

Stack Emissions Testing Summary Sheet

CAT-1227: VIP-Polymers Ltd, Huntingdon

		Particulate Matter		Total VOCs				Test Dates	Flow Rate (REF)	Reference Condition
Release Point	Units	Result	Limit	Result	Limit			m³/hr		
Stack 8	mg/m³	0.25	10	1.7	50			04/09/2012	6779	STP Wet Gas
	g/hr	1.7	-	52.8	-					
Stack 8a	mg/m³	0.42	10	0.71	50			04/09/2012	1694	STP Wet Gas
	g/hr	0.71	-	0.74	-					
Stack 8b	mg/m³	0.5	10	0.83	50			04/09/2012	1691	STP Wet Gas
	g/hr	1.5	-	1.4	-					
Stack 8c	mg/m³	0.42	10	0.51	50			04/09/2012	3533	STP Wet Gas
	g/hr	1.5	-	1.8	-					
Stack 7	mg/m³	0.36	10	1.6	50			04/09/2012	2641	STP Wet Gas
	g/hr	1	-	4.1	-					
Stack 35d	mg/m³	0.36	10	3.6	50			05/09/2012	15718	STP Wet Gas
	g/hr	5.7	-	52.8	-					
Stack 55	mg/m³	0.22	10	2.5	50			05/09/2012	9327	STP Wet Gas
	g/hr	2.1	-	22.9	-					
Stack 44	mg/m³	0.39	10	11.2	50			05/09/2012	9404.0	STP Wet Gas
	g/hr	3.7	-	105	-					
Standard Reference Method		BS EN 13284-1		BS EN 13526						
Accreditation Status of Test		UKAS & MCERTS		UKAS & MCERTS						

Summary Writer	Adam Dixon	MCERTS Accreditation	MCERTS Level 2	MCERTS Number	MM 10 1079	Report Date	27th September 2012
Summary Approver	James Eldridge	MCERTS Accreditation	MCERTS Level 2	MCERTS Number	MM 05 641	Report Version	Version 2



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Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: PPC 11/94

Stack Reference

Stack No.7

Dates of the Monitoring Campaign

4th September 2012

Job Reference Number

CAT-1227

Report Written by

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Report Date

13th September 2012

Version

Version 1

Signature of Report Approver

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Executive Summary

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MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

Stack No.7

4th September 2012

Overall Aim of the Monitoring Campaign

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

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary

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MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon
Stack No.7
4th September 2012

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.36	0.20	10	g/hr	1.0	0.5	-
Total VOCs (as Carbon)	¹ mg/m ³	1.6	0.17	50	g/hr	4.1	0.5	-
Water Vapour	% v/v	0.26	0.03					
Stack Gas Temperature	°C	27.1						
Stack Gas Velocity	m/s	11.3						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	2888						
Volumetric Flow Rate (REF)	¹ m ³ /hr	2641						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM THE PRELIMINARY VELOCITY TRAVERSE.

¹ Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

MONITORING DATE(S) & TIMES

VIP-Polymers Ltd, Huntingdon
Stack No.7
4th September 2012

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m³	0.36	g/hr	1.0	04/09/2012	15:54 - 16:54	60
Total VOCs (as Carbon)	R1	mg/m³	1.6	g/hr	4.1	04/09/2012	14:45 - 15:45	60
Velocity & Volumetric Flow Rate	R1					04/09/2012	14:50 - 14:56	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon
Stack No.7
4th September 2012

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operation
Capacity (of 100%) and Tonnes / Hour	0.054 Tonnes per Hour
Continuous or Batch Process	Batch
Feedstock (if applicable)	Under cured Parts, Viton Seals
Abatement System	None
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon

Stack No.7

4th September 2012

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.08 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.14 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

Catalyst Environmental Ltd (CAT)	UKAS Accreditation Number: 4279
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SUMMARY OF SAMPLING DEVIATIONS

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

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

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

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

BS EN 15259 Homogeneity Test Requirements

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

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

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	64.0		> 5 Pa	Yes
Mean Velocity	m/s	11.35		-	-
Lowest Gas Velocity	m/s	8.63		-	-
Highest Gas Velocity	m/s	13.11		-	-
Ratio of Above	: 1	1.52		< 3 : 1	Yes
Maximum Angle of Swirl	°	0		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

PLANT PHOTOS

Photo 1



Photo 2



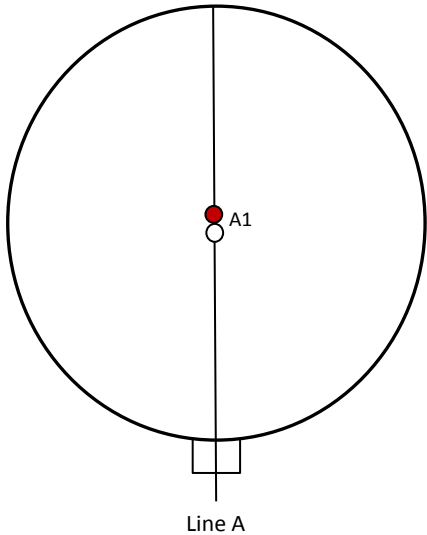
Photo 3



Photo 4

N/A

SAMPLE POINTS



- where

○ = isokinetic point sampled at

● = isokinetic point not sampled at

● = combustion gases sample point

○ = non-isokinetic sample point

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Adam Dixon	MCERTS Level 2	MM 10 1079	TE1 & TE4
Technician	Darius Niknejad	MCERTS Level 1	MM 09 1036	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 7.5	Horiba PG-250	-	Digital Manometer (1)	CAT 3.47
Box Thermocouples	CAT 3.12	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.12	Eco Physics CLD 822Mh	-	Digital Temperature Meter	CAT 3.47
Oven Box	-	Testo 350 XL	-	Stopwatch	CAT 7.5
Probe	CAT 5.18	Servomex 5200MP	-	Barometer	CAT 13.6
S-Pitot (1)	CAT 21S.15	JCT JCC P-1 Cooler	-	Stack Thermocouple (1)	CAT 4.223
S-Pitot (2)	CAT 21S.40	FT-IR	-	Stack Thermocouple (2)	-
L-Pitot	-	FT-IR Sampling System	-	1m Heated Line (1)	-
500g Check Weight	CAT 17.2	Bernath 3006 FID	CAT 3.6	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.2	Heated Head Filter	CAT 12.91	1m Heated Line (3)	-
Last Impinger Arm	-	Mass Flow Controller (1)	CAT 6.19	5m Heated Line (1)	-
Callipers	CAT 2.37	Mass Flow Controller (2)	CAT 6.20	15m Heated Line (1)	-
Tubes Kit Thermocouple	-	Mass View (1)	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	Mass View (2)	-	20m Heated Line (1)	CAT 20.17
Tape Measure	CAT 16.10	Easylogger EN-EL-12 Bit	CAT 11.13	Dual Channel Heater Controller	-

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.30
Stack Width, W	m	-
Stack Area, A	m ²	0.07
Average Stack Gas Temperature, T _a	°C	27.1
Average Stack Gas Pressure	Pa	112.7
Average Stack Static Pressure, P _{static}	kPa	0.015
Average Barometric Pressure, P _b	kPa	101.8
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.75	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.93	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	0.26	0.0026	18.02	0.8037	0.00209

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	1.177
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.176

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

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

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	27.1	0.0
Total Pressure	kPa	101.8	101.3
Moisture	%	0.26	0.26

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	2888
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	2641
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	2634
Gas Volumetric Flowrate REF ¹	m ³ /hr	2641

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	04/09/2012
Time of Survey	-	14:50 - 14:56
Atmospheric Pressure	kPa	101.8
Stack Static Pressure	Pa	15
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	78.0	26.4	1.179	9.53
2	0.05	64.0	26.5	1.178	8.63
3	0.08	72.0	26.6	1.178	9.16
4	0.11	100.0	26.7	1.177	10.80
5	0.14	103.0	27.1	1.176	10.96
6	0.17	125.0	27.2	1.175	12.08
7	0.20	146.0	27.5	1.174	13.06
8	0.23	147.0	27.5	1.174	13.11
9	0.26	147.0	27.5	1.174	13.11
10	0.29	145.0	27.6	1.174	13.02
Mean		112.7	27.1	1.176	11.35

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
Stack No.7

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.36		0.36
Uncertainty	±mg/m ³	0.20		0.20
Mass Emission	g/hr	1.0		1.0
Uncertainty	±g/hr	0.52		0.52

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.26		0.26
Uncertainty	±% v/v	0.03		0.03

Blank Runs

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

General Sampling Information

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

Reference Conditions

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

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	763.5	
Stack static pressure, P_{static}	mmH ₂ O	1.5	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	763.6	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-1.0	
Total mass collected in impingers (silica trap)	g	4.1	
Total mass of liquid collected, V_{lc}	g	3.1	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0039	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.6340	
Gas meter correction factor, Y_d	-	0.9920	
Average dry gas meter temperature, T_m	°C	28.8	
Average pressure drop across orifice, ΔH	mmH ₂ O	68.8	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.4830	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0026	
B_{wo} as a percentage	% v/v	0.26	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.26	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.4868	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.81	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K_p	-	34.97	
Velocity pressure coefficient, C_p	-	0.83	
Average of velocity heads, ΔP_{avg}	mmH ₂ O	11.79	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	3.43	
Average stack gas temperature, T_s	°C	29.0	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (V(M_s)(P_s))$	m/s	11.68	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})			
Area of stack, A_s	m ²	0.07	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	49.5	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	45.0	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	44.9	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	6.81	
Nozzle area, A_n	mm ²	36.46	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	106.8	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	15:54 - 16:54	
Sampling Dates	-	04/09/2012	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.4868	
Filter I.D. Number	-	47-10323	
Start Filter Mass	g	0.15322	
End Filter Mass	g	0.15338	
Total Mass on Filter	g	0.00016	
Probe Rinse I.D. Number	-	PR-47-10323	
Start Probe Rinse Mass	g	2.91262	
End Probe Rinse Mass	g	2.91300	
Total Mass in Probe Rinse	g	0.00038	
Total Mass Collected	mg	0.54	
Calculated Concentration	mg/m ³	0.36	
Balance Uncertainty / LOD	mg/m ³	0.08	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	04/09/2012	
Average Volume Sampled (REF)	m ³	1.4868	
Filter I.D. Number	-	47-10346	
Start Filter Mass	g	0.15607	
End Filter Mass	g	0.15614	
Total Mass on Filter	g	0.00007	
Probe Rinse I.D. Number	-	PR-47-10346	
Start Probe Rinse Mass	g	2.89468	
End Probe Rinse Mass	g	2.89476	
Total Mass in Probe Rinse	g	0.00008	
Total Mass Collected	mg	0.15	
Calculated Concentration	mg/m ³	0.10	
Balance Uncertainty / LOD	mg/m ³	0.08	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

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Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	27.02	
Pre-Sampling Leak Rate	l/min	0.06	
Post-Sampling Leak Rate	l/min	0.06	
Allowable Leak Rate	l/min	0.54	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	10.2	
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	%	106.8	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.24	
Overall Weighing Uncertainty	± mg/m ³	0.16	
ELV [Daily ELV for WID]	mg/m ³	10.00	
Allowable Weighing Uncertainty	mg/m ³	0.50	
Weighing Uncertainty Acceptable	-	Yes	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	29	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

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Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	20.00	
Pre-Sampling Leak Rate	l/min	0.02	
Post-Sampling Leak Rate	l/min	0.02	
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	
There are no deviations associated with the sampling employed.	wx	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V_m	1.6340		uV_m	m ³	0.0327	
Sampled Gas Temperature	T_m	301.8		uT_m	K	2.0	
Sampled Gas Pressure	p_m	101.8		up_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Leak	L	0.22		uL	%	-	
Mass of Particulate	m	0.54		um	mg	0.12	
Oxygen Content	$O_{2,m}$	N/A		$uO_{2,m}$	% v/v	N/A	
Uncollected Mass	UCM	0.15		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.66		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.22		≤2%
Mass of Particulate	%	0.81		<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	1.4830		0.24	
Leak	L	mg/m ³	0.0005		1.00	
Mass of Particulate	L_r	mg	0.540		0.67	
Factor for O ₂ Correction	$O_{2,m}$	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.09		0.67	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.009	
Leak	mg/m ³	0.0005	
Mass of Particulate	mg/m ³	0.0807	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.0582	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.10	
Expanded uncertainty (95% confidence)	mg/m ³	0.20	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.20	
Reported Uncertainty	mg/m ³	0.20	
Expanded uncertainty (95% confidence)	%	53.9	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	53.9	
Reported Uncertainty	%	53.9	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
Stack No.7

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.6		1.6
Uncertainty	±mg/m ³	0.17		0.17
Mass Emission	g/hr	4.1		4.1
Uncertainty	±g/hr	0.46		0.46

General Sampling Information

Parameter	Value
Standard	BS EN 13526
Technical Procedure	CAT-TP-20
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Reference Number	CYL 1.0053
Span Gas Expiry Date	30/12/2012
Span Gas Start Pressure (bar)	110
Gas Cylinder Concentration (ppm)	80.3
Span Gas Uncertainty (%)	2
Zero Gas Type	Synthetic Air (5 Grade)
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A1

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

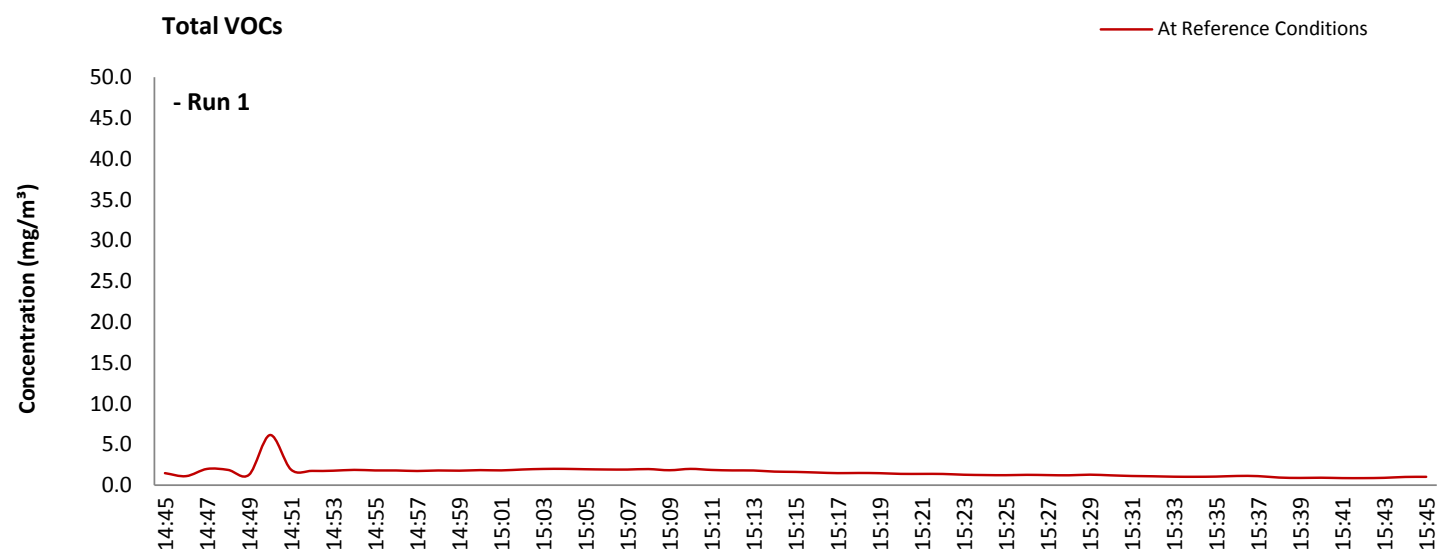
FORMAT: Number Used / Number Required

Reference Conditions

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

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	14:45 - 15:45	
Sampling Dates	-	04:09 - 04-09	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.30	
	Zero Down Sampling Line (Post)	ppm	0.70	
	Zero Drift	ppm	0.40	
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	31.70	
	Span Down Sampling Line (Post)	ppm	33.00	
	Span Drift	ppm	1.30	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	17 - 19	

Method Deviations

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

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

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

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.031		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.022		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.01		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.06		
Expanded uncertainty (95% confidence)	ppm	0.11		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.11		
Reported Uncertainty	ppm	0.11		
Expanded uncertainty (95% confidence)	%	11.1		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	11.1		
Reported Uncertainty	%	11.1		



Air Tech Environmental Consultancy Services



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Your Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: PPC 11/94

Stack Reference

Stack No.8

Dates of the Monitoring Campaign

4th September 2012

Job Reference Number

CAT-1227

Report Written by
Adam Dixon Team Leader MCERTS Level 2 MM 10 1079 TE1 & TE4
Report Approved by
James Eldridge Team Leader MCERTS Level 2 MM 05 641 TE1 TE2 TE3 TE4
Report Date
13th September 2012
Version
Version 1
Signature of Report Approver


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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

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

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Executive Summary

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MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

Stack No.8

4th September 2012

Overall Aim of the Monitoring Campaign

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

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon
Stack No.8
4th September 2012

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.25	1.7	10	g/hr	1.7	11.4	-
Total VOCs (as Carbon)	¹ mg/m ³	1.7	0.18	50	g/hr	11.7	1.2	-
Water Vapour	% v/v	1.3	0.07					
Stack Gas Temperature	°C	27.8						
Stack Gas Velocity	m/s	10.5						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	7442						
Volumetric Flow Rate (REF)	¹ m ³ /hr	6779						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM THE PRELIMINARY VELOCITY TRAVERSE.

¹ Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

MONITORING DATE(S) & TIMES

VIP-Polymers Ltd, Huntingdon
Stack No.8
4th September 2012

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m³	0.25	g/hr	1.7	04/09/2012	12:02 - 12:32, 12:35 - 13:05	60
Total VOCs (as Carbon)	R1	mg/m³	1.7	g/hr	11.7	04/09/2012	12:30 - 13:30	60
Velocity & Volumetric Flow Rate	R1					04/09/2012	11:02 - 11:13	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon
Stack No.8
4th September 2012

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operation
Capacity (of 100%) and Tonnes / Hour	0.01461875 Tonnes per Hour
Continuous or Batch Process	Batch
Feedstock (if applicable)	Small Compression Moulding
Abatement System	None
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	Not Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon

Stack No.8

4th September 2012

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.1 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.14 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

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

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	All Runs	The sample points where the angle of swirl was > 15° were omitted from the sampling exercise. The effective number of points was doubled and any non-compliant swirl points after this increase were omitted.
Total Particulate Matter	All Runs	Ratio highest to lowest velocities between 3 and 5 : 1.
Total VOCs (as Carbon)	All Runs	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

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

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

BS EN 15259 Homogeneity Test Requirements

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

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

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	14.0		> 5 Pa	Yes
Mean Velocity	m/s	10.53		-	-
Lowest Gas Velocity	m/s	4.06		-	-
Highest Gas Velocity	m/s	13.95		-	-
Ratio of Above	: 1	3.44		< 3 : 1	No
Maximum Angle of Swirl	°	35		< 15°	No
No Local Negative Flow	-	Yes		-	Yes

PLANT PHOTOS

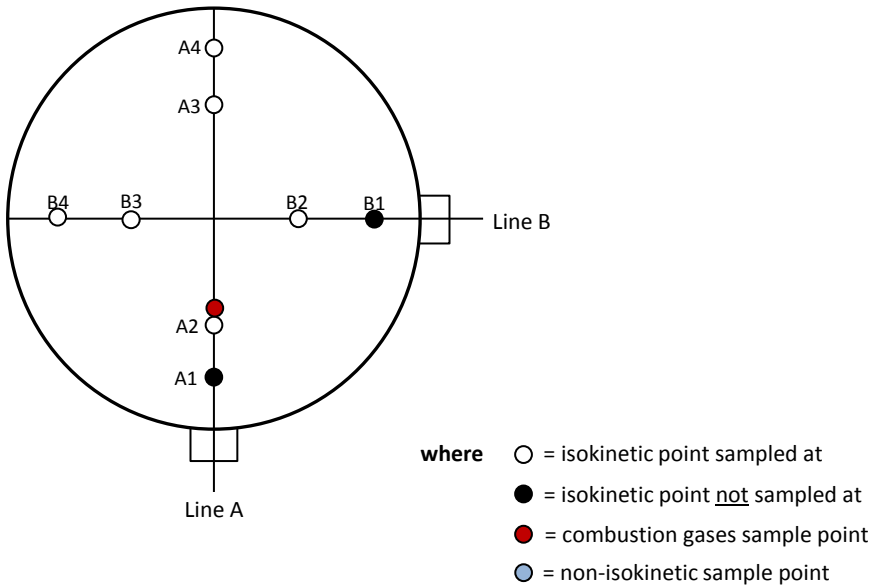
Photo 1



Photo 2



SAMPLE POINTS



APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Adam Dixon	MCERTS Level 2	MM 10 1079	TE1 & TE4
Technician	Darius Niknejad	MCERTS Level 1	MM 09 1036	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 7.5	Horiba PG-250	-	Digital Manometer (1)	CAT 3.47
Box Thermocouples	CAT 3.12	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.12	Eco Physics CLD 822Mh	-	Digital Temperature Meter	CAT 3.47
Oven Box	-	Testo 350 XL	-	Stopwatch	CAT 7.5
Probe	CAT 5.18	Servomex 5200MP	-	Barometer	CAT 13.6
S-Pitot (1)	CAT 21S.15	JCT JCC P-1 Cooler	-	Stack Thermocouple (1)	CAT 4.223
S-Pitot (2)	CAT 21S.40	FT-IR	-	Stack Thermocouple (2)	-
L-Pitot	-	FT-IR Sampling System	-	1m Heated Line (1)	-
500g Check Weight	CAT 17.2	Bernath 3006 FID	CAT 3.6	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.2	Heated Head Filter	CAT 12.91	1m Heated Line (3)	-
Last Impinger Arm	-	Mass Flow Controller (1)	CAT 6.19	5m Heated Line (1)	-
Callipers	CAT 2.37	Mass Flow Controller (2)	CAT 6.20	15m Heated Line (1)	-
Tubes Kit Thermocouple	-	Mass View (1)	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	Mass View (2)	-	20m Heated Line (1)	CAT 20.17
Tape Measure	CAT 16.10	Easylogger EN-EL-12 Bit	CAT 11.13	Dual Channel Heater Controller	-

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.50
Stack Width, W	m	-
Stack Area, A	m ²	0.20
Average Stack Gas Temperature, T _a	°C	27.8
Average Stack Gas Pressure	Pa	101.7
Average Stack Static Pressure, P _{static}	kPa	-0.140
Average Barometric Pressure, P _b	kPa	101.8
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂ (Estimated)	-	20.80	20.53	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	78.11	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	1.30	0.0130	18.02	0.8037	0.0105

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P _{STD}	kg/m ³	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.281
Dry Density (Actual), P _{Actual}	kg/m ³	1.173
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.167

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

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

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	27.8	0.0
Total Pressure	kPa	101.7	101.3
Moisture	%	1.30	1.30

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	7442
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	6779
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	6690
Gas Volumetric Flowrate REF ¹	m ³ /hr	6779

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	04/09/2012
Time of Survey	-	11:02 - 11:13
Atmospheric Pressure	kPa	101.8
Stack Static Pressure	Pa	-140
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	-	Horizontal
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 (°)	35	12	14	5	25	13	10	8												

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	142.0	26.2	1.173	12.89	102.0	27.4	1.168	10.95
2	0.08	158.0	26.7	1.171	13.61	106.0	27.5	1.168	11.16
3	0.13	141.0	27.0	1.170	12.86	143.0	27.6	1.167	12.96
4	0.18	129.0	27.1	1.169	12.30	14.0	27.9	1.166	4.06
5	0.23	23.0	27.4	1.168	5.20	72.0	28.2	1.165	9.21
6	0.28	18.0	27.6	1.167	4.60	66.0	28.2	1.165	8.82
7	0.33	77.0	27.7	1.167	9.52	56.0	28.5	1.164	8.13
8	0.38	90.0	27.8	1.167	10.29	165.0	28.6	1.164	13.95
9	0.43	132.0	28.0	1.166	12.46	138.0	28.8	1.163	12.76
10	0.48	128.0	28.3	1.165	12.28	133.0	28.7	1.163	12.53
Mean		103.8	27.4	1.168	10.60	99.5	28.1	1.165	10.45

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
Stack No.8

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.25		0.25
Uncertainty	±mg/m ³	1.7		1.7
Mass Emission	g/hr	1.7		1.7
Uncertainty	±g/hr	11.4		11.4

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	1.3		1.3
Uncertainty	±% v/v	0.07		0.07

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.25		0.25

General Sampling Information

Parameter	Value	
Standard	BS EN 13284-1	
Technical Procedure	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Quartz Fibre	
Number of Sampling Lines Used	2 / 2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	6 / 8	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A2, A3, A4 & B2, B3, B4	

Reference Conditions

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

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	763.5	
Stack static pressure, P_{static}	mmH ₂ O	-14.3	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	762.5	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	7.2	
Total mass collected in impingers (silica trap)	g	6.0	
Total mass of liquid collected, V_{lc}	g	13.2	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0164	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.3929	
Gas meter correction factor, Y_d	-	0.9920	
Average dry gas meter temperature, T_m	°C	33.1	
Average pressure drop across orifice, ΔH	mmH ₂ O	50.5	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.2439	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0130	
B_{wo} as a percentage	% v/v	1.30	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	1.30	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.2604	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	28.70	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K_p	-	34.97	
Velocity pressure coefficient, C_p	-	0.83	
Average of velocity heads, ΔP_{avg}	mmH ₂ O	14.13	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	3.76	
Average stack gas temperature, T_s	°C	29.8	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (V(M_s)(P_s))$	m/s	12.83	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})			
Area of stack, A_s	m ²	0.20	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	151.2	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	136.8	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	135.0	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	6.01	
Nozzle area, A_n	mm ²	28.37	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	106.3	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	12:02 - 12:32, 12:35 - 13:05	
Sampling Dates	-	04/09/2012	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.2604	
Filter I.D. Number	-	47-10321	
Start Filter Mass	g	0.15519	
End Filter Mass	g	0.15475	
Total Mass on Filter	g	-0.00044	
Probe Rinse I.D. Number	-	PR-47-10321	
Start Probe Rinse Mass	g	3.13043	
End Probe Rinse Mass	g	3.13076	
Total Mass in Probe Rinse	g	0.00033	
Total Mass Collected	mg	-0.11	
Calculated Concentration	mg/m ³	-0.09	
Balance Uncertainty / LOD	mg/m ³	0.10	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	04/09/2012	
Average Volume Sampled (REF)	m ³	1.2604	
Filter I.D. Number	-	47-10350	
Start Filter Mass	g	0.15236	
End Filter Mass	g	0.15253	
Total Mass on Filter	g	0.00017	
Probe Rinse I.D. Number	-	PR-47-10350	
Start Probe Rinse Mass	g	3.09085	
End Probe Rinse Mass	g	3.09099	
Total Mass in Probe Rinse	g	0.00014	
Total Mass Collected	mg	0.31	
Calculated Concentration	mg/m ³	0.25	
Balance Uncertainty / LOD	mg/m ³	0.10	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	23.03	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.10	
Allowable Leak Rate	l/min	0.46	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	5.6	
Allowable MU	%	20	
MU Acceptable	%	Yes	

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

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	106.3	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.24	
Overall Weighing Uncertainty	± mg/m ³	0.19	
ELV [Daily ELV for WID]	mg/m ³	10.00	
Allowable Weighing Uncertainty	mg/m ³	0.50	
Weighing Uncertainty Acceptable	-	Yes	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	30	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	20.00	
Pre-Sampling Leak Rate	l/min	0.09	
Post-Sampling Leak Rate	l/min	0.09	
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 sample points where the angle of swirl was > 15° were omitted from the sampling exercise. The effective number of points was doubled and any non-compliant swirl points after this increase were omitted.	x	
Ratio highest to lowest velocities between 3 and 5 : 1.	x	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V_m	1.3929		uV_m	m ³	0.0279	
Sampled Gas Temperature	T_m	306.1		uT_m	K	2.0	
Sampled Gas Pressure	p_m	101.7		up_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Leak	L	0.43		uL	%	-	
Mass of Particulate	m	0.12		um	mg	0.12	
Oxygen Content	$O_{2,m}$	N/A		$uO_{2,m}$	% v/v	N/A	
Uncollected Mass	UCM	0.31		$uUCM$	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.65		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.43		≤2%
Mass of Particulate	%	2.46		<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	1.2439		0.20	
Leak	L	mg/m ³	0.001		1.00	
Mass of Particulate	L_r	mg	0.120		2.05	
Factor for O ₂ Correction	$O_{2,m}$	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.18		2.05	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.006	
Leak	mg/m ³	0.0006	
Mass of Particulate	mg/m ³	0.2460	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.3669	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.44	
Expanded uncertainty (95% confidence)	mg/m ³	0.87	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	1.69	
Reported Uncertainty	mg/m ³	1.69	
Expanded uncertainty (95% confidence)	%	352.0	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	686.4	
Reported Uncertainty	%	686.4	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
Stack No.8

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	1.7		1.7
Uncertainty	±mg/m ³	0.18		0.18
Mass Emission	g/hr	11.7		11.7
Uncertainty	±g/hr	1.2		1.2

General Sampling Information

Parameter	Value
Standard	BS EN 13526
Technical Procedure	CAT-TP-20
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Reference Number	CYL 1.0053
Span Gas Expiry Date	30/12/2012
Span Gas Start Pressure (bar)	120
Gas Cylinder Concentration (ppm)	80.3
Span Gas Uncertainty (%)	2
Zero Gas Type	Synthetic Air (5 Grade)
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A2

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

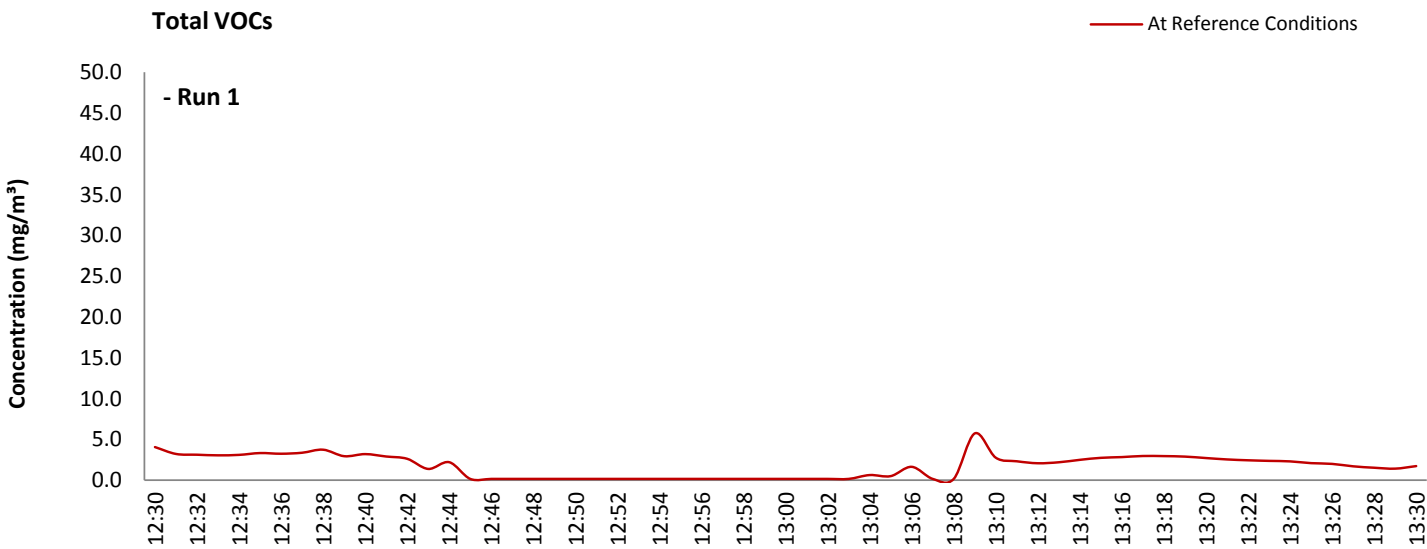
FORMAT: Number Used / Number Required

Reference Conditions

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

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	12:30 - 13:30	
Sampling Dates	-	04:09 - 04-09	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.20	
	Zero Down Sampling Line (Post)	ppm	0.50	
	Zero Drift	ppm	0.30	
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	31.40	
	Span Down Sampling Line (Post)	ppm	31.90	
	Span Drift	ppm	0.50	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	15 - 18	

Method Deviations

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

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	100.0		
Measured Reading	ppm	1.1		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.031		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.025		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.01		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.06		
Expanded uncertainty (95% confidence)	ppm	0.11		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.11		
Reported Uncertainty	ppm	0.11		
Expanded uncertainty (95% confidence)	%	10.2		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	10.2		
Reported Uncertainty	%	10.2		



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Your Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: PPC 11/94

Stack Reference

Stack No.8a

Dates of the Monitoring Campaign

4th September 2012

Job Reference Number

CAT-1227

Report Written by

Adam Dixon
Team Leader
MCERTS Level 2
MM 10 1079
TE1 & TE4

Report Approved by

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Team Leader
MCERTS Level 2
MM 05 641
TE1 TE2 TE3 TE4

Report Date

13th September 2012

Version

Version 1

Signature of Report Approver

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Executive Summary

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MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

Stack No.8a

4th September 2012

Overall Aim of the Monitoring Campaign

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

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary

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MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon
 Stack No.8a
 4th September 2012

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m³	0.42	0.54	10	g/hr	1.3	1.6	-
Total VOCs (as Carbon)	¹ mg/m³	0.43	0.16	50	g/hr	1.3	0.47	-
Water Vapour	% v/v	1.7	0.09					
Stack Gas Temperature	°C	32.0						
Stack Gas Velocity	m/s	7.4						
Volumetric Flow Rate (ACTUAL)	m³/hr	3349						
Volumetric Flow Rate (REF)	¹ m³/hr	3012						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM THE PRELIMINARY VELOCITY TRAVERSE.

¹ Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

MONITORING DATE(S) & TIMES

VIP-Polymers Ltd, Huntingdon
Stack No.8a
4th September 2012

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m³	0.42	g/hr	1.3	04/09/2012	13:25- 14:25	60
Total VOCs (as Carbon)	R1	mg/m³	0.43	g/hr	1.3	04/09/2012	13:34 - 14:34	60
Velocity & Volumetric Flow Rate	R1					04/09/2012	12:50 - 13:01	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon
Stack No.8a
4th September 2012

Standard Operating Conditions

Parameter	Value
Process Status	Normal Conditions
Capacity (of 100%) and Tonnes / Hour	0.0420025 Tonnes per Hour
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Under Cured Parts, Viton Seals
Abatement System	None
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon

Stack No.8a

4th September 2012

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.11 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.14 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

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

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	All Runs	The sample points where the angle of swirl was > 15° were omitted from the sampling exercise.
Total Particulate Matter	All Runs	Only one sampling line was installed on the stack, however the number of sample points used on the available line were increased to meet the requirements of the Standard.
Total VOCs (as Carbon)	All Runs	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.40
Width	m	-
Area	m ²	0.13
Port Depth	cm	4
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

BS EN 15259 Homogeneity Test Requirements

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

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

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	9.0		> 5 Pa	Yes
Mean Velocity	m/s	7.40		-	-
Lowest Gas Velocity	m/s	3.28		-	-
Highest Gas Velocity	m/s	10.42		-	-
Ratio of Above	: 1	3.18		< 3 : 1	No
Maximum Angle of Swirl	°	45		< 15°	No
No Local Negative Flow	-	Yes		-	Yes

Executive Summary

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PLANT PHOTOS

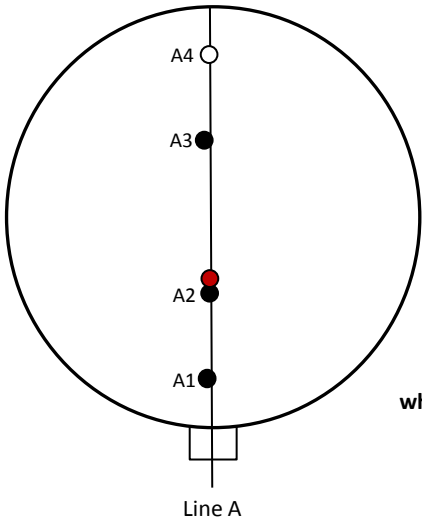
Photo 1



Photo 2



SAMPLE POINTS



- where

○ = isokinetic point sampled at

● = isokinetic point not sampled at

● = combustion gases sample point

● = non-isokinetic sample point

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Adam Dixon	MCERTS Level 2	MM 10 1079	TE1 & TE4
Technician	Darius Niknejad	MCERTS Level 1	MM 09 1036	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 7.5	Horiba PG-250	-	Digital Manometer (1)	CAT 3.47
Box Thermocouples	CAT 3.12	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.12	Eco Physics CLD 822Mh	-	Digital Temperature Meter	CAT 3.47
Oven Box	-	Testo 350 XL	-	Stopwatch	CAT 7.5
Probe	CAT 5.18	Servomex 5200MP	-	Barometer	CAT 13.6
S-Pitot (1)	CAT 21S.15	JCT JCC P-1 Cooler	-	Stack Thermocouple (1)	CAT 4.223
S-Pitot (2)	CAT 21S.40	FT-IR	-	Stack Thermocouple (2)	-
L-Pitot	-	FT-IR Sampling System	-	1m Heated Line (1)	-
500g Check Weight	CAT 17.2	Bernath 3006 FID	CAT 3.6	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.2	Heated Head Filter	CAT 12.91	1m Heated Line (3)	-
Last Impinger Arm	-	Mass Flow Controller (1)	CAT 6.19	5m Heated Line (1)	-
Callipers	CAT 2.37	Mass Flow Controller (2)	CAT 6.20	15m Heated Line (1)	-
Tubes Kit Thermocouple	-	Mass View (1)	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	Mass View (2)	-	20m Heated Line (1)	CAT 20.17
Tape Measure	CAT 16.10	Easylogger EN-EL-12 Bit	CAT 11.13	Dual Channel Heater Controller	-

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.40
Stack Width, W	m	-
Stack Area, A	m ²	0.13
Average Stack Gas Temperature, T _a	°C	32.0
Average Stack Gas Pressure	Pa	52.6
Average Stack Static Pressure, P _{static}	kPa	-0.023
Average Barometric Pressure, P _b	kPa	101.8
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂ (Estimated)	-	20.80	20.44	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	77.78	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	1.72	0.0172	18.02	0.8037	0.0138

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P _{STD}	kg/m ³	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.279
Dry Density (Actual), P _{Actual}	kg/m ³	1.158
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.150

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

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

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	32.0	0.0
Total Pressure	kPa	101.8	101.3
Moisture	%	1.72	1.72

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	3349
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	3012
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	2960
Gas Volumetric Flowrate REF ¹	m ³ /hr	3012

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	04/09/2012
Time of Survey	-	12:50 - 13:01
Atmospheric Pressure	kPa	101.8
Stack Static Pressure	Pa	-23
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 (°)	45	25	20	12																

Sampling Line A					
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	47.0	31.7	1.151	7.48
2	0.06	11.0	31.7	1.151	3.62
3	0.10	9.0	31.8	1.151	3.28
4	0.14	10.0	31.9	1.151	3.45
5	0.18	37.0	31.9	1.151	6.64
6	0.22	80.0	32.0	1.150	9.77
7	0.26	82.0	32.0	1.150	9.89
8	0.30	91.0	32.1	1.150	10.42
9	0.34	89.0	32.4	1.149	10.31
10	0.38	70.0	32.5	1.148	9.15
Mean		52.6	32.0	1.150	7.40

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
Stack No.8a

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	0.42		0.42
Uncertainty	±mg/m³	0.54		0.54
Mass Emission	g/hr	1.3		1.3
Uncertainty	±g/hr	1.6		1.6

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	1.7		1.7
Uncertainty	±% v/v	0.09		0.09

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	0.25		0.25

General Sampling Information

Parameter	Value	
Standard	BS EN 13284-1	
Technical Procedure	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Quartz Fibre	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 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.

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	763.5	
Stack static pressure, P_{static}	mmH ₂ O	-2.3	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	763.3	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	8.0	
Total mass collected in impingers (silica trap)	g	6.8	
Total mass of liquid collected, V_{lc}	g	14.8	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0184	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.1870	
Gas meter correction factor, Y_d	-	0.9920	
Average dry gas meter temperature, T_m	°C	34.8	
Average pressure drop across orifice, ΔH	mmH ₂ O	37.6	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.0531	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0172	
B_{wo} as a percentage	% v/v	1.72	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	1.72	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.0716	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
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	28.66	
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	5.67	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	2.38	
Average stack gas temperature, T_s	°C	29.2	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (V(M_s)(P_s))$	m/s	8.12	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})			
Area of stack, A_s	m ²	0.13	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	61.2	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	55.6	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	54.6	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	7.00	
Nozzle area, A_n	mm ²	38.49	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	104.9	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	13:25- 14:25	
Sampling Dates	-	04/09/2012	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.0716	
Filter I.D. Number	-	47-10314	
Start Filter Mass	g	0.15360	
End Filter Mass	g	0.15372	
Total Mass on Filter	g	0.00012	
Probe Rinse I.D. Number	-	PR-47-10314	
Start Probe Rinse Mass	g	3.06332	
End Probe Rinse Mass	g	3.06365	
Total Mass in Probe Rinse	g	0.00033	
Total Mass Collected	mg	0.45	
Calculated Concentration	mg/m ³	0.42	
Balance Uncertainty / LOD	mg/m ³	0.11	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	04/09/2012	
Average Volume Sampled (REF)	m ³	1.0716	
Filter I.D. Number	-	47-9949	
Start Filter Mass	g	0.15482	
End Filter Mass	g	0.15493	
Total Mass on Filter	g	0.00011	
Probe Rinse I.D. Number	-	PR-47-9949	
Start Probe Rinse Mass	g	2.93098	
End Probe Rinse Mass	g	2.93114	
Total Mass in Probe Rinse	g	0.00016	
Total Mass Collected	mg	0.27	
Calculated Concentration	mg/m ³	0.25	
Balance Uncertainty / LOD	mg/m ³	0.11	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	19.6	
Pre-Sampling Leak Rate	l/min	0.04	
Post-Sampling Leak Rate	l/min	0.03	
Allowable Leak Rate	l/min	0.39	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	5.5	
Allowable MU	%	20	
MU Acceptable	%	Yes	

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

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	105	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.24	
Overall Weighing Uncertainty	± mg/m ³	0.22	
ELV [Daily ELV for WID]	mg/m ³	10.0	
Allowable Weighing Uncertainty	mg/m ³	0.50	
Weighing Uncertainty Acceptable	-	Yes	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	29	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	20.0	
Pre-Sampling Leak Rate	l/min	0.08	
Post-Sampling Leak Rate	l/min	0.08	
Allowable Leak Rate	l/min	0.40	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m³	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 sample points where the angle of swirl was > 15° were omitted from the sampling exercise.	x	
Only one sampling line was installed on the stack, however the number of sample points used on the available line were increased to meet the requirements of the Standard.		
Ratio highest to lowest velocities between 3 and 5 : 1.		

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V_m	1.1870		uV_m	m ³	0.0237	
Sampled Gas Temperature	T_m	307.8		uT_m	K	2.0	
Sampled Gas Pressure	p_m	101.8		up_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Leak	L	0.15		uL	%	-	
Mass of Particulate	m	0.45		um	mg	0.12	
Oxygen Content	$O_{2,m}$	N/A		$uO_{2,m}$	% v/v	N/A	
Uncollected Mass	UCM	0.27		$uUCM$	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.65		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.15		≤2%
Mass of Particulate	%	1.12		<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	1.0531		0.40	
Leak	L	mg/m ³	0.0004		1.00	
Mass of Particulate	L_r	mg	0.450		0.93	
Factor for O ₂ Correction	$O_{2,m}$	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.16		0.93	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.011	
Leak	mg/m ³	0.0004	
Mass of Particulate	mg/m ³	0.1120	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.1455	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.18	
Expanded uncertainty (95% confidence)	mg/m ³	0.36	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.54	
Reported Uncertainty	mg/m ³	0.54	
Expanded uncertainty (95% confidence)	%	85.8	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	128.8	
Reported Uncertainty	%	128.8	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
Stack No.8a

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.43		0.43
Uncertainty	±mg/m ³	0.16		0.16
Mass Emission	g/hr	1.3		1.3
Uncertainty	±g/hr	0.47		0.47

General Sampling Information

Parameter	Value
Standard	BS EN 13526
Technical Procedure	CAT-TP-20
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Reference Number	CYL 1.0053
Span Gas Expiry Date	30/12/2012
Span Gas Start Pressure (bar)	120
Gas Cylinder Concentration (ppm)	80.3
Span Gas Uncertainty (%)	2
Zero Gas Type	Synthetic Air (5 Grade)
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A2

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

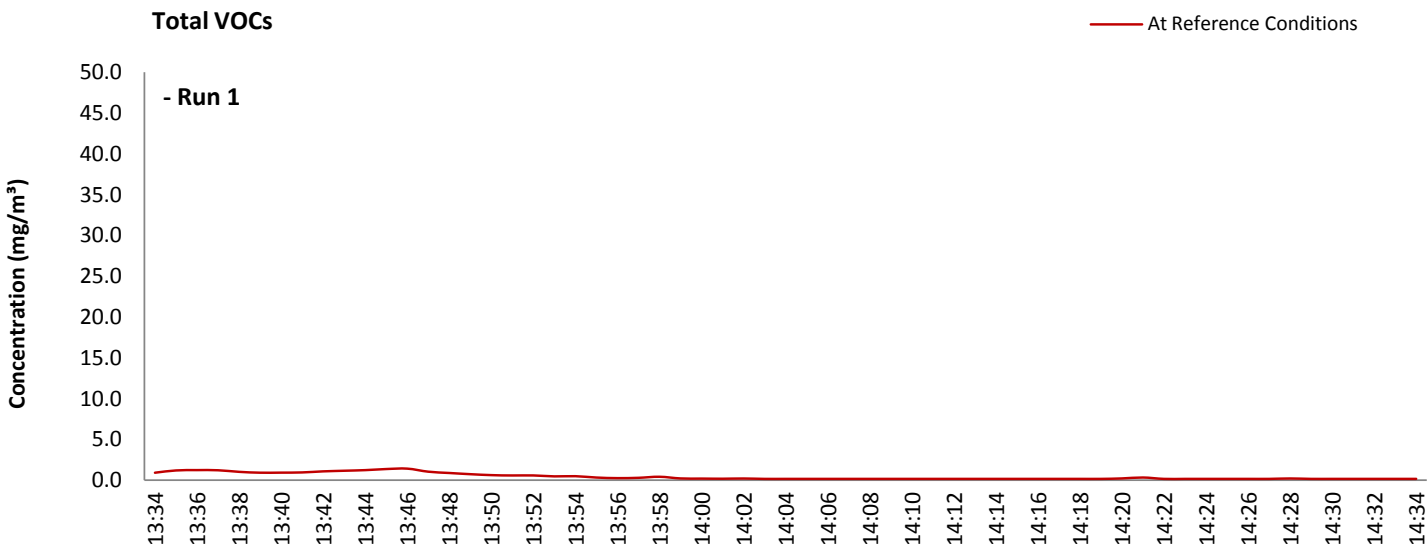
FORMAT: Number Used / Number Required

Reference Conditions

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

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	13:34 - 14:34	
Sampling Dates	-	04:09 - 04-09	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.20	
	Zero Down Sampling Line (Post)	ppm	0.50	
	Zero Drift	ppm	0.30	
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	
	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	31.40	
	Span Down Sampling Line (Post)	ppm	31.80	
	Span Drift	ppm	0.40	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	
	Test Conditions	Units	Run 1	
	Run Ambient Temperature Range	°C	17 - 19	

Method Deviations

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

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	100		
Measured Reading	ppm	0.3		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.031		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.006		
Leak	ppm	0.000		
Calibration Gas Uncertainty	ppm	0.002		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.002		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.05		
Expanded uncertainty (95% confidence)	ppm	0.10		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.10		
Reported Uncertainty	ppm	0.10		
Expanded uncertainty (95% confidence)	%	36.1		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	36.1		
Reported Uncertainty	%	36.1		



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Your Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: PPC 11/94

Stack Reference

Stack No.8b

Dates of the Monitoring Campaign

4th September 2012

Job Reference Number

CAT-1227

Report Written by
Adam Dixon Team Leader MCERTS Level 2 MM 10 1079 TE1 & TE4

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

Report Date
13th September 2012

Version
Version 1

Signature of Report Approver


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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

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Executive Summary

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MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

Stack No.8b

4th September 2012

Overall Aim of the Monitoring Campaign

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

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon
 Stack No.8b
 4th September 2012

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.90	0.35	10	g/hr	1.5	0.59	-
Total VOCs (as Carbon)	¹ mg/m ³	0.83	0.16	50	g/hr	1.4	0.27	-
Water Vapour	% v/v	0.77	0.06					
Stack Gas Temperature	°C	32.0						
Stack Gas Velocity	m/s	7.4						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	1880						
Volumetric Flow Rate (REF)	¹ m ³ /hr	1691						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM THE PRELIMINARY VELOCITY TRAVERSE.

¹ Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

MONITORING DATE(S) & TIMES

VIP-Polymers Ltd, Huntingdon
Stack No.8b
4th September 2012

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m³	0.90	g/hr	1.5	04/09/2012	14:42 - 15:42	60
Total VOCs (as Carbon)	R1	mg/m³	0.83	g/hr	1.4	04/09/2012	15:55 - 16:55	60
Velocity & Volumetric Flow Rate	R1					04/09/2012	12:50 - 13:01	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon
Stack No.8b
4th September 2012

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operation
Capacity (of 100%) and Tonnes / Hour	100 % Capacity
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Under Cured Parts, Viton Seals
Abatement System	None
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon

Stack No.8b

4th September 2012

	Monitoring				Analysis					
Parameter	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab	MCERTS Testing	LOD (Average)
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.14 mg/m³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.14 mg/m³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

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

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	All Runs	Ratio highest to lowest velocities between 3 and 5 : 1.
Total VOCs (as Carbon)	All Runs	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

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

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

BS EN 15259 Homogeneity Test Requirements

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

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

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	9.0		> 5 Pa	Yes
Mean Velocity	m/s	7.39		-	-
Lowest Gas Velocity	m/s	3.27		-	-
Highest Gas Velocity	m/s	10.40		-	-
Ratio of Above	: 1	3.18		< 3 : 1	No
Maximum Angle of Swirl	°	12		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

PLANT PHOTOS

Photo 1



Photo 2



Photo 3

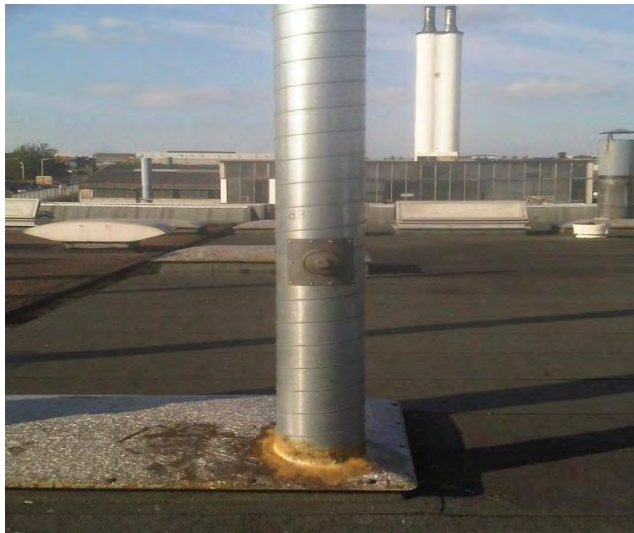
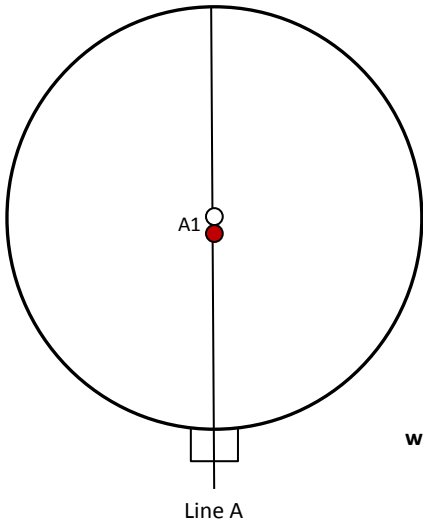


Photo 4

N/A

SAMPLE POINTS



- where

○ = isokinetic point sampled at

● = isokinetic point not sampled at

● = combustion gases sample point

● = non-isokinetic sample point

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Adam Dixon	MCERTS Level 2	MM 10 1079	TE1 & TE4
Technician	Darius Niknejad	MCERTS Level 1	MM 09 1036	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 7.5	Horiba PG-250	-	Digital Manometer (1)	CAT 3.47
Box Thermocouples	CAT 3.12	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.12	Eco Physics CLD 822Mh	-	Digital Temperature Meter	CAT 3.47
Oven Box	-	Testo 350 XL	-	Stopwatch	CAT 7.5
Probe	CAT 5.18	Servomex 5200MP	-	Barometer	CAT 13.6
S-Pitot (1)	CAT 21S.15	JCT JCC P-1 Cooler	-	Stack Thermocouple (1)	CAT 4.223
S-Pitot (2)	CAT 21S.40	FT-IR	-	Stack Thermocouple (2)	-
L-Pitot	-	FT-IR Sampling System	-	1m Heated Line (1)	-
500g Check Weight	CAT 17.2	Bernath 3006 FID	CAT 3.6	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.2	Heated Head Filter	CAT 12.91	1m Heated Line (3)	-
Last Impinger Arm	-	Mass Flow Controller (1)	CAT 6.19	5m Heated Line (1)	-
Callipers	CAT 2.37	Mass Flow Controller (2)	CAT 6.20	15m Heated Line (1)	-
Tubes Kit Thermocouple	-	Mass View (1)	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	Mass View (2)	-	20m Heated Line (1)	CAT 20.17
Tape Measure	CAT 16.10	Easylogger EN-EL-12 Bit	CAT 11.13	Dual Channel Heater Controller	-

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.30
Stack Width, W	m	-
Stack Area, A	m ²	0.07
Average Stack Gas Temperature, T _a	°C	32.0
Average Stack Gas Pressure	Pa	52.6
Average Stack Static Pressure, P _{static}	kPa	-0.026
Average Barometric Pressure, P _b	kPa	101.8
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂ (Estimated)	-	20.80	20.64	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	78.53	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	0.77	0.0077	18.02	0.8037	0.0062

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	1.158
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.154

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

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

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	32.0	0.0
Total Pressure	kPa	101.8	101.3
Moisture	%	0.77	0.77

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	1880
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	1691
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	1678
Gas Volumetric Flowrate REF ¹	m ³ /hr	1691

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	04/09/2012
Time of Survey	-	12:50 - 13:01
Atmospheric Pressure	kPa	101.8
Stack Static Pressure	Pa	-26
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 (°)	12																			

Sampling Line A					
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	47.0	31.7	1.155	7.47
2	0.05	11.0	31.7	1.155	3.61
3	0.08	9.0	31.8	1.155	3.27
4	0.11	10.0	31.9	1.155	3.45
5	0.14	37.0	31.9	1.155	6.63
6	0.17	80.0	32.0	1.154	9.75
7	0.20	82.0	32.0	1.154	9.87
8	0.23	91.0	32.1	1.154	10.40
9	0.26	89.0	32.4	1.153	10.29
10	0.29	70.0	32.5	1.152	9.13
Mean		52.6	32.0	1.154	7.39

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
Stack No.8b

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.90		0.90
Uncertainty	±mg/m ³	0.35		0.35
Mass Emission	g/hr	1.5		1.5
Uncertainty	±g/hr	0.59		0.59

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.77		0.77
Uncertainty	±% v/v	0.06		0.06

Blank Runs

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

General Sampling Information

Parameter	Value	
Standard	BS EN 13284-1	
Technical Procedure	CAT-TP-01	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	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.

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	763.5	
Stack static pressure, P_{static}	mmH ₂ O	-2.7	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	763.3	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	1.6	
Total mass collected in impingers (silica trap)	g	3.7	
Total mass of liquid collected, V_{lc}	g	5.3	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0066	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	0.9531	
Gas meter correction factor, Y_d	-	0.9920	
Average dry gas meter temperature, T_m	°C	32.0	
Average pressure drop across orifice, ΔH	mmH ₂ O	22.1	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.8518	
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	0.8585	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
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	1.30	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	1.14	
Average stack gas temperature, T_s	°C	41.0	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (V(M_s)(P_s))$	m/s	3.95	
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	16.8	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	14.6	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	14.5	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	8.97	
Nozzle area, A_n	mm ²	63.16	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	109.4	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	14:42 - 15:42	
Sampling Dates	-	04/09/2012	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.8585	
Filter I.D. Number	-	47-10319	
Start Filter Mass	g	0.15498	
End Filter Mass	g	0.15521	
Total Mass on Filter	g	0.00023	
Probe Rinse I.D. Number	-	PR-47-10319	
Start Probe Rinse Mass	g	3.03628	
End Probe Rinse Mass	g	3.03682	
Total Mass in Probe Rinse	g	0.00054	
Total Mass Collected	mg	0.77	
Calculated Concentration	mg/m ³	0.90	
Balance Uncertainty / LOD	mg/m ³	0.14	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	04/09/2012	
Average Volume Sampled (REF)	m ³	0.8585	
Filter I.D. Number	-	47-10345	
Start Filter Mass	g	0.15460	
End Filter Mass	g	0.15468	
Total Mass on Filter	g	0.00008	
Probe Rinse I.D. Number	-	PR-47-10345	
Start Probe Rinse Mass	g	2.84920	
End Probe Rinse Mass	g	2.84928	
Total Mass in Probe Rinse	g	0.00008	
Total Mass Collected	mg	0.16	
Calculated Concentration	mg/m ³	0.19	
Balance Uncertainty / LOD	mg/m ³	0.14	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	15.76	
Pre-Sampling Leak Rate	l/min	0.00	
Post-Sampling Leak Rate	l/min	0.02	
Allowable Leak Rate	l/min	0.32	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	7.3	
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	%	109.4	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.24	
Overall Weighing Uncertainty	± mg/m ³	0.28	
ELV [Daily ELV for WID]	mg/m ³	10.00	
Allowable Weighing Uncertainty	mg/m ³	0.50	
Weighing Uncertainty Acceptable	-	Yes	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	41	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	20.00	
Pre-Sampling Leak Rate	l/min	0.03	
Post-Sampling Leak Rate	l/min	0.03	
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	
Ratio highest to lowest velocities between 3 and 5 : 1.	wx	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V_m	0.9531		uV_m	m ³	0.0191	
Sampled Gas Temperature	T_m	305.0		uT_m	K	2.0	
Sampled Gas Pressure	p_m	101.8		up_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Leak	L	0.13		uL	%	-	
Mass of Particulate	m	0.77		um	mg	0.12	
Oxygen Content	$O_{2,m}$	N/A		$uO_{2,m}$	% v/v	N/A	
Uncollected Mass	UCM	0.16		$uUCM$	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.66		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.13		≤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	0.8518		1.05	
Leak	L	mg/m ³	0.001		1.00	
Mass of Particulate	L_r	mg	0.770		1.16	
Factor for O ₂ Correction	$O_{2,m}$	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.09		1.16	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.023	
Leak	mg/m ³	0.0007	
Mass of Particulate	mg/m ³	0.1398	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.1076	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.18	
Expanded uncertainty (95% confidence)	mg/m ³	0.35	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.35	
Reported Uncertainty	mg/m ³	0.35	
Expanded uncertainty (95% confidence)	%	38.9	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	38.9	
Reported Uncertainty	%	38.9	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
Stack No.8b

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.83		0.83
Uncertainty	±mg/m ³	0.16		0.16
Mass Emission	g/hr	1.4		1.4
Uncertainty	±g/hr	0.27		0.27

General Sampling Information

Parameter	Value
Standard	BS EN 13526
Technical Procedure	CAT-TP-20
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Reference Number	CYL 1.0053
Span Gas Expiry Date	30/12/2012
Span Gas Start Pressure (bar)	110
Gas Cylinder Concentration (ppm)	80.3
Span Gas Uncertainty (%)	2
Zero Gas Type	Synthetic Air (5 Grade)
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A1

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

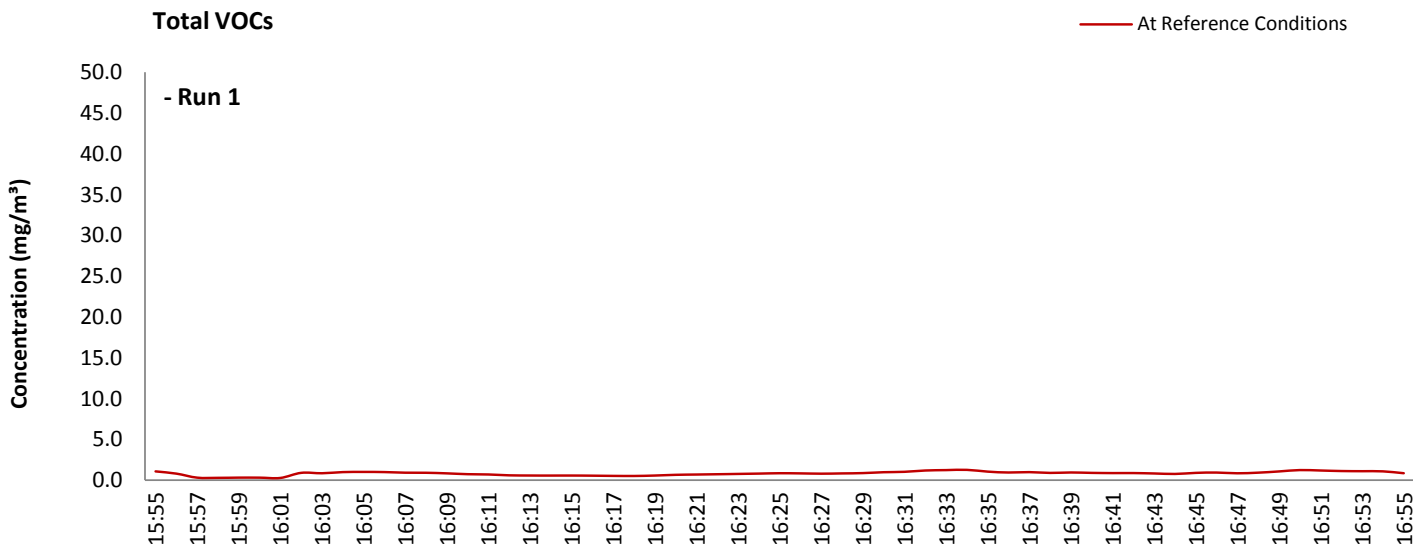
FORMAT: Number Used / Number Required

Reference Conditions

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

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	15:55 - 16:55	
Sampling Dates	-	04:09 - 04-09	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.30	
	Zero Down Sampling Line (Post)	ppm	0.70	
	Zero Drift	ppm	0.40	
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	31.70	
	Span Down Sampling Line (Post)	ppm	33.00	
	Span Drift	ppm	1.30	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	17 - 19	

Method Deviations

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

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

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

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.031		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.012		
Leak	ppm	0.000		
Calibration Gas Uncertainty	ppm	0.003		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.004		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.05		
Expanded uncertainty (95% confidence)	ppm	0.10		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.10		
Reported Uncertainty	ppm	0.10		
Expanded uncertainty (95% confidence)	%	19.4		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	19.4		
Reported Uncertainty	%	19.4		



Air Tech Environmental Consultancy Services

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Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: PPC 11/94

Stack Reference

8c

Dates of the Monitoring Campaign

4th September 2012

Job Reference Number

CAT-1227

Report Written by

Adam Dixon
Team Leader
MCERTS Level 2
MM 10 1079
TE1 & TE4

Report Approved by

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

Report Date

13th September 2012

Version

Version 1

Signature of Report Approver

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APPENDIX 2 - Raw Data, Sampling Equations & Charts	

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

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Executive Summary

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MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

8c

4th September 2012

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions testing on the 8c by VIP-Polymers Ltd at Huntingdon.

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon
8c
4th September 2012

Parameter	Concentration					Mass Emission			
	Units	Result	MU +/-	Limit		Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.42	0.26	10		g/hr	1.5	0.91	-
Total VOCs (as Carbon)	¹ mg/m ³	0.51	0.16	50		g/hr	1.8	0.56	-
Water Vapour	% v/v	0.56	0.04						
Stack Gas Temperature	°C	30.4							
Stack Gas Velocity	m/s	8.6							
Volumetric Flow Rate (ACTUAL)	m ³ /hr	3907							
Volumetric Flow Rate (REF)	¹ m ³ /hr	3533							

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM THE PRELIMINARY VELOCITY TRAVERSE.

¹ Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

Executive Summary

(Page 3 of 7)

MONITORING DATE(S) & TIMES

VIP-Polymers Ltd, Huntingdon

8c

4th September 2012

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m ³	0.42	g/hr	1.5	04/09/2012	17:15 - 18:15	60
Total VOCs (as Carbon)	R1	mg/m ³	0.51	g/hr	1.8	04/09/2012	17:15 - 18:15	60
Velocity & Volumetric Flow Rate	R1					04/09/2012	17:00 - 17:06	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon
8c
4th September 2012

Standard Operating Conditions

Parameter	Value
Process Status	Normal Conditions
Capacity (of 100%) and Tonnes / Hour	0.0029375 Tonnes per Hour
Continuous or Batch Process	Batch
Feedstock (if applicable)	Small Compressions Mouldings
Abatement System	None
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary

(Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon

8c

4th September 2012

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.11 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.14 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

Catalyst Environmental Ltd (CAT)	UKAS Accreditation Number: 4279
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SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	All Runs	Only one sampling line was installed on the stack, however the number of sample points used on the available line were increased to meet the requirements of the Standard.
Total VOCs (as Carbon)	All Runs	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.40
Width	m	-
Area	m ²	0.13
Port Depth	cm	4
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

BS EN 15259 Homogeneity Test Requirements

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

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

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	49.0		> 5 Pa	Yes
Mean Velocity	m/s	8.64		-	-
Lowest Gas Velocity	m/s	7.61		-	-
Highest Gas Velocity	m/s	9.65		-	-
Ratio of Above	: 1	1.27		< 3 : 1	Yes
Maximum Angle of Swirl	°	14		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

PLANT PHOTOS

Photo 1



Photo 2



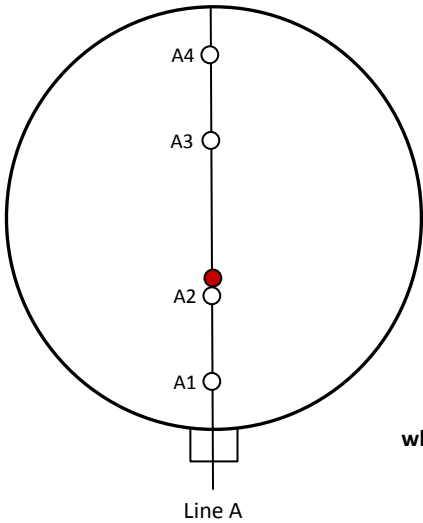
Photo 3



Photo 4

N/A

SAMPLE POINTS



where

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



APPENDICES



APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Adam Dixon	MCERTS Level 2	MM 10 1079	TE1 & TE4
Technician	Darius Niknejad	MCERTS Level 1	MM 09 1036	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 7.5	Horiba PG-250	-	Digital Manometer (1)	CAT 3.47
Box Thermocouples	CAT 3.12	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.12	Eco Physics CLD 822Mh	-	Digital Temperature Meter	CAT 3.47
Oven Box	-	Testo 350 XL	-	Stopwatch	CAT 7.5
Probe	CAT 5.18	Servomex 5200MP	-	Barometer	CAT 13.6
S-Pitot (1)	CAT 21S.15	JCT JCC P-1 Cooler	-	Stack Thermocouple (1)	CAT 4.223
S-Pitot (2)	CAT 21S.40	FT-IR	-	Stack Thermocouple (2)	-
L-Pitot	-	FT-IR Sampling System	-	1m Heated Line (1)	-
500g Check Weight	CAT 17.2	Bernath 3006 FID	CAT 3.6	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.2	Heated Head Filter	CAT 12.91	1m Heated Line (3)	-
Last Impinger Arm	-	Mass Flow Controller (1)	CAT 6.19	5m Heated Line (1)	-
Callipers	CAT 2.37	Mass Flow Controller (2)	CAT 6.20	15m Heated Line (1)	-
Tubes Kit Thermocouple	-	Mass View (1)	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	Mass View (2)	-	20m Heated Line (1)	CAT 20.17
Tape Measure	CAT 16.10	Easylogger EN-EL-12 Bit	CAT 11.13	Dual Channel Heater Controller	-

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.40
Stack Width, W	m	-
Stack Area, A	m ²	0.13
Average Stack Gas Temperature, T _a	°C	30.4
Average Stack Gas Pressure	Pa	63.5
Average Stack Static Pressure, P _{static}	kPa	0.015
Average Barometric Pressure, P _b	kPa	101.8
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂ (Estimated)	-	20.80	20.68	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	78.69	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	0.56	0.0056	18.02	0.8037	0.0045

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	1.164
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.162

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

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

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	30.4	0.0
Total Pressure	kPa	101.8	101.3
Moisture	%	0.56	0.56

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	3907
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	3533
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	3513
Gas Volumetric Flowrate REF ¹	m ³ /hr	3533

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	04/09/2012
Time of Survey	-	17:00 - 17:06
Atmospheric Pressure	kPa	101.8
Stack Static Pressure	Pa	15
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 (°)	8	14	2	4																

Sampling Line A					
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.02	78.0	29.8	1.164	9.59
2	0.06	79.0	29.9	1.164	9.65
3	0.10	71.0	30.0	1.163	9.15
4	0.14	59.0	30.4	1.162	8.35
5	0.18	65.0	30.6	1.161	8.77
6	0.22	63.0	30.6	1.161	8.63
7	0.26	64.0	30.5	1.161	8.70
8	0.30	52.0	30.7	1.161	7.84
9	0.34	49.0	30.8	1.160	7.61
10	0.38	55.0	31.0	1.159	8.07
Mean		63.5	30.4	1.162	8.64

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
8c

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	0.42		0.42
Uncertainty	±mg/m³	0.26		0.26
Mass Emission	g/hr	1.5		1.5
Uncertainty	±g/hr	0.91		0.91

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.56		0.56
Uncertainty	±% v/v	0.04		0.04

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	0.13		0.13

General Sampling Information

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

Reference Conditions

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

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	763.5	
Stack static pressure, P_{static}	mmH ₂ O	1.5	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	763.6	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	2.1	
Total mass collected in impingers (silica trap)	g	3.0	
Total mass of liquid collected, V_{lc}	g	5.1	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0064	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.2530	
Gas meter correction factor, Y_d	-	0.9920	
Average dry gas meter temperature, T_m	°C	32.0	
Average pressure drop across orifice, ΔH	mmH ₂ O	40.9	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.1219	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0056	
B_{wo} as a percentage	% v/v	0.56	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	0.56	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.1283	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
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	6.35	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	2.52	
Average stack gas temperature, T_s	°C	30.7	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (V(M_s)(P_s))$	m/s	8.60	
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	64.9	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	58.6	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	58.2	
$Q_{stw@O_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	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	6.97	
Nozzle area, A_n	mm ²	38.16	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	105.7	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	17:15 - 18:15	
Sampling Dates	-	04/09/2012	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.1283	
Filter I.D. Number	-	47-10177	
Start Filter Mass	g	0.15257	
End Filter Mass	g	0.15263	
Total Mass on Filter	g	0.00006	
Probe Rinse I.D. Number	-	PR-47-10177	
Start Probe Rinse Mass	g	2.97781	
End Probe Rinse Mass	g	2.97822	
Total Mass in Probe Rinse	g	0.00041	
Total Mass Collected	mg	0.47	
Calculated Concentration	mg/m ³	0.42	
Balance Uncertainty / LOD	mg/m ³	0.11	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	04/09/2012	
Average Volume Sampled (REF)	m ³	1.1283	
Filter I.D. Number	-	47-10176	
Start Filter Mass	g	0.15501	
End Filter Mass	g	0.15505	
Total Mass on Filter	g	0.00004	
Probe Rinse I.D. Number	-	PR-47-10176	
Start Probe Rinse Mass	g	2.92263	
End Probe Rinse Mass	g	2.92274	
Total Mass in Probe Rinse	g	0.00011	
Total Mass Collected	mg	0.15	
Calculated Concentration	mg/m ³	0.13	
Balance Uncertainty / LOD	mg/m ³	0.11	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	20.7	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.09	
Allowable Leak Rate	l/min	0.41	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	7.5	
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	%	106	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.24	
Overall Weighing Uncertainty	± mg/m ³	0.21	
ELV [Daily ELV for WID]	mg/m ³	10.0	
Allowable Weighing Uncertainty	mg/m ³	0.50	
Weighing Uncertainty Acceptable	-	Yes	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	31	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE
(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	20.0	
Pre-Sampling Leak Rate	l/min	0.15	
Post-Sampling Leak Rate	l/min	0.15	
Allowable Leak Rate	l/min	0.40	
Leak Test Acceptable	-	Yes	

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

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

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
Only one sampling line was installed on the stack, however the number of sample points used on the available line were increased to meet the requirements of the Standard.	x	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V_m	1.2530		uV_m	m ³	0.0251	
Sampled Gas Temperature	T_m	305.0		uT_m	K	2.0	
Sampled Gas Pressure	p_m	101.8		up_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Leak	L	0.43		uL	%	-	
Mass of Particulate	m	0.47		um	mg	0.12	
Oxygen Content	$O_{2,m}$	N/A		$uO_{2,m}$	% v/v	N/A	
Uncollected Mass	UCM	0.15		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.66		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.43		≤2%
Mass of Particulate	%	1.06		<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	1.1219		0.37	
Leak	L	mg/m ³	0.001		1.00	
Mass of Particulate	L_r	mg	0.470		0.89	
Factor for O ₂ Correction	$O_{2,m}$	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.09		0.89	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.011	
Leak	mg/m ³	0.0010	
Mass of Particulate	mg/m ³	0.1064	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.0768	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.13	
Expanded uncertainty (95% confidence)	mg/m ³	0.26	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.26	
Reported Uncertainty	mg/m ³	0.26	
Expanded uncertainty (95% confidence)	%	61.9	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	61.9	
Reported Uncertainty	%	61.9	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon

8c

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.51		0.51
Uncertainty	±mg/m ³	0.16		0.16
Mass Emission	g/hr	1.8		1.8
Uncertainty	±g/hr	0.56		0.56

General Sampling Information

Parameter	Value
Standard	BS EN 13526
Technical Procedure	CAT-TP-20
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Reference Number	CYL 1.0053
Span Gas Expiry Date	30/12/2012
Span Gas Start Pressure (bar)	110
Gas Cylinder Concentration (ppm)	80.3
Span Gas Uncertainty (%)	2
Zero Gas Type	Synthetic Air (5 Grade)
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A1

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

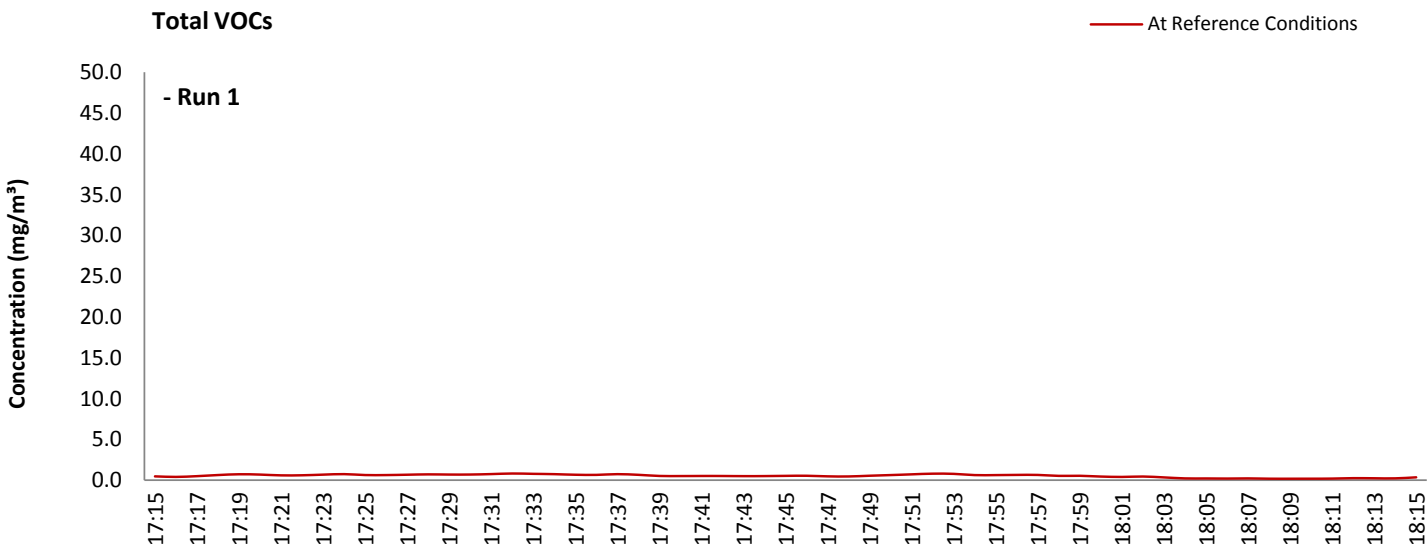
FORMAT: Number Used / Number Required

Reference Conditions

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

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	17:15 - 18:15	
Sampling Dates	-	04:09 - 04-09	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.30	
	Zero Down Sampling Line (Post)	ppm	0.70	
	Zero Drift	ppm	0.40	
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	
	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	31.70	
	Span Down Sampling Line (Post)	ppm	33.00	
	Span Drift	ppm	1.30	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	
	Test Conditions	Units	Run 1	
	Run Ambient Temperature Range	°C	17 - 19	

Method Deviations

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

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	100		
Measured Reading	ppm	0.3		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.031		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.007		
Leak	ppm	0.000		
Calibration Gas Uncertainty	ppm	0.002		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.003		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.05		
Expanded uncertainty (95% confidence)	ppm	0.10		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.10		
Reported Uncertainty	ppm	0.10		
Expanded uncertainty (95% confidence)	%	31.0		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	31.0		
Reported Uncertainty	%	31.0		



Air Tech Environmental Consultancy Services

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Your Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: PPC 11/94

Stack Reference

35d

Dates of the Monitoring Campaign

5th September 2012

Job Reference Number

CAT-1227

Report Written by
Adam Dixon Team Leader MCERTS Level 2 MM 10 1079 TE1 & TE4

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

Report Date
13th September 2012

Version
Version 1

Signature of Report Approver


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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

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

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Executive Summary

(Page 1 of 7)

MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

35d

5th September 2012

Overall Aim of the Monitoring Campaign

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

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon
 35d
 5th September 2012

		Concentration				Mass Emission			
Parameter		Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹	mg/m³	0.36	1.4	10	g/hr	4.7	17.7	-
Total VOCs (as Carbon)	¹	mg/m³	3.4	0.23	50	g/hr	43.5	2.9	-
Water Vapour		% v/v	1.1	0.07					
Stack Gas Temperature		°C	16.3						
Stack Gas Velocity		m/s	10.2						
Volumetric Flow Rate (ACTUAL)		m³/hr	13671						
Volumetric Flow Rate (REF)	¹	m³/hr	12956						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM THE PRELIMINARY VELOCITY TRAVERSE.

¹ Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

Executive Summary
(Page 3 of 7)

MONITORING DATE(S) & TIMES

VIP-Polymers Ltd, Huntingdon
35d
5th September 2012

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m³	0.36	g/hr	4.7	05/09/2012	10:12 - 10:42, 11:45 - 11:15	60
Total VOCs (as Carbon)	R1	mg/m³	3.4	g/hr	43.5	05/09/2012	10:15 - 11:15	60
Velocity & Volumetric Flow Rate	R1					04/09/2012	16:12 - 16:21	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon
35d
5th September 2012

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operation
Capacity (of 100%) and Tonnes / Hour	0.0490625 Tonnes per Hour
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Under cured Parts, Viton Seals
Abatement System	None
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary

(Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon

35d

5th September 2012

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.13 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.14 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

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

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
All Parametera	All Runs	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.69
Width	m	-
Area	m ²	0.37
Port Depth	cm	5
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

BS EN 15259 Homogeneity Test Requirements

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

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

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	39.0		> 5 Pa	Yes
Mean Velocity	m/s	10.15		-	-
Lowest Gas Velocity	m/s	6.64		-	-
Highest Gas Velocity	m/s	14.14		-	-
Ratio of Above	: 1	2.13		< 3 : 1	Yes
Maximum Angle of Swirl	°	15		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

PLANT PHOTOS

Photo 1



Photo 2



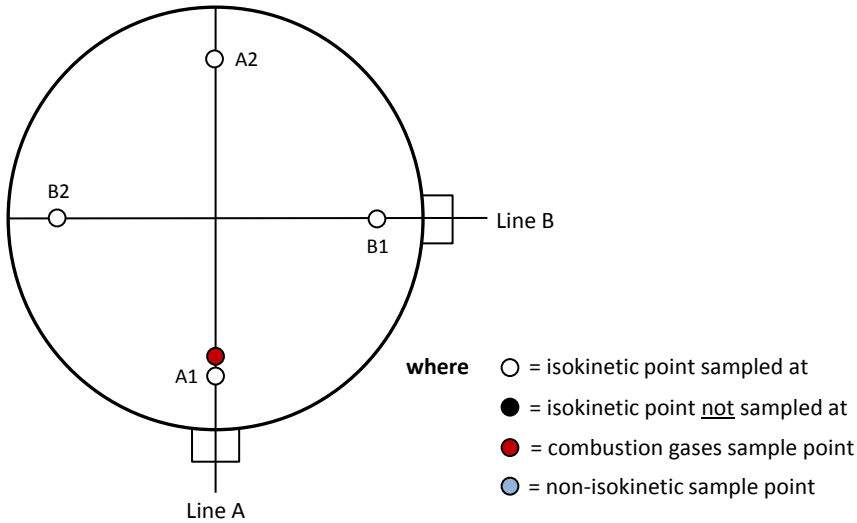
Photo 3



Photo 4

N/A

SAMPLE POINTS





APPENDICES



APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Adam Dixon	MCERTS Level 2	MM 10 1079	TE1 & TE4
Technician	Darius Niknejad	MCERTS Level 1	MM 09 1036	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 7.5	Horiba PG-250	-	Digital Manometer (1)	CAT 3.47
Box Thermocouples	CAT 3.12	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.12	Eco Physics CLD 822Mh	-	Digital Temperature Meter	CAT 3.47
Oven Box	-	Testo 350 XL	-	Stopwatch	CAT 7.5
Probe	CAT 5.18	Servomex 5200MP	-	Barometer	CAT 13.6
S-Pitot (1)	CAT 21S.15	JCT JCC P-1 Cooler	-	Stack Thermocouple (1)	CAT 4.223
S-Pitot (2)	CAT 21S.40	FT-IR	-	Stack Thermocouple (2)	-
L-Pitot	-	FT-IR Sampling System	-	1m Heated Line (1)	-
500g Check Weight	CAT 17.2	Bernath 3006 FID	CAT 3.6	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.2	Heated Head Filter	CAT 12.91	1m Heated Line (3)	-
Last Impinger Arm	-	Mass Flow Controller (1)	CAT 6.19	5m Heated Line (1)	-
Callipers	CAT 2.37	Mass Flow Controller (2)	CAT 6.20	15m Heated Line (1)	-
Tubes Kit Thermocouple	-	Mass View (1)	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	Mass View (2)	-	20m Heated Line (1)	CAT 20.17
Tape Measure	CAT 16.10	Easylogger EN-EL-12 Bit	CAT 11.13	Dual Channel Heater Controller	-

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.69
Stack Width, W	m	-
Stack Area, A	m ²	0.37
Average Stack Gas Temperature, T _a	°C	16.3
Average Stack Gas Pressure	Pa	97.8
Average Stack Static Pressure, P _{static}	kPa	-0.059
Average Barometric Pressure, P _b	kPa	101.8
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂ (Estimated)	-	20.80	20.57	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	78.25	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	1.12	0.0112	18.02	0.8037	0.0090

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P _{STD}	kg/m ³	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.282
Dry Density (Actual), P _{Actual}	kg/m ³	1.220
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.215

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

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

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	16.3	0.0
Total Pressure	kPa	101.7	101.3
Moisture	%	1.12	1.12

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	13671
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	12956
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	12811
Gas Volumetric Flowrate REF ¹	m ³ /hr	12956

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	04/09/2012
Time of Survey	-	16:12 - 16:21
Atmospheric Pressure	kPa	101.8
Stack Static Pressure	Pa	-59
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 (°)	12	15	10	10																

Sampling Line A						Sampling Line B			
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m³	Velocity m/s	ΔP Pa	Temp °C	Wet Density kg/m³	Velocity m/s
1	0.03	80.0	15.7	1.217	9.50	81.0	15.4	1.219	9.55
2	0.10	76.0	16.0	1.216	9.26	59.0	15.3	1.219	8.15
3	0.17	39.0	16.2	1.215	6.64	44.0	15.3	1.219	7.04
4	0.24	40.0	16.4	1.214	6.72	63.0	15.3	1.219	8.42
5	0.31	39.0	16.6	1.214	6.64	101.0	15.4	1.219	10.66
6	0.38	39.0	16.8	1.213	6.64	141.0	15.8	1.217	12.61
7	0.45	76.0	17.3	1.211	9.28	155.0	16.0	1.216	13.22
8	0.52	91.0	17.7	1.209	10.16	166.0	16.1	1.216	13.69
9	0.59	143.0	17.9	1.208	12.74	177.0	16.3	1.215	14.14
10	0.66	172.0	18.5	1.206	13.99	174.0	16.6	1.214	14.03
Mean		79.5	16.9	1.212	9.16	116.1	15.8	1.217	11.15

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
35d

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.36		0.36
Uncertainty	±mg/m ³	1.4		1.4
Mass Emission	g/hr	4.7		4.7
Uncertainty	±g/hr	17.7		17.7

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

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	1.1		1.1
Uncertainty	±% v/v	0.07		0.07

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.36		0.36

General Sampling Information

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

Reference Conditions

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

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	-6.0	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	766.1	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	5.9	
Total mass collected in impingers (silica trap)	g	2.5	
Total mass of liquid collected, V_{lc}	g	8.4	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0105	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.0077	
Gas meter correction factor, Y_d	-	0.9920	
Average dry gas meter temperature, T_m	°C	25.5	
Average pressure drop across orifice, ΔH	mmH ₂ O	26.8	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	0.9243	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0112	
B_{wo} as a percentage	% v/v	1.12	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	1.12	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	0.9347	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
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	28.72	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K_p	-	34.97	
Velocity pressure coefficient, C_p	-	0.83	
Average of velocity heads, ΔP_{avg}	mmH ₂ O	7.50	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	2.74	
Average stack gas temperature, T_s	°C	22.6	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (V(M_s)(P_s))$	m/s	9.21	
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	0.37	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	206.7	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	192.5	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	190.3	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	6.01	
Nozzle area, A_n	mm ²	28.37	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	106.7	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	10:12 - 10:42, 11:45 - 11:15	
Sampling Dates	-	05/09/2012	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	0.9347	
Filter I.D. Number	-	47-10349	
Start Filter Mass	g	0.15453	
End Filter Mass	g	0.15458	
Total Mass on Filter	g	0.00005	
Probe Rinse I.D. Number	-	PR-47-10349	
Start Probe Rinse Mass	g	3.05406	
End Probe Rinse Mass	g	3.05412	
Total Mass in Probe Rinse	g	0.00006	
Total Mass Collected	mg	0.11	
Calculated Concentration	mg/m ³	0.12	
Balance Uncertainty / LOD	mg/m ³	0.13	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	05/09/2012	
Average Volume Sampled (REF)	m ³	0.9347	
Filter I.D. Number	-	47-10178	
Start Filter Mass	g	0.15355	
End Filter Mass	g	0.15374	
Total Mass on Filter	g	0.00019	
Probe Rinse I.D. Number	-	PR-47-10178	
Start Probe Rinse Mass	g	2.96463	
End Probe Rinse Mass	g	2.96478	
Total Mass in Probe Rinse	g	0.00015	
Total Mass Collected	mg	0.34	
Calculated Concentration	mg/m ³	0.36	
Balance Uncertainty / LOD	mg/m ³	0.13	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	16.7	
Pre-Sampling Leak Rate	l/min	0.03	
Post-Sampling Leak Rate	l/min	0.04	
Allowable Leak Rate	l/min	0.33	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	6.0	
Allowable MU	%	20	
MU Acceptable	%	Yes	
Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	
Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	107	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.24	
Overall Weighing Uncertainty	± mg/m ³	0.26	
ELV [Daily ELV for WID]	mg/m ³	10.0	
Allowable Weighing Uncertainty	mg/m ³	0.50	
Weighing Uncertainty Acceptable	-	Yes	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	23	
Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE
(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	20.0	
Pre-Sampling Leak Rate	l/min	0.02	
Post-Sampling Leak Rate	l/min	0.02	
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	
There are no deviations associated with the sampling employed.	x	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V_m	1.0077		uV_m	m ³	0.0202	
Sampled Gas Temperature	T_m	298.5		uT_m	K	2.0	
Sampled Gas Pressure	p_m	102.2		up_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Leak	L	0.24		uL	%	-	
Mass of Particulate	m	0.12		um	mg	0.12	
Oxygen Content	$O_{2,m}$	N/A		$uO_{2,m}$	% v/v	N/A	
Uncollected Mass	UCM	0.34		$uUCM$	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	%	0.24		≤2%
Mass of Particulate	%	3.64		<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	0.9243		0.39	
Leak	L	mg/m ³	0.001		1.00	
Mass of Particulate	L_r	mg	0.120		3.03	
Factor for O ₂ Correction	$O_{2,m}$	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.20		3.03	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.009	
Leak	mg/m ³	0.0005	
Mass of Particulate	mg/m ³	0.3637	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.5950	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.70	
Expanded uncertainty (95% confidence)	mg/m ³	1.37	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	1.37	
Reported Uncertainty	mg/m ³	1.37	
Expanded uncertainty (95% confidence)	%	375.8	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	375.8	
Reported Uncertainty	%	375.8	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon

35d

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	3.4		3.4
Uncertainty	±mg/m ³	0.23		0.23
Mass Emission	g/hr	43.5		43.5
Uncertainty	±g/hr	2.9		2.9

General Sampling Information

Parameter	Value
Standard	BS EN 13526
Technical Procedure	CAT-TP-20
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Reference Number	CYL 1.0053
Span Gas Expiry Date	30/12/2013
Span Gas Start Pressure (bar)	110
Gas Cylinder Concentration (ppm)	80.3
Span Gas Uncertainty (%)	2
Zero Gas Type	Synthetic Air (5 Grade)
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A1

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

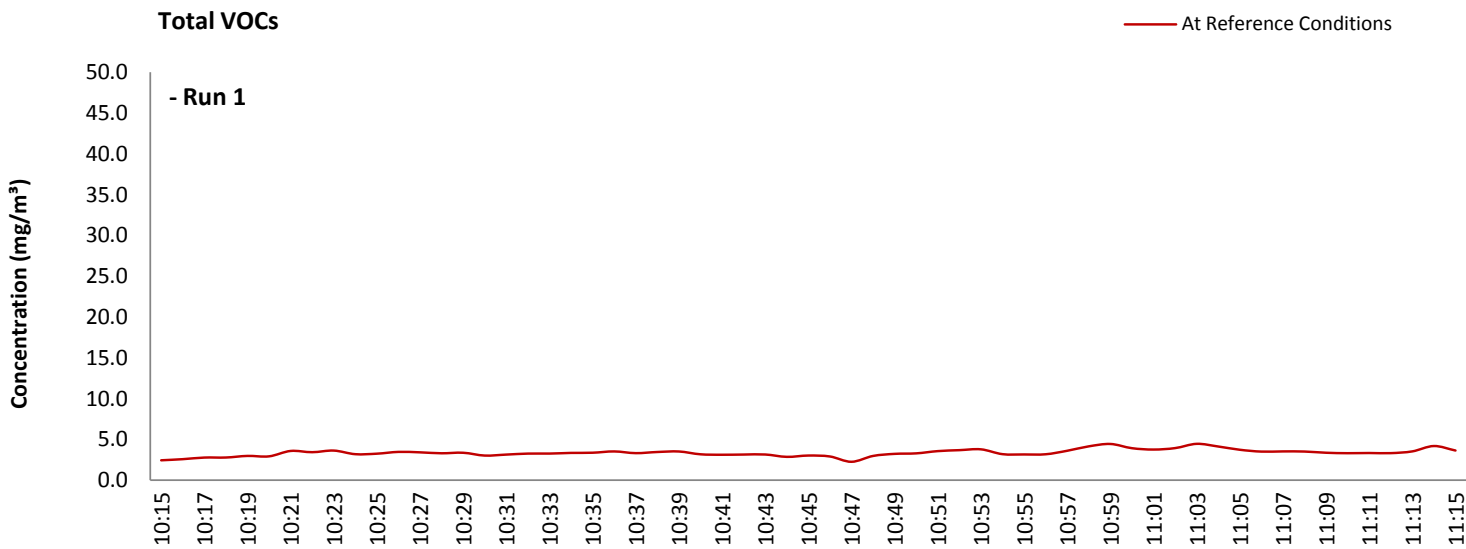
FORMAT: Number Used / Number Required

Reference Conditions

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

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	10:15 - 11:15	
Sampling Dates	-	05:09 - 05-09	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.50	
	Zero Down Sampling Line (Post)	ppm	0.10	
	Zero Drift	ppm	-0.40	
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	
	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	31.70	
	Span Down Sampling Line (Post)	ppm	32.00	
	Span Drift	ppm	0.30	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	
	Test Conditions	Units	Run 1	
	Run Ambient Temperature Range	°C	17 - 19	

Method Deviations

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

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	100		
Measured Reading	ppm	2.1		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.031		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.048		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.01		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.02		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.07		
Expanded uncertainty (95% confidence)	ppm	0.14		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.14		
Reported Uncertainty	ppm	0.14		
Expanded uncertainty (95% confidence)	%	6.8		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	6.8		
Reported Uncertainty	%	6.8		



Air Tech Environmental Consultancy Services

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Your Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: PPC 11/94

Stack Reference

Stack No.44

Dates of the Monitoring Campaign

5th September 2012

Job Reference Number

CAT-1227

Report Written by
Adam Dixon Team Leader MCERTS Level 2 MM 10 1079 TE1 & TE4

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

Report Date
13th September 2012

Version
Version 1

Signature of Report Approver


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TITLE PAGE

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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

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Executive Summary

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MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

Stack No.44

5th September 2012

Overall Aim of the Monitoring Campaign

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

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon
Stack No.44
5th September 2012

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.39	0.39	10	g/hr	3.7	3.7	-
Total VOCs (as Carbon)	¹ mg/m ³	11.2	0.57	50	g/hr	105	5.4	-
Water Vapour	% v/v	0.71	0.04					
Stack Gas Temperature	°C	18.3						
Stack Gas Velocity	m/s	17.2						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	9869						
Volumetric Flow Rate (REF)	¹ m ³ /hr	9404						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM THE PRELIMINARY VELOCITY TRAVERSE.

¹ Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

MONITORING DATE(S) & TIMES

VIP-Polymers Ltd, Huntingdon
Stack No.44
5th September 2012

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m³	0.39	g/hr	3.7	05/09/2012	13:35 - 14:35	60
Total VOCs (as Carbon)	R1	mg/m³	11.2	g/hr	105	05/09/2012	13:35 - 14:35	60
Velocity & Volumetric Flow Rate	R1					05/09/2012	12:50 - 12:53	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon
Stack No.44
5th September 2012

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operation
Capacity (of 100%) and Tonnes / Hour	0.3 Tonnes per Hour
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Carbon
Abatement System	Bag Filter
Abatement System Running Status	On
Fuel	N/A
Plume Appearance	Not Visible

Executive Summary

(Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon

Stack No.44

5th September 2012

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.1 mg/m ³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.14 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

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

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
Total Particulate Matter	All Runs	Only one sampling line was installed on the stack, however the number of sample points used on the available line were increased to meet the requirements of the Standard.
Total Particulate Matter	All Runs	In order to maintain isokinetic sampling, a nozzle size smaller than that specified in the Standard was used.
Total Particulate Matter	All Runs	The sample points where the angle of swirl was > 15° were omitted from the sampling exercise.
Total VOCs (as Carbon)	All Runs	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.45
Width	m	-
Area	m ²	0.16
Port Depth	cm	5
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

BS EN 15259 Homogeneity Test Requirements

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

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

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	248.0		> 5 Pa	Yes
Mean Velocity	m/s	17.23		-	-
Lowest Gas Velocity	m/s	16.72		-	-
Highest Gas Velocity	m/s	17.98		-	-
Ratio of Above	: 1	1.08		< 3 : 1	Yes
Maximum Angle of Swirl	°	22		< 15°	No
No Local Negative Flow	-	Yes		-	Yes

PLANT PHOTOS

Photo 1



Photo 2

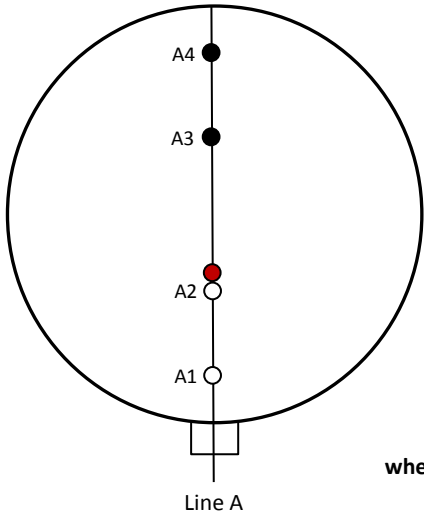


Photo 3



Photo 4

SAMPLE POINTS



where

○ = isokinetic point sampled at

● = isokinetic point not sampled at

● = combustion gases sample point

○ = non-isokinetic sample point

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Adam Dixon	MCERTS Level 2	MM 10 1079	TE1 & TE4
Technician	Darius Niknejad	MCERTS Level 1	MM 09 1036	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 7.5	Horiba PG-250	-	Digital Manometer (1)	CAT 3.47
Box Thermocouples	CAT 3.12	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.12	Eco Physics CLD 822Mh	-	Digital Temperature Meter	CAT 3.47
Oven Box	-	Testo 350 XL	-	Stopwatch	CAT 7.5
Probe	CAT 5.18	Servomex 5200MP	-	Barometer	CAT 13.6
S-Pitot (1)	CAT 21S.15	JCT JCC P-1 Cooler	-	Stack Thermocouple (1)	CAT 4.223
S-Pitot (2)	CAT 21S.40	FT-IR	-	Stack Thermocouple (2)	-
L-Pitot	-	FT-IR Sampling System	-	1m Heated Line (1)	-
500g Check Weight	CAT 17.2	Bernath 3006 FID	CAT 3.6	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.2	Heated Head Filter	CAT 12.91	1m Heated Line (3)	-
Last Impinger Arm	-	Mass Flow Controller (1)	CAT 6.19	5m Heated Line (1)	-
Callipers	CAT 2.37	Mass Flow Controller (2)	CAT 6.20	15m Heated Line (1)	-
Tubes Kit Thermocouple	-	Mass View (1)	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	Mass View (2)	-	20m Heated Line (1)	CAT 20.17
Tape Measure	CAT 16.10	Easylogger EN-EL-12 Bit	CAT 11.13	Dual Channel Heater Controller	-

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.45
Stack Width, W	m	-
Stack Area, A	m ²	0.16
Average Stack Gas Temperature, T _a	°C	18.3
Average Stack Gas Pressure	Pa	264.9
Average Stack Static Pressure, P _{static}	kPa	0.208
Average Barometric Pressure, P _b	kPa	102.8
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂ (Estimated)	-	20.80	20.65	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	78.58	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	0.71	0.0071	18.02	0.8037	0.0057

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	1.227
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.223

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

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

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	18.3	0.0
Total Pressure	kPa	103.0	101.3
Moisture	%	0.71	0.71

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	9869
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	9404
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	9337
Gas Volumetric Flowrate REF ¹	m ³ /hr	9404

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	05/09/2012
Time of Survey	-	12:50 - 12:53
Atmospheric Pressure	kPa	102.8
Stack Static Pressure	Pa	208
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	4	20	22																

Sampling Line A					
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m³	Velocity m/s
1	0.02	253.0	16.9	1.229	16.81
2	0.07	263.0	17.2	1.228	17.14
3	0.11	259.0	17.5	1.227	17.02
4	0.16	257.0	17.8	1.226	16.96
5	0.20	263.0	18.3	1.223	17.18
6	0.25	266.0	18.6	1.222	17.28
7	0.29	275.0	18.8	1.221	17.58
8	0.34	278.0	19.0	1.221	17.68
9	0.38	287.0	19.4	1.219	17.98
10	0.43	248.0	19.8	1.217	16.72
Mean		264.9	18.3	1.223	17.23

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
Stack No.44

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	0.39		0.39
Uncertainty	±mg/m ³	0.39		0.39
Mass Emission	g/hr	3.7		3.7
Uncertainty	±g/hr	3.7		3.7

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.71		0.71
Uncertainty	±% v/v	0.04		0.04

Blank Runs

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

General Sampling Information

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

Reference Conditions

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

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	766.5	
Stack static pressure, P_{static}	mmH ₂ O	21.2	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	768.1	
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	4.0	
Total mass of liquid collected, V_{lc}	g	7.1	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0088	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.3455	
Gas meter correction factor, Y_d	-	0.9920	
Average dry gas meter temperature, T_m	°C	24.1	
Average pressure drop across orifice, ΔH	mmH ₂ O	48.1	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.2425	
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	1.2514	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
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	28.13	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	5.30	
Average stack gas temperature, T_s	°C	31.5	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (V(M_s)(P_s))$	m/s	18.07	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})			
Area of stack, A_s	m ²	0.16	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	172.5	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	156.3	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	155.2	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	5.04	
Nozzle area, A_n	mm ²	19.95	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	106.4	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	13:35 - 14:35	
Sampling Dates	-	05/09/2012	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.2514	
Filter I.D. Number	-	47-10245	
Start Filter Mass	g	0.15961	
End Filter Mass	g	0.15976	
Total Mass on Filter	g	0.00015	
Probe Rinse I.D. Number	-	PR-47-10245	
Start Probe Rinse Mass	g	2.89180	
End Probe Rinse Mass	g	2.89214	
Total Mass in Probe Rinse	g	0.00034	
Total Mass Collected	mg	0.49	
Calculated Concentration	mg/m ³	0.39	
Balance Uncertainty / LOD	mg/m ³	0.10	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	05/09/2012	
Average Volume Sampled (REF)	m ³	1.2514	
Filter I.D. Number	-	47-10165	
Start Filter Mass	g	0.15212	
End Filter Mass	g	0.15217	
Total Mass on Filter	g	0.00005	
Probe Rinse I.D. Number	-	PR-47-10165	
Start Probe Rinse Mass	g	2.85184	
End Probe Rinse Mass	g	2.85195	
Total Mass in Probe Rinse	g	0.00011	
Total Mass Collected	mg	0.16	
Calculated Concentration	mg/m ³	0.13	
Balance Uncertainty / LOD	mg/m ³	0.10	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	22.25	
Pre-Sampling Leak Rate	l/min	0.02	
Post-Sampling Leak Rate	l/min	0.04	
Allowable Leak Rate	l/min	0.44	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	6.4	
Allowable MU	%	20	
MU Acceptable	%	Yes	

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

Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	106.4	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	

Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.24	
Overall Weighing Uncertainty	± mg/m ³	0.19	
ELV [Daily ELV for WID]	mg/m ³	10.00	
Allowable Weighing Uncertainty	mg/m ³	0.50	
Weighing Uncertainty Acceptable	-	Yes	

Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	32	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	20.00	
Pre-Sampling Leak Rate	l/min	0.05	
Post-Sampling Leak Rate	l/min	0.05	
Allowable Leak Rate	l/min	0.40	
Leak Test Acceptable	-	Yes	

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

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

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
Only one sampling line was installed on the stack, however the number of sample points used on the available line were increased to meet the requirements of the Standard.	wx	
In order to maintain isokinetic sampling, a nozzle size smaller than that specified in the Standard was used.	x	
The sample points where the angle of swirl was > 15° were omitted from the sampling exercise.	x	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V_m	1.3455		uV_m	m ³	0.0269	
Sampled Gas Temperature	T_m	297.1		uT_m	K	2.0	
Sampled Gas Pressure	p_m	102.4		up_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Leak	L	0.18		uL	%	-	
Mass of Particulate	m	0.49		um	mg	0.12	
Oxygen Content	$O_{2,m}$	N/A		$uO_{2,m}$	% v/v	N/A	
Uncollected Mass	UCM	0.16		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	%	0.18		≤2%
Mass of Particulate	%	0.96		<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	1.2425		0.32	
Leak	L	mg/m ³	0.0004		1.00	
Mass of Particulate	L_r	mg	0.490		0.80	
Factor for O ₂ Correction	$O_{2,m}$	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.09		0.80	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.010	
Leak	mg/m ³	0.0004	
Mass of Particulate	mg/m ³	0.0959	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.0738	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.12	
Expanded uncertainty (95% confidence)	mg/m ³	0.24	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.39	
Reported Uncertainty	mg/m ³	0.39	
Expanded uncertainty (95% confidence)	%	60.8	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	100.3	
Reported Uncertainty	%	100.3	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
Stack No.44

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	11.2		11.2
Uncertainty	±mg/m ³	0.57		0.57
Mass Emission	g/hr	105		105
Uncertainty	±g/hr	5.4		5.4

General Sampling Information

Parameter	Value
Standard	BS EN 13526
Technical Procedure	CAT-TP-20
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Reference Number	CYL 1.0053
Span Gas Expiry Date	30/12/2012
Span Gas Start Pressure (bar)	100
Gas Cylinder Concentration (ppm)	80.3
Span Gas Uncertainty (%)	2
Zero Gas Type	Synthetic Air (5 Grade)
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A2

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

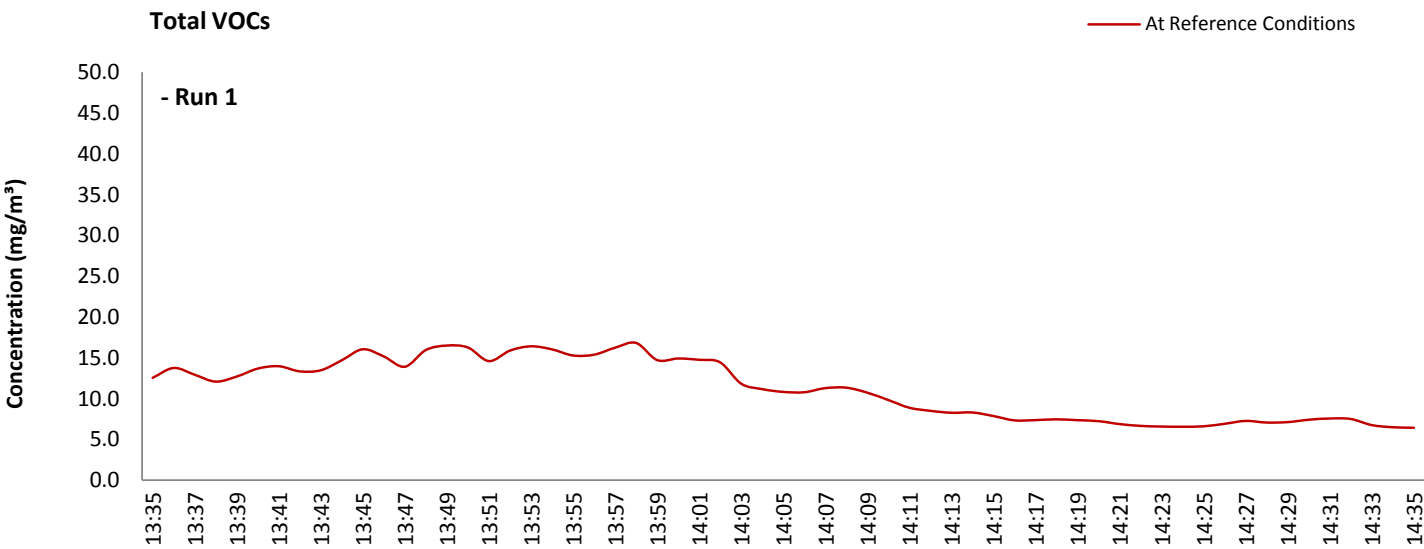
FORMAT: Number Used / Number Required

Reference Conditions

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

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	13:35 - 14:35	
Sampling Dates	-	05:09 - 05-09	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.40	
	Zero Down Sampling Line (Post)	ppm	0.60	
	Zero Drift	ppm	0.20	
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	31.60	
	Span Down Sampling Line (Post)	ppm	31.70	
	Span Drift	ppm	0.10	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	16 - 19	

Method Deviations

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

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	100.0		
Measured Reading	ppm	7.0		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.031		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.161		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.04		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.06		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.18		
Expanded uncertainty (95% confidence)	ppm	0.36		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.36		
Reported Uncertainty	ppm	0.36		
Expanded uncertainty (95% confidence)	%	5.1		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	5.1		
Reported Uncertainty	%	5.1		

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



Air Tech Environmental Consultancy Services

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Your Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: PPC 11/94

Stack Reference

55

Dates of the Monitoring Campaign

5th September 2012

Job Reference Number

CAT-1227

Report Written by
Adam Dixon Team Leader MCERTS Level 2 MM 10 1079 TE1 TE2 TE3 TE4
Report Approved by
James Eldridge Team Leader MCERTS Level 2 MM 05 641 TE1 TE2 TE3 TE4
Report Date
13th September 2012
Version
Version 1
Signature of Report Approver




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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

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Executive Summary

(Page 1 of 7)

MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon
55
5th September 2012

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions testing on the 55 by VIP-Polymers Ltd at Huntingdon.

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

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter, Total VOCs (as Carbon)

Executive Summary

(Page 2 of 7)

MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon
55
5th September 2012

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter	¹ mg/m ³	0.22	0.26	10	g/hr	2.1	2.5	-
Total VOCs (as Carbon)	¹ mg/m ³	2.5	0.20	50	g/hr	22.9	1.8	-
Water Vapour	% v/v	1.6	0.09					
Stack Gas Temperature	°C	23.3						
Stack Gas Velocity	m/s	9.0						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	10087						
Volumetric Flow Rate (REF)	¹ m ³ /hr	9327						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM THE PRELIMINARY VELOCITY TRAVERSE.

¹ Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

Executive Summary

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MONITORING DATE(S) & TIMES

VIP-Polymers Ltd, Huntingdon

55

5th September 2012

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m³	0.22	g/hr	2.1	05/09/2012	09:02 - 09:32, 09:34 - 10:04	60
Total VOCs (as Carbon)	R1	mg/m³	2.5	g/hr	22.9	05/09/2012	09:04 - 10:04	60
Velocity & Volumetric Flow Rate	R1					04/09/2012	17:08 - 17:10	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon
55
5th September 2012

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operations
Capacity (of 100%) and Tonnes / Hour	0.011875 Tonnes per hour
Continuous or Batch Process	Continuous
Feedstock (if applicable)	MIR's
Abatement System	None
Abatement System Running Status	N/A
Fuel	N/A
Plume Appearance	None Visible

Executive Summary

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MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon
55
5th September 2012

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab		
Total Particulate Matter	BS EN 13284-1	CAT-TP-01	Yes	CAT	CAT-TP-03	Gravimetric	Yes	CAT	Yes	0.11 mg/m³
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.14 mg/m³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

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

SUMMARY OF SAMPLING DEVIATIONS

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

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.63
Width	m	-
Area	m ²	0.31
Port Depth	cm	4
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

BS EN 15259 Homogeneity Test Requirements

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

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

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	6.0		> 5 Pa	Yes
Mean Velocity	m/s	8.99		-	-
Lowest Gas Velocity	m/s	2.64		-	-
Highest Gas Velocity	m/s	13.55		-	-
Ratio of Above	: 1	5.14		< 3 : 1	No
Maximum Angle of Swirl	°	13		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

PLANT PHOTOS

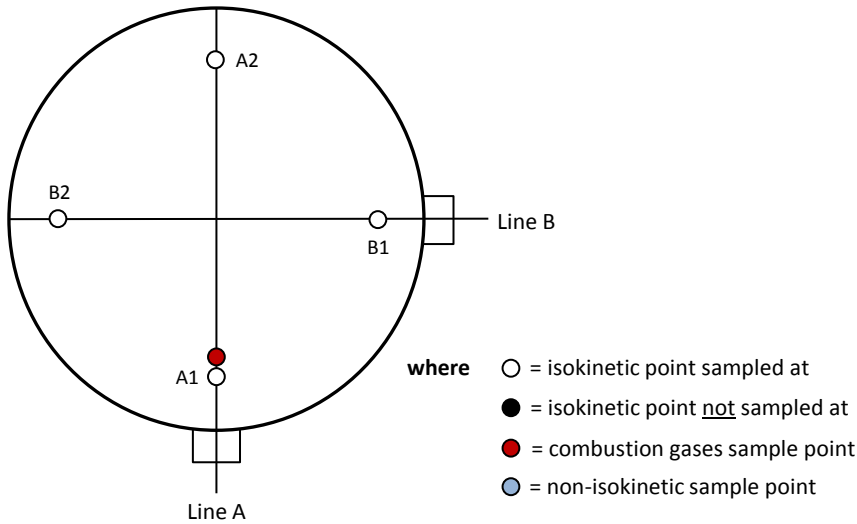
Photo 1



Photo 2



SAMPLE POINTS





APPENDICES

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Adam Dixon	MCERTS Level 2	MM 10 1079	TE1 & TE4
Technician	Darius Niknejad	MCERTS Level 1	MM 09 1036	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 7.5	Horiba PG-250	-	Digital Manometer (1)	CAT 3.47
Box Thermocouples	CAT 3.12	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.12	Eco Physics CLD 822Mh	-	Digital Temperature Meter	CAT 3.47
Oven Box	-	Testo 350 XL	-	Stopwatch	CAT 7.5
Probe	CAT 5.18	Servomex 5200MP	-	Barometer	CAT 13.6
S-Pitot (1)	CAT 21S.15	JCT JCC P-1 Cooler	-	Stack Thermocouple (1)	CAT 4.223
S-Pitot (2)	CAT 21S.40	FT-IR	-	Stack Thermocouple (2)	-
L-Pitot	-	FT-IR Sampling System	-	1m Heated Line (1)	-
500g Check Weight	CAT 17.2	Bernath 3006 FID	CAT 3.6	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.2	Heated Head Filter	CAT 12.91	1m Heated Line (3)	-
Last Impinger Arm	-	Mass Flow Controller (1)	CAT 6.19	5m Heated Line (1)	-
Callipers	CAT 2.37	Mass Flow Controller (2)	CAT 6.20	15m Heated Line (1)	-
Tubes Kit Thermocouple	-	Mass View (1)	-	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18	Mass View (2)	-	20m Heated Line (1)	CAT 20.17
Tape Measure	CAT 16.10	Easylogger EN-EL-12 Bit	CAT 11.13	Dual Channel Heater Controller	-

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	BS EN 13284-1	CAT-TP-01
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.63
Stack Width, W	m	-
Stack Area, A	m ²	0.31
Average Stack Gas Temperature, T _a	°C	23.3
Average Stack Gas Pressure	Pa	81.5
Average Stack Static Pressure, P _{static}	kPa	-0.150
Average Barometric Pressure, P _b	kPa	101.8
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.0012
O ₂ (Estimated)	-	20.80	20.47	0.2080	32.00	1.4277	0.2970
N ₂	-	79.14	77.88	0.7914	28.01	1.2498	0.9891
Moisture (H ₂ O)	-	-	1.59	0.0159	18.02	0.8037	0.0128

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P _{STD}	kg/m ³	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.280
Dry Density (Actual), P _{Actual}	kg/m ³	1.190
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} = sum of all wet concentrations / 100 x density, kg/m³ (including water vapour)

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	23.3	0.0
Total Pressure	kPa	101.7	101.3
Moisture	%	1.59	1.59

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	10087
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	9327
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	9179
Gas Volumetric Flowrate REF ¹	m ³ /hr	9327

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	04/09/2012
Time of Survey	-	17:08 - 17:10
Atmospheric Pressure	kPa	101.8
Stack Static Pressure	Pa	-150
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 (°)	13	7	12	10																

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	87.0	22.1	1.188	10.03	55.0	22.9	1.185	7.98
2	0.09	53.0	22.5	1.186	7.83	20.0	23.0	1.184	4.81
3	0.16	22.0	22.6	1.186	5.05	6.0	23.1	1.184	2.64
4	0.22	15.0	22.7	1.185	4.17	24.0	23.2	1.183	5.28
5	0.28	8.0	23.1	1.184	3.05	114.0	23.2	1.183	11.50
6	0.35	38.0	23.3	1.183	6.64	137.0	23.5	1.182	12.61
7	0.41	64.0	23.6	1.182	8.62	142.0	23.6	1.182	12.84
8	0.47	125.0	23.7	1.181	12.05	138.0	23.9	1.181	12.66
9	0.54	158.0	23.8	1.181	13.55	142.0	23.9	1.181	12.85
10	0.60	142.0	23.8	1.181	12.85	140.0	23.9	1.181	12.76
Mean		71.2	23.1	1.184	8.38	91.8	23.4	1.183	9.59

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
55

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	0.22		0.22
Uncertainty	±mg/m³	0.26		0.26
Mass Emission	g/hr	2.1		2.1
Uncertainty	±g/hr	2.5		2.5

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	1.6		1.6
Uncertainty	±% v/v	0.09		0.09

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	0.13		0.13

General Sampling Information

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

Reference Conditions

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

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	-15.3	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	765.4	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	5.3	
Total mass collected in impingers (silica trap)	g	8.4	
Total mass of liquid collected, V_{lc}	g	13.7	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0171	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	1.1285	
Gas meter correction factor, Y_d	-	0.9920	
Average dry gas meter temperature, T_m	°C	19.3	
Average pressure drop across orifice, ΔH	mmH ₂ O	33.9	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.0578	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0159	
B_{wo} as a percentage	% v/v	1.59	
Reported Water Vapour, checked with Tables in BS EN 14790, R_{wv}	% v/v	1.59	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m ³	1.0749	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
WID & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
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	28.67	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K_p	-	34.97	
Velocity pressure coefficient, C_p	-	0.83	
Average of velocity heads, ΔP_{avg}	mmH ₂ O	9.81	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	3.13	
Average stack gas temperature, T_s	°C	25.3	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s + 273})) / (V(M_s)(P_s))$	m/s	10.60	
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	0.31	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	198.3	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	182.7	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m ³ /min	179.8	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)(O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)(O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	6.01	
Nozzle area, A_n	mm ²	28.37	
Total sampling time, q	min	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	107.7	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	09:02 - 09:32, 09:34 - 10:04	
Sampling Dates	-	05/09/2012	
Sampling Device	-	ISO	
Volume Sampled (REF)	m ³	1.0749	
Filter I.D. Number	-	47-10315	
Start Filter Mass	g	0.15669	
End Filter Mass	g	0.15683	
Total Mass on Filter	g	0.00014	
Probe Rinse I.D. Number	-	PR-47-10315	
Start Probe Rinse Mass	g	3.01402	
End Probe Rinse Mass	g	3.01412	
Total Mass in Probe Rinse	g	0.00010	
Total Mass Collected	mg	0.24	
Calculated Concentration	mg/m ³	0.22	
Balance Uncertainty / LOD	mg/m ³	0.11	

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1	
Blank Dates	-	05/09/2012	
Average Volume Sampled (REF)	m ³	1.0749	
Filter I.D. Number	-	47-10344	
Start Filter Mass	g	0.15726	
End Filter Mass	g	0.15734	
Total Mass on Filter	g	0.00008	
Probe Rinse I.D. Number	-	PR-47-10344	
Start Probe Rinse Mass	g	2.85207	
End Probe Rinse Mass	g	2.85213	
Total Mass in Probe Rinse	g	0.00006	
Total Mass Collected	mg	0.14	
Calculated Concentration	mg/m ³	0.13	
Balance Uncertainty / LOD	mg/m ³	0.11	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	18.7	
Pre-Sampling Leak Rate	l/min	0.04	
Post-Sampling Leak Rate	l/min	0.05	
Allowable Leak Rate	l/min	0.37	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	5.4	
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	%	108	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Weighing Uncertainty Criteria	Units	Run 1	
Overall Weighing Uncertainty	± mg	0.24	
Overall Weighing Uncertainty	± mg/m³	0.22	
ELV [Daily ELV for WID]	mg/m³	10.0	
Allowable Weighing Uncertainty	mg/m³	0.50	
Weighing Uncertainty Acceptable	-	Yes	
Filter Temperatures	Units	Run 1	
Pre-Conditioning Temperature	°C	180	
Post-Conditioning Temperature	°C	160	
Maximum Filter Temperature	°C	25	
Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	20.0	
Pre-Sampling Leak Rate	l/min	0.05	
Post-Sampling Leak Rate	l/min	0.05	
Allowable Leak Rate	l/min	0.40	
Leak Test Acceptable	-	Yes	

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

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

Method Deviations

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

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (Actual)	V_m	1.1285		uV_m	m ³	0.0226	
Sampled Gas Temperature	T_m	292.3		uT_m	K	2.0	
Sampled Gas Pressure	p_m	102.1		up_m	kPa	0.5	
Sampled Gas Humidity	H_m	0.0		uH_m	% v/v	1.0	
Leak	L	0.27		uL	%	-	
Mass of Particulate	m	0.24		um	mg	0.12	
Oxygen Content	$O_{2,m}$	N/A		$uO_{2,m}$	% v/v	N/A	
Uncollected Mass	UCM	0.14		uUCM	mg	-	

Uncertainty as a Percentage				
Measured Quantities	Units	Run 1		Requirement of Standard
Sampled Volume (Actual)	%	2.00		≤2%
Sampled Gas Temperature	%	0.68		≤1%
Sampled Gas Pressure	%	0.49		≤1%
Sampled Gas Humidity	%	1.00		≤1%
Leak	%	0.27		≤2%
Mass of Particulate	%	1.12		<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	1.0578		0.21	
Leak	L	mg/m ³	0.0003		1.00	
Mass of Particulate	L_r	mg	0.240		0.93	
Factor for O ₂ Correction	$O_{2,m}$	% v/v	N/A		N/A	
Uncollected Mass	UCM	mg	0.08		0.93	

Uncertainty in Result			
Measured Quantities	Units	Run 1	
Sampled Volume (STP)	mg/m ³	0.006	
Leak	mg/m ³	0.0003	
Mass of Particulate	mg/m ³	0.1116	
Factor for O ₂ Correction	mg/m ³	N/A	
Uncollected Mass	mg/m ³	0.0752	

Parameter	Units	Run 1	
Combined uncertainty	mg/m ³	0.13	
Expanded uncertainty (95% confidence)	mg/m ³	0.26	
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.26	
Reported Uncertainty	mg/m ³	0.26	
Expanded uncertainty (95% confidence)	%	118.3	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	118.3	
Reported Uncertainty	%	118.3	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon

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Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	2.5		2.5
Uncertainty	±mg/m ³	0.20		0.20
Mass Emission	g/hr	22.9		22.9
Uncertainty	±g/hr	1.8		1.8

General Sampling Information

Parameter	Value
Standard	BS EN 13526
Technical Procedure	CAT-TP-20
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Reference Number	CYL 1.0053
Span Gas Expiry Date	30/012/2013
Span Gas Start Pressure (bar)	110
Gas Cylinder Concentration (ppm)	80.3
Span Gas Uncertainty (%)	2
Zero Gas Type	Synthetic Air (5 Grade)
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A1

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

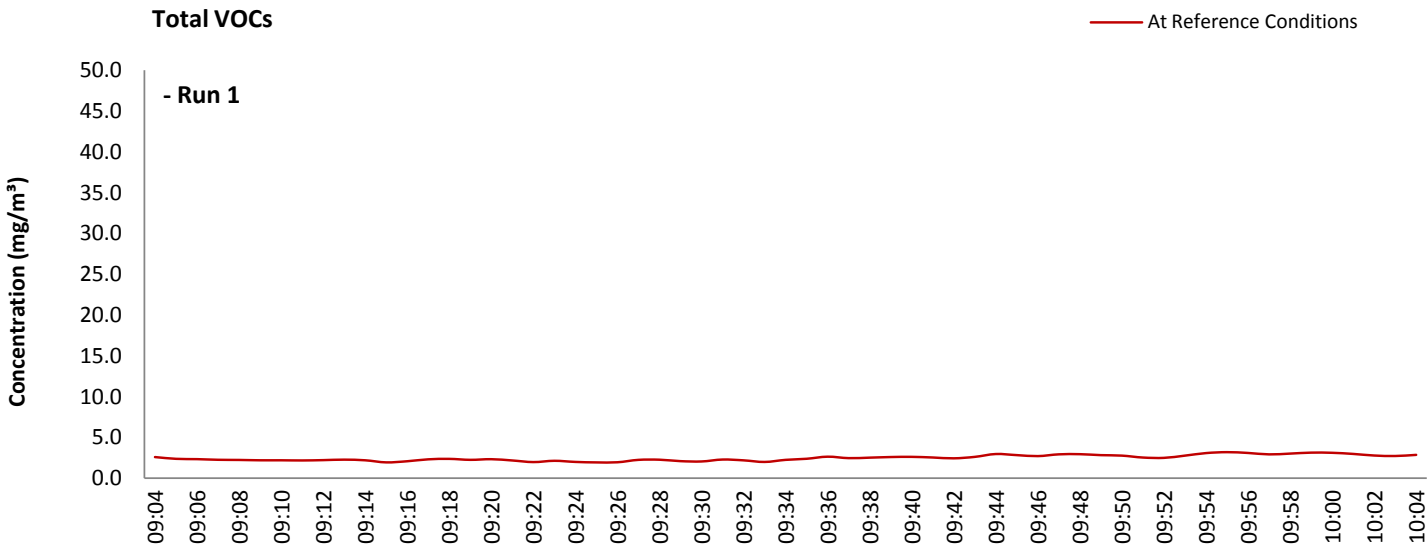
FORMAT: Number Used / Number Required

Reference Conditions

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

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	09:04 - 10:04	
Sampling Dates	-	05:09 - 05-09	
Instrument Range	ppm	100	
Span Gas Value	ppm	31.1	

Quality Assurance

	Zero Drift	Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.10	
	Zero Down Sampling Line (Post)	ppm	0.10	
	Zero Drift	ppm	0.00	
	Allowable Zero Drift	± ppm	1.56	
	Zero Drift Acceptable	-	Yes	
	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	31.20	
	Span Down Sampling Line (Post)	ppm	32.00	
	Span Drift	ppm	0.80	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	
	Test Conditions	Units	Run 1	
	Run Ambient Temperature Range	°C	17 - 19	

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run)	1	

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	100		
Measured Reading	ppm	1.5		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.031		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.035		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.01		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.01		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.06		
Expanded uncertainty (95% confidence)	ppm	0.12		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.12		
Reported Uncertainty	ppm	0.12		
Expanded uncertainty (95% confidence)	%	8.0		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	8.0		
Reported Uncertainty	%	8.0		



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Your Catalyst Contact: Toby Campbell (07825 130 074)

Stack Emissions Testing Report Commissioned by

Air Tech Environmental Consultancy Services

Installation Name & Address

VIP-Polymers Ltd
15 Windover Road
Huntingdon
Cambridgeshire
PE29 7DA

PPC Permit: PPC 11/94

Stack Reference

Stack No.46

Dates of the Monitoring Campaign

12th October 2012

Job Reference Number

CAT-1299

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

Report Approved by
Toby Campbell Regional Manager MCERTS Level 2 MM 03 155 TE1 TE2 TE3 TE4

Report Date
12th October 2012

Version
Version 1

Signature of Report Approver


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APPENDIX 1 - Monitoring Personnel & List of Equipment

APPENDIX 2 - Raw Data, Sampling Equations & Charts

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Executive Summary

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MONITORING OBJECTIVES

VIP-Polymers Ltd, Huntingdon

Stack No.46

12th October 2012

Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd, in partnership with Air Tech Environmental Consultancy Services, were commissioned to carry out stack emissions testing on the Stack No.46 by VIP-Polymers Ltd at Huntingdon.

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

Special Requirements

There were no special requirements.

Target Parameters

Total VOCs (as Carbon)

Executive Summary

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MONITORING RESULTS

VIP-Polymers Ltd, Huntingdon
 Stack No.46
 12th October 2012

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total VOCs (as Carbon)	¹ mg/m ³	15.5	0.78	50	g/hr	114	5.7	-
Water Vapour	% v/v	1.2	0.2					
Stack Gas Temperature	°C	12.7						
Stack Gas Velocity	m/s	5.6						
Volumetric Flow Rate (ACTUAL)	m ³ /hr	7810						
Volumetric Flow Rate (REF)	¹ m ³ /hr	7362						

NOTE: VOLUMETRIC FLOW RATE DATA TAKEN FROM THE PRELIMINARY VELOCITY TRAVERSE.

¹ Reference Conditions (REF) are: 273K, 101.3kPa, without correction for water vapour content.

MONITORING DATE(S) & TIMES

VIP-Polymers Ltd, Huntingdon
Stack No.46
12th October 2012

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total VOCs (as Carbon)	R1	mg/m³	15.5	g/hr	114	12/10/2012	11:10 - 12:10	60
Water Vapour	R1	% v/v	1.2			12/10/2012	9:20 - 9:50	30
Velocity & Volumetric Flow Rate	R1					12/10/2012	9:50 - 10:00	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

VIP-Polymers Ltd, Huntingdon
Stack No.46
12th October 2012

Standard Operating Conditions

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

Executive Summary

(Page 5 of 7)

MONITORING & ANALYTICAL METHODS

VIP-Polymers Ltd, Huntingdon

Stack No.46

12th October 2012

Parameter	Monitoring				Analysis				MCERTS Testing	LOD (Average)
	Standard	Technical Procedure	UKAS Testing	Testing Lab	Analytical Procedure	Analytical Technique	UKAS Analysis	Analysis Lab		
Water Vapour	BS EN 14790	CAT-TP-05	Yes	CAT	CAT-TP-05	Gravimetric	Yes	CAT	Yes	0.1 % v/v
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20	Yes	CAT	Flame Ionisation Detection by Sick 3006 FID				Yes	0.48 mg/m ³
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04	Yes	CAT	Pitot Tube and Thermocouple				Yes	N/A

ANALYSIS LABORATORIES

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

Catalyst Environmental Ltd (CAT)	UKAS Accreditation Number: 4279
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SUMMARY OF SAMPLING DEVIATIONS

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

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.70
Width	m	-
Area	m ²	0.38
Port Depth	cm	5
Orientation of Duct	-	Vertical
Sample Port Size	-	4" BSP

Location of Sampling Platform

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

Platform Details

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

Sampling Location / Platform Improvement Recommendations

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

BS EN 15259 Homogeneity Test Requirements

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

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

Criteria in M1	Units	Traverse 1		Required	Compliant
Lowest Differential Pressure	Pa	16.0		> 5 Pa	Yes
Mean Velocity	m/s	5.64		-	-
Lowest Gas Velocity	m/s	4.26		-	-
Highest Gas Velocity	m/s	6.82		-	-
Ratio of Above	: 1	1.60		< 3 : 1	Yes
Maximum Angle of Swirl	°	5		< 15°	Yes
No Local Negative Flow	-	Yes		-	Yes

Executive Summary

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PLANT PHOTOS

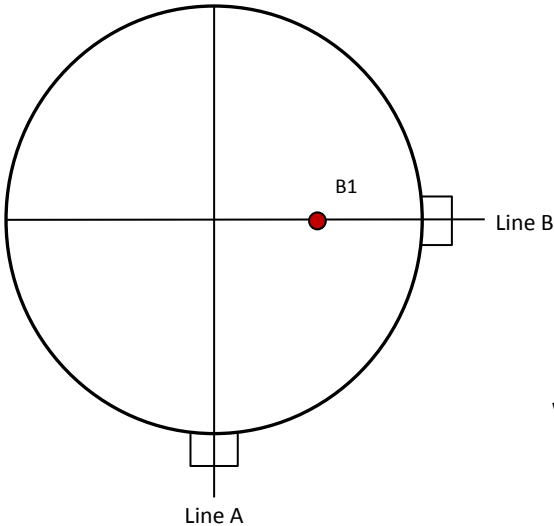
Photo 1



Photo 2



SAMPLE POINTS



- where

○ = isokinetic point sampled at

● = isokinetic point not sampled at

● = combustion gases sample point

○ = non-isokinetic sample point

APPENDIX CONTENTS

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

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Scott Pilkington	MCERTS Level 2	MM 04 501	TE1 TE2 TE3 TE4
Trainee	Andrew Ingle	MCERTS Trainee	MM 12 1172	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	-	Horiba PG-250	-	Digital Manometer (1)	CAT 3.32
Box Thermocouples	-	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	-	Eco Physics CLD 822Mh	-	Digital Temperature Meter	CAT 3.32
Oven Box	-	Testo 350 XL	-	Stopwatch	CAT 14:314
Probe	-	Servomex 5200MP	-	Barometer	CAT 13.12
S-Pitot (1)	CAT 21s21	JCT JCC P1 Cooler	-	Stack Thermocouple (1)	CAT 4.228
S-Pitot (2)	-	FT-IR	-	Stack Thermocouple (2)	-
L-Pitot	-	FT-IR Sampling System	-	1m Heated Line (1)	-
500g Check Weight	CAT 17.12	Bernath 3006 FID	CAT 8.8	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.12	Heated Head Filter	CAT 12.31	1m Heated Line (3)	-
Last Impinger Arm	-	Mass Flow Controller (1)	CAT 6.6	10m Heated Line (1)	CAT 20.82
Callipers	-	Mass Flow Controller (2)	CAT 6.5	15m Heated Line (1)	-
Tubes Kit Thermocouple	CAT 4.999	Mass View (1)	CAT 25.14	15m Heated Line (2)	-
Laboratory Balance	-	Mass View (2)	CAT 25.15	20m Heated Line (1)	-
Tape Measure	CAT 16.24	Easylogger EN-EL-12 Bit	CAT 11.27	Dual Channel Heater Controller	-

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Water Vapour	BS EN 14790	CAT-TP-05
Total VOCs (as Carbon)	BS EN 13526	CAT-TP-20
Velocity & Vol. Flow Rate	BS EN 13284-1	CAT-TP-04

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.70
Stack Width, W	m	-
Stack Area, A	m ²	0.38
Average Stack Gas Temperature, T _a	°C	12.7
Average Stack Gas Pressure	Pa	28.6
Average Stack Static Pressure, P _{static}	kPa	0.033
Average Barometric Pressure, P _b	kPa	99.9
Average Pitot Tube Calibration Coefficient, C _p	-	0.83

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.56	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.23	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	1.15	0.0115	18.02	0.8037	0.00928

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P _{STD}	kg/m ³	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.282
Dry Density (Actual), P _{Actual}	kg/m ³	1.213
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.208

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

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

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

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

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	12.7	0.0
Total Pressure	kPa	99.9	101.3
Moisture	%	1.15	1.15

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	7810
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	7362
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	7277
Gas Volumetric Flowrate REF ¹	m ³ /hr	7362

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE

(1 of 1)

Parameter	Units	Value
Date of Survey	-	12/10/2012
Time of Survey	-	9:50 - 10:00
Atmospheric Pressure	kPa	99.9
Stack Static Pressure	Pa	33
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	-	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 (°)	5																			

Sampling Line A						Sampling Line B			
Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s	ΔP Pa	Temp °C	Wet Density kg/m ³	Velocity m/s
1	0.04	16.0	12.7	1.208	4.26	18.0	12.7	1.208	4.52
2	0.11	22.0	12.7	1.208	5.00	17.0	12.7	1.208	4.39
3	0.18	19.0	12.7	1.208	4.65	22.0	12.7	1.208	5.00
4	0.25	19.0	12.7	1.208	4.65	35.0	12.7	1.208	6.31
5	0.32	31.0	12.7	1.208	5.93	39.0	12.7	1.208	6.66
6	0.39	34.0	12.7	1.208	6.21	41.0	12.7	1.208	6.82
7	0.46	34.0	12.7	1.208	6.21	32.0	12.7	1.208	6.03
8	0.53	35.0	12.7	1.208	6.31	36.0	12.7	1.208	6.39
9	0.60	37.0	12.7	1.208	6.48	29.0	12.7	1.208	5.74
10	0.67	30.0	12.7	1.208	5.84	25.0	12.7	1.208	5.33
Mean		27.7	12.7	1.208	5.55	29.4	12.7	1.208	5.72

WATER VAPOUR: RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
Stack No.46

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	% v/v	1.15		1.15
Uncertainty	±% v/v	0.15		0.15

General Sampling Information

Parameter	Value
Standard	BS EN 14790
Technical Procedure	CAT-TP-05

WATER VAPOUR: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	
Sampling Times	-	9:20 - 9:50	
Sampling Dates	-	12/10/2012	
Sampling Device	-	MFC / MV	
Duration	mins	30	
Volume Sampled (STP, Dry)	m ³	0.1494	
Volume Sampled (STP, Wet)	m ³	0.1511	
Sample Flow Rate	l/min	4.98	
Liquid Trap Start Mass	g	3991.6	
Liquid Trap End Mass	g	3992.0	
Silica Trap Start Mass	g	1522.1	
Silica Trap End Mass	g	1523.1	
Total Mass Of Water Vapour	g	1.4	
Calculated Water Vapour	% v/v	1.15	

Where: MFC stands for Mass Flow Controller, MV stands for Mass View Flowmeter

WATER VAPOUR: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	5.0	
Pre-Sampling Leak Rate	l/min	0.02	
Post-Sampling Leak Rate	l/min	0.02	
Allowable Leak Rate	l/min	0.10	
Leak Test Acceptable	-	Yes	

Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	

Measurement Uncertainty	Units	Run 1	
Measurement Uncertainty (MU)	%	13.2	
Allowable MU	%	20.0	
MU Acceptable	%	Yes	

Silica Gel	Units	Run 1	
Less than 50% Faded	%	Yes	

Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run)	1	
Ratio highest to lowest velocities between 3 and 5 : 1.	x	

WATER VAPOUR: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			Standard uncertainty			
	Symbol	Run 1		Symbol	Units	Run 1	
Sampled Volume (STP)	V_m	0.1494		uV_m	m ³	0.003	
Repeatability of Weighing	R_w	1.40		uR_w	g	0.09	
Reading of Balance	R_b	1.40		uR_b	g	0.01	
Leak	L	0.40			%	-	

Measured Quantities	Uncertainty as a Percentage			Requirement of Standard
	Units	Run 1		
Sampled Volume (STP)	%	2.00		≤2%
Repeatability of Weighing	%	6.43		No Requirement
Reading of Balance	%	0.50		No Requirement
Leak	%	0.40		≤2%

Measured Quantities	Uncertainty in Measurement Units				Sensitivity Coefficient	
	Symbol	Units	Run 1		Run 1	
Sampled Volume (STP)	V_m	m ³	0.1494		7.73	
Repeatability of Weighing	R_w	g	1.40		0.82	
Reading of Balance	R_b	g	1.40		0.82	
Leak	L	% v/v	0.003		1.00	

Measured Quantities	Uncertainty in Result		
	Units	Run 1	
Sampled Volume (STP)	% v/v	0.023	
Repeatability of Weighing	% v/v	0.074	
Reading of Balance	% v/v	0.006	
Leak	% v/v	0.003	

Parameter	Units	Run 1	
Combined uncertainty	% v/v	0.08	
Expanded uncertainty (95% confidence)	% v/v	0.15	
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.15	
Uncertainty if Water Droplets are present	% v/v	N/A	
Reported Uncertainty	% v/v	0.15	
Expanded uncertainty (95% confidence)	%	13.2	
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	13.2	
Uncertainty if Water Droplets are present	%	N/A	
Reported Uncertainty	%	13.2	

TOTAL VOCs (as CARBON): RESULTS SUMMARY

VIP-Polymers Ltd, Huntingdon
Stack No.46

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m ³	15.5		15.5
Uncertainty	±mg/m ³	0.78		0.78
Mass Emission	g/hr	114		114
Uncertainty	±g/hr	5.7		5.7

General Sampling Information

Parameter	Value
Standard	BS EN 13526
Technical Procedure	CAT-TP-20
Probe Material	Stainless Steel
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Reference Number	CYL 1.0063
Span Gas Expiry Date	31/05/2017
Span Gas Start Pressure (bar)	130
Gas Cylinder Concentration (ppm)	77.1
Span Gas Uncertainty (%)	2
Zero Gas Type	Synthetic Air (5 Grade)
Number of Sampling Lines Used	1 / 1
Number of Sampling Points Used	1 / 1
Sample Point I.D.'s	A1

NOTE: Dilution performed to achieve correct span value

FORMAT: Number Used / Number Required

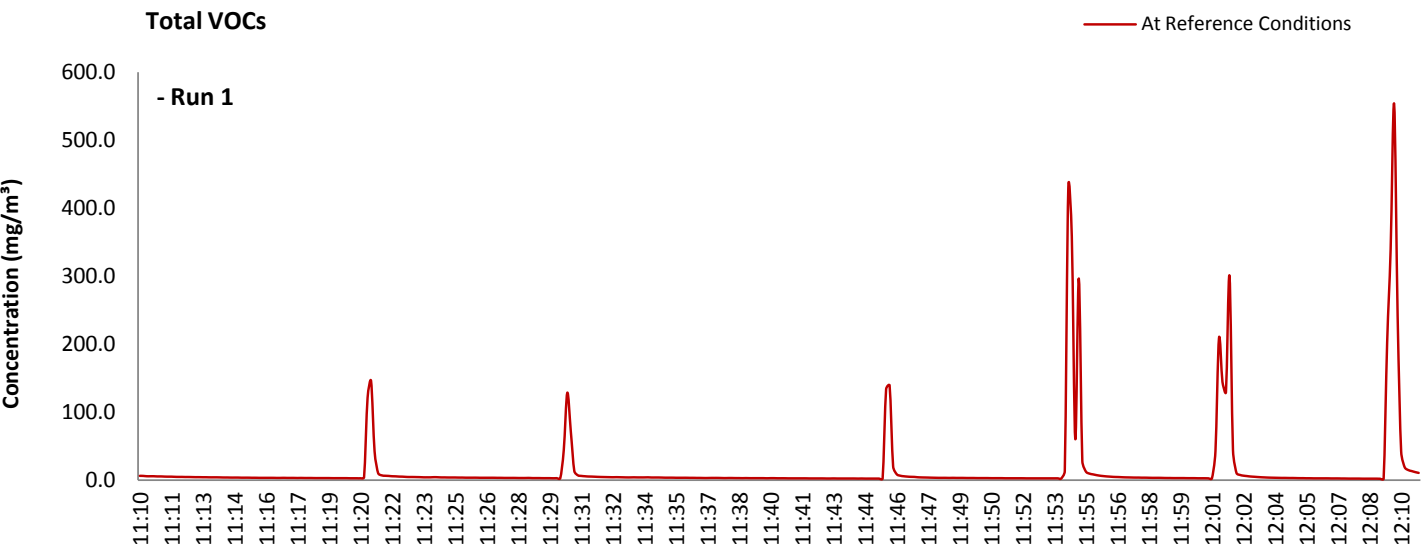
FORMAT: Number Used / Number Required

Reference Conditions

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

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



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

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	11:10 - 12:10	
Sampling Dates	-	12/10/2012	
Instrument Range	ppm	1000	
Span Gas Value	ppm	31.1	

Quality Assurance

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

	Span Drift	Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	31.00	
	Span Down Sampling Line (Post)	ppm	31.00	
	Span Drift	ppm	0.00	
	Allowable Span Drift	± ppm	1.56	
	Span Drift Acceptable	-	Yes	

Test Conditions	Units	Run 1	
Run Ambient Temperature Range	°C	8 -14	

Method Deviations

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

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value			
	Units	Run 1	Run 2	Run 3
MCERTS Certified Range of Analyser	ppm	9.3		
Operational Range of Analyser	ppm	1000.0		
Measured Reading	ppm	9.6		

Measured Quantities	Individual Errors as Standard Uncertainties			
	Units	Run 1	Run 2	Run 3
Nonlinearity	ppm	0.025		
Temperature Dependent Zero Drift	ppm	0.027		
Temperature Dependent Span Drift	ppm	0.027		
Cross-Sensitivity	ppm	0.222		
Leak	ppm	0.00		
Calibration Gas Uncertainty	ppm	0.06		
Mass Flow Controllers (dilution) Uncertainty	ppm	0.08		

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	ppm	0.25		
Expanded uncertainty (95% confidence)	ppm	0.48		
Expanded uncertainty (95% confidence), estimated with Method Deviations	ppm	0.48		
Reported Uncertainty	ppm	0.48		
Expanded uncertainty (95% confidence)	%	5.0		
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	5.0		
Reported Uncertainty	%	5.0		

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