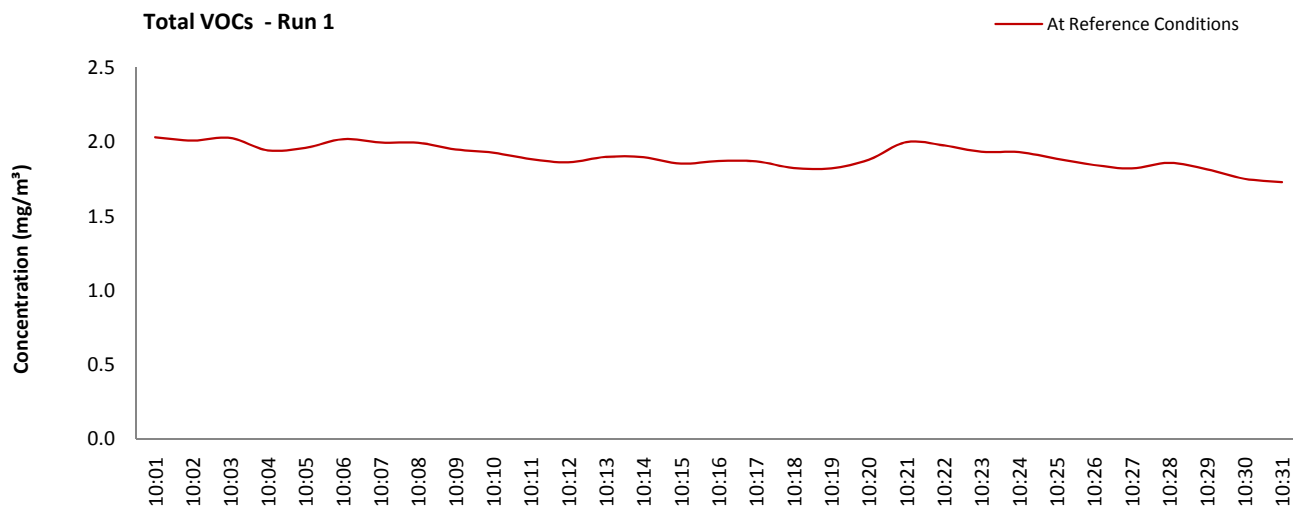
Reference Conditions

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

APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	10:01 - 10:31	
Sampling Dates	-	17/09/2008	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

Zero Drift	Units	Run 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	
Span Down Sampling Line (Pre)	ppm	30.80	
Span Down Sampling Line (Post)	ppm	30.20	
Span Drift	ppm	-0.60	
Allowable Span Drift	± ppm	1.56	
Span Drift Acceptable	-	Yes	

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
Range	ppm	100.0		
Measured Reading	ppm	1.2		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.289		
Temperature Dependent Zero Drift	ppm	0.289		
Temperature Dependent Span Drift	ppm	0.289		
Cross-Sensitivity	ppm	0.027		
Leak	ppm	0.01		
Calibration Gas Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.50		
Expanded uncertainty (95% confidence)	ppm	0.98		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.98		
Reported Uncertainty	ppm	0.98		
Expanded uncertainty (95% confidence)	%	82.8		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	82.8		
Reported Uncertainty	%	82.8		



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Your Catalyst Contact: Stuart Davidson (07957 554 956)

Stack Emissions Testing Report Commissioned by

VIP-Polymers Ltd

Installation Name & Address

VIP-Polymers Ltd

15 Windover Road

Huntingdon

Cambridgeshire

PE29 3DA

PPC Permit: 11/94

Stack Reference

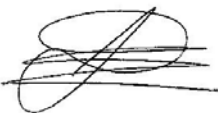
27 - Desma 16 Booth

Dates of the Monitoring Campaign

15th September 2008

Job Reference Number

CAT-0043

Report Written by
Rob Hester Technician MCERTS Level 1 MM 06 766 None
Report Approved by
James Harmer Technical Manager MCERTS Level 2 MM 03 156 TE1 TE2 TE3 TE4
Report Date
25th September 2008
Report Version
Version 1
Signature of Report Approver




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TITLE PAGE

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APPENDICES

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

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Executive Summary (Page 1 of 7)

MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

27 - Desma 16 Booth

15th September 2008

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions monitoring on the 27 - Desma 16 Booth by VIP Polymers Ltd at their Plant in Huntingdon.

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

Special Requirements

There were no special requirements.

Executive Summary (Page 2 of 7)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon

27 - Desma 16 Booth

15th September 2008

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	mg/m ³	0.59	1.3	10	g/hr	1.0	2.4	N/A
Total VOCs (as Carbon)	mg/m ³	1.1	1.6	50	g/hr	1.9	2.8	N/A
Water Vapour	% v/v	0.71	0.05					
Stack Gas Temperature	°C	24.6						
Stack Gas Velocity	m/s	6.6						
Stack Gas Volumetric Flow Rate (ACTUAL)	m ³ /hr	1901						
Stack Gas Volumetric Flow Rate (REF)	m ³ /hr	1761						

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

Executive Summary (Page 3 of 7)

MONITORING DATES & TIMES

VIP-Polymers Ltd, Huntingdon

27 - Desma 16 Booth

15th September 2008

Parameter		Sampling Date/s	Sampling Times	Sampling Duration (mins)
Total Particulate Matter	Run 1	15/09/2008	13:08 - 13:38	30
Total VOCs (as Carbon)	Run 1	15/09/2008	12:35 - 13:05	30
Velocity & Volumetric Flow Rate	Run 1	15/09/2008	12:10 - 12:15	

Executive Summary (Page 4 of 7)

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon

27 - Desma 16 Booth

15th September 2008

Standard Operating Conditions

Parameter	Value
Process Status	Normal
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Rubber
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary (Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon
27 - Desma 16 Booth
15th September 2008

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.15 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.22 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	1	The mass of total particulate matter collected was less than 20 x the balance uncertainty.

Executive Summary (Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

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

Sampling Platform

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

M1 Platform Requirements	Value
Minimum Platform Area 5m ²	N/A
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
Obstructions do not hamper insertion of sampling equipment	Yes
Depth of Platform = Minimum of 2m or Probe Length + 1m	Yes

Sampling Location / Platform Improvement Recommendations

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

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

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	20.0		> 5 Pa	Yes
Mean Velocity	m/s	6.57		-	-
Lowest Gas Velocity	m/s	4.80		-	-
Highest Gas Velocity	m/s	8.60		-	-
Ratio of Above	: 1	1.79		< 3 : 1	Yes
Maximum Angle of Swirl	°	2		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes
Other Criteria	Units	Traverse		Required	Compliant
Homogeneous Flow Stream	-	Yes		-	-

Executive Summary (Page 7 of 7)

PLANT PHOTOS

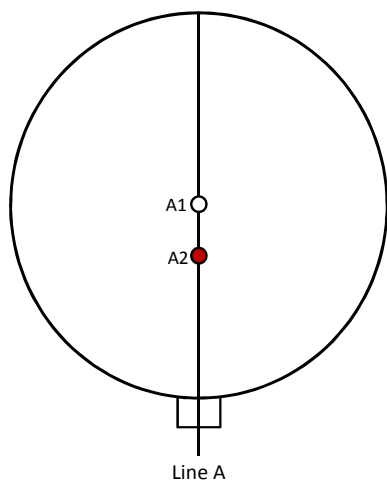
Photo 1



Photo 2



SAMPLE POINTS



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

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Paul Martin
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 04 503
	Technical Endorsements	TE1 TE2 TE3 TE4
Technician	Name	Robert Hester
	MCERTS Accreditation	MCERTS Level 1
	MCERTS Number	MM 06 766
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.3
Box Thermocouples	CAT 3.8
Umbilical	CAT 03.08
Oven Box	CAT 12.3
Probe	CAT 5.3
S-Pitot (1)	CAT 21P.3
S-Pitot (2)	CAT 21S.7
L-Pitot	-
500g Check Weight	CAT 17.3
1Kg Check Weight	CAT 17.3
Last Impinger Arm	-
Calipers	CAT 23.3
Small DGM	-
Laboratory Balance	CAT 1.18
Tapemeasure	CAT 16.1

Instrumental Analysers	
Equipment Type	Equipment I.D.
Horiba PG-250 Analyser	-
JCT JCC P-1 Cooler	-
5m FT-IR	-
5m FT-IR Sampling System	-
Bernath 3006 FID	CAT 8.2
Heated Head Filter	-
Mass Flow Controller (1)	CAT 6.5
Mass Flow Controller (2)	CAT 6.6
Easylogger EN-EL-12 Bit	CAT 11.1

Miscellaneous Items	
Equipment Type	Equipment I.D.
Digital Manometer (1)	CAT 3.3
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.3
Stopwatch	CAT 14.7
Protractor	-
Barometer	CAT 13.3
Stack Thermocouple (1)	CAT 4.16
Stack Thermocouple (2)	CAT 4.35
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	CAT 20.3
15m Heated Line (1)	-
15m Heated Line (2)	-
20m Heated Line (1)	-

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details	Units	Value
Stack Diameter / Depth, D	m	0.32
Stack Width, W	m	-
Stack Area, A	m ²	0.08
Average Stack Gas Temperature, T _a	°C	24.3
Average Stack Gas Pressure	Pa	38.5
Average Stack Static Pressure, P _{static}	kPa	-0.040
Average Barometric Pressure, P _b	kPa	102.2
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂	-	20.80	20.65	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.58	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.71	0.0071	18.02	0.8037	0.00573

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P _{STD}	kg/m ³	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.284
Dry Density (Actual), P _{Actual}	kg/m ³	1.192
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.189

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

$P_{STW} = (P_{STD} + p_i \text{ of H}_2\text{O}) / (1 + (p_i \text{ of H}_2\text{O} / 0.8037))$

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	Reference
Temperature	°C	24	0
Total Pressure	kPa	102.2	101.3
Moisture	%	0.7	0.7

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	1901
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	1761
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	1748

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	15/09/2008
Time of Survey	-	12:10 - 12:15
Atmospheric Pressure	kPa	102.2
Stack Static Pressure	Pa	-40
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																			

Sampling Line A					
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	20.0	23.8	1.191	4.80
2	0.05	26.0	23.8	1.191	5.47
3	0.08	22.0	24.2	1.189	5.04
4	0.11	39.0	24.2	1.189	6.71
5	0.14	32.0	24.3	1.189	6.08
6	0.18	39.0	24.2	1.189	6.71
7	0.21	44.0	24.3	1.189	7.13
8	0.24	51.0	24.6	1.188	7.68
9	0.27	64.0	24.7	1.187	8.60
10	0.30	48.0	24.8	1.187	7.45
Mean		38.5	24.3	1.189	6.57

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
27 - Desma 16 Booth

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.59		0.59
Uncertainty	±mg/m ³	1.34		1.34
Mass Emission	g/hr	1.0		1.0
Uncertainty	±g/hr	2.4		2.4

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

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.71		0.71
Uncertainty	±% v/v	0.05		0.05

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.59		0.59

General Sampling Information

Parameter	Value	
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	766.5	
Stack static pressure, P_{static}	mmH ₂ O	-4.1	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	766.2	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-5.0	
Total mass collected in impingers (silica trap)	g	10.8	
Total mass of liquid collected, V_{lc}	g	5.8	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0072	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.0579	
Gas meter correction factor, Y_d	-	1.0130	
Average dry gas meter temperature, T_m	°C	23.8	
Average pressure drop across orifice, ΔH	mmH ₂ O	124.9	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.0059	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0071	
B_{wo} as a percentage	% v/v	0.71	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.71	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.0132	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.76	
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	5.23	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	2.29	
Average stack gas temperature, T_s	°C	25.0	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (\sqrt{M_s}(P_s))$	m/s	7.71	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})			
Area of stack, A_s	m ²	0.08	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	37.2	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	34.4	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	34.1	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	9.89	
Nozzle area, A_n	mm ²	76.88	
Total sampling time, q	min	30	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	102.7	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	13:08 - 13:38	
Sampling Dates	-	15/09/2008	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.0132	
Filter I.D. Number	-	47-0240	
Start Filter Mass	g	0.15344	
End Filter Mass	g	0.15357	
Total Mass on Filter	g	0.00013	
Probe Rinse I.D. Number	-	PR-47-0240	
Start Probe Rinse Mass	g	3.62052	
End Probe Rinse Mass	g	3.62088	
Total Mass in Probe Rinse	g	0.00036	
Total Mass Collected	mg	0.49	
Calculated Concentration	mg/m ³	0.48	
Balance Uncertainty / LOD	mg/m ³	0.15	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	15/09/2008	
Average Volume Sampled (REF)	m ³	1.0132	
Filter I.D. Number	-	47-0239	
Start Filter Mass	g	0.15360	
End Filter Mass	g	0.15368	
Total Mass on Filter	g	0.00008	
Probe Rinse I.D. Number	-	PR-47-0239	
Start Probe Rinse Mass	g	3.62358	
End Probe Rinse Mass	g	3.62410	
Total Mass in Probe Rinse	g	0.00052	
Total Mass Collected	mg	0.60	
Calculated Concentration	mg/m ³	0.59	
Balance Uncertainty / LOD	mg/m ³	0.15	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	35.72	
Pre-Sampling Leak Rate	l/min	0.15	
Post-Sampling Leak Rate	l/min	0.25	
Allowable Leak Rate	l/min	0.71	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	7.4	
Allowable MU	%	20	
MU Acceptable	%	Yes	

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

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	102.7	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.15	
Balance Uncertainty	± mg/m ³	0.15	
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	0.15	
20 x Balance Uncertainty	mg	3.00	
Mass Collected	mg	0.49	
Sample Time	mins	30	
Balance Uncertainty Acceptable	-	No	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	25	

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	0.16	
Post-Sampling Leak Rate	l/min	0.18	
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 was less than 20 x the balance uncertainty.	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	1.0579		uV _m	m ³	0.0212	
Sampled Gas Temperature	T _m	298.0		uT _m	K	2.0	
Sampled Gas Pressure	p _m	103.4		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.70		uL	%	-	
Mass of Particulate	m	0.49		um	mg	0.15	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.60		uUCM	mg	-	

Uncertainty as a Percentage				Requirement of Standard
Measured Quantities	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.70		≤2%
Mass of Particulate	%	1.81		<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	1.0059	0.59	
Leak	L	mg/m ³	0.002	1.00	
Mass of Particulate	L _r	mg	0.490	1.21	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A	N/A	
Uncollected Mass	UCM	mg	0.35	1.21	

Uncertainty in Result		
Measured Quantities	Units	Run 1
Sampled Volume (STP)	mg/m ³	0.015
Leak	mg/m ³	0.0024
Mass of Particulate	mg/m ³	0.1813
Factor for O ₂ Correction	mg/m ³	N/A
Uncollected Mass	mg/m ³	0.4187

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.456	
Expanded uncertainty (95% confidence)	mg/m ³	0.895	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	1.342	
Reported Uncertainty	mg/m ³	1.342	
Expanded uncertainty (95% confidence)	%	151.1	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	226.6	
Reported Uncertainty	%	226.6	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

(CONCURRENT WATER VAPOUR)

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	1.0579		uV _m	m ³	0.0212	
Sampled Gas Temperature	T _m	298.0		uT _m	K	2.0	
Sampled Gas Pressure	p _m	103.4		uρ _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Repeatability of Weighing	R _w	5.80		uR _w	g	0.16	
Reading of Balance	R _b	5.80		uR _b	g	0.03	
Leak	L	0.70			%	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Repeatability of Weighing	%	2.76		No Requirement
Reading of Balance	%	0.50		No Requirement
Leak	%	0.70		≤2%

Measured Quantities	Uncertainty in Measurement Units				Sensitivity Coefficient	
	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V _m	m ³	1.0059		0.71	
Repeatability of Weighing	R _w	g	5.80		0.12	
Reading of Balance	R _b	g	5.80		0.12	
Leak	L	% v/v	0.00		1.00	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	% v/v	0.018	
Repeatability of Weighing	% v/v	0.0197	
Reading of Balance	% v/v	0.0036	
Leak	% v/v	0.0029	

Parameter	Units	Run 1	
Combined uncertainty	% v/v	0.03	
Expanded uncertainty (95% confidence)	% v/v	0.05	
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.05	
Uncertainty if Water Droplets are present	% v/v		
Reported Uncertainty	% v/v	0.05	
Expanded uncertainty (95% confidence)	%	7.4	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	7.4	
Uncertainty if Water Droplets are present	%		
Reported Uncertainty	%	7.4	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
27 - Desma 16 Booth

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.1		1.1
Uncertainty	±mg/m ³	1.6		1.6
Mass Emission	g/hr	1.9		1.9
Uncertainty	±g/hr	2.8		2.8

General Sampling Information

Parameter	Value
Probe Material	Stainless Steel
Filtration Type / Size	0.5µm Ceramic
Heated Head Filter Used	No
Heated Line Temperature	180
Span Gas Reference Number	CAT 1.003
Span Gas Expiry Date	01/08/2011
Span Gas Start Pressure (bar)	195
Gas Cylinder Concentration (ppm)	79
Span Gas Uncertainty (%)	2
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A2

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

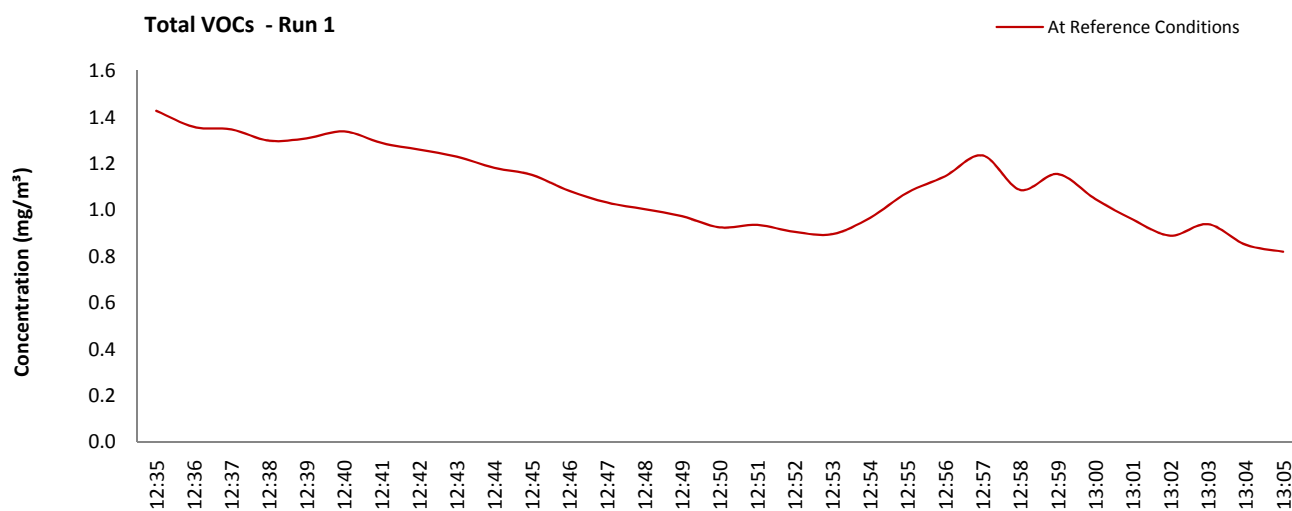
Reference Conditions

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	-	12:35 - 13:05	
Sampling Dates	-	15/09/2008	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

Zero Drift	Units	Run 1	
Zero Down Sampling Line (Pre)	ppm	0.20	
Zero Down Sampling Line (Post)	ppm	-0.03	
Zero Drift	ppm	-0.23	
Allowable Zero Drift	± ppm	1.56	
Zero Drift Acceptable	-	Yes	

Span Drift	Units	Run 1	
Span Down Sampling Line (Pre)	ppm	31.00	
Span Down Sampling Line (Post)	ppm	30.90	
Span Drift	ppm	-0.10	
Allowable Span Drift	± ppm	1.56	
Span Drift Acceptable	-	Yes	

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
Range	ppm	100.0		
Measured Reading	ppm	0.7		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.289		
Temperature Dependent Zero Drift	ppm	0.289		
Temperature Dependent Span Drift	ppm	0.289		
Cross-Sensitivity	ppm	0.016		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.50		
Expanded uncertainty (95% confidence)	ppm	0.98		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.98		
Reported Uncertainty	ppm	0.98		
Expanded uncertainty (95% confidence)	%	143.2		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	143.2		
Reported Uncertainty	%	143.2		



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Stack Emissions Testing Report Commissioned by

VIP-Polymers Ltd

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 3DA

PPC Permit: 11/94

Stack Reference

26 - Desma 12 Booth

Dates of the Monitoring Campaign

15th September 2008

Job Reference Number

CAT-0043

Report Written by
Paul Martin Team Leader MCERTS Level 2 MM 04 503 TE1 TE2 TE3 TE4
Report Approved by
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Report Date
24th September 2008
Report Version
Version 1
Signature of Report Approver


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APPENDICES

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Executive Summary (Page 1 of 7)

MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

26 - Desma 12 Booth

15th September 2008

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions monitoring on the 26 - Desma 12 Booth by VIP Polymers Ltd at their Plant in Huntingdon.

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

Special Requirements

There were no special requirements.

Executive Summary (Page 2 of 7)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon

26 - Desma 12 Booth

15th September 2008

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	mg/m ³	0.62	1.1	10	g/hr	1.4	2.5	N/A
Total VOCs (as Carbon)	mg/m ³	1.9	1.6	50	g/hr	4.3	3.6	N/A
Water Vapour	% v/v	0.17	0.04					
Stack Gas Temperature	°C	26.3						
Stack Gas Velocity	m/s	9.8						
Stack Gas Volumetric Flow Rate (ACTUAL)	m ³ /hr	2503						
Stack Gas Volumetric Flow Rate (REF)	m ³ /hr	2305						

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

Executive Summary (Page 3 of 7)

MONITORING DATES & TIMES

VIP-Polymers Ltd, Huntingdon

26 - Desma 12 Booth

15th September 2008

Parameter		Sampling Date/s	Sampling Times	Sampling Duration (mins)
Total Particulate Matter	Run 1	15/09/2008	15:45 - 16:15	30
Total VOCs (as Carbon)	Run 1	15/09/2008	14:55 - 15:25	30
Velocity & Volumetric Flow Rate	Run 1	15/09/2008	15:10 - 15:20	

Executive Summary (Page 4 of 7)

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon

26 - Desma 12 Booth

15th September 2008

Standard Operating Conditions

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

Executive Summary (Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon
26 - Desma 12 Booth
15th September 2008

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.17 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.22 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	1	The mass of particulate collected was less than 20 x the balance uncertainty.
Total Particulate Matter & Water Vapour	1	The method uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.

Executive Summary (Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.30
Width	m	-
Area	m ²	0.07
Port Depth	cm	4
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Sampling Platform

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

M1 Platform Requirements	Value
Minimum Platform Area 5m ²	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
Obstructions do not hamper insertion of sampling equipment	Yes
Depth of Platform = Minimum of 2m or Probe Length + 1m	Yes

Sampling Location / Platform Improvement Recommendations

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

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

Criteria in M1	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	69.0	> 5 Pa	Yes
Mean Velocity	m/s	9.84	-	-
Lowest Gas Velocity	m/s	8.94	-	-
Highest Gas Velocity	m/s	10.91	-	-
Ratio of Above	: 1	1.22	< 3 : 1	Yes
Maximum Angle of Swirl	°	6	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes
Other Criteria	Units	Traverse	Required	Compliant
Homogeneous Flow Stream	-	Yes	-	-

Executive Summary (Page 7 of 7)

PLANT PHOTOS

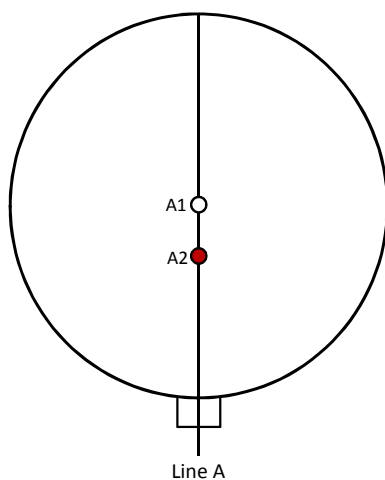
Photo 1



Photo 2



SAMPLE POINTS



where

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

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Paul Martin
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 04 503
	Technical Endorsements	TE1 TE2 TE3 TE4
Technician	Name	Robert Hester
	MCERTS Accreditation	MCERTS Level 1
	MCERTS Number	MM 06 766
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.3
Box Thermocouples	CAT 3.8
Umbilical	CAT 03.08
Oven Box	CAT 12.3
Probe	CAT 5.3
S-Pitot (1)	CAT 21P.3
S-Pitot (2)	CAT 21S.7
L-Pitot	-
500g Check Weight	CAT 17.3
1Kg Check Weight	CAT 17.3
Last Impinger Arm	-
Calipers	CAT 23.3
Small DGM	-
Laboratory Balance	CAT 1.18
Tapemeasure	CAT 16.1

Instrumental Analysers	
Equipment Type	Equipment I.D.
Horiba PG-250 Analyser	-
JCT JCC P-1 Cooler	-
5m FT-IR	-
5m FT-IR Sampling System	-
Bernath 3006 FID	CAT 8.2
Heated Head Filter	-
Mass Flow Controller (1)	CAT 6.5
Mass Flow Controller (2)	CAT 6.6
Easylogger EN-EL-12 Bit	CAT 11.1

Miscellaneous Items	
Equipment Type	Equipment I.D.
Digital Manometer (1)	CAT 3.3
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.3
Stopwatch	CAT 14.7
Protractor	-
Barometer	CAT 13.3
Stack Thermocouple (1)	CAT 4.16
Stack Thermocouple (2)	CAT 4.35
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	CAT 20.3
15m Heated Line (1)	-
15m Heated Line (2)	-
20m Heated Line (1)	-

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details	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	25.7
Average Stack Gas Pressure	Pa	83.9
Average Stack Static Pressure, P _{static}	kPa	-0.070
Average Barometric Pressure, P _b	kPa	102.1
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂	-	20.80	20.77	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	79.01	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.17	0.0017	18.02	0.8037	0.00133

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P _{STD}	kg/m ³	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.286
Dry Density (Actual), P _{Actual}	kg/m ³	1.185
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.184

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

$P_{STW} = (P_{STD} + p_i \text{ of H}_2\text{O}) / (1 + (p_i \text{ of H}_2\text{O} / 0.8037))$

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	Reference
Temperature	°C	26	0
Total Pressure	kPa	102.0	101.3
Moisture	%	0.2	0.2

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	2503
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	2305
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	2301

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	15/09/2008
Time of Survey	-	15:10 - 15:20
Atmospheric Pressure	kPa	102.1
Stack Static Pressure	Pa	-70
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																			

Sampling Line A					
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	84.0	25.5	1.185	9.86
2	0.05	93.0	25.3	1.186	10.37
3	0.08	99.0	25.1	1.187	10.70
4	0.11	103.0	25.1	1.187	10.91
5	0.14	91.0	25.5	1.185	10.27
6	0.17	69.0	25.8	1.184	8.94
7	0.20	77.0	26.2	1.182	9.45
8	0.23	82.0	26.2	1.182	9.76
9	0.26	70.0	25.9	1.183	9.01
10	0.29	71.0	25.9	1.183	9.07
Mean		83.9	25.7	1.184	9.84

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
26 - Desma 12 Booth

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.62		0.62
Uncertainty	±mg/m ³	1.09		1.09
Mass Emission	g/hr	1.4		1.4
Uncertainty	±g/hr	2.5		2.5

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.17		0.17
Uncertainty	±% v/v	0.04		0.04

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.57		0.57

General Sampling Information

Parameter	Value	
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	765.8	
Stack static pressure, P_{static}	mmH ₂ O	-7.1	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	765.2	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-13.3	
Total mass collected in impingers (silica trap)	g	14.5	
Total mass of liquid collected, V_{lc}	g	1.2	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0015	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.9662	
Gas meter correction factor, Y_d	-	1.0130	
Average dry gas meter temperature, T_m	°C	27.7	
Average pressure drop across orifice, ΔH	mmH ₂ O	102.5	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.9042	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0017	
B_{wo} as a percentage	% v/v	0.17	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.17	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.9057	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.82	
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	9.79	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	3.13	
Average stack gas temperature, T_s	°C	27.0	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (\sqrt{M_s}(P_s))$	m/s	10.59	
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	0.07	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	44.9	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	41.2	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	41.1	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	8.00	
Nozzle area, A_n	mm ²	50.31	
Total sampling time, q	min	30	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	103.0	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	15:45 - 16:15	
Sampling Dates	-	15/09/2008	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.9057	
Filter I.D. Number	-	47-0232	
Start Filter Mass	g	0.15059	
End Filter Mass	g	0.15088	
Total Mass on Filter	g	0.00029	
Probe Rinse I.D. Number	-	PR-47-0232	
Start Probe Rinse Mass	g	3.63342	
End Probe Rinse Mass	g	3.63369	
Total Mass in Probe Rinse	g	0.00027	
Total Mass Collected	mg	0.56	
Calculated Concentration	mg/m ³	0.62	
Balance Uncertainty / LOD	mg/m ³	0.17	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	15/09/2008	
Average Volume Sampled (REF)	m ³	0.9057	
Filter I.D. Number	-	47-0238	
Start Filter Mass	g	0.15176	
End Filter Mass	g	0.15184	
Total Mass on Filter	g	0.00008	
Probe Rinse I.D. Number	-	PR-47-0238	
Start Probe Rinse Mass	g	3.72488	
End Probe Rinse Mass	g	3.72532	
Total Mass in Probe Rinse	g	0.00044	
Total Mass Collected	mg	0.52	
Calculated Concentration	mg/m ³	0.57	
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	32.63	
Pre-Sampling Leak Rate	l/min	0.15	
Post-Sampling Leak Rate	l/min	0.10	
Allowable Leak Rate	l/min	0.65	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	26.6	
Allowable MU	%	20	
MU Acceptable	%	No	

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

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	103.0	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.15	
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	0.15	
20 x Balance Uncertainty	mg	3.00	
Mass Collected	mg	0.56	
Sample Time	mins	30	
Balance Uncertainty Acceptable	-	No	

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

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	0.30	
Post-Sampling Leak Rate	l/min	0.28	
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 particulate collected was less than 20x the balance uncertainty.	x	
The method uncertainty for water vapour was greater than 20%. This was due to the low level of water vapour which was found to be present in the stack.	wx	

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	0.9662		uV _m	m ³	0.0193	
Sampled Gas Temperature	T _m	300.0		uT _m	K	2.0	
Sampled Gas Pressure	p _m	103.1		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.31		uL	%	-	
Mass of Particulate	m	0.56		um	mg	0.15	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.52		uUCM	mg	-	

Uncertainty as a Percentage				Requirement of Standard
Measured Quantities	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.31		≤2%
Mass of Particulate	%	1.66		<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	0.9042	0.68	
Leak	L	mg/m ³	0.001	1.00	
Mass of Particulate	L _r	mg	0.560	1.10	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A	N/A	
Uncollected Mass	UCM	mg	0.30	1.10	

Uncertainty in Result		
Measured Quantities	Units	Run 1
Sampled Volume (STP)	mg/m ³	0.015
Leak	mg/m ³	0.0011
Mass of Particulate	mg/m ³	0.1656
Factor for O ₂ Correction	mg/m ³	N/A
Uncollected Mass	mg/m ³	0.3315

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.371	
Expanded uncertainty (95% confidence)	mg/m ³	0.727	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	1.090	
Reported Uncertainty	mg/m ³	1.090	
Expanded uncertainty (95% confidence)	%	117.6	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	176.3	
Reported Uncertainty	%	176.3	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

(CONCURRENT WATER VAPOUR)

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	0.9662		uV _m	m ³	0.0193	
Sampled Gas Temperature	T _m	300.0		uT _m	K	2.0	
Sampled Gas Pressure	p _m	103.1		uρ _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Repeatability of Weighing	R _w	1.20		uR _w	g	0.16	
Reading of Balance	R _b	1.20		uR _b	g	0.01	
Leak	L	0.31			%	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Repeatability of Weighing	%	13.33		No Requirement
Reading of Balance	%	0.50		No Requirement
Leak	%	0.31		≤2%

Measured Quantities	Uncertainty in Measurement Units				Sensitivity Coefficient	
	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V _m	m ³	0.9042		0.18	
Repeatability of Weighing	R _w	g	1.20		0.14	
Reading of Balance	R _b	g	1.20		0.14	
Leak	L	% v/v	0.00		1.00	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	% v/v	0.004	
Repeatability of Weighing	% v/v	0.0220	
Reading of Balance	% v/v	0.0008	
Leak	% v/v	0.0003	

Parameter	Units	Run 1	
Combined uncertainty	% v/v	0.02	
Expanded uncertainty (95% confidence)	% v/v	0.04	
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.04	
Uncertainty if Water Droplets are present	% v/v		
Reported Uncertainty	% v/v	0.04	
Expanded uncertainty (95% confidence)	%	26.6	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	26.6	
Uncertainty if Water Droplets are present	%		
Reported Uncertainty	%	26.6	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
26 - Desma 12 Booth

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.9		1.9
Uncertainty	±mg/m ³	1.6		1.6
Mass Emission	g/hr	4.3		4.3
Uncertainty	±g/hr	3.6		3.6

General Sampling Information

Parameter	Value	
Probe Material	Stainless Steel	
Filtration Type / Size	0.5µm Stainless Steel	
Heated Head Filter Used	No	
Heated Line Temperature	180°C	
Span Gas Reference Number	CAT 1.003	
Span Gas Expiry Date	01/08/2011	
Span Gas Start Pressure (bar)	195	
Gas Cylinder Concentration (ppm)	79	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A2	

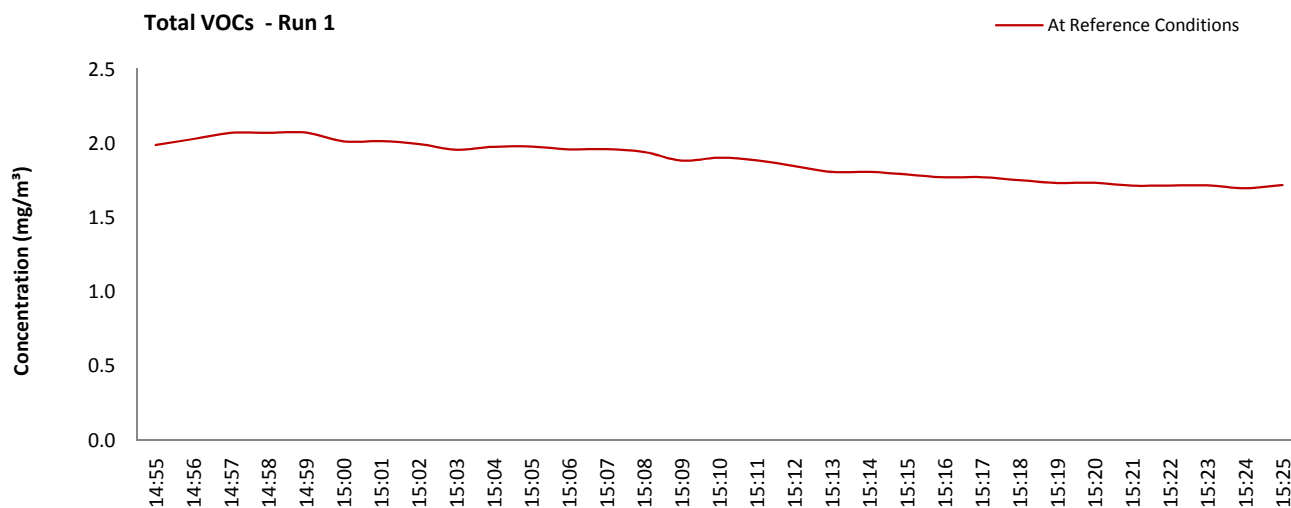
Reference Conditions

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

APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	14:55 - 15:25	
Sampling Dates	-	15/09/2008	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

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

Span Drift	Units	Run 1	
Span Down Sampling Line (Pre)	ppm	31.10	
Span Down Sampling Line (Post)	ppm	30.60	
Span Drift	ppm	-0.50	
Allowable Span Drift	± ppm	1.56	
Span Drift Acceptable	-	Yes	

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
Range	ppm	100.0		
Measured Reading	ppm	1.2		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.289		
Temperature Dependent Zero Drift	ppm	0.289		
Temperature Dependent Span Drift	ppm	0.289		
Cross-Sensitivity	ppm	0.027		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.50		
Expanded uncertainty (95% confidence)	ppm	0.98		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.98		
Reported Uncertainty	ppm	0.98		
Expanded uncertainty (95% confidence)	%	83.9		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	83.9		
Reported Uncertainty	%	83.9		



Air Tech Environmental Consultancy Services



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Your Catalyst Contact: Stuart Davidson (07957 554 956)

Stack Emissions Testing Report Commissioned by
VIP-Polymers Ltd

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 3DA

PPC Permit: 11/94

Stack Reference

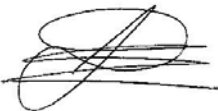
25 - Desma 11 Booth

Dates of the Monitoring Campaign

15th September 2008

Job Reference Number

CAT-0043

Report Written by
Paul Martin Team Leader MCERTS Level 2 MM 04 503 TE1 TE2 TE3 TE4
Report Approved by
James Harmer Technical Manager MCERTS Level 2 MM 03 156 TE1 TE2 TE3 TE4
Report Date
24th September 2008
Report Version
Version 1
Signature of Report Approver




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APPENDICES

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

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Executive Summary (Page 1 of 7)

MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon
25 - Desma 11 Booth
15th September 2008

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions monitoring on the 25 - Desma 11 Booth by VIP Polymers Ltd at their Plant in Huntingdon.

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

Special Requirements

There were no special requirements.

Executive Summary (Page 2 of 7)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon

25 - Desma 11 Booth

15th September 2008

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	mg/m ³	0.62	1.6	10	g/hr	1.6	4.1	N/A
Total VOCs (as Carbon)	mg/m ³	2.2	1.6	50	g/hr	5.5	4.0	N/A
Water Vapour	% v/v	0.80	0.06					
Stack Gas Temperature	°C	25.8						
Stack Gas Velocity	m/s	10.9						
Stack Gas Volumetric Flow Rate (ACTUAL)	m ³ /hr	2763						
Stack Gas Volumetric Flow Rate (REF)	m ³ /hr	2546						

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

Executive Summary (Page 3 of 7)

MONITORING DATES & TIMES

VIP-Polymers Ltd, Huntingdon

25 - Desma 11 Booth

15th September 2008

Parameter		Sampling Date/s	Sampling Times	Sampling Duration (mins)
Total Particulate Matter	Run 1	15/09/2008	14:27 - 14:57	30
Total VOCs (as Carbon)	Run 1	15/09/2008	13:51 - 14:21	30
Velocity & Volumetric Flow Rate	Run 1	15/09/2008	13:55 - 14:00	

Executive Summary (Page 4 of 7)

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon

25 - Desma 11 Booth

15th September 2008

Standard Operating Conditions

Parameter	Value
Process Status	Normal
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Rubber
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary (Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon
25 - Desma 11 Booth
15th September 2008

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.15 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.22 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	1	The mass of particulate collected was less than 20 x the balance uncertainty.

Executive Summary (Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.30
Width	m	-
Area	m ²	0.07
Port Depth	cm	4
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Sampling Platform

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

M1 Platform Requirements	Value
Minimum Platform Area 5m ²	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
Obstructions do not hamper insertion of sampling equipment	Yes
Depth of Platform = Minimum of 2m or Probe Length + 1m	Yes

Sampling Location / Platform Improvement Recommendations

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

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

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	73.0		> 5 Pa	Yes
Mean Velocity	m/s	10.86		-	-
Lowest Gas Velocity	m/s	9.20		-	-
Highest Gas Velocity	m/s	12.89		-	-
Ratio of Above	: 1	1.40		< 3 : 1	Yes
Maximum Angle of Swirl	°	3		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes
Other Criteria	Units	Traverse		Required	Compliant
Homogeneous Flow Stream	-	Yes		-	-

Executive Summary (Page 7 of 7)

PLANT PHOTOS

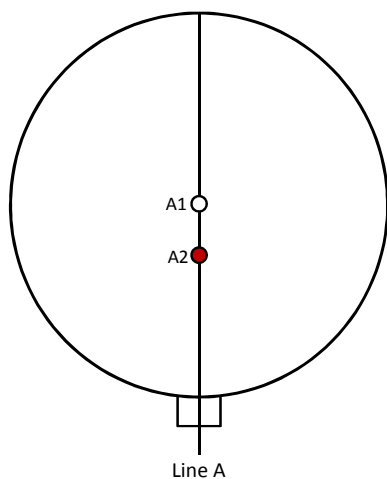
Photo 1



Photo 2



SAMPLE POINTS



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

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Paul Martin
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 04 503
	Technical Endorsements	TE1 TE2 TE3 TE4
Technician	Name	Robert Hester
	MCERTS Accreditation	MCERTS Level 1
	MCERTS Number	MM 06 766
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.3	Horiba PG-250 Analyser	-	Digital Manometer (1)	CAT 3.3
Box Thermocouples	CAT 3.8	JCT JCC P-1 Cooler	-	Digital Manometer (2)	-
Umbilical	CAT 03.08	5m FT-IR	-	Digital Temperature Meter	CAT 3.3
Oven Box	CAT 12.3	5m FT-IR Sampling System	-	Stopwatch	CAT 14.7
Probe	CAT 5.3	Bernath 3006 FID	CAT 8.2	Protractor	-
S-Pitot (1)	CAT 21P.3	Heated Head Filter	-	Barometer	CAT 13.3
S-Pitot (2)	CAT 21S.7	Mass Flow Controller (1)	CAT 6.5	Stack Thermocouple (1)	CAT 4.16
L-Pitot	-	Mass Flow Controller (2)	CAT 6.6	Stack Thermocouple (2)	CAT 4.35
500g Check Weight	CAT 17.3	Easylogger EN-EL-12 Bit	CAT 11.1	1m Heated Line (1)	-
1Kg Check Weight	CAT 17.3			1m Heated Line (2)	-
Last Impinger Arm	-			1m Heated Line (3)	-
Calipers	CAT 23.3			5m Heated Line (1)	CAT 20.3
Small DGM	-			15m Heated Line (1)	-
Laboratory Balance	CAT 1.18			15m Heated Line (2)	-
Tapemeasure	CAT 16.1			20m Heated Line (1)	-

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details	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	25.7
Average Stack Gas Pressure	Pa	102.8
Average Stack Static Pressure, P _{static}	kPa	-0.085
Average Barometric Pressure, P _b	kPa	102.2
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂	-	20.80	20.63	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.50	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.80	0.0080	18.02	0.8037	0.00646

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	1.186
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.183

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

$P_{STW} = (P_{STD} + p_i \text{ of H}_2\text{O}) / (1 + (p_i \text{ of H}_2\text{O} / 0.8037))$

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	Reference
Temperature	°C	26	0
Total Pressure	kPa	102.1	101.3
Moisture	%	0.8	0.8

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	2763
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	2546
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	2526

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	15/09/2008
Time of Survey	-	13:55 - 14:00
Atmospheric Pressure	kPa	102.2
Stack Static Pressure	Pa	-85
Type of Pitot Used	-	S-Type Pitot
Are Water Droplets Present?	-	Yes

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 (°)	3																			

Sampling Line A					
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	113.0	25.4	1.184	11.45
2	0.05	143.0	26.1	1.181	12.89
3	0.08	117.0	26.6	1.179	11.67
4	0.11	126.0	26.5	1.179	12.11
5	0.14	98.0	25.5	1.183	10.66
6	0.17	112.0	25.3	1.184	11.39
7	0.20	77.0	25.4	1.184	9.45
8	0.23	94.0	25.3	1.184	10.44
9	0.26	73.0	25.3	1.184	9.20
10	0.29	75.0	25.3	1.184	9.32
Mean		102.8	25.7	1.183	10.86

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
25 - Desma 11 Booth

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.62		0.62
Uncertainty	±mg/m ³	1.6		1.6
Mass Emission	g/hr	1.6		1.6
Uncertainty	±g/hr	4.1		4.1

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

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.80		0.80
Uncertainty	±% v/v	0.06		0.06

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.62		0.62

General Sampling Information

Parameter	Value	
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	FORMAT: Number Used / Number Required
Number of Sampling Points Used	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	766.5	
Stack static pressure, P_{static}	mmH ₂ O	-8.7	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	765.9	
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	13.0	
Total mass of liquid collected, V_{lc}	g	6.6	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0082	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.0716	
Gas meter correction factor, Y_d	-	1.0130	
Average dry gas meter temperature, T_m	°C	25.2	
Average pressure drop across orifice, ΔH	mmH ₂ O	128.9	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.0148	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0080	
B_{wo} as a percentage	% v/v	0.80	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.80	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.0230	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.75	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K_p	-	34.97	
Velocity pressure coefficient, C_p	-	0.83	
Average of velocity heads, ΔP_{avg}	mmH ₂ O	12.58	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	3.55	
Average stack gas temperature, T_s	°C	26.0	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (\sqrt{M_s}(P_s))$	m/s	12.00	
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	50.9	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	46.8	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	46.4	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	8.00	
Nozzle area, A_n	mm ²	50.31	
Total sampling time, q	min	30	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	102.3	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	14:27 - 14:57	
Sampling Dates	-	15/09/2008	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.0230	
Filter I.D. Number	-	47-0242	
Start Filter Mass	g	0.15328	
End Filter Mass	g	0.15351	
Total Mass on Filter	g	0.00023	
Probe Rinse I.D. Number	-	PR-47-0242	
Start Probe Rinse Mass	g	3.50841	
End Probe Rinse Mass	g	3.50862	
Total Mass in Probe Rinse	g	0.00021	
Total Mass Collected	mg	0.44	
Calculated Concentration	mg/m ³	0.43	
Balance Uncertainty / LOD	mg/m ³	0.15	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	15/09/2008	
Average Volume Sampled (REF)	m ³	1.0230	
Filter I.D. Number	-	47-0241	
Start Filter Mass	g	0.15118	
End Filter Mass	g	0.15123	
Total Mass on Filter	g	0.00005	
Probe Rinse I.D. Number	-	PR-47-0241	
Start Probe Rinse Mass	g	3.44611	
End Probe Rinse Mass	g	3.44669	
Total Mass in Probe Rinse	g	0.00058	
Total Mass Collected	mg	0.63	
Calculated Concentration	mg/m ³	0.62	
Balance Uncertainty / LOD	mg/m ³	0.15	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	36.18	
Pre-Sampling Leak Rate	l/min	0.22	
Post-Sampling Leak Rate	l/min	0.26	
Allowable Leak Rate	l/min	0.72	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	6.9	
Allowable MU	%	20	
MU Acceptable	%	Yes	

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

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	102.3	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.15	
Balance Uncertainty	± mg/m ³	0.15	
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	0.15	
20 x Balance Uncertainty	mg	3.00	
Mass Collected	mg	0.44	
Sample Time	mins	30	
Balance Uncertainty Acceptable	-	No	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	26	

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	0.27	
Post-Sampling Leak Rate	l/min	0.25	
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 particulate collected was less than 20 x the balance uncertainty.	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	1.0716		uV_m	m^3	0.0214	
Sampled Gas Temperature	T_m	299.0		uT_m	K	2.0	
Sampled Gas Pressure	p_m	103.5		up_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Leak	L	0.72		uL	%	-	
Mass of Particulate	m	0.44		um	mg	0.15	
Oxygen Content	$O_{2,m}$	N/A		$uO_{2,m}$	% v/v	N/A	
Uncollected Mass	UCM	0.63		$uUCM$	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		$\leq 2\%$
Sampled Gas Temperature	%	0.67		$\leq 1\%$
Sampled Gas Pressure	%	0.48		$\leq 1\%$
Sampled Gas Humidity	%	1.00		$\leq 1\%$
Leak	%	0.72		$\leq 2\%$
Mass of Particulate	%	2.10		$< 5\%$ of ELV
Oxygen Content	%	N/A		$\leq 5\%$
Uncollected Mass	%	-		-

Uncertainty in Measurement Units					Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V_m	m^3	1.0148		0.61	
Leak	L	mg/ m^3	0.003		1.00	
Mass of Particulate	L_r	mg	0.440		1.40	
Factor for O_2 Correction	$O_{2,m}$	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.36		1.40	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/ m^3	0.015	
Leak	mg/ m^3	0.0026	
Mass of Particulate	mg/ m^3	0.2099	
Factor for O_2 Correction	mg/ m^3	N/A	
Uncollected Mass	mg/ m^3	0.5091	

Parameter	Units	Run 1	
Combined uncertainty	mg/ m^3	0.551	
Expanded uncertainty (95% confidence)	mg/ m^3	1.080	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/ m^3	1.620	
Reported Uncertainty	mg/ m^3	1.620	
Expanded uncertainty (95% confidence)	%	175.3	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	263.0	
Reported Uncertainty	%	263.0	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

(CONCURRENT WATER VAPOUR)

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	1.0716		uV _m	m ³	0.0214	
Sampled Gas Temperature	T _m	299.0		uT _m	K	2.0	
Sampled Gas Pressure	p _m	103.5		uP _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Repeatability of Weighing	R _w	6.60		uR _w	g	0.16	
Reading of Balance	R _b	6.60		uR _b	g	0.03	
Leak	L	0.72			%	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Repeatability of Weighing	%	2.42		No Requirement
Reading of Balance	%	0.50		No Requirement
Leak	%	0.72		≤2%

Measured Quantities	Uncertainty in Measurement Units				Sensitivity Coefficient	
	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V _m	m ³	1.0148		0.79	
Repeatability of Weighing	R _w	g	6.60		0.12	
Reading of Balance	R _b	g	6.60		0.12	
Leak	L	% v/v	0.00		1.00	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	% v/v	0.020	
Repeatability of Weighing	% v/v	0.0195	
Reading of Balance	% v/v	0.0040	
Leak	% v/v	0.0033	

Parameter	Units	Run 1	
Combined uncertainty	% v/v	0.03	
Expanded uncertainty (95% confidence)	% v/v	0.06	
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.06	
Uncertainty if Water Droplets are present	% v/v		
Reported Uncertainty	% v/v	0.06	
Expanded uncertainty (95% confidence)	%	6.9	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	6.9	
Uncertainty if Water Droplets are present	%		
Reported Uncertainty	%	6.9	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
25 - Desma 11 Booth

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	2.16		2.16
Uncertainty	±mg/m ³	1.58		1.58
Mass Emission	g/hr	5.5		5.5
Uncertainty	±g/hr	4.0		4.0

General Sampling Information

Parameter	Value	
Probe Material	Stainless Steel	
Filtration Type / Size	0.5µm Ceramic	
Heated Head Filter Used	No	
Heated Line Temperature	180°C	
Span Gas Reference Number	CAT 1.003	
Span Gas Expiry Date	01/08/2011	
Span Gas Start Pressure (bar)	195	
Gas Cylinder Concentration (ppm)	79	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	

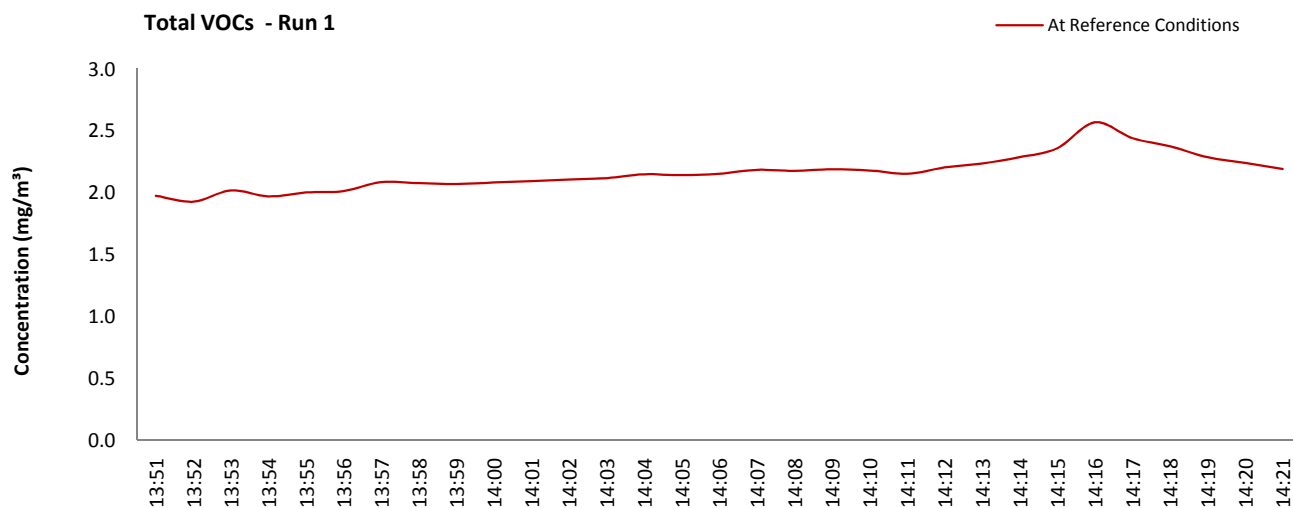
Reference Conditions

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	-	13:51 - 14:21	
Sampling Dates	-	15/09/2008	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

Zero Drift	Units	Run 1	
Zero Down Sampling Line (Pre)	ppm	0.02	
Zero Down Sampling Line (Post)	ppm	-0.20	
Zero Drift	ppm	-0.22	
Allowable Zero Drift	± ppm	1.56	
Zero Drift Acceptable	-	Yes	

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

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
Range	ppm	100.0		
Measured Reading	ppm	1.3		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.289		
Temperature Dependent Zero Drift	ppm	0.289		
Temperature Dependent Span Drift	ppm	0.289		
Cross-Sensitivity	ppm	0.031		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.50		
Expanded uncertainty (95% confidence)	ppm	0.98		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.98		
Reported Uncertainty	ppm	0.98		
Expanded uncertainty (95% confidence)	%	72.9		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	72.9		
Reported Uncertainty	%	72.9		



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Stack Emissions Testing Report Commissioned by
VIP-Polymers Ltd

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 3DA

PPC Permit: 11/94

Stack Reference

8C - Press 19

Dates of the Monitoring Campaign

16th September 2008

Job Reference Number

CAT-0043

Report Written by
Paul Martin Team Leader MCERTS Level 2 MM 04 503 TE1 TE2 TE3 TE4
Report Approved by
James Harmer Technical Manager MCERTS Level 2 MM 03 156 TE1 TE2 TE3 TE4
Report Date
24th September 2008
Report Version
Version 1
Signature of Report Approver




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APPENDICES

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

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Executive Summary (Page 1 of 7)

MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

8C - Press 19

16th September 2008

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions monitoring on the 8C - Press 19 stack by VIP Polymers Ltd at their Plant in Huntingdon.

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

Special Requirements

There were no special requirements.

Executive Summary (Page 2 of 7)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon

8C - Press 19

16th September 2008

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	mg/m ³	0.40	2.2	10	g/hr	1.2	6.8	N/A
Total VOCs (as Carbon)	mg/m ³	3.2	1.6	50	g/hr	9.9	4.9	N/A
Water Vapour	% v/v	0.75	0.06					
Stack Gas Temperature	°C	25.1						
Stack Gas Velocity	m/s	7.4						
Stack Gas Volumetric Flow Rate (ACTUAL)	m ³ /hr	3355						
Stack Gas Volumetric Flow Rate (REF)	m ³ /hr	3101						

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

Executive Summary (Page 3 of 7)

MONITORING DATES & TIMES

VIP-Polymers Ltd, Huntingdon

8C - Press 19

16th September 2008

Parameter		Sampling Date/s	Sampling Times	Sampling Duration (mins)
Total Particulate Matter	Run 1	16/09/2008	13:53 - 14:23	32
Total VOCs (as Carbon)	Run 1	16/09/2008	13:53 - 14:23	30
Velocity & Volumetric Flow Rate	Run 1	16/09/2008	12:50 - 13:00	

Executive Summary (Page 4 of 7)

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon

8C - Press 19

16th September 2008

Standard Operating Conditions

Parameter	Value
Process Status	Normal
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Rubber
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary (Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon
8C - Press 19
16th September 2008

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.18 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.22 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	All	Ratio highest to lowest velocities > 5 : 1.
Total Particulate Matter	All	The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty.
Total Particulate Matter	All	It was not possible to sample at a point where the angle of swirl was greater than 15°.

Executive Summary (Page 6 of 7)

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

Sampling Platform

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

M1 Platform Requirements	Value
Minimum Platform Area 5m ²	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
Obstructions do not hamper insertion of sampling equipment	Yes
Depth of Platform = Minimum of 2m or Probe Length + 1m	Yes

Sampling Location / Platform Improvement Recommendations

Although the sampling location meets the platform requirements in M1, not all of the sampling plane validation criteria were met (see below).

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

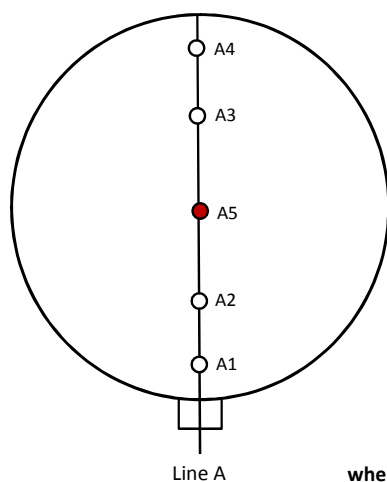
Criteria in M1	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	8.0	> 5 Pa	Yes
Mean Velocity	m/s	7.42	-	-
Lowest Gas Velocity	m/s	3.04	-	-
Highest Gas Velocity	m/s	10.64	-	-
Ratio of Above	: 1	3.50	< 3 : 1	No
Maximum Angle of Swirl	°	63	< 15°	No
No Local Negative Flow	-	Yes	-	Yes
Other Criteria	Units	Traverse	Required	Compliant
Homogeneous Flow Stream	-	No	-	-

Executive Summary (Page 7 of 7)

PLANT PHOTOS



SAMPLE POINTS



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

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Paul Martin
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 04 503
	Technical Endorsements	TE1 TE2 TE3 TE4
Technician	Name	Robert Hester
	MCERTS Accreditation	MCERTS Level 1
	MCERTS Number	MM 06 766
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.3
Box Thermocouples	CAT 3.8
Umbilical	CAT 03.08
Oven Box	CAT 12.3
Probe	CAT 5.3
S-Pitot (1)	CAT 21P.3
S-Pitot (2)	CAT 21S.7
L-Pitot	-
500g Check Weight	CAT 17.3
1Kg Check Weight	CAT 17.3
Last Impinger Arm	-
Calipers	CAT 23.3
Small DGM	-
Laboratory Balance	CAT 1.18
Tapemeasure	CAT 16.1

Instrumental Analysers	
Equipment Type	Equipment I.D.
Horiba PG-250 Analyser	-
JCT JCC P-1 Cooler	-
5m FT-IR	-
5m FT-IR Sampling System	-
Bernath 3006 FID	CAT 8.2
Heated Head Filter	-
Mass Flow Controller (1)	CAT 6.5
Mass Flow Controller (2)	CAT 6.6
Easylogger EN-EL-12 Bit	CAT 11.1

Miscellaneous Items	
Equipment Type	Equipment I.D.
Digital Manometer (1)	CAT 3.3
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.3
Stopwatch	CAT 14.7
Protractor	-
Barometer	CAT 13.3
Stack Thermocouple (1)	CAT 4.16
Stack Thermocouple (2)	CAT 4.35
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	CAT 20.3
15m Heated Line (1)	-
15m Heated Line (2)	-
20m Heated Line (1)	-

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details	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	24.6
Average Stack Gas Pressure	Pa	54.3
Average Stack Static Pressure, P _{static}	kPa	-0.050
Average Barometric Pressure, P _b	kPa	102.1
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂	-	20.80	20.64	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.55	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.75	0.0075	18.02	0.8037	0.00599

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P _{STD}	kg/m ³	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.284
Dry Density (Actual), P _{Actual}	kg/m ³	1.190
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.186

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

$P_{STW} = (P_{STD} + p_i \text{ of H}_2\text{O}) / (1 + (p_i \text{ of H}_2\text{O} / 0.8037))$

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	Reference
Temperature	°C	25	0
Total Pressure	kPa	102.1	101.3
Moisture	%	0.7	0.7

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	3355
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	3101
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	3078

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	16/09/2008
Time of Survey	-	12:50 - 13:00
Atmospheric Pressure	kPa	102.1
Stack Static Pressure	Pa	-50
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 (°)	63	52	48	56																

Sampling Line A					
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	50.0	25.0	1.185	7.61
2	0.06	31.0	24.9	1.185	5.99
3	0.10	8.0	24.9	1.185	3.04
4	0.14	11.0	24.8	1.185	3.57
5	0.18	20.0	24.4	1.187	4.81
6	0.22	51.0	24.4	1.187	7.68
7	0.26	86.0	24.3	1.187	9.97
8	0.30	92.0	24.3	1.187	10.31
9	0.34	98.0	24.4	1.187	10.64
10	0.38	96.0	24.3	1.187	10.53
Mean		54.3	24.6	1.186	7.42

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
8C - Press 19

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.40		0.40
Uncertainty	±mg/m ³	2.20		2.20
Mass Emission	g/hr	1.2		1.2
Uncertainty	±g/hr	6.8		6.8

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.75		0.75
Uncertainty	±% v/v	0.06		0.06

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.30		0.30

General Sampling Information

Parameter	Value	
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	1 / 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	765.0	
Stack static pressure, P_{static}	mmH ₂ O	-5.1	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	764.6	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-5.6	
Total mass collected in impingers (silica trap)	g	10.6	
Total mass of liquid collected, V_{lc}	g	5.0	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0062	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.8782	
Gas meter correction factor, Y_d	-	1.0130	
Average dry gas meter temperature, T_m	°C	24.1	
Average pressure drop across orifice, ΔH	mmH ₂ O	77.4	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.8290	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0075	
B_{wo} as a percentage	% v/v	0.75	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.75	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.8353	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.76	
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	4.69	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	2.17	
Average stack gas temperature, T_s	°C	25.6	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (\sqrt{M_s}(P_s))$	m/s	7.32	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} ($Q_{stw@O_2}$), Dry@O_{2REF} ($Q_{std@O_2}$)			
Area of stack, A_s	m ²	0.13	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	55.2	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	50.8	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	50.4	
$Q_{stw@O_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{std@O_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	8.98	
Nozzle area, A_n	mm ²	63.34	
Total sampling time, q	min	32	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	102.0	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	13:53 - 14:23	
Sampling Dates	-	16/09/2008	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.8353	
Filter I.D. Number	-	47-0215	
Start Filter Mass	g	0.15310	
End Filter Mass	g	0.15331	
Total Mass on Filter	g	0.00021	
Probe Rinse I.D. Number	-	PR-47-0215	
Start Probe Rinse Mass	g	3.82633	
End Probe Rinse Mass	g	3.82645	
Total Mass in Probe Rinse	g	0.00012	
Total Mass Collected	mg	0.33	
Calculated Concentration	mg/m ³	0.40	
Balance Uncertainty / LOD	mg/m ³	0.18	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	16/09/2008	
Average Volume Sampled (REF)	m ³	0.8353	
Filter I.D. Number	-	47-0214	
Start Filter Mass	g	0.15177	
End Filter Mass	g	0.15190	
Total Mass on Filter	g	0.00013	
Probe Rinse I.D. Number	-	PR-47-0214	
Start Probe Rinse Mass	g	3.58294	
End Probe Rinse Mass	g	3.58306	
Total Mass in Probe Rinse	g	0.00012	
Total Mass Collected	mg	0.25	
Calculated Concentration	mg/m ³	0.30	
Balance Uncertainty / LOD	mg/m ³	0.18	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	27.80	
Pre-Sampling Leak Rate	l/min	0.28	
Post-Sampling Leak Rate	l/min	0.40	
Allowable Leak Rate	l/min	0.56	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	8.2	
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	%	102.0	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.15	
Balance Uncertainty	± mg/m ³	0.18	
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	0.15	
20 x Balance Uncertainty	mg	3.00	
Mass Collected	mg	0.33	
Sample Time	mins	32	
Balance Uncertainty Acceptable	-	No	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	26	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	30.00	
Pre-Sampling Leak Rate	l/min	0.35	
Post-Sampling Leak Rate	l/min	0.30	
Allowable Leak Rate	l/min	0.60	
Leak Test Acceptable	-	Yes	

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

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

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
Ratio highest to lowest velocities > 5 : 1.	x	
The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty.	x	
It was not possible to sample at a point where the angle of swirl was greater than 15°.	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	0.8782		uV_m	m^3	0.0176	
Sampled Gas Temperature	T_m	298.6		uT_m	K	2.0	
Sampled Gas Pressure	p_m	102.8		up_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Leak	L	1.44		uL	%	-	
Mass of Particulate	m	0.33		um	mg	0.15	
Oxygen Content	$O_{2,m}$	N/A		$uO_{2,m}$	% v/v	N/A	
Uncollected Mass	UCM	0.25		$uUCM$	mg	-	

Uncertainty as a Percentage				Requirement of Standard
Measured Quantities	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	1.44		≤2%
Mass of Particulate	%	1.80		<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	0.8290	0.48	
Leak	L	mg/ m^3	0.003	1.00	
Mass of Particulate	L_r	mg	0.330	1.20	
Factor for O_2 Correction	$O_{2,m}$	% v/v	N/A	N/A	
Uncollected Mass	UCM	mg	0.14	1.20	

Uncertainty in Result		
Measured Quantities	Units	Run 1
Sampled Volume (STP)	mg/ m^3	0.010
Leak	mg/ m^3	0.0033
Mass of Particulate	mg/ m^3	0.1796
Factor for O_2 Correction	mg/ m^3	N/A
Uncollected Mass	mg/ m^3	0.1728

Parameter	Units	Run 1
Combined uncertainty	mg/ m^3	0.249
Expanded uncertainty (95% confidence)	mg/ m^3	0.489
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/ m^3	2.200
Reported Uncertainty	mg/ m^3	2.200
Expanded uncertainty (95% confidence)	%	123.7
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	556.9
Reported Uncertainty	%	556.9

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

(CONCURRENT WATER VAPOUR)

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	0.8782		uV _m	m ³	0.0176	
Sampled Gas Temperature	T _m	298.6		uT _m	K	2.0	
Sampled Gas Pressure	p _m	102.8		uρ _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Repeatability of Weighing	R _w	5.00		uR _w	g	0.16	
Reading of Balance	R _b	5.00		uR _b	g	0.03	
Leak	L	1.44			%	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Repeatability of Weighing	%	3.20		No Requirement
Reading of Balance	%	0.50		No Requirement
Leak	%	1.44		≤2%

Measured Quantities	Uncertainty in Measurement Units				Sensitivity Coefficient	
	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V _m	m ³	0.8290		0.90	
Repeatability of Weighing	R _w	g	5.00		0.15	
Reading of Balance	R _b	g	5.00		0.15	
Leak	L	% v/v	0.01		1.00	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	% v/v	0.019	
Repeatability of Weighing	% v/v	0.0239	
Reading of Balance	% v/v	0.0037	
Leak	% v/v	0.0062	

Parameter	Units	Run 1	
Combined uncertainty	% v/v	0.03	
Expanded uncertainty (95% confidence)	% v/v	0.06	
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.06	
Uncertainty if Water Droplets are present	% v/v		
Reported Uncertainty	% v/v	0.06	
Expanded uncertainty (95% confidence)	%	8.2	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	8.2	
Uncertainty if Water Droplets are present	%		
Reported Uncertainty	%	8.2	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
8C - Press 19

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	3.2		3.2
Uncertainty	±mg/m ³	1.6		1.6
Mass Emission	g/hr	9.9		9.9
Uncertainty	±g/hr	4.9		4.9

General Sampling Information

Parameter	Value
Probe Material	Stainless Steel
Filtration Type / Size	0.5µm Ceramic
Heated Head Filter Used	No
Heated Line Temperature	180°C
Span Gas Reference Number	CYL 1.003
Span Gas Expiry Date	01/08/2011
Span Gas Start Pressure (bar)	195
Gas Cylinder Concentration (ppm)	79
Span Gas Uncertainty (%)	2
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A5

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

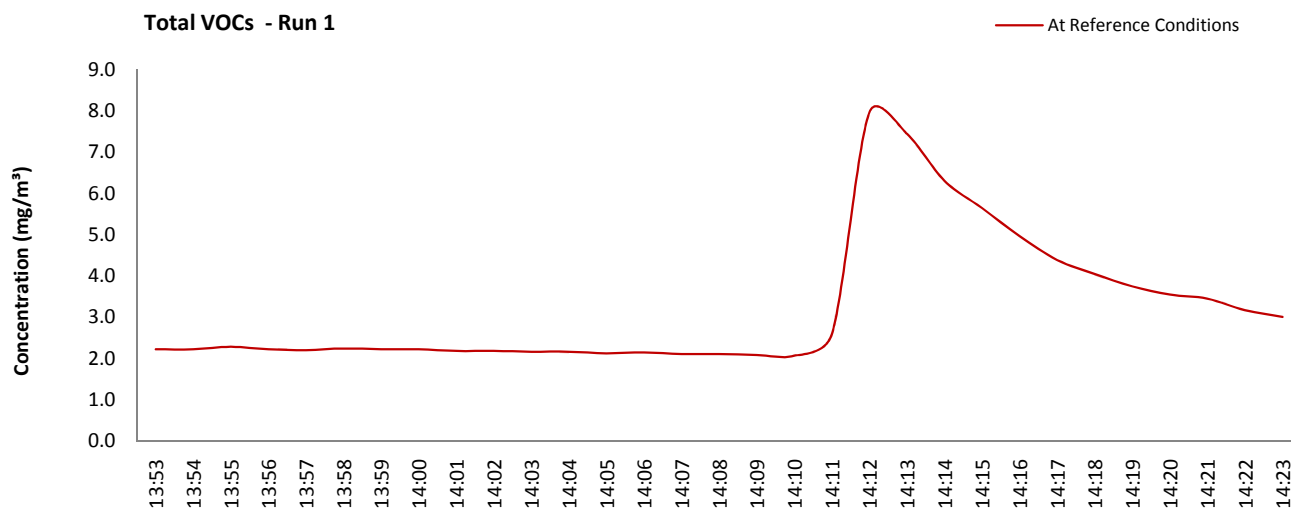
Reference Conditions

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

APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	13:53 - 14:23	
Sampling Dates	-	16/09/2008	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

Zero Drift	Units	Run 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	
Span Down Sampling Line (Pre)	ppm	30.80	
Span Down Sampling Line (Post)	ppm	30.60	
Span Drift	ppm	-0.20	
Allowable Span Drift	± ppm	1.56	
Span Drift Acceptable	-	Yes	

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
Range	ppm	100.0		
Measured Reading	ppm	2.0		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.289		
Temperature Dependent Zero Drift	ppm	0.289		
Temperature Dependent Span Drift	ppm	0.289		
Cross-Sensitivity	ppm	0.046		
Leak	ppm	0.01		
Calibration Gas Uncertainty	ppm	0.02		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.50		
Expanded uncertainty (95% confidence)	ppm	0.98		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.98		
Reported Uncertainty	ppm	0.98		
Expanded uncertainty (95% confidence)	%	49.5		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	49.5		
Reported Uncertainty	%	49.5		



Air Tech Environmental Consultancy Services



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Stack Emissions Testing Report Commissioned by
VIP-Polymers Ltd

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 3DA

PPC Permit: 11/94

Stack Reference

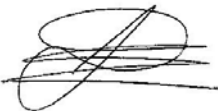
8A - Press 18

Dates of the Monitoring Campaign

16th September 2008

Job Reference Number

CAT-0043

Report Written by
Paul Martin Team Leader MCERTS Level 2 MM 04 503 TE1 TE2 TE3 TE4
Report Approved by
James Harmer Technical Manager MCERTS Level 2 MM 03 156 TE1 TE2 TE3 TE4
Report Date
24th September 2008
Report Version
Version 1
Signature of Report Approver




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TITLE PAGE

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APPENDICES

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Executive Summary (Page 1 of 7)

MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

8A - Press 18

16th September 2008

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions monitoring on the 8A - Press 18 stack by VIP Polymers Ltd at their Plant in Huntingdon.

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

Special Requirements

There were no special requirements.

Executive Summary (Page 2 of 7)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon

8A - Press 18

16th September 2008

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	mg/m ³	0.45	8.0	10	g/hr	1.1	20.2	N/A
Total VOCs (as Carbon)	mg/m ³	1.8	1.6	50	g/hr	4.5	4.0	N/A
Water Vapour	% v/v	0.91	0.07					
Stack Gas Temperature	°C	24.8						
Stack Gas Velocity	m/s	6.0						
Stack Gas Volumetric Flow Rate (ACTUAL)	m ³ /hr	2732						
Stack Gas Volumetric Flow Rate (REF)	m ³ /hr	2521						

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

Executive Summary (Page 3 of 7)

MONITORING DATES & TIMES

VIP-Polymers Ltd, Huntingdon

8A - Press 18

16th September 2008

Parameter		Sampling Date/s	Sampling Times	Sampling Duration (mins)
Total Particulate Matter	Run 1	16/09/2008	15:14 - 15:46	32
Total VOCs (as Carbon)	Run 1	16/09/2008	15:14 - 15:44	30
Velocity & Volumetric Flow Rate	Run 1	16/09/2008	14:52 - 15:00	

Executive Summary (Page 4 of 7)

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon

8A - Press 18

16th September 2008

Standard Operating Conditions

Parameter	Value
Process Status	Normal
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Rubber
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary (Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon
8A - Press 18
16th September 2008

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.19 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.22 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	All	Lowest differential pressure < 5 Pa.
Total Particulate Matter	All	Ratio highest to lowest velocities > 5 : 1.
Total Particulate Matter	All	It was not possible to sample at a point where the angle of swirl was greater than 15°.
Total Particulate Matter	All	The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty.

Executive Summary (Page 6 of 7)

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

Sampling Platform

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

M1 Platform Requirements	Value
Minimum Platform Area 5m ²	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
Obstructions do not hamper insertion of sampling equipment	Yes
Depth of Platform = Minimum of 2m or Probe Length + 1m	Yes

Sampling Location / Platform Improvement Recommendations

Although the sampling location meets the platform requirements in M1, none of the sampling plane validation criteria were met (see below).

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

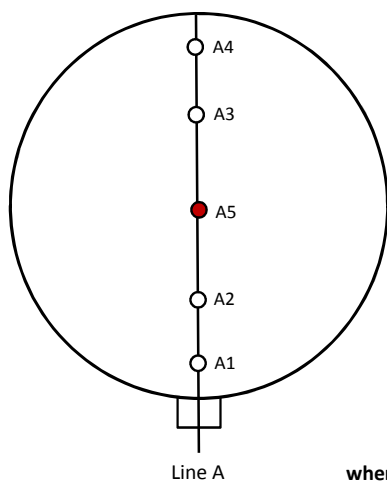
Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	2.0		> 5 Pa	No
Mean Velocity	m/s	6.04		-	-
Lowest Gas Velocity	m/s	1.52		-	-
Highest Gas Velocity	m/s	11.88		-	-
Ratio of Above	: 1	7.80		< 3 : 1	No
Maximum Angle of Swirl	°	71		< 15°	No
No Local Negative Flow	-	Yes		-	Yes
Other Criteria	Units	Traverse		Required	Compliant
Homogeneous Flow Stream	-	No		-	-

Executive Summary (Page 7 of 7)

PLANT PHOTOS



SAMPLE POINTS



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

APPENDICES

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APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Paul Martin
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 04 503
	Technical Endorsements	TE1 TE2 TE3 TE4
Technician	Name	Robert Hester
	MCERTS Accreditation	MCERTS Level 1
	MCERTS Number	MM 06 766
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.3
Box Thermocouples	CAT 3.8
Umbilical	CAT 03.08
Oven Box	CAT 12.3
Probe	CAT 5.3
S-Pitot (1)	CAT 21P.3
S-Pitot (2)	CAT 21S.7
L-Pitot	-
500g Check Weight	CAT 17.3
1Kg Check Weight	CAT 17.3
Last Impinger Arm	-
Calipers	CAT 23.3
Small DGM	-
Laboratory Balance	CAT 1.18
Tapemeasure	CAT 16.1

Instrumental Analysers	
Equipment Type	Equipment I.D.
Horiba PG-250 Analyser	-
JCT JCC P-1 Cooler	-
5m FT-IR	-
5m FT-IR Sampling System	-
Bernath 3006 FID	CAT 8.2
Heated Head Filter	-
Mass Flow Controller (1)	CAT 6.5
Mass Flow Controller (2)	CAT 6.6
Easylogger EN-EL-12 Bit	CAT 11.1

Miscellaneous Items	
Equipment Type	Equipment I.D.
Digital Manometer (1)	CAT 3.3
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.3
Stopwatch	CAT 14.7
Protractor	-
Barometer	CAT 13.3
Stack Thermocouple (1)	CAT 4.16
Stack Thermocouple (2)	CAT 4.35
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	CAT 20.3
15m Heated Line (1)	-
15m Heated Line (2)	-
20m Heated Line (1)	-

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details	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	24.6
Average Stack Gas Pressure	Pa	43.6
Average Stack Static Pressure, P _{static}	kPa	-0.100
Average Barometric Pressure, P _b	kPa	102.0
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂	-	20.80	20.61	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.42	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.91	0.0091	18.02	0.8037	0.00734

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	1.188
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.184

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

$P_{STW} = (P_{STD} + p_i \text{ of H}_2\text{O}) / (1 + (p_i \text{ of H}_2\text{O} / 0.8037))$

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	Reference
Temperature	°C	25	0
Total Pressure	kPa	101.9	101.3
Moisture	%	0.9	0.9

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	2732
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	2521
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	2498

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	16/09/2008
Time of Survey	-	14:52 - 15:00
Atmospheric Pressure	kPa	102.0
Stack Static Pressure	Pa	-100
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 (°)	58	71	63	62																

Sampling Line A					
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	38.0	24.8	1.183	6.64
2	0.06	6.0	25.4	1.181	2.64
3	0.10	3.0	25.4	1.181	1.87
4	0.14	2.0	25.0	1.182	1.52
5	0.18	9.0	24.9	1.183	3.23
6	0.22	15.0	24.8	1.183	4.17
7	0.26	43.0	24.5	1.184	7.06
8	0.30	92.0	24.4	1.185	10.32
9	0.34	122.0	24.0	1.186	11.88
10	0.38	106.0	22.5	1.192	11.05
Mean		43.6	24.6	1.184	6.04

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
8A - Press 18

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.45		0.45
Uncertainty	±mg/m ³	8.0		8.0
Mass Emission	g/hr	1.1		1.1
Uncertainty	±g/hr	20.2		20.2

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

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.91		0.91
Uncertainty	±% v/v	0.07		0.07

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.45		0.45

General Sampling Information

Parameter	Value	
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	765.0	
Stack static pressure, P_{static}	mmH ₂ O	-10.2	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	764.3	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-3.1	
Total mass collected in impingers (silica trap)	g	8.8	
Total mass of liquid collected, V_{lc}	g	5.7	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0071	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.8111	
Gas meter correction factor, Y_d	-	1.0130	
Average dry gas meter temperature, T_m	°C	21.9	
Average pressure drop across orifice, ΔH	mmH ₂ O	67.6	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.7706	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0091	
B_{wo} as a percentage	% v/v	0.91	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.91	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.7777	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.74	
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	4.13	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	2.03	
Average stack gas temperature, T_s	°C	25.0	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (\sqrt{M_s}(P_s))$	m/s	6.87	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} ($Q_{stw@O_2}$), Dry@O_{2REF} ($Q_{std@O_2}$)			
Area of stack, A_s	m ²	0.13	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	51.8	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	47.7	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	47.3	
$Q_{stw@O_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{std@O_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	8.98	
Nozzle area, A_n	mm ²	63.34	
Total sampling time, q	min	32	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	101.1	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	15:14 - 15:46	
Sampling Dates	-	16/09/2008	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.7777	
Filter I.D. Number	-	47-0217	
Start Filter Mass	g	0.15212	
End Filter Mass	g	0.15228	
Total Mass on Filter	g	0.00016	
Probe Rinse I.D. Number	-	PR-47-0217	
Start Probe Rinse Mass	g	3.54328	
End Probe Rinse Mass	g	3.54322	
Total Mass in Probe Rinse	g	-0.00006	
Total Mass Collected	mg	0.10	
Calculated Concentration	mg/m ³	0.13	
Balance Uncertainty / LOD	mg/m ³	0.19	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	16/09/2008	
Average Volume Sampled (REF)	m ³	0.7777	
Filter I.D. Number	-	47-0216	
Start Filter Mass	g	0.15233	
End Filter Mass	g	0.15247	
Total Mass on Filter	g	0.00014	
Probe Rinse I.D. Number	-	PR-47-0216	
Start Probe Rinse Mass	g	3.57479	
End Probe Rinse Mass	g	3.57500	
Total Mass in Probe Rinse	g	0.00021	
Total Mass Collected	mg	0.35	
Calculated Concentration	mg/m ³	0.45	
Balance Uncertainty / LOD	mg/m ³	0.19	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	25.68	
Pre-Sampling Leak Rate	l/min	0.05	
Post-Sampling Leak Rate	l/min	0.16	
Allowable Leak Rate	l/min	0.51	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	7.4	
Allowable MU	%	20	
MU Acceptable	%	Yes	
Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	
Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	101.1	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.15	
Balance Uncertainty	± mg/m ³	0.19	
Daily ELV	mg/m ³	10.00	
Allowable Balance Uncertainty	± mg/m ³	0.50	
Balance Uncertainty Acceptable	-	Yes	
Balance Uncertainty Criteria (2)	Units	Run 1	
Balance Uncertainty	± mg	0.15	
20 x Balance Uncertainty	mg	3.00	
Mass Collected	mg	0.10	
Sample Time	mins	32	
Balance Uncertainty Acceptable	-	No	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	25	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	30.00	
Pre-Sampling Leak Rate	l/min	0.43	
Post-Sampling Leak Rate	l/min	0.40	
Allowable Leak Rate	l/min	0.60	
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	
Lowest differential pressure < 5 Pa.	x	
Ratio highest to lowest velocities > 5 : 1.	x	
It was not possible to sample at a point where the angle of swirl was less than 15°.	x	
The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty.	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	0.8111		uV _m	m ³	0.0162	
Sampled Gas Temperature	T _m	298.0		uT _m	K	2.0	
Sampled Gas Pressure	p _m	102.7		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.62		uL	%	-	
Mass of Particulate	m	0.15		um	mg	0.15	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.35		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.62		≤2%
Mass of Particulate	%	4.50		<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	0.7706	0.58	
Leak	L	mg/m ³	0.002	1.00	
Mass of Particulate	L _r	mg	0.150	3.00	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A	N/A	
Uncollected Mass	UCM	mg	0.20	3.00	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.011	
Leak	mg/m ³	0.0016	
Mass of Particulate	mg/m ³	0.4500	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.6063	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.755	
Expanded uncertainty (95% confidence)	mg/m ³	1.480	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	7.992	
Reported Uncertainty	mg/m ³	7.992	
Expanded uncertainty (95% confidence)	%	328.9	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	1775.9	
Reported Uncertainty	%	1775.9	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

(CONCURRENT WATER VAPOUR)

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V_m	0.8111		uV_m	m^3	0.0162	
Sampled Gas Temperature	T_m	298.0		uT_m	K	2.0	
Sampled Gas Pressure	p_m	102.7		up_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Repeatability of Weighing	R_w	5.70		uR_w	g	0.16	
Reading of Balance	R_b	5.70		uR_b	g	0.03	
Leak	L	0.62			%	-	

Uncertainty as a Percentage				Requirement of Standard
Measured Quantities	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Repeatability of Weighing	%	2.81		No Requirement
Reading of Balance	%	0.50		No Requirement
Leak	%	0.62		≤2%

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V_m	m^3	0.7706	1.19	
Repeatability of Weighing	R_w	g	5.70	0.16	
Reading of Balance	R_b	g	5.70	0.16	
Leak	L	% v/v	0.00	1.00	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	% v/v	0.023	
Repeatability of Weighing	% v/v	0.0256	
Reading of Balance	% v/v	0.0046	
Leak	% v/v	0.0033	

Parameter	Units	Run 1	
Combined uncertainty	% v/v	0.03	
Expanded uncertainty (95% confidence)	% v/v	0.07	
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.07	
Uncertainty if Water Droplets are present	% v/v		
Reported Uncertainty	% v/v	0.07	
Expanded uncertainty (95% confidence)	%	7.4	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	7.4	
Uncertainty if Water Droplets are present	%		
Reported Uncertainty	%	7.4	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
8A - Press 18

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.8		1.8
Uncertainty	±mg/m ³	1.6		1.6
Mass Emission	g/hr	4.5		4.5
Uncertainty	±g/hr	4.0		4.0

General Sampling Information

Parameter	Value	
Probe Material	Stainless Steel	
Filtration Type / Size	0.5µm Stainless Steel	
Heated Head Filter Used	No	
Heated Line Temperature	180	
Span Gas Reference Number	CAT 1.003	
Span Gas Expiry Date	01/08/2011	
Span Gas Start Pressure (bar)	195	
Gas Cylinder Concentration (ppm)	79	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A5	

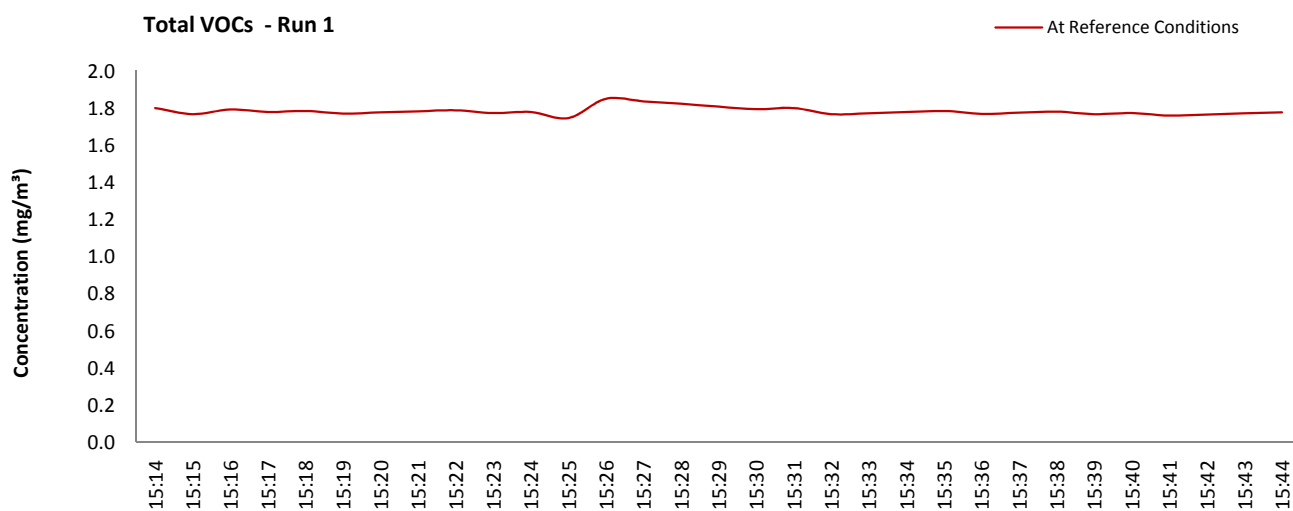
Reference Conditions

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

APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	15:14 - 15:44	
Sampling Dates	-	16/09/2008	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

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

Span Drift	Units	Run 1	
Span Down Sampling Line (Pre)	ppm	30.90	
Span Down Sampling Line (Post)	ppm	31.00	
Span Drift	ppm	0.10	
Allowable Span Drift	± ppm	1.56	
Span Drift Acceptable	-	Yes	

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
Range	ppm	100.0		
Measured Reading	ppm	1.1		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.289		
Temperature Dependent Zero Drift	ppm	0.289		
Temperature Dependent Span Drift	ppm	0.289		
Cross-Sensitivity	ppm	0.026		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.50		
Expanded uncertainty (95% confidence)	ppm	0.98		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.98		
Reported Uncertainty	ppm	0.98		
Expanded uncertainty (95% confidence)	%	88.4		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	88.4		
Reported Uncertainty	%	88.4		



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Stack Emissions Testing Report Commissioned by
VIP-Polymers Ltd

Installation Name & Address

VIP-Polymers Ltd
St Peters Road
Huntingdon
Cambridgeshire
PE29 3DA

PPC Permit: 11/94

Stack Reference

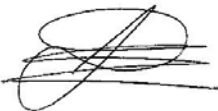
7 - Thompson

Dates of the Monitoring Campaign

16th September 2008

Job Reference Number

CAT-0043

Report Written by
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Report Date
24th September 2008
Report Version
Version 1
Signature of Report Approver




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TITLE PAGE

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APPENDICES

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Executive Summary (Page 1 of 7)

MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

7 - Thompson

16th September 2008

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions monitoring on the 7 - Thompson stack by VIP Polymers Ltd at their Plant in Huntingdon.

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

Special Requirements

There were no special requirements.

Executive Summary (Page 2 of 7)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon

7 - Thompson

16th September 2008

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	mg/m ³	0.70	1.4	10	g/hr	1.9	3.8	N/A
Total VOCs (as Carbon)	mg/m ³	2.5	1.6	50	g/hr	6.9	4.4	N/A
Water Vapour	% v/v	0.57	0.05					
Stack Gas Temperature	°C	26.1						
Stack Gas Velocity	m/s	11.8						
Stack Gas Volumetric Flow Rate (ACTUAL)	m ³ /hr	3001						
Stack Gas Volumetric Flow Rate (REF)	m ³ /hr	2758						

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

Executive Summary (Page 3 of 7)

MONITORING DATES & TIMES

VIP-Polymers Ltd, Huntingdon

7 - Thompson

16th September 2008

Parameter		Sampling Date/s	Sampling Times	Sampling Duration (mins)
Total Particulate Matter	Run 1	16/09/2008	16:16 - 16:46	30
Total VOCs (as Carbon)	Run 1	16/09/2008	16:03 - 16:33	30
Velocity & Volumetric Flow Rate	Run 1	16/09/2008	15:36 - 15:40	

Executive Summary (Page 4 of 7)

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon

7 - Thompson

16th September 2008

Standard Operating Conditions

Parameter	Value
Process Status	Normal
Continuous or Batch Process	Continuous
Abatement System	N/A
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary (Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon
7 - Thompson
16th September 2008

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	UKAS Number	Analytical Procedure	Analytical Technique	UKAS Analysis	UKAS Number		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	4279	CAT-TP-01	Gravimetric	Yes	4279	Yes	0.15 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	4279	CAT-TP-05	Gravimetric	Yes	4279	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	4279	Flame Ionisation Detection by Sick 3006 FID				Yes	0.22 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284	CAT-TP-04	Yes	4279	Pitot Tube and Thermocouple				Yes	N/A

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	All	The mass of Total Particulate Matter collected on the filter was less than 20 x the balance uncertainty.

Executive Summary (Page 6 of 7)

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.30
Width	m	-
Area	m ²	0.07
Port Depth	cm	4
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Sampling Platform

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

M1 Platform Requirements	Value
Minimum Platform Area 5m ²	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
Obstructions do not hamper insertion of sampling equipment	Yes
Depth of Platform = Minimum of 2m or Probe Length + 1m	Yes

Sampling Location / Platform Improvement Recommendations

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

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

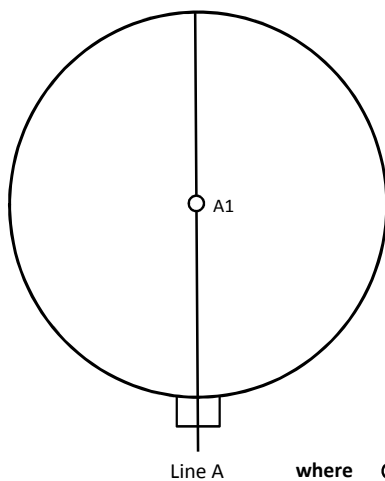
Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	92.0		> 5 Pa	Yes
Mean Velocity	m/s	11.79		-	-
Lowest Gas Velocity	m/s	10.34		-	-
Highest Gas Velocity	m/s	14.11		-	-
Ratio of Above	: 1	1.36		< 3 : 1	Yes
Maximum Angle of Swirl	°	10		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes
Other Criteria	Units	Traverse		Required	Compliant
Homogeneous Flow Stream	-	Yes		-	-

Executive Summary (Page 7 of 7)

PLANT PHOTOS



SAMPLE POINTS



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

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel and List of Equipment

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Team Leader	Name	Paul Martin
	MCERTS Accreditation	MCERTS Level 2
	MCERTS Number	MM 04 503
	Technical Endorsements	TE1 TE2 TE3 TE4
Technician	Name	Robert Hester
	MCERTS Accreditation	MCERTS Level 1
	MCERTS Number	MM 06 766
	Technical Endorsements	None

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.3
Box Thermocouples	CAT 3.8
Umbilical	CAT 03.08
Oven Box	CAT 12.3
Probe	CAT 5.3
S-Pitot (1)	CAT 21P.3
S-Pitot (2)	CAT 21S.7
L-Pitot	-
500g Check Weight	CAT 17.3
1Kg Check Weight	CAT 17.3
Last Impinger Arm	-
Calipers	CAT 23.3
Small DGM	-
Laboratory Balance	CAT 1.18
Tapemeasure	CAT 16.1

Instrumental Analysers	
Equipment Type	Equipment I.D.
Horiba PG-250 Analyser	-
JCT JCC P-1 Cooler	-
5m FT-IR	-
5m FT-IR Sampling System	-
Bernath 3006 FID	CAT 8.2
Heated Head Filter	-
Mass Flow Controller (1)	CAT 6.5
Mass Flow Controller (2)	CAT 6.6
Easylogger EN-EL-12 Bit	CAT 11.1

Miscellaneous Items	
Equipment Type	Equipment I.D.
Digital Manometer (1)	CAT 3.3
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.3
Stopwatch	CAT 14.7
Protractor	-
Barometer	CAT 13.3
Stack Thermocouple (1)	CAT 4.16
Stack Thermocouple (2)	CAT 4.35
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	CAT 20.3
15m Heated Line (1)	-
15m Heated Line (2)	-
20m Heated Line (1)	-

APPENDIX 2

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details	Units	Value
Stack Diameter / Depth, D	m	0.30
Stack Width, W	m	-
Stack Area, A	m ²	0.07
Average Stack Gas Temperature, T _a	°C	26.1
Average Stack Gas Pressure	Pa	120.7
Average Stack Static Pressure, P _{static}	kPa	-0.070
Average Barometric Pressure, P _b	kPa	102.1
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂	-	20.80	20.68	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.69	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.57	0.0057	18.02	0.8037	0.00456

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	1.183
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.181

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

$P_{STW} = (P_{STD} + p_i \text{ of H}_2\text{O}) / (1 + (p_i \text{ of H}_2\text{O} / 0.8037))$

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	Reference
Temperature	°C	26	0
Total Pressure	kPa	102.0	101.3
Moisture	%	0.6	0.6

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	3001
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	2758
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	2743

APPENDIX 2

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	16/09/2008
Time of Survey	-	15:36 - 15:40
Atmospheric Pressure	kPa	102.1
Stack Static Pressure	Pa	-70
Type of Pitot Used	-	S-Type Pitot
Are Water Droplets Present?	-	No

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C _p	-	0.83
Number of Lines Available	-	1
Number of Lines Used	-	1

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

Sampling Line A					
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	127.0	26.6	1.179	12.16
2	0.05	104.0	26.7	1.179	11.00
3	0.08	111.0	26.6	1.179	11.37
4	0.11	103.0	26.7	1.179	10.95
5	0.14	108.0	26.6	1.179	11.21
6	0.17	106.0	26.6	1.179	11.11
7	0.20	92.0	26.2	1.180	10.34
8	0.23	138.0	25.8	1.182	12.66
9	0.26	172.0	24.8	1.186	14.11
10	0.29	146.0	24.7	1.186	13.00
Mean		120.7	26.1	1.181	11.79

APPENDIX 2

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
7 - Thompson

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.70		0.70
Uncertainty	±mg/m ³	1.38		1.38
Mass Emission	g/hr	1.9		1.9
Uncertainty	±g/hr	3.8		3.8

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

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.57		0.57
Uncertainty	±% v/v	0.05		0.05

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.70		0.70

General Sampling Information

Parameter	Value	
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	765.8	
Stack static pressure, P _{static}	mmH ₂ O	-7.1	
P _s = (P _b + (P _{static} / 13.6))	mmHg	765.2	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-7.5	
Total mass collected in impingers (silica trap)	g	12.2	
Total mass of liquid collected, V _{lc}	g	4.7	
V _{wstd} = (0.001246)(V _{lc})	m ³	0.0059	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V _m	m ³	1.0739	
Gas meter correction factor, Y _d	-	1.0130	
Average dry gas meter temperature, T _m	°C	22.4	
Average pressure drop across orifice, ΔH	mmH ₂ O	130.7	
V _{mstd} = ((0.3592)(V _m)(P _b + (ΔH/13.6))(Y _d)) / (T _m + 273)	m ³	1.0256	
Moisture content, B_{wo} & R_{wv}			
B _{wo} = V _{wstd} / (V _{mstd} + V _{wstd})	m ³	0.0057	
B _{wo} as a percentage	% v/v	0.57	
Reported Water Vapour, checked with Tables in BS EN 14790, R _{wv}	% v/v	0.57	
Volume of gas metered wet, V_{mstw}			
V _{mstw} = (V _{mstd})(100/(100 - R _{wv}))	m ³	1.0315	
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 (Estimated)			
CO ₂	% v/v	0.06	
O ₂	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
M _d = 0.44(%CO ₂) + 0.32(%O ₂) + 0.28(%N ₂)	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
M _s = M _d (1 - (R _{wv} /100)) + 18(R _{wv} /100)	g/gmol	28.78	
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	12.67	
Average square root of velocity heads, √ΔP	√mmH ₂ O	3.56	
Average stack gas temperature, T _s	°C	26.0	
V _s = ((K _p)(C _p)(√ΔP)(√T _s + 273)) / (√(M _s)(P _s))	m/s	12.04	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO₂}), Dry@O_{2REF} (Q_{stdO₂})			
Area of stack, A _s	m ²	0.07	
Q _a = (60)(A _s)(V _s)	m ³ /min	51.1	
Conversion factor (K/mm.Hg), C _f	-	0.3592	
Q _{stw} = ((Q _a)(P _s)(C _f)) / ((T _s + 273))	m ³ /min	46.9	
Q _{std} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273))	m ³ /min	46.7	
Q _{stwO₂} = ((Q _a)(P _s)(C _f)) / ((T _s + 273)(O _{2REFw}))	m ³ /min	N/A	
Q _{stdO₂} = ((Q _a)(P _s)(C _f)(1 - (R _{wv} /100))) / ((T _s + 273)(O _{2REFd}))	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D _n	mm	8.00	
Nozzle area, A _n	mm ²	50.31	
Total sampling time, q	min	30	
%I = (4.6398E ⁶)(T _s + 273)(V _{mstd}) / (P _s)(V _s)(A _n)(q)(1 - (R _{wv} /100))	%	102.9	

APPENDIX 2

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	16:16 - 16:46	
Sampling Dates	-	16/09/2008	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.0315	
Filter I.D. Number	-	47-0219	
Start Filter Mass	g	0.15162	
End Filter Mass	g	0.15205	
Total Mass on Filter	g	0.00043	
Probe Rinse I.D. Number	-	PR-47-0219	
Start Probe Rinse Mass	g	3.58359	
End Probe Rinse Mass	g	3.58382	
Total Mass in Probe Rinse	g	0.00023	
Total Mass Collected	mg	0.66	
Calculated Concentration	mg/m ³	0.64	
Balance Uncertainty / LOD	mg/m ³	0.15	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	16/09/2008	
Average Volume Sampled (REF)	m ³	1.0315	
Filter I.D. Number	-	47-0218	
Start Filter Mass	g	0.15158	
End Filter Mass	g	0.15172	
Total Mass on Filter	g	0.00014	
Probe Rinse I.D. Number	-	PR-47-0218	
Start Probe Rinse Mass	g	3.50771	
End Probe Rinse Mass	g	3.50829	
Total Mass in Probe Rinse	g	0.00058	
Total Mass Collected	mg	0.72	
Calculated Concentration	mg/m ³	0.70	
Balance Uncertainty / LOD	mg/m ³	0.15	

APPENDIX 2

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	36.26	
Pre-Sampling Leak Rate	l/min	0.12	
Post-Sampling Leak Rate	l/min	0.14	
Allowable Leak Rate	l/min	0.73	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	8.3	
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	%	102.9	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Balance Uncertainty Criteria (1)	Units	Run 1	
Balance Uncertainty	± mg	0.15	
Balance Uncertainty	± mg/m ³	0.15	
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	0.15	
20 x Balance Uncertainty	mg	3.00	
Mass Collected	mg	0.66	
Sample Time	mins	30	
Balance Uncertainty Acceptable	-	No	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	26	

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	0.33	
Post-Sampling Leak Rate	l/min	0.33	
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.	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	1.0739		uV _m	m ³	0.0215	
Sampled Gas Temperature	T _m	299.0		uT _m	K	2.0	
Sampled Gas Pressure	p _m	103.4		up _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Leak	L	0.39		uL	%	-	
Mass of Particulate	m	0.66		um	mg	0.15	
Oxygen Content	O _{2,m}	N/A		uO _{2,m}	% v/v	N/A	
Uncollected Mass	UCM	0.72		uUCM	mg	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.39		≤2%
Mass of Particulate	%	1.59		<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	1.0256		0.68	
Leak	L	mg/m ³	0.002		1.00	
Mass of Particulate	L _r	mg	0.660		1.06	
Factor for O ₂ Correction	O _{2,m}	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.42		1.06	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.017	
Leak	mg/m ³	0.0016	
Mass of Particulate	mg/m ³	0.1586	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.4396	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.468	
Expanded uncertainty (95% confidence)	mg/m ³	0.917	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	1.375	
Reported Uncertainty	mg/m ³	1.375	
Expanded uncertainty (95% confidence)	%	131.3	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	197.0	
Reported Uncertainty	%	197.0	

APPENDIX 2

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

(CONCURRENT WATER VAPOUR)

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V _m	1.0739		uV _m	m ³	0.0215	
Sampled Gas Temperature	T _m	299.0		uT _m	K	2.0	
Sampled Gas Pressure	p _m	103.4		uρ _m	kPa	0.5	
Sampled Gas Humidity	H _m	0.0		uH _m	% v/v	1.0	
Repeatability of Weighing	R _w	4.70		uR _w	g	0.16	
Reading of Balance	R _b	4.70		uR _b	g	0.02	
Leak	L	0.39			%	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.67		≤1%
Sampled Gas Pressure	%	0.48		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Repeatability of Weighing	%	3.40		No Requirement
Reading of Balance	%	0.50		No Requirement
Leak	%	0.39		≤2%

Measured Quantities	Uncertainty in Measurement Units				Sensitivity Coefficient	
	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V _m	m ³	1.0256		0.55	
Repeatability of Weighing	R _w	g	4.70		0.12	
Reading of Balance	R _b	g	4.70		0.12	
Leak	L	% v/v	0.00		1.00	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	% v/v	0.014	
Repeatability of Weighing	% v/v	0.0193	
Reading of Balance	% v/v	0.0028	
Leak	% v/v	0.0013	

Parameter	Units	Run 1	
Combined uncertainty	% v/v	0.02	
Expanded uncertainty (95% confidence)	% v/v	0.05	
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.05	
Uncertainty if Water Droplets are present	% v/v		
Reported Uncertainty	% v/v	0.05	
Expanded uncertainty (95% confidence)	%	8.3	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	8.3	
Uncertainty if Water Droplets are present	%		
Reported Uncertainty	%	8.3	

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
7 - Thompson

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	2.5		2.5
Uncertainty	±mg/m ³	1.6		1.6
Mass Emission	g/hr	6.9		6.9
Uncertainty	±g/hr	4.4		4.4

General Sampling Information

Parameter	Value	
Probe Material	Stainless Steel	
Filtration Type / Size	0.5µm Stainless Steel	
Heated Head Filter Used	No	
Heated Line Temperature	180°C	
Span Gas Reference Number	CAT 1.003	
Span Gas Expiry Date	01/08/2011	
Span Gas Start Pressure (bar)	190	
Gas Cylinder Concentration (ppm)	79	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	

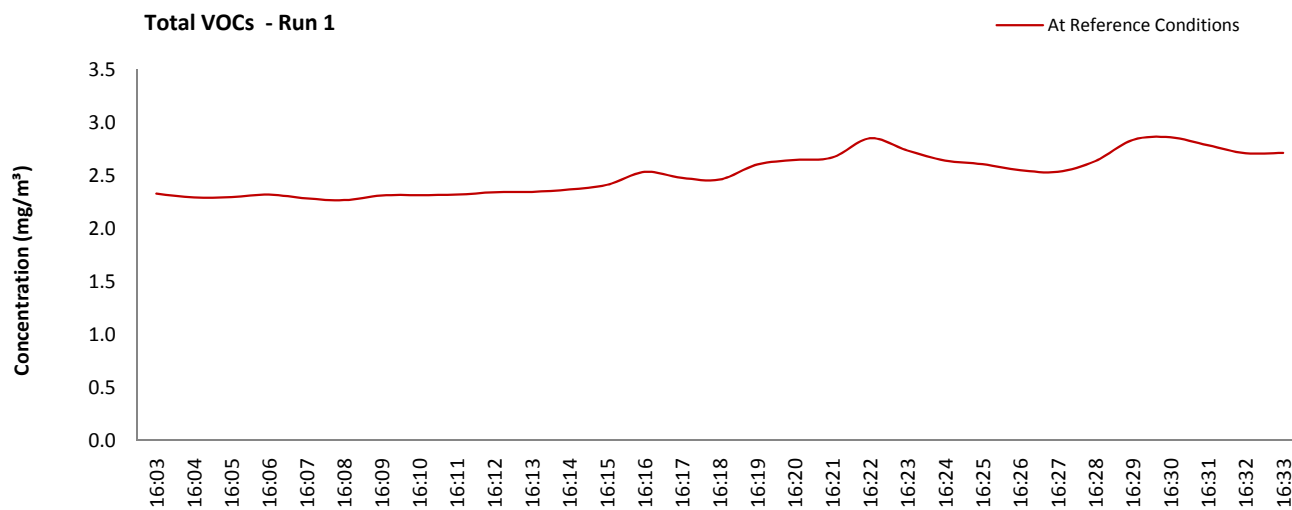
Reference Conditions

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	-	16:03 - 16:33	
Sampling Dates	-	16/09/2008	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

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

Span Drift	Units	Run 1	
Span Down Sampling Line (Pre)	ppm	31.00	
Span Down Sampling Line (Post)	ppm	31.10	
Span Drift	ppm	0.10	
Allowable Span Drift	± ppm	1.56	
Span Drift Acceptable	-	Yes	

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
Range	ppm	100.0		
Measured Reading	ppm	1.6		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.289		
Temperature Dependent Zero Drift	ppm	0.289		
Temperature Dependent Span Drift	ppm	0.289		
Cross-Sensitivity	ppm	0.036		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.50		
Expanded uncertainty (95% confidence)	ppm	0.98		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.98		
Reported Uncertainty	ppm	0.98		
Expanded uncertainty (95% confidence)	%	62.7		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	62.7		
Reported Uncertainty	%	62.7		