

Report for the Periodic Monitoring of Emissions to Air

Part 1. Executive Summary



Permit Number: PPC 11/94

Operator: VIP Polymers Ltd

Installation: Huntingdon

Monitoring Date(s): 29 September 2014 - 30 September 2014

E.E. Report Ref.: 70496

Client Name: VIP Polymers Ltd

Client Address: 15 Windover Road
Huntingdon
Cambridgeshire
PE29 7EB

Monitoring Organisation: Environmental Evaluation Ltd. (Head Office)
Lawton Square
Delph
Oldham
OL3 5DT

Date of Report: 17 October 2014

Report Written by: N Teixeira

Function: MCERTS Level 2 Team Leader

Report Approved By: P Waters

MCERTS Registration No.: MM 04 527

MCERTS Level: MCERTS Level 2

Technical Endorsements: TE1, TE2, TE3, TE4

Signed:

P Waters

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1 Part 1: Executive Summary

1.1 Monitoring Objectives

VIP Polymers Ltd has been permitted under the Environmental Protection Act and associated legislation to operate various processes at the Huntingdon site, and a condition of that permit is that emission monitoring is undertaken on a regular basis to prove compliance or otherwise against prescribed emission limit values.

This report details the testing undertaken between the 29 September 2014 and the 30 September

The substance monitoring requirements for each emission point are detailed below.

Substances Monitored	Emission Point Identification				
	Stack 8 - Panstone's 6C, 6D, 6E & 6F	Stack 9 - Terenzio's 3A, 3B & Cooling Table	Stack 11 - Strip Press & Cooling booth	Stack 16 - 3C & 3D Cooling Table	Stack 15 - Panstone's 3C & 3D
Flow	✓	✓	✓	✓	✓
Temperature	✓	✓	✓	✓	✓
Total Particulates	✓	✓	✓	✓	✓
Total VOCs	✓	✓	✓	✓	✓
Water vapour	✓	✓	✓	✓	✓

Substances Monitored	Emission Point Identification				
	Stack 27 - The Cooling Booth on Desma 16	Stack 26 - The Cooling Booth on MIR 13	Stack 24 - The Cooling Booth on Desma 14	Stack 44 - Carbon Black	Stack 46 - Spray booth
Flow	✓	✓	✓	✓	✓
Temperature	✓	✓	✓	✓	✓
Total Particulates	✓	✓	✓	✓	✓
Total VOCs	✓	✓	✓	✓	✓
Water vapour	✓	✓	✓	✓	✓

1.2 Monitoring Results

Emission Point	Substance to be Monitored	Emission Limit Value	Measured Concentration	Uncertainty	Units	Reference Conditions	Date of Monitoring	Start and End Times	Monitoring Method Reference	Accreditation for use of Method	Operating Status
Stack 8 - Panstone's 6C, 6D, 6E & 6F	Total Particulate Matter	10	0.4	± 0.05	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	29/09/2014	10:50 - 11:55	BS EN 13284:2002	UKAS MCERTS	Normal
Stack 8 - Panstone's 6C, 6D, 6E & 6F	Total VOCs	No Limit	3.0	± 1.3	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	29/09/2014	11:15 - 11:45	BS EN 12619:2013	UKAS MCERTS	Normal
Stack 9 - Terenzio's 3A, 3B & Cooling Table	Total Particulate Matter	10	1.4	± 0.2	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	29/09/2014	12:20 - 13:25	BS EN 13284:2002	UKAS MCERTS	Normal
Stack 9 - Terenzio's 3A, 3B & Cooling Table	Total VOCs	No Limit	0.9	± 1.3	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	29/09/2014	12:20 - 12:50	BS EN 12619:2013	UKAS MCERTS	Normal
Stack 11 - Strip Press & Cooling booth	Total Particulate Matter	10	0.6	± 0.1	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	29/09/2014	13:55 - 13:55	BS EN 13284:2002	UKAS MCERTS	Normal
Stack 11 - Strip Press & Cooling booth	Total VOCs	No Limit	1.9	± 1.3	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	29/09/2014	14:00 - 14:30	BS EN 12619:2013	UKAS MCERTS	Normal
Stack 16 - 3C & 3D Cooling Table	Total Particulate Matter	10	0.5	± 0.1	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	29/09/2014	15:15 - 16:15	BS EN 13284:2002	UKAS MCERTS	Normal
Stack 16 - 3C & 3D Cooling Table	Total VOCs	No Limit	1.8	± 1.3	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	29/09/2014	14:20 - 14:50	BS EN 12619:2013	UKAS MCERTS	Normal
Stack 15 - Panstone's 3C & 3D	Total Particulate Matter	10	0.8	± 0.1	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	29/09/2014	16:30 - 17:30	BS EN 13284:2002	UKAS MCERTS	Normal
Stack 15 - Panstone's 3C & 3D	Total VOCs	No Limit	0.4	± 1.3	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	29/09/2014	16:55 - 17:25	BS EN 12619:2013	UKAS MCERTS	Normal

1.2 Monitoring Results

Emission Point	Substance to be Monitored	Emission Limit Value	Measured Concentration	Uncertainty	Units	Reference Conditions	Date of Monitoring	Start and End Times	Monitoring Method Reference	Accreditation for use of Method	Operating Status
Stack 27 - The Cooling Booth on Desma 16	Total Particulate Matter	10	1.3	± 0.1	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	29/09/2014	09:45 - 10:45	BS EN 13284:2002	UKAS MCERTS	Normal
Stack 27 - The Cooling Booth on Desma 16	Total VOCs	No Limit	3.0	± 1.3	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	30/09/2014	10:30 - 11:00	BS EN 12619:2013	UKAS MCERTS	Normal
Stack 26 - The Cooling Booth on MIR 13	Total Particulate Matter	10	0.7	± 0.1	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	30/09/2014	11:05 - 12:05	BS EN 13284:2002	UKAS MCERTS	Normal
Stack 26 - The Cooling Booth on MIR 13	Total VOCs	No Limit	0.4	± 1.3	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	30/09/2014	11:30 - 12:00	BS EN 12619:2013	UKAS MCERTS	Normal
Stack 24 -The Cooling Booth on Desma 14	Total Particulate Matter	10	1.8	± 0.2	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	30/09/2014	12:15 - 13:15	BS EN 13284:2002	UKAS MCERTS	Normal
Stack 24 -The Cooling Booth on Desma 14	Total VOCs	No Limit	0.1	± 1.3	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	30/09/2014	12:30 - 13:00	BS EN 12619:2013	UKAS MCERTS	Normal
Stack 44 - Carbon Black	Total Particulate Matter	10	0.9	± 0.1	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	30/09/2014	14:00 - 15:00	BS EN 13284:2002	UKAS MCERTS	Normal
Stack 44 - Carbon Black	Total VOCs	No Limit	2.8	± 1.3	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	30/09/2014	14:10 - 14:40	BS EN 12619:2013	UKAS MCERTS	Normal
Stack 46 - Spray booth	Total Particulate Matter	10	0.8	± 0.1	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	30/09/2014	16:20 - 17:25	BS EN 13284:2002	UKAS MCERTS	Normal
Stack 46 - Spray booth	Total VOCs	No Limit	84.2	± 1.3	mgm ⁻³	273K and 101.3 kPa, No Oxygen Correction, Wet Basis	30/09/2014	16:50 - 17:20	BS EN 12619:2013	UKAS MCERTS	Normal

1.3 Operating Information

Emission Point Reference	Date	Process Type	Process Duration	Feedstock	Abatement
Stack 8 - Panstone's 6C, 6D, 6E & 6F	30 September 2014	Compression Moulding	Continuous	Rubber Products	None
Stack 9 - Terenzio's 3A, 3B & Cooling Table	30 September 2014	Compression Moulding	Continuous	Rubber Products	None
Stack 11 - Strip Press & Cooling booth	30 September 2014	Compression Press	Batch 15 - 20 min cycle	Rubber Products	None
Stack 16 - 3C & 3D Cooling Table	30 September 2014	Large compression press	Batch - 12 -15 min cycle	Rubber Products	None
Stack 15 - Panstone's 3C & 3D	30 September 2014	Large compression press	Batch - 12 -15 min cycle	Rubber Products	None
Stack 27 - The Cooling Booth on Desma 16	30 September 2014	Injection press	Batch 3 - 4 min cycle	Rubber Products	None
Stack 26 - The Cooling Booth on MIR 13	30 September 2014	Injection press	Batch 3 - 4 min cycle	Rubber Products	None
Stack 24 -The Cooling Booth on Desma 14	30 September 2014	Injection press	Batch 3 - 4 min cycle	Rubber Products	None
Stack 44 - Carbon Black	30 September 2014	Extraction from raw product mixing	Continuous	Carbon black , Natural rubber, Synthetic rubber + Chemicals	Bag filter
Stack 46 - Spray booth	30 September 2014	Paint spraying	Batch	Solvents + Paint	Water backed booth

1.4 Monitoring Deviations

Emission Point Reference	Substance Deviations	Monitoring Deviations	Other Relevant Issues
Stack 8 - Panstone's 6C, 6D, 6E & 6F	None	Areas of negative flow were found within the stack. The number of sampling points were doubled	Monitoring was carried out "instack"
Stack 9 - Terenzio's 3A, 3B & Cooling Table	None	Areas of negative flow were found within the stack. The number of sampling points were doubled	Monitoring was carried out "instack"
Stack 11 - Strip Press & Cooling booth	None	None	Monitoring was carried out "instack"
Stack 16 - 3C & 3D Cooling Table	None	Only one axis is available for sampling. 2 axes are required for sampling to BS EN 13284. The number of sampling points along the one line were doubled	Monitoring was carried out "instack"
Stack 15 - Panstone's 3C & 3D	None	Only one axis is available for sampling. 2 axes are required for sampling to BS EN 13284. The number of sampling points along the one line were doubled	Monitoring was carried out "instack"
Stack 27 - The Cooling Booth on Desma 16	None	Only one axis is available for sampling. 2 axes are required for sampling to BS EN 13284 for flow and temperature measurement	Monitoring was carried out "instack"
Stack 26 - The Cooling Booth on MIR 13	None	Only one axis is available for sampling. 2 axes are required for sampling to BS EN 13284 for flow and temperature measurement	Monitoring was carried out "instack"
Stack 24 -The Cooling Booth on Desma 14	None	Only one axis is available for sampling. 2 axes are required for sampling to BS EN 13284 for flow and temperature measurement	Monitoring was carried out "instack"
Stack 44 - Carbon Black	None	The a sampling ports are not at the same level.	Monitoring was carried out "instack"
Stack 46 - Spray booth	None	None	Monitoring was carried out "instack"

Report for the Periodic Monitoring of Emissions to Air

Part 2. Supporting Information



Permit Number: PPC 11/94

Operator: VIP Polymers Ltd

Installation: Huntingdon

Monitoring Date: 29 September 2014 - 30 September 2014

E.E. Report Ref.: 70496

Client Name: VIP Polymers Ltd

Client Address: 15 Windover Road
Huntingdon
Cambridgeshire
PE29 7EB

Monitoring Organisation: Environmental Evaluation Ltd. (Head Office)
Lawton Square
Delph
Oldham
OL3 5DT

Date of Report: 17 October 2014

Report Written by: N Teixeira

Function: MCERTS Level 2 Team Leader

Report Approved By: P Waters

MCERTS Registration No.: MM 04 527

MCERTS Level: MCERTS Level 2

Technical Endorsements: TE1, TE2, TE3, TE4

Signed:

P Waters

APPENDICES

Appendix A: General Information

A1. Environmental Evaluation Limited Staff Details

Team Leader:	N Teixeira
MCERTS No.	MM 05 583
Certification Level:	MCERTS Level 2
Technical Endorsements:	TE1, TE2, TE3, TE4
Site Technician:	P Soley
MCERTS No.	MM 12 1187
Certification Level:	MCERTS Level 1
Technical Endorsements:	None

A2. Environmental Evaluation Limited Method Details

The indicated substances were measured by the standards and in house methods specified in the table below:

Substance	Standard	EE. Reference
Flow	BS EN 13284:2002	EE/P/001 & 2
Temperature	BS EN 13284:2002	EE/P/001 & 2
Particulate	BS EN 13284:2002	EE/P/001 & 1a
Total VOCs	BS EN 12619:2013	EE/P/015
Water vapour	BS EN 14790:2005	EE/P/013

A3. Sub-Contract

Analysis was subcontracted to a UKAS accredited laboratory.

A4. Equipment Used in the Monitoring Campaign

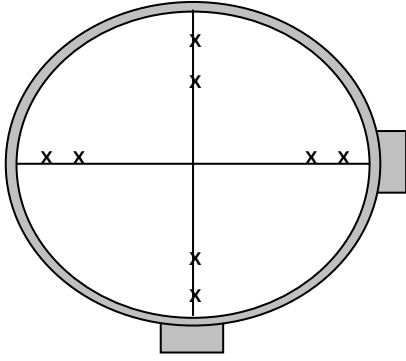
Equipment checklists appropriate to the methods were used.

Equipment Type	EE Equipment Reference Code
Method 5 Train	LCL 1
Pitot	LCL 38 S Type
Manometer	LCL 2
Thermosensor	LCL 15
Thermocouple	LCL 30
Tape Measure	LCL 18
Barometer	LCL 23
Vernier Callipers	LCL 14
Stop Watch	LCL 25
FID Analyser	LCL50
Scales	LCL69
Check Weight	LCL89
Heated Line	LCL60
Propane Cylinder No.	TG 45 - 237500

Appendix B: Emission Information

B1 - Stack 8 - Panstone's 6C, 6D, 6E & 6F Information

B1.1 Diagrams Showing the Dimensions and Monitoring Facilities of Stack 8 - Panstone's 6C, 6D, 6E & 6F

Photograph of Monitoring Point	Schematic of Sample Plane
	

B1.2 Preliminary Velocity and Temperature Measurement of Stack 8 - Panstone's 6C, 6D, 6E & 6F

Traverse Point	Sample Line A			Sample Line B			Sample Line C			Sample line D		
	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)
1	26	10	0	26	10	0						
2	26	11.5	0	26	11.5	0						
3	26	8	0	26	10	0						
4	26	3	5	26	4	5						
5	26	-1	10	26	-1	10						
6	26	3.5	10	26	3	10						
7	26	13	0	26	11	0						
8	26	16	0	26	17	0						
9	26	17	0	26	20	0						
10	26	14	0	26	19	0						
	ΣΔP _A	95		ΣΔP _B	104.5		ΣΔP _C			ΣΔP _D		

Barometric Pressure (mmHg)	760	Stack velocity (actual) ms ⁻¹	11
Static Pressure (mmH ₂ O)	11.00	Volumetric Flow (actual) m ³ min ⁻¹	129
Diameter (m)	0.50	Assumed CO ₂ (%)	0.0
---		Assumed O ₂ (%)	20.9
Stack Area (m ²)	0.196	Assumed CO (%)	0.0
Port Size (mm)	100	Assumed H ₂ O (%)	0.0

Appendix B1.3 - Particulate Site Measurements - Stack 8 - Panstone's 6C, 6D, 6E & 6F

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	29/09/2014
Plant Identification	Stack 8 - Panstone's 6C, 6D, 6E & 6F	Run Number	1

Water Vapour Measurements

Impinger	Initial Wt (g)	Final Wt (g)
1	748.8	749
2	782.7	782.8
3	601.1	601.1
4	930.5	930.9
5		
6		
7		

Sample Reference Information

Filter Ref.	70496-29/09/14-F1
Probe Wash Ref.	70496-29/09/14-S1
Blank Filter Ref.	70496-29/09/14-F2
Blank Probe Wash Ref.	70496-29/09/14-S2

Leak Test Results

Initial Leak Test lmin ⁻¹	0.2000
Test Vacuum ("Hg)	23
Final Leak Test lmin ⁻¹	0.20000
Test Vacuum ("Hg)	23

Sampling Measurements

Point	Start and End Times	Duration (Min)	Vac ("Hg)	Stack Temp (°C)	Velocity Head ΔP (mmH ₂ O)	√ΔP (√mm.H ₂ O)	ΔP Orifice Meter (mm H ₂ O)	DGM (litres)	DGM Temp (°C)		Temp (°C)			
									In	Out	Probe	Filter	Impinger	Resin
1	10:50	4	2	26	10	3.16	46.14	1528874	19	19	161	-	9	---
2		4	2	26	10	3.16	46.14	1529034	20	19	162	-	9	---
3		4	2	26	1.5	1.22	6.92	1529143	21	19	161	-	9	---
4		4	2	26	1.5	1.22	6.92	1529204	22	20	160	-	9	---
5		4	2	26	16	4.00	73.82	1529310	23	21	163	-	9	---
6		4	2	26	16	4.00	73.82	1529378	24	22	163	-	9	---
7		4	2	26	17	4.12	78.43	1529463	25	23	162	-	9	---
8		4	2	26	17	4.12	78.43	1529550	26	25	164	-	9	---
9		4	2	26	10	3.16	46.14	1529631	27	25	161	-	9	---
10		4	2	26	10	3.16	46.14	1529724	28	26	160	-	9	---
11		4	2	26	4	2.00	18.45	1529819	31	28	163	-	9	---
12		4	2	26	4	2.00	18.45	1529887	33	30	162	-	9	---
13		4	2	26	17	4.12	78.43	1529979	33	31	162	-	9	---
14		4	2	26	17	4.12	78.43	1530059	34	32	162	-	9	---
15		4	2	26	19	4.36	87.66	1530149	34	32	160	-	9	---
16	11:55	4	2	26	19	4.36	87.66	1530180	34	32	162	-	9	---
17														
18														
19														
20														
	65	64	2.00	26.00	11.81	3.27	54.50	1306.00	27.13	25.25	161.75		9.00	

Appendix B1.3 - Total Particulates to BS EN 13284:2002 - Stack 8 - Panstone's 6C, 6D, 6E & 6F

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley			
Site	Huntingdon	Date of Test	29 September 2014			
Plant Identification	Stack 8 - Panstone's 6C, 6D, 6E					
Volume of Water Vapour at Standard Conditions V_{wstd}						
$V_{wstd} = (0.00124) \times V_{lc}$	=	Blank	Test 1	Units		
		0.0009	0.0009	m^3		
Where:						
Constant	=	0.00124	0.00124			
V_{lc} is the mass of water collected	=	0.7	0.7		g	
Volume of Gas Metered, Standard Conditions V_{mstd}						
$V_{mstd} = \frac{(0.3592) \times V_m \times \left(P_b + \frac{\Delta H}{13.6} \right) \times Y_d}{(273 + T_m)}$	=	Blank	Test 1	Units		
		1.2207	1.2207	m^3		
Where:						
Correction for standard temperature and pressure	=	0.3592	0.3592		$Kmm.Hg^{-1}$	
V_m is the volume metered	=	1.3060	1.3060		m^3	
P_b is the barometric pressure	=	760	760		mm.Hg	
ΔH_{ave} is the average meter flow	=	54.5	54.5		mm.H ₂ O	
conversion from mm.H ₂ O to mm.Hg	=	13.6	13.6			
Y_d is the meter correction factor	=	1.0190	1.0190			
$^{\circ}C$ to K conversion constant	=	273	273		K	
T_m is the meter temperature	=	26.2	26.2		$^{\circ}C$	
Moisture Content B_{wo}						
$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$	=	Blank	Test 1			
		0.001	0.001			
Where:						
V_{wstd} is the volume of water vapour at standard conditions	=	0.0009	0.0009		m^3	
V_{mstd} is the volume of gas metered, standard conditions	=	1.2207	1.2207		m^3	
Velocity of Stack Gases V_s						
$V_s = K_p \times C_p \times \sqrt{\Delta P} \times \frac{\sqrt{T_s} + 273}{\sqrt{M_s \times P_s}}$	=	Blank	Test 1	ms^{-1}		
		11.3	11.3			
Where:						
K_p is the pitot tube velocity constant	=	34.97	34.97			
C_p is the pitot coefficient	=	0.834	0.834			
$(\sqrt{\Delta P})_{ave}$ is the average square root of velocity heads	=	3.27	3.27		$\sqrt{mm.H_2O}$	
T_s is the stack temperature	=	26.0	26.0		$^{\circ}C$	
$^{\circ}C$ to K conversion constant	=	273	273		K	
M_s is the molecular weight of gas	=	28.00	28.00		g/g mole	
P_s is the absolute pressure of stack gas	=	761	761		mm.Hg	

Appendix B1.3 - Total Particulates to BS EN 13284:2002 - Stack 8 - Panstone's 6C, 6D, 6E & 6F

Actual Flow Rate of Stack Gases Q_a					
$Q_a = 60 \times A_s \times V_s$	=	Blank 133.1	Test 1 133.1		$\text{m}^3 \text{min}^{-1}$
Where:					
Second to minute conversion	=	60	60		
A_s is the cross-sectional area of stack	=	0.196	0.196		m^2
V_s is the velocity of stack gases	=	11.3	11.3		ms^{-1}
Dry Total Flow Rate of Stack Gas Q_{std}					
$Q_{std} = \frac{Q_a \times P_s \times 0.3592 \times (1 - B_{wo})}{(\overline{T_s}) + 273}$	=	Blank 121.5	Test 1 121.5		$\text{m}^3 \text{min}^{-1}$
Where:					
Q_a is the actual flow rate of stack gases	=	133.1	133.1		$\text{m}^3 \text{min}^{-1}$
P_s is the absolute pressure of stack gas	=	761	761		mm.Hg
Correction for standard temperature and pressure	=	0.3592	0.3592		Kmm.Hg ⁻¹
B_{wo} is the moisture content	=	0.001	0.001		
T_s is the stack temperature	=	26.0	26.0		°C
°C to K conversion constant	=	273	273		K
V_s is the velocity of stack gases	=	11.3	11.3		ms^{-1}
Percent Isokineticity %I					
$\%I = \frac{(4.6398 \times 10^6) \times (\overline{T_s} + 273) \times V_{mstd}}{P_s \times V_s \times A_n \times \theta \times (1 - B_{wo})}$	=	Blank 108.7	Test 1 108.7		%
Where:					
Constant	=	4.6398E+06	4.6398E+06		
T_s is the stack temperature	=	26.0	26.0		°C
°C to K conversion constant	=	273	273		K
V_{mstd} is the volume of gas metered, standard conditions	=	1.2207	1.2207		m^3
P_s is the absolute pressure of stack gas	=	761	761		mm.Hg
V_s is the velocity of stack gases	=	11.3	11.3		ms^{-1}
A_n is the cross-sectional area of nozzle	=	28.34	28.34		mm^2
θ is the duration of test	=	64	64		minutes
B_{wo} is the moisture content	=	0.001	0.001		
Particulate Concentration $\text{C}_{\text{mgm}^{-3}}$ - Dry Basis					
$C_{\text{mgm}^{-3}} = \frac{M_n}{V_{mstd}}$	=	Blank 0.4	Test 1 0.4		mgm^{-3}
Where:					
Filter reference number		70496-29/09/14-F2	70496-29/09/14-F1		
Mn1 Particulate mass on filter.	=	0.04	0.04		mg
Probe wash reference number		70496-29/09/14-S2	70496-29/09/14-S1		
Mn2 Particulate mass in probe rinse.	=	0.5	0.5		mg
V_{mstd} is the volume of gas metered, standard conditions	=	1.2207	1.2207		m^3

Appendix B1.3 - Total Particulates to BS EN 13284:2002 - Stack 8 - Panstone's 6C, 6D, 6E & 6F

Particulate Concentration $C_{mgm^{-3}}$ - Wet Basis					
$C_{mgm^{-3} (wet)} = C_{mgm^{-3}} \times \frac{(100 - W_v)}{100}$	=	Blank 0.4	Test 1 0.4		mgm^{-3}
Where					
Concentrations at 273k and 101.3kPa Dry Basis	=	0.4	0.4		mgm^{-3}
W _v is the water vapour content %	=	0.1	0.1		%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis					
$C_{atx\%} = C_{mgm^{-3}} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}}$	=	Blank 0.4	Test 1 0.4		mgm^{-3}
Where:					
Atmospheric oxygen concentration	=	20.9	20.9		%
O _{2ref} is the reference oxygen concentration	=	N/A	N/A		%
O _{2meas} is the measured oxygen concentration	=	N/A	N/A		%
N/A = Not Applicable - Oxygen Not Measured					
Particulate Emission Rate $E_{ghr^{-1}}$					
$E_{ghr^{-1}} = C \times Q_{std} \times \frac{60}{1000}$	=	Blank 3	Test 1 3		ghr^{-1}
Where:					
C _{mgm⁻³} is the particulate concentration, dry basis	=	0.4	0.4		mgm^{-3}
Q _{std} is the dry total flow rate of stack gas	=	121.5	121.5		$m^3 min^{-1}$
60/1000 Conversion factor	=	0.060	0.060		
Comments on Compliance with BS EN 13284:2002					
Temperature maintained above 160°C	Pass				
Isokinetic Rate 95% to 115%	Pass				
Leak Rate <2%	Pass				
Overall Blank Value <10% of the LV ^a	Pass				
Duct gas flow with regard to stack axis <15°	Pass				
Duct gas flow: negative velocity - not permitted	Fail				
Duct gas flow: differential pressure at the pitot tube >5pa	Fail				
Duct gas flow: ratio of max to min velocity <3:1	Pass				
Number of sampling points	Pass				
Were all of the requirements of BS EN 13284:2002 fulfilled during the test? ☐ X Yes No					

Appendix B1.3 - Total Particulates to BS EN 13284:2002 - Stack 8 - Panstone's 6C, 6D, 6E & 6F

Uncertainty Calculations						
Measurement Data						
Measured Quantities	Symbol	Value	Standard Uncertainty			Units
Sampled Volume	V_m	1.2207	(1%) uV_m	0.01221		m^3
Sampled Gas Temperature	T_m	299.2	uT_m	3		k
Sampled Gas Pressure	p_m	101.8	up_m	0.1		kPa
Sampled Gas Humidity	H_m	0.1	uH_m	0.1		% by volume
Oxygen Content	$O_{2,m}$	N/A	$uO_{2,m}$	0.01		% by volume
Mass Particulate	m	0.54	um_m	0.03		mg
Leak	L	2	%	0.02		%
Uncollected Mass	UCM	0				mg
Intermediate Calculation to Correct for Standardisation of Conditions						
Factor for Std Conditions	fs	0.92				
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fs)		
	p_m	0.009		0.001		
	H_m	0.009		0.001		
	T_m	0.003		0.009		
	ufs			0.009		
Corrected Volume	V	1.12	uV	0.017		m^3
Intermediate Calculation to Correct for Oxygen Correction						
Factor for O_2 Correction	fc	1.00				
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fc)		
	$O_{2,m}$	1.00		0.010		
Factor for O_2 Correction	ufc	1.00		0.010		%
Calculation of Expanded Uncertainty						
Parameter		Value	Units	Sensitivity Coefficient	Uncertainty in Result	
Volume (Std conditions)	V	1.12	m^3	0.40	0.01	$mg.m^{-3}$
Mass	m	0.54	mg	0.82	0.02	$mg.m^{-3}$
Factor for O_2 Correction	fc	1.00		0.44	0.00	$mg.m^{-3}$
Leak	L	0.01	$mg.m^{-3}$	1.00	0.01	$mg.m^{-3}$
Uncollected mass	UCM	0.00	mg	0.82	0.00	$mg.m^{-3}$
Combined uncertainty					0.02	$mg.m^{-3}$
Expanded Uncertainty K=2					10.87	%
Expanded Uncertainty K=2					0.05	$mg.m^{-3}$

Appendix B1.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 8 - Panstone's 6C, 6D, 6E & 6F

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	29 September 2014
Plant Identification	Stack 8 - Panstone's 6C, 6D, 6E	File Name:	

Choice of Measurement Range and Span Gas Concentration							
Parameter	ELV ppm C ₃ H ₈	Ideal Range (ppm)	Actual Range (ppm)	Ideal Span Gas Value	Actual Span Gas Value	2% of Span Gas Conc.	Analysers repeatability at zero
VOCs			100	50 - 90	75.7	1.51	0.830

Analyser and System, Zero and Span Checks (ppm)							
Times of pre and post system calibration checks				Time	10:40	Time	17:30
Parameter	Analysers Zero	Analysers Span	Analysers Zero Check	Pre-Test System Zero Check	Pre-Test System Span Check	Post-Test System Zero Check	Post-Test System Span Check
VOCs	0.0	75.7	0.3	0.3	75.0	0.2	75.0

Zero, Span and Drift Checks							
Parameter	Analysers Zero Check		Zero Drift Check		Span Drift Check		Overall Check
VOCs	0.3	Pass	-0.1	Pass	0	Pass	Pass

Correction of Data For Drift Effect					
Parameter	Adjustment	Check	Deviation	Drift/minute	
VOCs	Span	1.0134	1.0120	-0.0014	0.0000
	Zero	-0.3040	-0.2024	0.1016	0.0002

As Determined Concentrations Wet Basis (as C)		
$C_{ppm} = \frac{\sum 1-n}{n} \times 3$		
=	5.6	ppm
where:		
Σ 1 - n is the sum of the readings	=	671
n is the total number of readings	=	361
3 is the conversion factor from ppm propane to ppm carbon	=	3

Concentrations at 273k and 101.3kPa Wet Basis		
$C_{mgm^{-3}} = C_{ppm} \times \frac{mw}{22.4}$		
=	3.0	mgm ⁻³
where:		
C _{ppm} is the average concentration	=	5.6 ppm
mw is the molecular weight of the gas under test	=	12
22.4 is the volume of 1 mole of gas at STP	=	22.4 litres

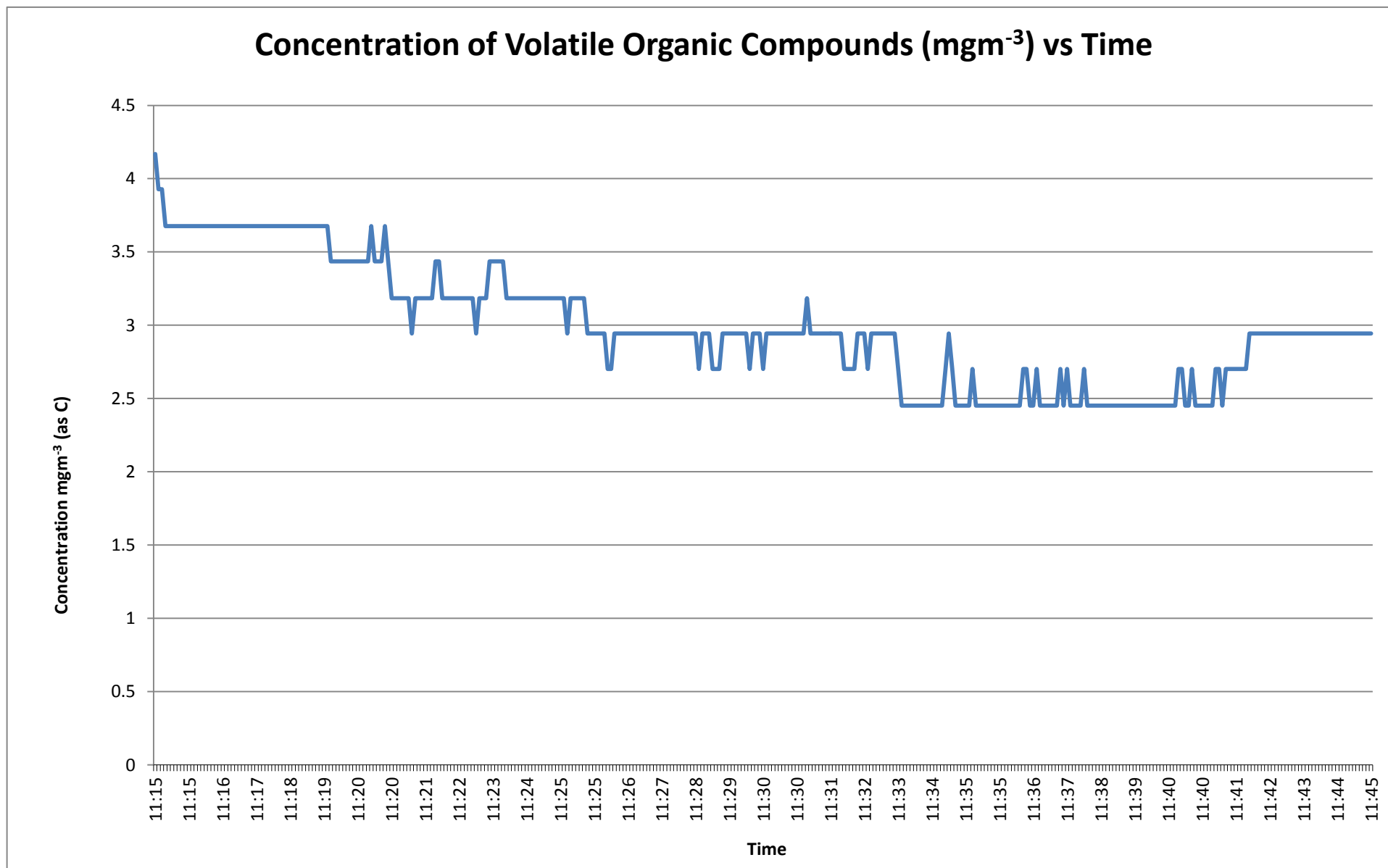
Appendix B1.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 8 - Panstone's 6C, 6D, 6E & 6F

Concentrations at 273k and 101.3kPa Dry Basis			
$C_{mgm^{-3}(wet)} = C_{mgm^{-3}} \times \frac{100}{(100 - Wv)}$	3.0		mgm ⁻³
where:			
Concentrations at 273k and 101.3kPa Dry Basis	=	3.0	mgm ⁻³
Wv is the water vapour content	=	0.1	%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis			
$C_{at\%} = C_{mgm^{-3}} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}}$	=	3.0	mgm ⁻³
where:			
20.9 is the atmospheric concentration of oxygen	=	20.9	%
O _{2ref} is the reference concentration	=	N/A	%
O _{2 meas} is the measured concentration	=	N/A	%
N/A = Oxygen Not Measured			
Actual Rates of Discharge			
$E_{g/hr} = C \times Q_{std} \times \frac{60}{1000}$	=	21.1	ghr ⁻¹
where:			
C is the dry Concentration at STP	=	3.0	
Q _{std} is the dry flow rate at STP	=	117.4	
60/1000 is the conversion factor	=	0.060	
Comments on Compliance with BS EN 12619:2001			
Temperature maintained above 180°C	Pass		
Pre-Test Analyser Zero Check	Pass		
Zero Drift Check	Pass		
Span Drift Check	Pass		
Overall Calibration Acceptability	Pass		
Were all of the requirements of BS EN 12619:2013 fulfilled during the test? ✓ Yes No			

Appendix B1.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 8 - Panstone's 6C, 6D, 6E &

Uncertainty Calculation of Volatile Organic Compounds to BS EN 12619:2013							
Symbol	Source of Uncertainty	Value +/- ppm	Probability Distribution	Divisor	Ci	Ui() +/- ppm	V ₁ or V _{eff}
U _{AP}	Air Pressure	0.3785	Normal(K=2)	2	1	0.2	
U _{SP}	Sample Pressure	0.757	Normal(K=2)	2	1	0.4	
U _{T0}	Temp at 0°C	1.514	Normal(K=2)	2	1	0.8	
U _{TS}	Temp (sensitivity)	0.757	Normal(K=2)	2	1	0.4	
U _{H2O}	H2O cross-sensitivity	0.18925	Normal(K=2)	2	1	0.1	
U _{CO}	CO cross-sensitivity	0.0757	Normal(K=2)	2	1	0.0	
U _{CO2}	CO2 cross-sensitivity	0.3785	Normal(K=2)	2	1	0.2	
U _{NO}	NO cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{SO2}	SO2 cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{ZD}	Zero Drift	0.01	Normal(K=2)	2	1	0.0	
U _S	sensitivity Drift	0.3785	Normal(K=2)	2	1	0.2	
U _C	Calibration	1.514	Normal(K=2)	2	1	0.8	
U _C ()	Combined standard		normal			1.25	
U	Expanded		enter coverage	1.96		2.45	ppm
U	Expanded		enter coverage	1.96		1.31	mgm ⁻³

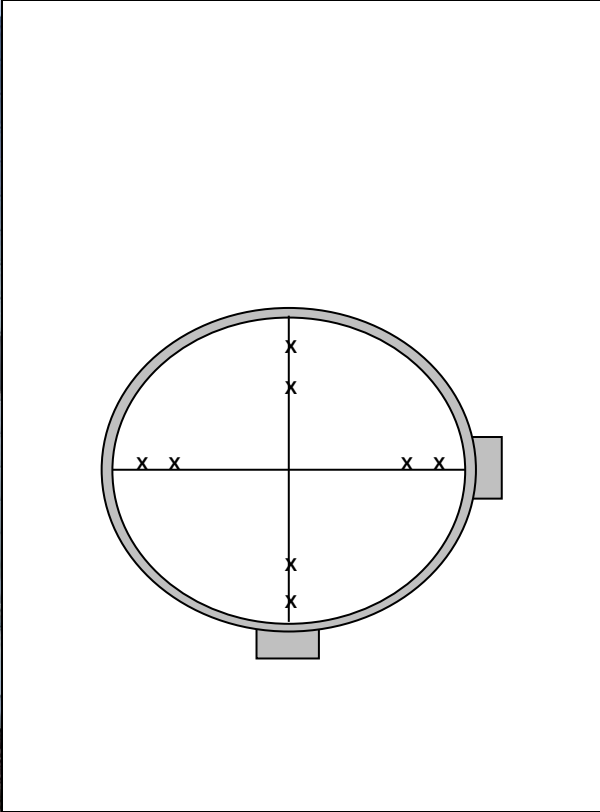
Appendix B1.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 8 - Panstone's 6C, 6D, 6E & 6F



Appendix B: Emission Information

B2 - Stack 9 - Terenzio's 3A, 3B & Cooling Table Information

B2.1 Diagrams Showing the Dimensions and Monitoring Facilities of Stack 9 - Terenzio's 3A, 3B & Cooling Table

Photograph of Monitoring Point	Schematic of Sample Plane
	

B2.2 Preliminary Velocity and Temperature Measurement of Stack 9 - Terenzio's 3A, 3B & Cooling Table

Traverse Point	Sample Line A			Sample Line B			Sample Line C			Sample line D		
	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)
1	26	11	0	26	9.5	0						
2	26	10	0	26	4	0						
3	26	1	0	26	2	0						
4	26	1	0	26	-1	0						
5	26	-1	0	26	1	0						
6	26	-1	0	26	12	0						
7	26	6.5	0	26	17	0						
8	26	15	0	26	18	0						
9	26	19	0	26	18.5	0						
10	26	17	0	26	15	0						
	ΣΔP _A	78.5		ΣΔP _B	96		ΣΔP _C			ΣΔP _D		

Barometric Pressure (mmHg)	760	Stack velocity (actual) ms ⁻¹	10
Static Pressure (mmH ₂ O)	22.50	Volumetric Flow (actual) m ³ min ⁻¹	120
Diameter (m)	0.50	Assumed CO ₂ (%)	0.0
---		Assumed O ₂ (%)	20.9
Stack Area (m ²)	0.196	Assumed CO (%)	0.0
Port Size (mm)	100	Assumed H ₂ O (%)	0.0

Appendix B2.3 - Particulate Site Measurements - Stack 9 - Terenzio's 3A, 3B & Cooling Table

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	29/09/2014
Plant Identification	Stack 9 - Terenzio's 3A, 3B & Cooling	Run Number	1

Water Vapour Measurements

Impinger	Initial Wt (g)	Final Wt (g)
1	749	749.3
2	782.8	782.8
3	601.1	601.1
4	930.9	931.3
5		
6		
7		

Sample Reference Information

Filter Ref.	70496-29/09/14-F3
Probe Wash Ref.	70496-29/09/14-S3
Blank Filter Ref.	70496-29/09/14-F4
Blank Probe Wash Ref.	70496-29/09/14-S4

Leak Test Results

Initial Leak Test lmin ⁻¹	0.2000
Test Vacuum ("Hg)	23
Final Leak Test lmin ⁻¹	0.20000
Test Vacuum ("Hg)	23

Sampling Measurements

Point	Start and End Times	Duration (Min)	Vac ("Hg)	Stack Temp (°C)	Velocity Head ΔP (mmH ₂ O)	√ΔP (√mm.H ₂ O)	ΔP Orifice Meter (mm H ₂ O)	DGM (litres)	DGM Temp (°C)		Temp (°C)			
								1530380	In	Out	Probe	Filter	Impinger	Resin
1	12:20	4	2	26	10	3.16	46.19	1530446	23	23	161	-	9	---
2		4	2	26	10	3.16	46.19	1530523	24	23	162	-	9	---
3		4	2	26	1	1.00	4.62	1530568	24	23	164	-	9	---
4		4	2	26	1	1.00	4.62	1530634	25	23	160	-	9	---
5		4	2	26	7	2.65	32.33	1530713	25	24	163	-	9	---
6		4	2	26	7	2.65	32.33	1530789	26	24	164	-	9	---
7		4	2	26	12	3.46	55.43	1530842	26	25	161	-	9	---
8		4	2	26	12	3.46	55.43	1530912	27	25	160	-	9	---
9		4	2	26	4	2.00	18.48	1530965	27	25	164	-	9	---
10		4	2	26	4	2.00	18.48	1531040	28	26	163	-	9	---
11		4	2	26	1	1.00	4.62	1531109	28	26	162	-	9	---
12		4	2	26	1	1.00	4.62	1531179	29	27	161	-	9	---
13		4	2	26	15	3.87	69.28	1531238	29	27	160	-	9	---
14		4	2	26	15	3.87	69.28	1531312	30	28	163	-	9	---
15		4	2	26	18	4.24	83.14	1531370	31	28	164	-	9	---
16	13:25	4	2	26	18	4.24	83.14	1531449	32	30	163	-	9	---
17														
18														
19														
20														
	65	64	2.00	26.00	8.50	2.67	39.26	1069.00	27.13	25.44	162.19		9.00	

Appendix B2.3 - Total Particulates to BS EN 13284:2002 - Stack 9 - Terenzio's 3A, 3B & Cooling Table

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley			
Site	Huntingdon	Date of Test	29 September 2014			
Plant Identification	Stack 9 - Terenzio's 3A, 3B & C					
Volume of Water Vapour at Standard Conditions V_{wstd}						
$V_{wstd} = (0.00124) \times V_{lc}$	=	Blank	Test 1	Units		
		0.0009	0.0009	m^3		
Where:						
Constant	=	0.00124	0.00124			
V_{lc} is the mass of water collected	=	0.7	0.7		g	
Volume of Gas Metered, Standard Conditions V_{mstd}						
$V_{mstd} = \frac{(0.3592) \times V_m \times \left(P_b + \frac{\Delta H}{13.6} \right) \times Y_d}{(273 + T_m)}$	=	Blank	Test 1	Units		
		0.9974	0.9974	m^3		
Where:						
Correction for standard temperature and pressure	=	0.3592	0.3592		$Kmm.Hg^{-1}$	
V_m is the volume metered	=	1.0690	1.0690		m^3	
P_b is the barometric pressure	=	760	760		mm.Hg	
ΔH_{ave} is the average meter flow	=	39.3	39.3		mm.H ₂ O	
conversion from mm.H ₂ O to mm.Hg	=	13.6	13.6			
Y_d is the meter correction factor	=	1.0190	1.0190			
$^{\circ}C$ to K conversion constant	=	273	273		K	
T_m is the meter temperature	=	26.3	26.3		$^{\circ}C$	
Moisture Content B_{wo}						
$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$	=	Blank	Test 1			
		0.001	0.001			
Where:						
V_{wstd} is the volume of water vapour at standard conditions	=	0.0009	0.0009		m^3	
V_{mstd} is the volume of gas metered, standard conditions	=	0.9974	0.9974		m^3	
Velocity of Stack Gases V_s						
$V_s = K_p \times C_p \times \sqrt{\Delta P} \times \frac{\sqrt{T_s} + 273}{\sqrt{M_s \times P_s}}$	=	Blank	Test 1	ms^{-1}		
		9.2	9.2			
Where:						
K_p is the pitot tube velocity constant	=	34.97	34.97			
C_p is the pitot coefficient	=	0.834	0.834			
$(\sqrt{\Delta P})_{ave}$ is the average square root of velocity heads	=	2.67	2.67		$\sqrt{mm.H_2O}$	
T_s is the stack temperature	=	26.0	26.0		$^{\circ}C$	
$^{\circ}C$ to K conversion constant	=	273	273		K	
M_s is the molecular weight of gas	=	28.00	28.00		g/g mole	
P_s is the absolute pressure of stack gas	=	762	762		mm.Hg	

Appendix B2.3 - Total Particulates to BS EN 13284:2002 - Stack 9 - Terenzio's 3A, 3B & Cooling Table

Actual Flow Rate of Stack Gases Q_a					
$Q_a = 60 \times A_s \times V_s$	=	Blank 108.8	Test 1 108.8		$\text{m}^3 \text{min}^{-1}$
Where:					
Second to minute conversion	=	60	60		
A_s is the cross-sectional area of stack	=	0.196	0.196		m^2
V_s is the velocity of stack gases	=	9.2	9.2		ms^{-1}
Dry Total Flow Rate of Stack Gas Q_{std}					
$Q_{std} = \frac{Q_a \times P_s \times 0.3592 \times (1 - B_{wo})}{(\overline{T_s}) + 273}$	=	Blank 99.4	Test 1 99.4		$\text{m}^3 \text{min}^{-1}$
Where:					
Q_a is the actual flow rate of stack gases	=	108.8	108.8		$\text{m}^3 \text{min}^{-1}$
P_s is the absolute pressure of stack gas	=	762	762		mm.Hg
Correction for standard temperature and pressure	=	0.3592	0.3592		Kmm.Hg ⁻¹
B_{wo} is the moisture content	=	0.001	0.001		
T_s is the stack temperature	=	26.0	26.0		°C
°C to K conversion constant	=	273	273		K
V_s is the velocity of stack gases	=	9.2	9.2		ms^{-1}
Percent Isokineticity %I					
$\%I = \frac{(4.6398 \times 10^6) \times (\overline{T_s} + 273) \times V_{mstd}}{P_s \times V_s \times A_n \times \theta \times (1 - B_{wo})}$	=	Blank 108.6	Test 1 108.6		%
Where:					
Constant	=	4.6398E+06	4.6398E+06		
T_s is the stack temperature	=	26.0	26.0		°C
°C to K conversion constant	=	273	273		K
V_{mstd} is the volume of gas metered, standard conditions	=	0.9974	0.9974		m^3
P_s is the absolute pressure of stack gas	=	762	762		mm.Hg
V_s is the velocity of stack gases	=	9.2	9.2		ms^{-1}
A_n is the cross-sectional area of nozzle	=	28.34	28.34		mm^2
θ is the duration of test	=	64	64		minutes
B_{wo} is the moisture content	=	0.001	0.001		
Particulate Concentration $\text{C}_{\text{mgm}^{-3}}$ - Dry Basis					
$C_{\text{mgm}^{-3}} = \frac{M_n}{V_{mstd}}$	=	Blank 0.5	Test 1 1.4		mgm^{-3}
Where:					
Filter reference number		70496-29/09/14-F4	70496-29/09/14-F3		
Mn1 Particulate mass on filter.	=	0.04	0.04		mg
Probe wash reference number		70496-29/09/14-S4	70496-29/09/14-S3		
Mn2 Particulate mass in probe rinse.	=	0.5	1.4		mg
V_{mstd} is the volume of gas metered, standard conditions	=	0.9974	0.9974		m^3

Appendix B2.3 - Total Particulates to BS EN 13284:2002 - Stack 9 - Terenzio's 3A, 3B & Cooling Table

Particulate Concentration $\text{C}_{\text{mgm}^{-3}}$ - Wet Basis					
$C_{\text{mgm}^{-3}(\text{wet})} = C_{\text{mgm}^{-3}} \times \frac{(100 - W_v)}{100}$	=	Blank 0.5	Test 1 1.4		mgm^{-3}
Where					
Concentrations at 273k and 101.3kPa Dry Basis	=	0.5	1.4		mgm^{-3}
W _v is the water vapour content %	=	0.1	0.1		%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis					
$C_{\text{atx}\%} = C_{\text{mgm}^{-3}} \times \frac{20.9 - O_{2\text{ref}}}{20.9 - O_{2\text{meas}}}$	=	Blank 0.5	Test 1 1.4		mgm^{-3}
Where:					
Atmospheric oxygen concentration	=	20.9	20.9		%
O _{2ref} is the reference oxygen concentration	=	N/A	N/A		%
O _{2meas} is the measured oxygen concentration	=	N/A	N/A		%
N/A = Not Applicable - Oxygen Not Measured					
Particulate Emission Rate $E_{\text{ghr}^{-1}}$					
$E_{\text{ghr}^{-1}} = C \times Q_{\text{std}} \times \frac{60}{1000}$	=	Blank 3	Test 1 9		ghr^{-1}
Where:					
$C_{\text{mgm}^{-3}}$ is the particulate concentration, dry basis	=	0.5	1.4		mgm^{-3}
Q _{std} is the dry total flow rate of stack gas	=	99.4	99.4		$\text{m}^3 \text{min}^{-1}$
60/1000 Conversion factor	=	0.060	0.060		
Comments on Compliance with BS EN 13284:2002					
Temperature maintained above 160°C	Pass				
Isokinetic Rate 95% to 115%	Pass				
Leak Rate <2%	Pass				
Overall Blank Value <10% of the LV ^a	Pass				
Duct gas flow with regard to stack axis <15°	Pass				
Duct gas flow: negative velocity - not permitted	Fail				
Duct gas flow: differential pressure at the pitot tube >5pa	Fail				
Duct gas flow: ratio of max to min velocity <3:1	Pass				
Number of sampling points	Pass				
Were all of the requirements of BS EN 13284:2002 fulfilled during the test? ☐ X Yes No					

Appendix B2.3 - Total Particulates to BS EN 13284:2002 - Stack 9 - Terenzio's 3A, 3B & Cooling Table

Uncertainty Calculations						
Measurement Data						
Measured Quantities	Symbol	Value	Standard Uncertainty			Units
Sampled Volume	V_m	0.9974	(1%) uV_m	0.00997		m^3
Sampled Gas Temperature	T_m	299.3	uT_m	3		K
Sampled Gas Pressure	p_m	101.7	up_m	0.1		kPa
Sampled Gas Humidity	H_m	0.1	uH_m	0.1		% by volume
Oxygen Content	$O_{2,m}$	N/A	$uO_{2,m}$	0.01		% by volume
Mass Particulate	m	1.44	um_m	0.07		mg
Leak	L	2	%	0.02		%
Uncollected Mass	UCM	0				mg
Intermediate Calculation to Correct for Standardisation of Conditions						
Factor for Std Conditions	fs	0.91				
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fs)		
	p_m	0.009		0.001		
	H_m	0.009		0.001		
	T_m	0.003		0.009		
	ufs			0.009		
Corrected Volume	V	0.91	uV	0.014		m^3
Intermediate Calculation to Correct for Oxygen Correction						
Factor for O_2 Correction	fc	1.00				
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fc)		
	$O_{2,m}$	1.00		0.010		
Factor for O_2 Correction	ufc	1.00		0.010		%
Calculation of Expanded Uncertainty						
Parameter		Value	Units	Sensitivity Coefficient	Uncertainty in Result	
Volume (Std conditions)	V	0.91	m^3	1.58	0.02	$mg.m^{-3}$
Mass	m	1.44	mg	1.00	0.07	$mg.m^{-3}$
Factor for O_2 Correction	fc	1.00		1.44	0.01	$mg.m^{-3}$
Leak	L	0.02	$mg.m^{-3}$	1.00	0.02	$mg.m^{-3}$
Uncollected mass	UCM	0.00	mg	1.00	0.00	$mg.m^{-3}$
Combined uncertainty					0.08	$mg.m^{-3}$
Expanded Uncertainty K=2					10.87	%
Expanded Uncertainty K=2					0.16	$mg.m^{-3}$

Appendix B2.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 9 - Terenzio's 3A, 3B & Cooling Table

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley				
Site	Huntingdon	Date of Test	29 September 2014				
Plant Identification	Stack 9 - Terenzio's 3A, 3B & C	File Name:					
Choice of Measurement Range and Span Gas Concentration							
Parameter	ELV ppm C ₃ H ₈	Ideal Range (ppm)	Actual Range (ppm)	Ideal Span Gas Value	Actual Span Gas Value	2% of Span Gas Conc.	Analysers repeatability at zero
VOCs			100	50 - 90	75.7	1.51	0.830
Analysers and System, Zero and Span Checks (ppm)							
Times of pre and post system calibration checks				Time	10:40	Time	17:30
Parameter	Analysers Zero	Analysers Span	Analysers Zero Check	Pre-Test System Zero Check	Pre-Test System Span Check	Post-Test System Zero Check	Post-Test System Span Check
VOCs	0.0	75.7	0.3	0.3	75.0	0.2	75.0
Zero, Span and Drift Checks							
Parameter	Analysers Zero Check		Zero Drift Check		Span Drift Check		Overall Check
VOCs	0.3	Pass	-0.1	Pass	0	Pass	Pass
Correction of Data For Drift Effect							
Parameter	Adjustment	Check	Deviation	Drift/minute			
VOCs	Span	1.0134	1.0120	-0.0014	0.0000		
	Zero	-0.3040	-0.2024	0.1016	0.0002		
As Determined Concentrations Wet Basis (as C)							
$C_{ppm} = \frac{\sum 1-n}{n} \times 3$				=	1.7	ppm	
where:							
Σ 1 - n is the sum of the readings				=	205		
n is the total number of readings				=	361		
3 is the conversion factor from ppm propane to ppm carbon				=	3		
Concentrations at 273k and 101.3kPa Wet Basis							
$C_{mgm^{-3}} = C_{ppm} \times \frac{mw}{22.4}$				=	0.9	mgm ⁻³	
where:							
C _{ppm} is the average concentration				=	1.7	ppm	
mw is the molecular weight of the gas under test				=	12		
22.4 is the volume of 1 mole of gas at STP				=	22.4	litres	

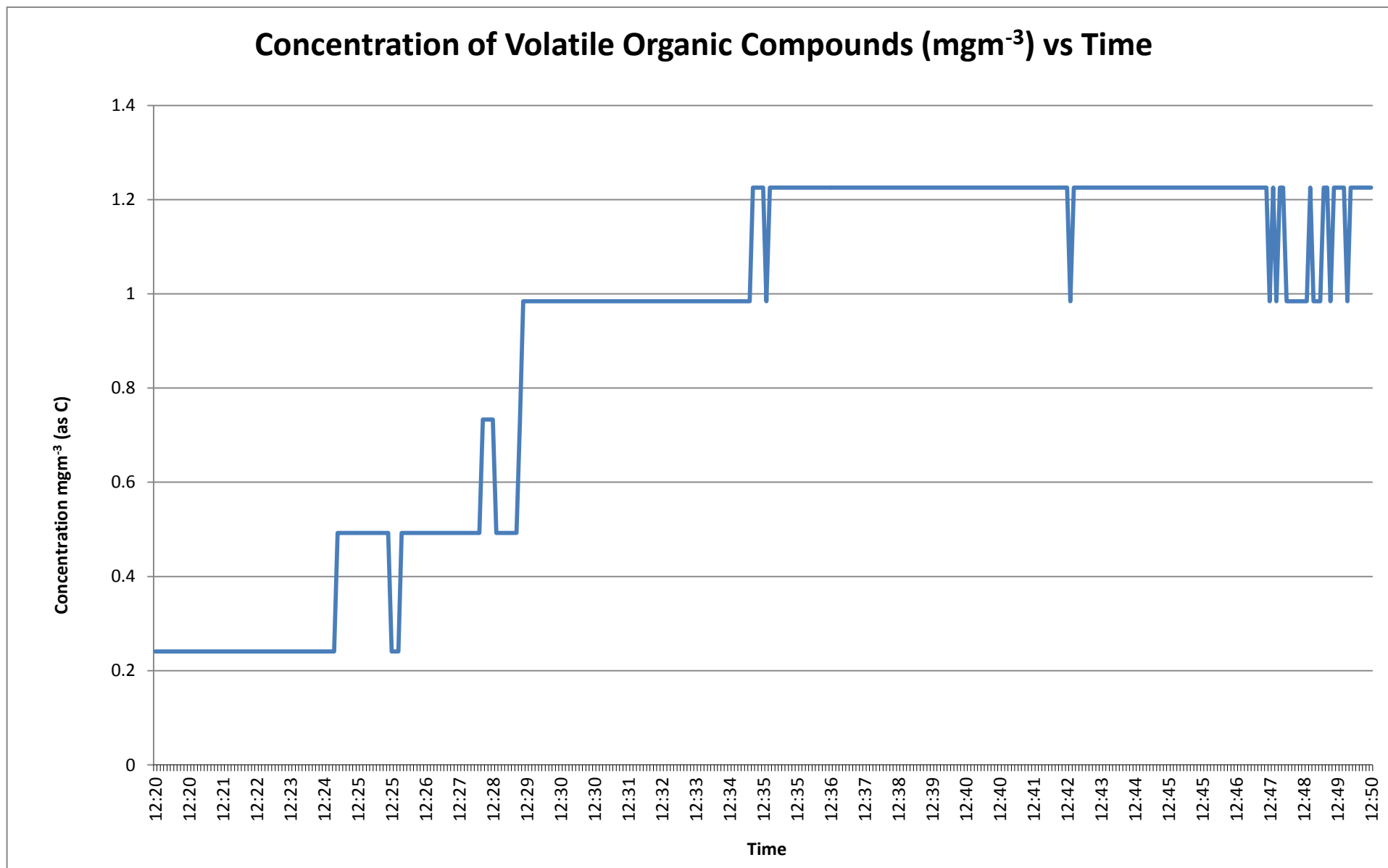
Appendix B2.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 9 - Terenzio's 3A, 3B & Cooling Table

Concentrations at 273k and 101.3kPa Dry Basis			
$C_{mgm-3(wet)} = C_{mgm-3} \times \frac{100}{(100 - Wv)}$	=	0.9	mgm ⁻³
where:			
Concentrations at 273k and 101.3kPa Dry Basis	=	0.9	mgm ⁻³
Wv is the water vapour content	=	0.1	%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis			
$C_{at\%} = C_{mgm-3} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}}$	=	0.9	mgm ⁻³
where:			
20.9 is the atmospheric concentration of oxygen	=	20.9	%
O _{2ref} is the reference concentration	=	N/A	%
O _{2meas} is the measured concentration	=	N/A	%
N/A = Oxygen Not Measured			
Actual Rates of Discharge			
$E_{g/hr} = C \times Q_{std} \times \frac{60}{1000}$	=	6.0	ghr ⁻¹
where:			
C is the dry Concentration at STP	=	0.9	
Q _{std} is the dry flow rate at STP	=	109.9	
60/1000 is the conversion factor	=	0.060	
Comments on Compliance with BS EN 12619:2001			
Temperature maintained above 180°C	Pass		
Pre-Test Analyser Zero Check	Pass		
Zero Drift Check	Pass		
Span Drift Check	Pass		
Overall Calibration Acceptability	Pass		
Were all of the requirements of BS EN 12619:2013 fulfilled during the test? ✓ Yes No			

Appendix B2.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 9 - Terenzio's 3A, 3B & Co

Uncertainty Calculation of Volatile Organic Compounds to BS EN 12619:2013							
Symbol	Source of Uncertainty	Value +/- ppm	Probability Distribution	Divisor	Ci	Ui() +/- ppm	V ₁ or V _{eff}
U _{AP}	Air Pressure	0.3785	Normal(K=2)	2	1	0.2	
U _{SP}	Sample Pressure	0.757	Normal(K=2)	2	1	0.4	
U _{T0}	Temp at 0°C	1.514	Normal(K=2)	2	1	0.8	
U _{TS}	Temp (sensitivity)	0.757	Normal(K=2)	2	1	0.4	
U _{H2O}	H2O cross-sensitivity	0.18925	Normal(K=2)	2	1	0.1	
U _{CO}	CO cross-sensitivity	0.0757	Normal(K=2)	2	1	0.0	
U _{CO2}	CO2 cross-sensitivity	0.3785	Normal(K=2)	2	1	0.2	
U _{NO}	NO cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{SO2}	SO2 cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{ZD}	Zero Drift	0.01	Normal(K=2)	2	1	0.0	
U _S	sensitivity Drift	0.3785	Normal(K=2)	2	1	0.2	
U _C	Calibration	1.514	Normal(K=2)	2	1	0.8	
U _C ()	Combined standard		normal			1.25	
U	Expanded		enter coverage	1.96		2.45	ppm
U	Expanded		enter coverage	1.96		1.31	mgm ⁻³

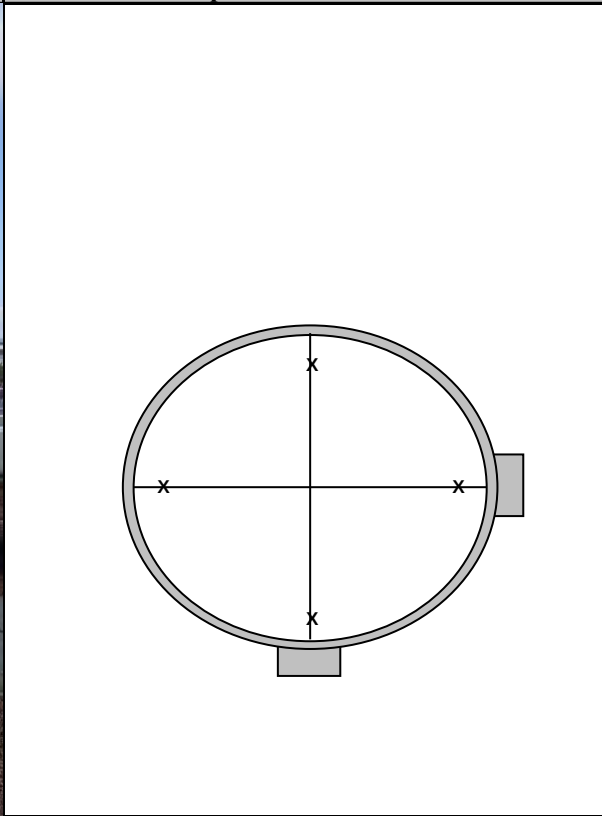
Appendix B2.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 9 - Terenzio's 3A, 3B & Cooling Table



Appendix B: Emission Information

B3 - Stack 11 - Strip Press & Cooling booth Information

B3.1 Diagrams Showing the Dimensions and Monitoring Facilities of Stack 11 - Strip Press & Cooling booth

Photograph of Monitoring Point	Schematic of Sample Plane
	

B3.2 Preliminary Velocity and Temperature Measurement of Stack 11 - Strip Press & Cooling booth

Traverse Point	Sample Line A			Sample Line B			Sample Line C			Sample line D		
	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)
1	26	9.5	0	26	9	0						
2	26	11	0	26	10.5	0						
3	26	3	0	26	2	0						
4	26	2	0	26	2	0						
5	26	2	0	26	4	0						
6	26	3.5	0	26	8	0						
7	26	10	0	26	12.5	0						
8	26	13.5	0	26	15	0						
9	26	14.5	0	26	16	0						
10	26	12	0	26	13	0						
	ΣΔP _A	81		ΣΔP _B	92		ΣΔP _C			ΣΔP _D		

Barometric Pressure (mmHg)	760	Stack velocity (actual) ms ⁻¹	10
Static Pressure (mmH ₂ O)	10.00	Volumetric Flow (actual) m ³ min ⁻¹	292
Diameter (m)	0.78	Assumed CO ₂ (%)	0.0
---		Assumed O ₂ (%)	20.9
Stack Area (m ²)	0.478	Assumed CO (%)	0.0
Port Size (mm)	100	Assumed H ₂ O (%)	0.0

Appendix B3.3 - Particulate Site Measurements - Stack 11 - Strip Press & Cooling booth

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	29/09/2014
Plant Identification	Stack 11 - Strip Press & Cooling booth	Run Number	1

Water Vapour Measurements

Impinger	Initial Wt (g)	Final Wt (g)
1	749.3	749.7
2	782.8	782.9
3	601.1	601.1
4	931.3	931.3
5		
6		
7		

Sample Reference Information

Filter Ref.	70496-29/09/14-F5
Probe Wash Ref.	70496-29/09/14-S5
Blank Filter Ref.	70496-29/09/14-F6
Blank Probe Wash Ref.	70496-29/09/14-S6

Leak Test Results

Initial Leak Test lmin ⁻¹	0.2000
Test Vacuum ("Hg)	23
Final Leak Test lmin ⁻¹	0.20000
Test Vacuum ("Hg)	23

Sampling Measurements

Point	Start and End Times	Duration (Min)	Vac ("Hg)	Stack Temp (°C)	Velocity Head ΔP (mmH ₂ O)	√ΔP (√mm.H ₂ O)	ΔP Orifice Meter (mm H ₂ O)	DGM (litres)	DGM Temp (°C)		Temp (°C)			
								1531548	In	Out	Probe	Filter	Impinger	Resin
1	13:55	5	4	26	3	1.73	13.84	1531638	23	23	161	-	9	---
2		5	4	26	3	1.73	13.84	1531717	23	23	161	-	9	---
3		5	4	26	3	1.73	13.84	1531822	24	23	162	-	9	---
4		5	4	26	12	3.46	55.36	1531918	24	23	160	-	9	---
5		5	4	26	12	3.46	55.36	1531978	25	24	164	-	9	---
6		5	4	26	12	3.46	55.36	1532092	25	24	162	-	9	---
7		5	4	26	4	2.00	18.45	1532178	26	24	163	-	9	---
8		5	4	26	4	2.00	18.45	1532259	26	24	164	-	9	---
9		5	4	26	4	2.00	18.45	1532356	27	24	163	-	9	---
10		5	4	26	15	3.87	69.20	1532448	28	25	164	-	9	---
11		5	4	26	15	3.87	69.20	1532524	30	27	162	-	9	---
12	15:00	5	4	26	15	3.87	69.20	1532631	31	28	160	-	9	---
13														
14														
15														
16														
17														
18														
19														
20														
		60	4.00	26.00	8.50	2.77	39.21	1083.00	26.00	24.33	162.17		9.00	

Appendix B3.3 - Total Particulates to BS EN 13284:2002 - Stack 11 - Strip Press & Cooling booth

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley			
Site	Huntingdon	Date of Test	29 September 2014			
Plant Identification	Stack 11 - Strip Press & Cooling					
Volume of Water Vapour at Standard Conditions V_{wstd}						
$V_{wstd} = (0.00124) \times V_{lc}$	=	Blank	Test 1	Units		
		0.0006	0.0006	m^3		
Where:						
Constant	=	0.00124	0.00124			
V_{lc} is the mass of water collected	=	0.5	0.5		g	
Volume of Gas Metered, Standard Conditions V_{mstd}						
$V_{mstd} = \frac{(0.3592) \times V_m \times \left(P_b + \frac{\Delta H}{13.6} \right) \times Y_d}{(273 + T_m)}$	=	Blank	Test 1	Units		
		1.0142	1.0142	m^3		
Where:						
Correction for standard temperature and pressure	=	0.3592	0.3592		$Kmm.Hg^{-1}$	
V_m is the volume metered	=	1.0830	1.0830		m^3	
P_b is the barometric pressure	=	760	760		mm.Hg	
ΔH_{ave} is the average meter flow	=	39.2	39.2		mm.H ₂ O	
conversion from mm.H ₂ O to mm.Hg	=	13.6	13.6			
Y_d is the meter correction factor	=	1.0190	1.0190			
$^{\circ}C$ to K conversion constant	=	273	273		K	
T_m is the meter temperature	=	25.2	25.2		$^{\circ}C$	
Moisture Content B_{wo}						
$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$	=	Blank	Test 1			
		0.001	0.001			
Where:						
V_{wstd} is the volume of water vapour at standard conditions	=	0.0006	0.0006		m^3	
V_{mstd} is the volume of gas metered, standard conditions	=	1.0142	1.0142		m^3	
Velocity of Stack Gases V_s						
$V_s = K_p \times C_p \times \sqrt{\Delta P} \times \frac{\sqrt{T_s} + 273}{\sqrt{M_s \times P_s}}$	=	Blank	Test 1	ms^{-1}		
		9.6	9.6			
Where:						
K_p is the pitot tube velocity constant	=	34.97	34.97			
C_p is the pitot coefficient	=	0.834	0.834			
$(\sqrt{\Delta P})_{ave}$ is the average square root of velocity heads	=	2.77	2.77		$\sqrt{mm.H_2O}$	
T_s is the stack temperature	=	26.0	26.0		$^{\circ}C$	
$^{\circ}C$ to K conversion constant	=	273	273		K	
M_s is the molecular weight of gas	=	28.00	28.00		g/g mole	
P_s is the absolute pressure of stack gas	=	761	761		mm.Hg	

Appendix B3.3 - Total Particulates to BS EN 13284:2002 - Stack 11 - Strip Press & Cooling booth

Actual Flow Rate of Stack Gases Q_a					
$Q_a = 60 \times A_s \times V_s$	=	Blank 274.1	Test 1 274.1		$\text{m}^3 \text{min}^{-1}$
Where:					
Second to minute conversion	=	60	60		
A_s is the cross-sectional area of stack	=	0.478	0.478		m^2
V_s is the velocity of stack gases	=	9.6	9.6		ms^{-1}
Dry Total Flow Rate of Stack Gas Q_{std}					
$Q_{std} = \frac{Q_a \times P_s \times 0.3592 \times (1 - B_{wo})}{(\overline{T_s}) + 273}$	=	Blank 250.4	Test 1 250.4		$\text{m}^3 \text{min}^{-1}$
Where:					
Q_a is the actual flow rate of stack gases	=	274.1	274.1		$\text{m}^3 \text{min}^{-1}$
P_s is the absolute pressure of stack gas	=	761	761		mm.Hg
Correction for standard temperature and pressure	=	0.3592	0.3592		Kmm.Hg $^{-1}$
B_{wo} is the moisture content	=	0.001	0.001		
T_s is the stack temperature	=	26.0	26.0		$^{\circ}\text{C}$
$^{\circ}\text{C}$ to K conversion constant	=	273	273		K
V_s is the velocity of stack gases	=	9.6	9.6		ms^{-1}
Percent Isokineticity %I					
$\%I = \frac{(4.6398 \times 10^6) \times (\overline{T_s} + 273) \times V_{mstd}}{P_s \times V_s \times A_n \times \theta \times (1 - B_{wo})}$	=	Blank 113.8	Test 1 113.8		%
Where:					
Constant	=	4.6398E+06	4.6398E+06		
T_s is the stack temperature	=	26.0	26.0		$^{\circ}\text{C}$
$^{\circ}\text{C}$ to K conversion constant	=	273	273		K
V_{mstd} is the volume of gas metered, standard conditions	=	1.0142	1.0142		m^3
P_s is the absolute pressure of stack gas	=	761	761		mm.Hg
V_s is the velocity of stack gases	=	9.6	9.6		ms^{-1}
A_n is the cross-sectional area of nozzle	=	28.34	28.34		mm^2
θ is the duration of test	=	60	60		minutes
B_{wo} is the moisture content	=	0.001	0.001		
Particulate Concentration $\text{C}_{\text{mgm}^{-3}}$ - Dry Basis					
$C_{\text{mgm}^{-3}} = \frac{M_n}{V_{mstd}}$	=	Blank 0.8	Test 1 0.6		mgm^{-3}
Where:					
Filter reference number		70496-29/09/14-F6	70496-29/09/14-F5		
Mn1 Particulate mass on filter.	=	0.04	0.04		mg
Probe wash reference number		70496-29/09/14-S6	70496-29/09/14-S5		
Mn2 Particulate mass in probe rinse.	=	0.8	0.6		mg
V_{mstd} is the volume of gas metered, standard conditions	=	1.0142	1.0142		m^3

Appendix B3.3 - Total Particulates to BS EN 13284:2002 - Stack 11 - Strip Press & Cooling booth

Particulate Concentration $C_{mgm^{-3}}$ - Wet Basis					
$C_{mgm^{-3} (wet)} = C_{mgm^{-3}} \times \frac{(100 - W_v)}{100}$	=	Blank 0.8	Test 1 0.6		mgm^{-3}
Where					
Concentrations at 273k and 101.3kPa Dry Basis	=	0.8	0.6		mgm^{-3}
W _v is the water vapour content %	=	0.1	0.1		%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis					
$C_{atx\%} = C_{mgm^{-3}} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}}$	=	Blank 0.8	Test 1 0.6		mgm^{-3}
Where:					
Atmospheric oxygen concentration	=	20.9	20.9		%
O _{2ref} is the reference oxygen concentration	=	N/A	N/A		%
O _{2meas} is the measured oxygen concentration	=	N/A	N/A		%
N/A = Not Applicable - Oxygen Not Measured					
Particulate Emission Rate $E_{ghr^{-1}}$					
$E_{ghr^{-1}} = C \times Q_{std} \times \frac{60}{1000}$	=	Blank 12	Test 1 9		ghr^{-1}
Where:					
$C_{mgm^{-3}}$ is the particulate concentration, dry basis	=	0.8	0.6		mgm^{-3}
Q _{std} is the dry total flow rate of stack gas	=	250.4	250.4		$m^3 min^{-1}$
60/1000 Conversion factor	=	0.060	0.060		
Comments on Compliance with BS EN 13284:2002					
Temperature maintained above 160°C	Pass				
Isokinetic Rate 95% to 115%	Pass				
Leak Rate <2%	Pass				
Overall Blank Value <10% of the LV ^a	Pass				
Duct gas flow with regard to stack axis <15°	Pass				
Duct gas flow: negative velocity - not permitted	Pass				
Duct gas flow: differential pressure at the pitot tube >5pa	Pass				
Duct gas flow: ratio of max to min velocity <3:1	Pass				
Number of sampling points	Pass				
Were all of the requirements of BS EN 13284:2002 fulfilled during the test? ☒ Yes ☐ No					

Appendix B3.3 - Total Particulates to BS EN 13284:2002 - Stack 11 - Strip Press & Cooling booth

Uncertainty Calculations						
Measurement Data						
Measured Quantities	Symbol	Value	Standard Uncertainty			Units
Sampled Volume	V_m	1.0142	(1%) uV_m	0.01014		m^3
Sampled Gas Temperature	T_m	298.2	uT_m	3		k
Sampled Gas Pressure	p_m	101.7	up_m	0.1		kPa
Sampled Gas Humidity	H_m	0.1	uH_m	0.1		% by volume
Oxygen Content	$O_{2,m}$	N/A	$uO_{2,m}$	0.01		% by volume
Mass Particulate	m	0.64	um_m	0.03		mg
Leak	L	2	%	0.02		%
Uncollected Mass	UCM	0				mg
Intermediate Calculation to Correct for Standardisation of Conditions						
Factor for Std Conditions	fs	0.92				
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fs)		
	p_m	0.009		0.001		
	H_m	0.009		0.001		
	T_m	0.003		0.009		
	ufs			0.009		
Corrected Volume	V	0.93	uV	0.014		m^3
Intermediate Calculation to Correct for Oxygen Correction						
Factor for O_2 Correction	fc	1.00				
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fc)		
	$O_{2,m}$	1.00		0.010		
Factor for O_2 Correction	ufc	1.00		0.010		%
Calculation of Expanded Uncertainty						
Parameter		Value	Units	Sensitivity Coefficient	Uncertainty in Result	
Volume (Std conditions)	V	0.93	m^3	0.68	0.01	$mg.m^{-3}$
Mass	m	0.64	mg	0.99	0.03	$mg.m^{-3}$
Factor for O_2 Correction	fc	1.00		0.63	0.01	$mg.m^{-3}$
Leak	L	0.01	$mg.m^{-3}$	1.00	0.01	$mg.m^{-3}$
Uncollected mass	UCM	0.00	mg	0.99	0.00	$mg.m^{-3}$
Combined uncertainty					0.03	$mg.m^{-3}$
Expanded Uncertainty K=2					10.87	%
Expanded Uncertainty K=2					0.07	$mg.m^{-3}$

Appendix B3.4 Volatile Organic Compounds to BS EN 12619:2013 Stack 11 - Strip Press & Cooling booth

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	29 September 2014
Plant Identification	Stack 11 - Strip Press & Cooling	File Name:	

Choice of Measurement Range and Span Gas Concentration							
Parameter	ELV ppm C ₃ H ₈	Ideal Range (ppm)	Actual Range (ppm)	Ideal Span Gas Value	Actual Span Gas Value	2% of Span Gas Conc.	Analysers repeatability at zero
VOCs			100	50 - 90	75.7	1.51	0.830

Analyser and System, Zero and Span Checks (ppm)							
Times of pre and post system calibration checks				Time	10:40	Time	17:30
Parameter	Analysers Zero	Analysers Span	Analysers Zero Check	Pre-Test System Zero Check	Pre-Test System Span Check	Post-Test System Zero Check	Post-Test System Span Check
VOCs	0.0	75.7	0.3	0.3	75.0	0.2	75.0

Zero, Span and Drift Checks							
Parameter	Analysers Zero Check		Zero Drift Check		Span Drift Check		Overall Check
VOCs	0.3	Pass	-0.1	Pass	0	Pass	Pass

Correction of Data For Drift Effect					
Parameter	Adjustment	Check	Deviation	Drift/minute	
VOCs	Span	1.0134	1.0120	-0.0014	0.0000
	Zero	-0.3040	-0.2024	0.1016	0.0002

As Determined Concentrations Wet Basis (as C)					
$C_{ppm} = \frac{\sum 1-n}{n} \times 3$			=	3.5	ppm
where:					
Σ 1 - n is the sum of the readings			=	424	
n is the total number of readings			=	361	
3 is the conversion factor from ppm propane to ppm carbon			=	3	

Concentrations at 273k and 101.3kPa Wet Basis					
$C_{mgm-3} = C_{ppm} \times \frac{mw}{22.4}$			=	1.9	mgm ⁻³
where:					
C _{ppm} is the average concentration			=	3.5	ppm
mw is the molecular weight of the gas under test			=	12	
22.4 is the volume of 1 mole of gas at STP			=	22.4	litres

Appendix B3.4 Volatile Organic Compounds to BS EN 12619:2013 Stack 11 - Strip Press & Cooling booth

Concentrations at 273k and 101.3kPa Dry Basis

$$C_{mgm^{-3}(wet)} = C_{mgm^{-3}} \times \frac{100}{(100 - Wv)} \quad 1.9 \quad mgm^{-3}$$

where:

Concentrations at 273k and 101.3kPa Dry Basis	=	1.9	mgm ⁻³
Wv is the water vapour content	=	0.1	%

Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis

$$C_{at\%} = C_{mgm^{-3}} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}} \quad = \quad 1.9 \quad mgm^{-3}$$

where:

20.9 is the atmospheric concentration of oxygen	=	20.9	%
O _{2ref} is the reference concentration	=	N/A	%
O _{2meas} is the measured concentration	=	N/A	%

N/A = Oxygen Not Measured

Actual Rates of Discharge

$$E_{g/hr} = C \times Q_{std} \times \frac{60}{1000} \quad = \quad 30.2 \quad ghr^{-1}$$

where:

C is the dry Concentration at STP	=	1.9	
Q _{std} is the dry flow rate at STP	=	266.1	
60/1000 is the conversion factor	=	0.060	

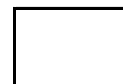
Comments on Compliance with BS EN 12619:2001

Temperature maintained above 180°C	Pass
Pre-Test Analyser Zero Check	Pass
Zero Drift Check	Pass
Span Drift Check	Pass
Overall Calibration Acceptability	Pass

Were all of the requirements of BS EN 12619:2013 fulfilled during the test?



Yes

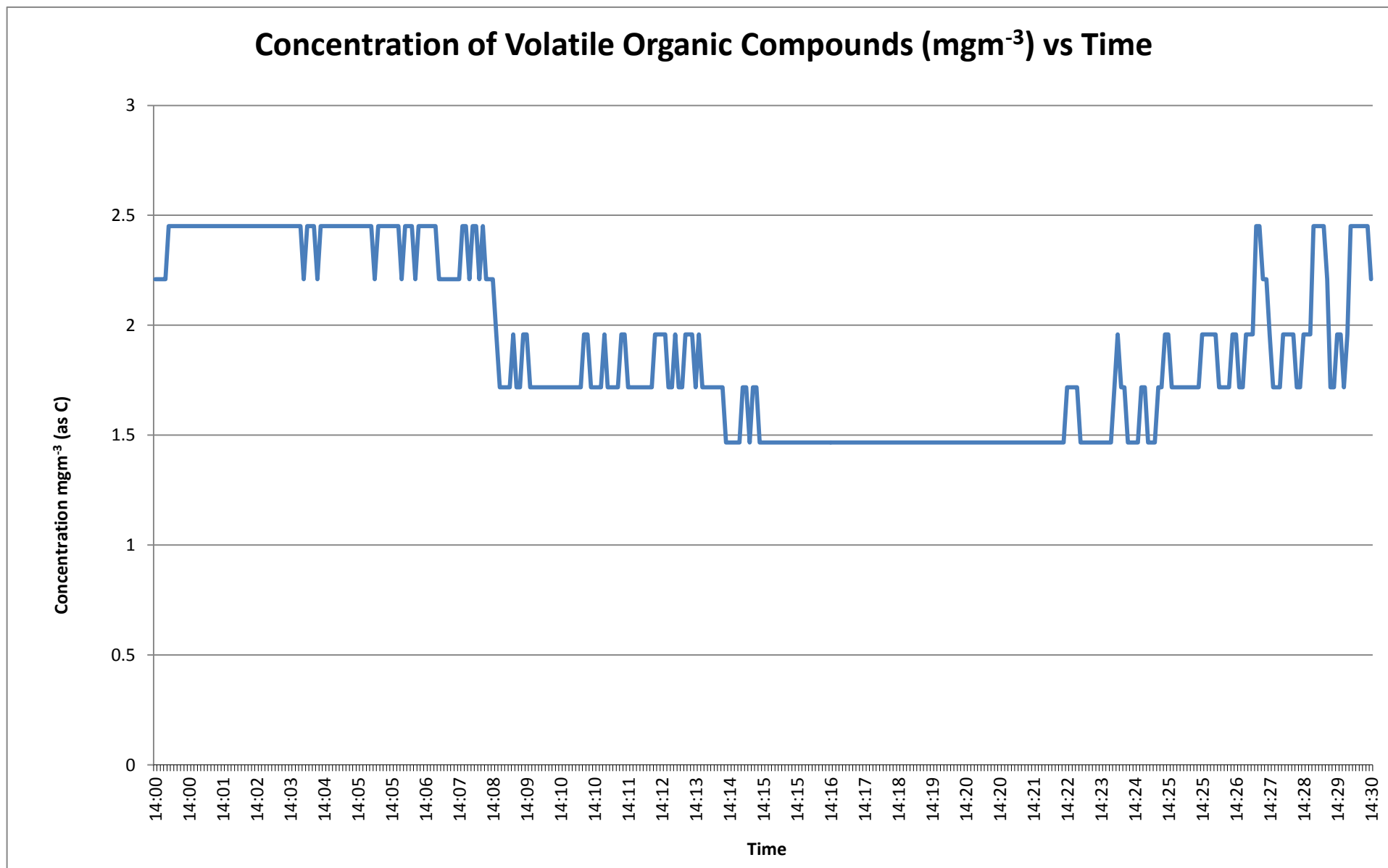


No

Appendix B3.4 Volatile Organic Compounds to BS EN 12619:2013 Stack 11 - Strip Press & Cooling bc

Uncertainty Calculation of Volatile Organic Compounds to BS EN 12619:2013							
Symbol	Source of Uncertainty	Value +/- ppm	Probability Distribution	Divisor	Ci	Ui() +/- ppm	V ₁ or V _{eff}
U _{AP}	Air Pressure	0.3785	Normal(K=2)	2	1	0.2	
U _{SP}	Sample Pressure	0.757	Normal(K=2)	2	1	0.4	
U _{T0}	Temp at 0°C	1.514	Normal(K=2)	2	1	0.8	
U _{TS}	Temp (sensitivity)	0.757	Normal(K=2)	2	1	0.4	
U _{H2O}	H2O cross-sensitivity	0.18925	Normal(K=2)	2	1	0.1	
U _{CO}	CO cross-sensitivity	0.0757	Normal(K=2)	2	1	0.0	
U _{CO2}	CO2 cross-sensitivity	0.3785	Normal(K=2)	2	1	0.2	
U _{NO}	NO cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{SO2}	SO2 cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{ZD}	Zero Drift	0.01	Normal(K=2)	2	1	0.0	
U _S	sensitivity Drift	0.3785	Normal(K=2)	2	1	0.2	
U _C	Calibration	1.514	Normal(K=2)	2	1	0.8	
U _C ()	Combined standard		normal			1.25	
U	Expanded		enter coverage	1.96		2.45	ppm
U	Expanded		enter coverage	1.96		1.31	mgm ⁻³

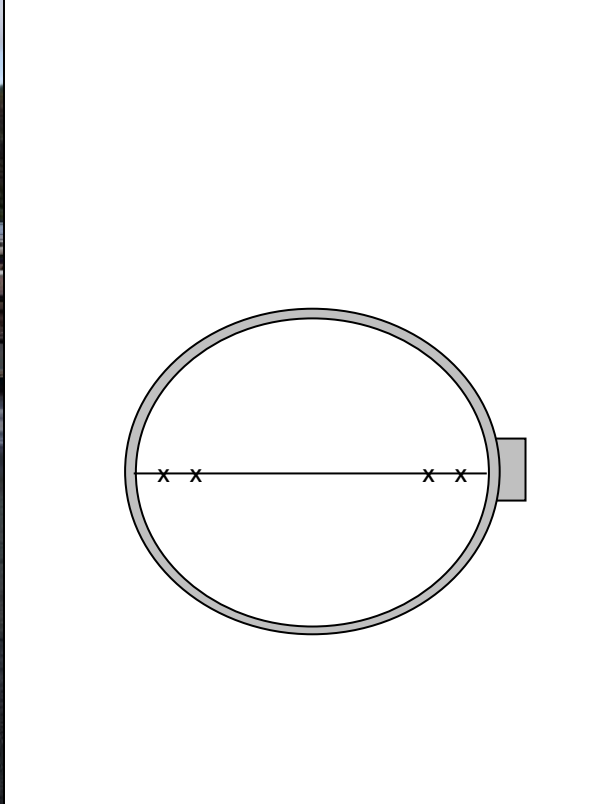
Appendix B3.4 Volatile Organic Compounds to BS EN 12619:2013 Stack 11 - Strip Press & Cooling booth



Appendix B: Emission Information

B4 - Stack 16 - 3C & 3D Cooling Table Information

B4.1 Diagrams Showing the Dimensions and Monitoring Facilities of Stack 16 - 3C & 3D Cooling Table

Photograph of Monitoring Point	Schematic of Sample Plane
	

B4.2 Preliminary Velocity and Temperature Measurement of Stack 16 - 3C & 3D Cooling Table

Traverse Point	Sample Line A			Sample Line B			Sample Line C			Sample line D		
	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)
1	26	8	0									
2	26	7	0									
3	26	6.5	0									
4	26	6.5	0									
5	26	7	0									
6	26	7.5	0									
7	26	9	0									
8	26	10.5	0									
9	26	13	0									
10	26	15.5	0									
	ΣΔP _A	90.5		ΣΔP _B			ΣΔP _C			ΣΔP _D		

Barometric Pressure (mmHg)	760	Stack velocity (actual) ms ⁻¹	10
Static Pressure (mmH ₂ O)	2.50	Volumetric Flow (actual) m ³ min ⁻¹	64
Diameter (m)	0.36	Assumed CO ₂ (%)	0.0
---		Assumed O ₂ (%)	20.9
Stack Area (m ²)	0.102	Assumed CO (%)	0.0
Port Size (mm)	100	Assumed H ₂ O (%)	0.0

Appendix B4.3 - Particulate Site Measurements - Stack 16 - 3C & 3D Cooling Table

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	29/09/2014
Plant Identification	Stack 16 - 3C & 3D Cooling Table	Run Number	1

Water Vapour Measurements

Impinger	Initial Wt (g)	Final Wt (g)
1	749.7	750.2
2	782.9	783
3	601.1	601.2
4	931.3	932.5
5		
6		
7		

Sample Reference Information

Filter Ref.	70496-29/09/14-F7
Probe Wash Ref.	70496-29/09/14-S7
Blank Filter Ref.	70496-29/09/14-F8
Blank Probe Wash Ref.	70496-29/09/14-S8

Leak Test Results

Initial Leak Test lmin ⁻¹	0.2000
Test Vacuum ("Hg)	23
Final Leak Test lmin ⁻¹	0.20000
Test Vacuum ("Hg)	23

Sampling Measurements

Point	Start and End Times	Duration (Min)	Vac ("Hg)	Stack Temp (°C)	Velocity Head ΔP (mmH ₂ O)	√ΔP (√mm.H ₂ O)	ΔP Orifice Meter (mm H ₂ O)	DGM (litres)	DGM Temp (°C)		Temp (°C)			
									In	Out	Probe	Filter	Impinger	Resin
1	15:15	5	2	26	6.5	2.55	29.96	1532678	24	24	161	-	9	---
2		5	2	26	6.5	2.55	29.96	1532856	25	24	162	-	9	---
3		5	2	26	6.5	2.55	29.96	1532941	26	24	160	-	9	---
4		5	2	26	7	2.65	32.27	1533039	27	24	163	-	9	---
5		5	2	26	7	2.65	32.27	1533131	27	24	163	-	9	---
6		5	2	26	7	2.65	32.27	1533208	28	27	162	-	9	---
7		5	2	26	9.5	3.08	43.79	1533301	29	27	160	-	9	---
8		5	2	26	9.5	3.08	43.79	1533398	31	29	164	-	9	---
9		5	2	26	9.5	3.08	43.79	1533483	31	29	165	-	9	---
10		5	2	26	10	3.16	46.10	1533568	32	30	165	-	9	---
11		5	2	26	10	3.16	46.10	1533643	32	30	163	-	9	---
12	16:15	5	2	26	10	3.16	46.10	1533748	33	31	162	-	9	---
13														
14														
15														
16														
17														
18														
19														
20														
	60	60	2.00	26.00	8.25	2.86	38.03	1070.00	28.75	26.92	162.50		9.00	

Appendix B4.3 - Total Particulates to BS EN 13284:2002 - Stack 16 - 3C & 3D Cooling Table

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley			
Site	Huntingdon	Date of Test	29 September 2014			
Plant Identification	Stack 16 - 3C & 3D Cooling Tab					
Volume of Water Vapour at Standard Conditions V_{wstd}						
$V_{wstd} = (0.00124) \times V_{lc}$	=	Blank	Test 1	Units		
		0.0024	0.0024	m^3		
Where:						
Constant	=	0.00124	0.00124			
V_{lc} is the mass of water collected	=	1.9	1.9		g	
Volume of Gas Metered, Standard Conditions V_{mstd}						
$V_{mstd} = \frac{(0.3592) \times V_m \times \left(P_b + \frac{\Delta H}{13.6} \right) \times Y_d}{(273 + T_m)}$	=	Blank	Test 1	Units		
		0.9931	0.9931	m^3		
Where:						
Correction for standard temperature and pressure	=	0.3592	0.3592		$Kmm.Hg^{-1}$	
V_m is the volume metered	=	1.0700	1.0700		m^3	
P_b is the barometric pressure	=	760	760		mm.Hg	
ΔH_{ave} is the average meter flow	=	38.0	38.0		mm.H ₂ O	
conversion from mm.H ₂ O to mm.Hg	=	13.6	13.6			
Y_d is the meter correction factor	=	1.0190	1.0190			
$^{\circ}C$ to K conversion constant	=	273	273		K	
T_m is the meter temperature	=	27.8	27.8		$^{\circ}C$	
Moisture Content B_{wo}						
$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$	=	Blank	Test 1			
		0.002	0.002			
Where:						
V_{wstd} is the volume of water vapour at standard conditions	=	0.0024	0.0024		m^3	
V_{mstd} is the volume of gas metered, standard conditions	=	0.9931	0.9931		m^3	
Velocity of Stack Gases V_s						
$V_s = K_p \times C_p \times \sqrt{\Delta P} \times \frac{\sqrt{T_s} + 273}{\sqrt{M_s \times P_s}}$	=	Blank	Test 1	ms^{-1}		
		9.9	9.9			
Where:						
K_p is the pitot tube velocity constant	=	34.97	34.97			
C_p is the pitot coefficient	=	0.834	0.834			
$(\sqrt{\Delta P})_{ave}$ is the average square root of velocity heads	=	2.86	2.86		$\sqrt{mm.H_2O}$	
T_s is the stack temperature	=	26.0	26.0		$^{\circ}C$	
$^{\circ}C$ to K conversion constant	=	273	273		K	
M_s is the molecular weight of gas	=	28.00	28.00		g/g mole	
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg	

Appendix B4.3 - Total Particulates to BS EN 13284:2002 - Stack 16 - 3C & 3D Cooling Table

Actual Flow Rate of Stack Gases Q_a					
$Q_a = 60 \times A_s \times V_s$	=	Blank 60.4	Test 1 60.4		$\text{m}^3 \text{min}^{-1}$
Where:					
Second to minute conversion	=	60	60		
A_s is the cross-sectional area of stack	=	0.102	0.102		m^2
V_s is the velocity of stack gases	=	9.9	9.9		ms^{-1}
Dry Total Flow Rate of Stack Gas Q_{std}					
$Q_{std} = \frac{Q_a \times P_s \times 0.3592 \times (1 - B_{wo})}{(\overline{T_s}) + 273}$	=	Blank 55.0	Test 1 55.0		$\text{m}^3 \text{min}^{-1}$
Where:					
Q_a is the actual flow rate of stack gases	=	60.4	60.4		$\text{m}^3 \text{min}^{-1}$
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg
Correction for standard temperature and pressure	=	0.3592	0.3592		Kmm.Hg ⁻¹
B_{wo} is the moisture content	=	0.002	0.002		
T_s is the stack temperature	=	26.0	26.0		°C
°C to K conversion constant	=	273	273		K
V_s is the velocity of stack gases	=	9.9	9.9		ms^{-1}
Percent Isokineticity %I					
$\%I = \frac{(4.6398 \times 10^6) \times (\overline{T_s} + 273) \times V_{mstd}}{P_s \times V_s \times A_n \times \theta \times (1 - B_{wo})}$	=	Blank 108.1	Test 1 108.1		%
Where:					
Constant	=	4.6398E+06	4.6398E+06		
T_s is the stack temperature	=	26.0	26.0		°C
°C to K conversion constant	=	273	273		K
V_{mstd} is the volume of gas metered, standard conditions	=	0.9931	0.9931		m^3
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg
V_s is the velocity of stack gases	=	9.9	9.9		ms^{-1}
A_n is the cross-sectional area of nozzle	=	28.34	28.34		mm^2
θ is the duration of test	=	60	60		minutes
B_{wo} is the moisture content	=	0.002	0.002		
Particulate Concentration $\text{C}_{\text{mgm}^{-3}}$ - Dry Basis					
$C_{\text{mgm}^{-3}} = \frac{M_n}{V_{mstd}}$	=	Blank 0.5	Test 1 0.5		mgm^{-3}
Where:					
Filter reference number		70496-29/09/14-F8	70496-29/09/14-F7		
Mn1 Particulate mass on filter.	=	0.04	0.04		mg
Probe wash reference number		70496-29/09/14-S8	70496-29/09/14-S7		
Mn2 Particulate mass in probe rinse.	=	0.5	0.5		mg
V_{mstd} is the volume of gas metered, standard conditions	=	0.9931	0.9931		m^3

Appendix B4.3 - Total Particulates to BS EN 13284:2002 - Stack 16 - 3C & 3D Cooling Table

Particulate Concentration $\text{C}_{\text{mgm}^{-3}}$ - Wet Basis					
$C_{\text{mgm}^{-3}(\text{wet})} = C_{\text{mgm}^{-3}} \times \frac{(100 - W_v)}{100}$	=	Blank 0.5	Test 1 0.5		mgm^{-3}
Where					
Concentrations at 273k and 101.3kPa Dry Basis	=	0.5	0.5		mgm^{-3}
Wv is the water vapour content %	=	0.2	0.2		%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis					
$C_{\text{atx}\%} = C_{\text{mgm}^{-3}} \times \frac{20.9 - O_{2\text{ref}}}{20.9 - O_{2\text{meas}}}$	=	Blank 0.5	Test 1 0.5		mgm^{-3}
Where:					
Atmospheric oxygen concentration	=	20.9	20.9		%
$O_{2\text{ref}}$ is the reference oxygen concentration	=	N/A	N/A		%
$O_{2\text{meas}}$ is the measured oxygen concentration	=	N/A	N/A		%
N/A = Not Applicable - Oxygen Not Measured					
Particulate Emission Rate $E_{\text{ghr}^{-1}}$					
$E_{\text{ghr}^{-1}} = C \times Q_{\text{std}} \times \frac{60}{1000}$	=	Blank 2	Test 1 2		ghr^{-1}
Where:					
$C_{\text{mgm}^{-3}}$ is the particulate concentration, dry basis	=	0.5	0.5		mgm^{-3}
Q_{std} is the dry total flow rate of stack gas	=	55.0	55.0		$\text{m}^3 \text{min}^{-1}$
60/1000 Conversion factor	=	0.060	0.060		
Comments on Compliance with BS EN 13284:2002					
Temperature maintained above 160°C	Pass				
Isokinetic Rate 95% to 115%	Pass				
Leak Rate <2%	Pass				
Overall Blank Value <10% of the LV ^a	Pass				
Duct gas flow with regard to stack axis <15°	Pass				
Duct gas flow: negative velocity - not permitted	Pass				
Duct gas flow: differential pressure at the pitot tube >5pa	Pass				
Duct gas flow: ratio of max to min velocity <3:1	Pass				
Number of sampling points	Pass				
Were all of the requirements of BS EN 13284:2002 fulfilled during the test? ✓ Yes No					

Appendix B4.3 - Total Particulates to BS EN 13284:2002 - Stack 16 - 3C & 3D Cooling Table

Uncertainty Calculations						
Measurement Data						
Measured Quantities	Symbol	Value	Standard Uncertainty			Units
Sampled Volume	V_m	0.9931	(1%) uV_m	0.00993		m^3
Sampled Gas Temperature	T_m	300.8	uT_m	3		k
Sampled Gas Pressure	p_m	101.7	up_m	0.1		kPa
Sampled Gas Humidity	H_m	0.2	uH_m	0.1		% by volume
Oxygen Content	$O_{2,m}$	N/A	$uO_{2,m}$	0.01		% by volume
Mass Particulate	m	0.54	um_m	0.03		mg
Leak	L	2	%	0.02		%
Uncollected Mass	UCM	0				mg
Intermediate Calculation to Correct for Standardisation of Conditions						
Factor for Std Conditions	fs	0.91				
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fs)		
	p_m	0.009		0.001		
	H_m	0.009		0.001		
	T_m	0.003		0.009		
	ufs			0.009		
Corrected Volume	V	0.90	uV	0.013		m^3
Intermediate Calculation to Correct for Oxygen Correction						
Factor for O_2 Correction	fc	1.00				
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fc)		
	$O_{2,m}$	1.00		0.010		
Factor for O_2 Correction	ufc	1.00		0.010		%
Calculation of Expanded Uncertainty						
Parameter		Value	Units	Sensitivity Coefficient	Uncertainty in Result	
Volume (Std conditions)	V	0.90	m^3	0.60	0.01	$mg.m^{-3}$
Mass	m	0.54	mg	1.00	0.03	$mg.m^{-3}$
Factor for O_2 Correction	fc	1.00		0.54	0.01	$mg.m^{-3}$
Leak	L	0.01	$mg.m^{-3}$	1.00	0.01	$mg.m^{-3}$
Uncollected mass	UCM	0.00	mg	1.00	0.00	$mg.m^{-3}$
Combined uncertainty					0.03	$mg.m^{-3}$
Expanded Uncertainty K=2					10.87	%
Expanded Uncertainty K=2					0.06	$mg.m^{-3}$

Appendix B4.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 16 - 3C & 3D Cooling Table

Company	VIP Polymers Ltd		Test Conducted by	N Teixeira & P Soley			
Site	Huntingdon		Date of Test	29 September 2014			
Plant Identification	Stack 16 - 3C & 3D Cooling Table		File Name:				
Choice of Measurement Range and Span Gas Concentration							
Parameter	ELV ppm C ₃ H ₈	Ideal Range (ppm)	Actual Range (ppm)	Ideal Span Gas Value	Actual Span Gas Value	2% of Span Gas Conc.	Analysers repeatability at zero
VOCs			100	50 - 90	75.7	1.51	0.830
Analysers and System, Zero and Span Checks (ppm)							
Times of pre and post system calibration checks				Time	10:40	Time	17:30
Parameter	Analysers Zero	Analysers Span	Analysers Zero Check	Pre-Test System Zero Check	Pre-Test System Span Check	Post-Test System Zero Check	Post-Test System Span Check
VOCs	0.0	75.7	0.3	0.3	75.0	0.2	75.0
Zero, Span and Drift Checks							
Parameter	Analysers Zero Check		Zero Drift Check		Span Drift Check		Overall Check
VOCs	0.3	Pass	-0.1	Pass	0	Pass	Pass
Correction of Data For Drift Effect							
Parameter	Adjustment	Check	Deviation	Drift/minute			
VOCs	Span	1.0134	1.0120	-0.0014	0.0000		
	Zero	-0.3040	-0.2024	0.1016	0.0002		
As Determined Concentrations Wet Basis (as C)							
$C_{ppm} = \frac{\sum 1 - n}{n} \times 3$				=	3.3 ppm		
where:							
Σ 1 - n is the sum of the readings				=	400		
n is the total number of readings				=	361		
3 is the conversion factor from ppm propane to ppm carbon				=	3		
Concentrations at 273k and 101.3kPa Wet Basis							
$C_{mgm^{-3}} = C_{ppm} \times \frac{mw}{22.4}$				=	1.8 mgm ⁻³		
where:							
C _{ppm} is the average concentration				=	3.3 ppm		
mw is the molecular weight of the gas under test				=	12		
22.4 is the volume of 1 mole of gas at STP				=	22.4 litres		

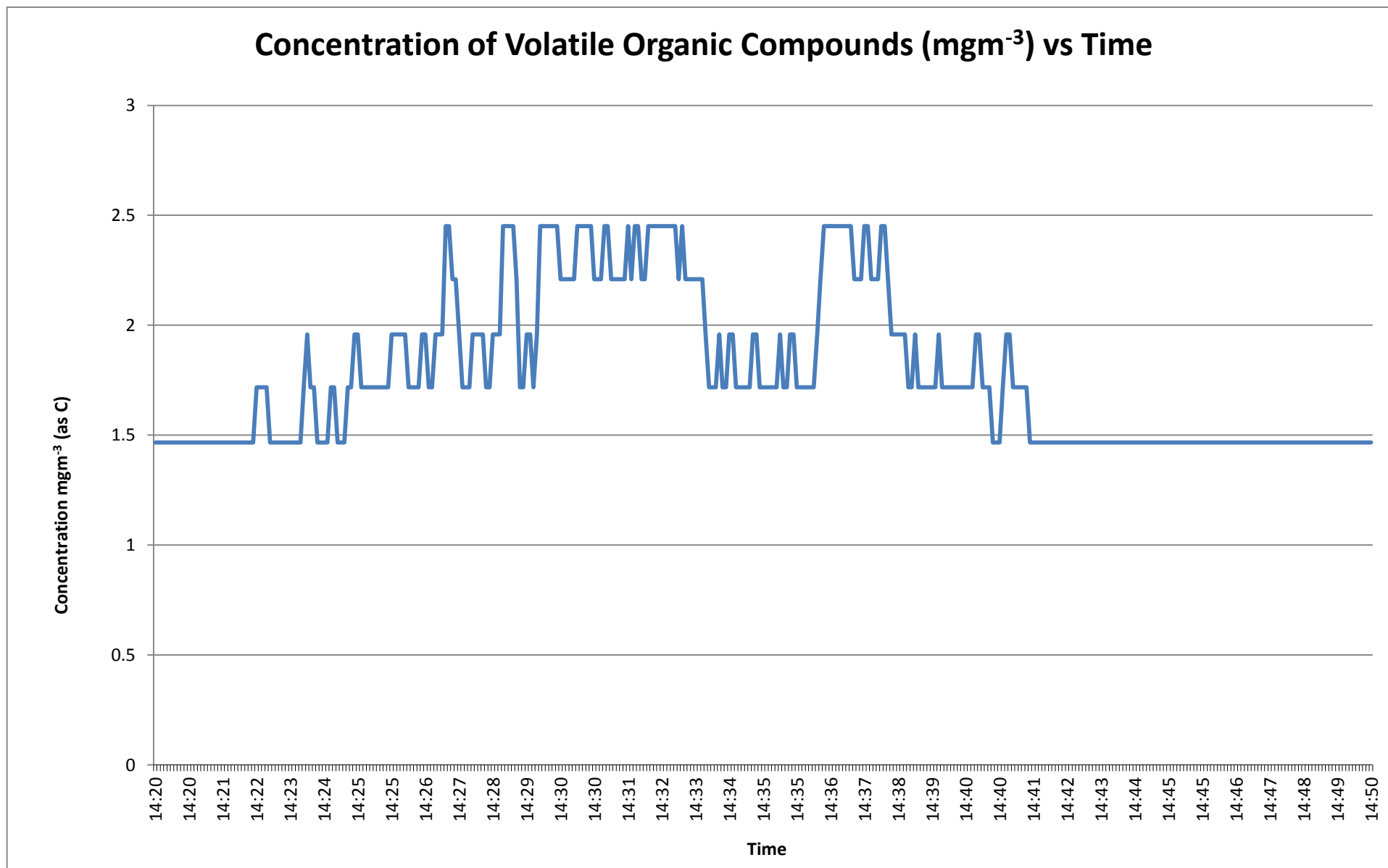
Appendix B4.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 16 - 3C & 3D Cooling Table

Concentrations at 273k and 101.3kPa Dry Basis			
$C_{mgm-3(wet)} = C_{mgm-3} \times \frac{100}{(100 - Wv)}$	=	1.8	mgm ⁻³
where:			
Concentrations at 273k and 101.3kPa Dry Basis	=	1.8	mgm ⁻³
Wv is the water vapour content	=	0.2	%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis			
$C_{at\%} = C_{mgm-3} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}}$	=	1.8	mgm ⁻³
where:			
20.9 is the atmospheric concentration of oxygen	=	20.9	%
O _{2ref} is the reference concentration	=	N/A	%
O _{2meas} is the measured concentration	=	N/A	%
N/A = Oxygen Not Measured			
Actual Rates of Discharge			
$E_{g/hr} = C \times Q_{std} \times \frac{60}{1000}$	=	6.2	ghr ⁻¹
where:			
C is the dry Concentration at STP	=	1.8	
Q _{std} is the dry flow rate at STP	=	57.9	
60/1000 is the conversion factor	=	0.060	
Comments on Compliance with BS EN 12619:2001			
Temperature maintained above 180°C	Pass		
Pre-Test Analyser Zero Check	Pass		
Zero Drift Check	Pass		
Span Drift Check	Pass		
Overall Calibration Acceptability	Pass		
Were all of the requirements of BS EN 12619:2013 fulfilled during the test? ✓ Yes No			

Appendix B4.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 16 - 3C & 3D Cooling Table

Uncertainty Calculation of Volatile Organic Compounds to BS EN 12619:2013							
Symbol	Source of Uncertainty	Value +/- ppm	Probability Distribution	Divisor	Ci	Ui() +/- ppm	V ₁ or V _{eff}
U _{AP}	Air Pressure	0.3785	Normal(K=2)	2	1	0.2	
U _{SP}	Sample Pressure	0.757	Normal(K=2)	2	1	0.4	
U _{T0}	Temp at 0°C	1.514	Normal(K=2)	2	1	0.8	
U _{TS}	Temp (sensitivity)	0.757	Normal(K=2)	2	1	0.4	
U _{H2O}	H2O cross-sensitivity	0.18925	Normal(K=2)	2	1	0.1	
U _{CO}	CO cross-sensitivity	0.0757	Normal(K=2)	2	1	0.0	
U _{CO2}	CO2 cross-sensitivity	0.3785	Normal(K=2)	2	1	0.2	
U _{NO}	NO cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{SO2}	SO2 cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{ZD}	Zero Drift	0.01	Normal(K=2)	2	1	0.0	
U _S	sensitivity Drift	0.3785	Normal(K=2)	2	1	0.2	
U _C	Calibration	1.514	Normal(K=2)	2	1	0.8	
U _C ()	Combined standard		normal			1.25	
U	Expanded		enter coverage	1.96		2.45	ppm
U	Expanded		enter coverage	1.96		1.31	mgm ⁻³

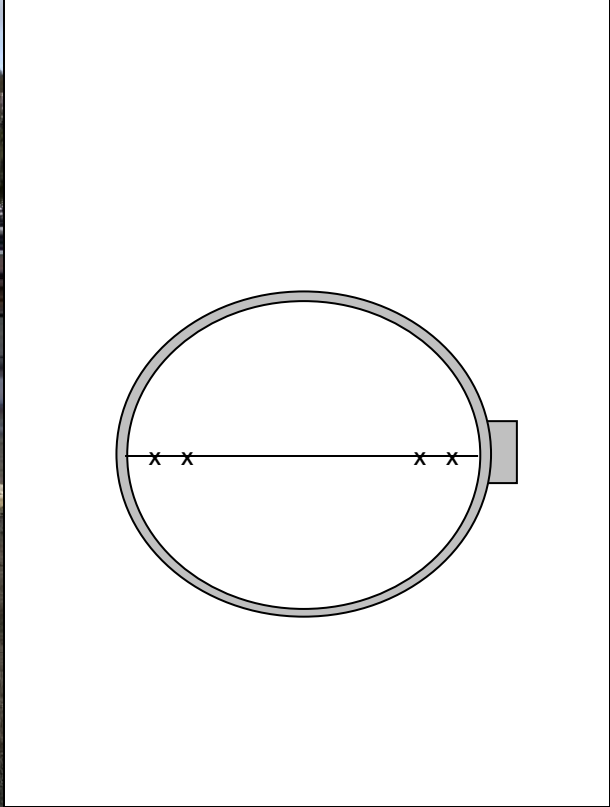
Appendix B4.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 16 - 3C & 3D Cooling Table



Appendix B: Emission Information

B5 - Stack 15 - Panstone's 3C & 3D Information

B5.1 Diagrams Showing the Dimensions and Monitoring Facilities of Stack 15 - Panstone's 3C & 3D

Photograph of Monitoring Point	Schematic of Sample Plane
	

B5.2 Preliminary Velocity and Temperature Measurement of Stack 15 - Panstone's 3C & 3D

Traverse Point	Sample Line A			Sample Line B			Sample Line C			Sample line D		
	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)
1	26	23	0									
2	26	20	0									
3	26	16.5	0									
4	26	15	0									
5	26	14	0									
6	26	13.5	0									
7	26	14.5	0									
8	26	14.5	0									
9	26	15	0									
10	26	15.5	0									
	ΣΔP _A	161.5		ΣΔP _B			ΣΔP _C			ΣΔP _D		

Barometric Pressure (mmHg)	760	Stack velocity (actual) ms ⁻¹	14
Static Pressure (mmH ₂ O)	9.00	Volumetric Flow (actual) m ³ min ⁻¹	85
Diameter (m)	0.36	Assumed CO ₂ (%)	0.0
---		Assumed O ₂ (%)	20.9
Stack Area (m ²)	0.102	Assumed CO (%)	0.0
Port Size (mm)	100	Assumed H ₂ O (%)	0.0

Appendix B5.3 - Particulate Site Measurements - Stack 15 - Panstone's 3C & 3D

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	29/09/2014
Plant Identification	Stack 15 - Panstone's 3C & 3D	Run Number	1

Water Vapour Measurements

Impinger	Initial Wt (g)	Final Wt (g)
1	750.2	751
2	783	783.2
3	601.2	601.2
4	932.5	932.5
5		
6		
7		

Sample Reference Information

Filter Ref.	70496-29/09/14-F9
Probe Wash Ref.	70496-29/09/14-S9
Blank Filter Ref.	70496-29/09/14-F10
Blank Probe Wash Ref.	70496-29/09/14-S10

Leak Test Results

Initial Leak Test lmin ⁻¹	0.2000
Test Vacuum ("Hg)	23
Final Leak Test lmin ⁻¹	0.20000
Test Vacuum ("Hg)	23

Sampling Measurements

Point	Start and End Times	Duration (Min)	Vac ("Hg)	Stack Temp (°C)	Velocity Head ΔP (mmH2O)	√ΔP (√mm.H2O)	ΔP Orifice Meter (mm H ₂ O)	DGM (litres)	DGM Temp (°C)		Temp (°C)			
								1533755	In	Out	Probe	Filter	Impinger	Resin
1	16:30	5	2	26	16	4.00	73.81	1533880	24	24	161	-	9	---
2		5	2	26	16	4.00	73.81	1534012	25	24	162	-	9	---
3		5	2	26	16	4.00	73.81	1534127	25	24	160	-	9	---
4		5	2	26	15	3.87	69.19	1534255	26	24	163	-	9	---
5		5	2	26	15	3.87	69.19	1534378	26	24	164	-	9	---
6		5	2	26	15	3.87	69.19	1534512	27	25	163	-	9	---
7		5	2	26	14.5	3.81	66.89	1534633	27	25	164	-	9	---
8		5	2	26	14.5	3.81	66.89	1534756	28	26	162	-	9	---
9		5	2	26	14.5	3.81	66.89	1534881	28	26	161	-	9	---
10		5	2	26	15	3.87	69.19	1535008	29	27	160	-	9	---
11		5	2	26	15	3.87	69.19	1535130	31	28	164	-	9	---
12	17:30	5	2	26	15	3.87	69.19	1535262	32	30	163	-	9	---
13														
14														
15														
16														
17														
18														
19														
20														
	60	60	2.00	26.00	15.13	3.89	69.77	1507.00	27.33	25.58	162.25		9.00	

Appendix B5.3 - Total Particulates to BS EN 13284:2002 - Stack 15 - Panstone's 3C & 3D

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley			
Site	Huntingdon	Date of Test	29 September 2014			
Plant Identification	Stack 15 - Panstone's 3C & 3D					
Volume of Water Vapour at Standard Conditions V_{wstd}						
$V_{wstd} = (0.00124) \times V_{lc}$	=	Blank	Test 1	Units		
		0.0012	0.0012	m^3		
Where:						
Constant	=	0.00124	0.00124			
V_{lc} is the mass of water collected	=	1	1		g	
Volume of Gas Metered, Standard Conditions V_{mstd}						
$V_{mstd} = \frac{(0.3592) \times V_m \times \left(P_b + \frac{\Delta H}{13.6} \right) \times Y_d}{(273 + T_m)}$	=	Blank	Test 1	Units		
		1.4094	1.4094	m^3		
Where:						
Correction for standard temperature and pressure	=	0.3592	0.3592		$Kmm.Hg^{-1}$	
V_m is the volume metered	=	1.5070	1.5070		m^3	
P_b is the barometric pressure	=	760	760		mm.Hg	
ΔH_{ave} is the average meter flow	=	69.8	69.8		mm.H ₂ O	
conversion from mm.H ₂ O to mm.Hg	=	13.6	13.6			
Y_d is the meter correction factor	=	1.0190	1.0190			
$^{\circ}C$ to K conversion constant	=	273	273		K	
T_m is the meter temperature	=	26.5	26.5		$^{\circ}C$	
Moisture Content B_{wo}						
$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$	=	Blank	Test 1			
		0.001	0.001			
Where:						
V_{wstd} is the volume of water vapour at standard conditions	=	0.0012	0.0012		m^3	
V_{mstd} is the volume of gas metered, standard conditions	=	1.4094	1.4094		m^3	
Velocity of Stack Gases V_s						
$V_s = K_p \times C_p \times \sqrt{\Delta P} \times \frac{\sqrt{T_s} + 273}{\sqrt{M_s \times P_s}}$	=	Blank	Test 1	ms^{-1}		
		13.4	13.4			
Where:						
K_p is the pitot tube velocity constant	=	34.97	34.97			
C_p is the pitot coefficient	=	0.834	0.834			
$(\sqrt{\Delta P})_{ave}$ is the average square root of velocity heads	=	3.89	3.89		$\sqrt{mm.H_2O}$	
T_s is the stack temperature	=	26.0	26.0		$^{\circ}C$	
$^{\circ}C$ to K conversion constant	=	273	273		K	
M_s is the molecular weight of gas	=	28.00	28.00		g/g mole	
P_s is the absolute pressure of stack gas	=	761	761		mm.Hg	

Appendix B5.3 - Total Particulates to BS EN 13284:2002 - Stack 15 - Panstone's 3C & 3D

Actual Flow Rate of Stack Gases Q_a					
$Q_a = 60 \times A_s \times V_s$	=	Blank 82.1	Test 1 82.1		$\text{m}^3 \text{min}^{-1}$
Where:					
Second to minute conversion	=	60	60		
A_s is the cross-sectional area of stack	=	0.102	0.102		m^2
V_s is the velocity of stack gases	=	13.4	13.4		ms^{-1}
Dry Total Flow Rate of Stack Gas Q_{std}					
$Q_{std} = \frac{Q_a \times P_s \times 0.3592 \times (1 - B_{wo})}{(\overline{T_s}) + 273}$	=	Blank 74.9	Test 1 74.9		$\text{m}^3 \text{min}^{-1}$
Where:					
Q_a is the actual flow rate of stack gases	=	82.1	82.1		$\text{m}^3 \text{min}^{-1}$
P_s is the absolute pressure of stack gas	=	761	761		mm.Hg
Correction for standard temperature and pressure	=	0.3592	0.3592		Kmm.Hg ⁻¹
B_{wo} is the moisture content	=	0.001	0.001		
T_s is the stack temperature	=	26.0	26.0		°C
°C to K conversion constant	=	273	273		K
V_s is the velocity of stack gases	=	13.4	13.4		ms^{-1}
Percent Isokineticity %I					
$\%I = \frac{(4.6398 \times 10^6) \times (\overline{T_s} + 273) \times V_{mstd}}{P_s \times V_s \times A_n \times \theta \times (1 - B_{wo})}$	=	Blank 112.6	Test 1 112.6		%
Where:					
Constant	=	4.6398E+06	4.6398E+06		
T_s is the stack temperature	=	26.0	26.0		°C
°C to K conversion constant	=	273	273		K
V_{mstd} is the volume of gas metered, standard conditions	=	1.4094	1.4094		m^3
P_s is the absolute pressure of stack gas	=	761	761		mm.Hg
V_s is the velocity of stack gases	=	13.4	13.4		ms^{-1}
A_n is the cross-sectional area of nozzle	=	28.34	28.34		mm^2
θ is the duration of test	=	60	60		minutes
B_{wo} is the moisture content	=	0.001	0.001		
Particulate Concentration $\text{C}_{\text{mgm}^{-3}}$ - Dry Basis					
$C_{\text{mgm}^{-3}} = \frac{M_n}{V_{mstd}}$	=	Blank 0.6	Test 1 0.8		mgm^{-3}
Where:					
Filter reference number		70496-29/09/14-F10	70496-29/09/14-F9		
Mn1 Particulate mass on filter.	=	0.04	0.04		mg
Probe wash reference number		70496-29/09/14-S10	70496-29/09/14-S9		
Mn2 Particulate mass in probe rinse.	=	0.8	1.1		mg
V_{mstd} is the volume of gas metered, standard conditions	=	1.4094	1.4094		m^3

Appendix B5.3 - Total Particulates to BS EN 13284:2002 - Stack 15 - Panstone's 3C & 3D

Particulate Concentration $C_{mgm^{-3}}$ - Wet Basis					
$C_{mgm^{-3} (wet)} = C_{mgm^{-3}} \times \frac{(100 - W_v)}{100}$	=	Blank 0.6	Test 1 0.8		mgm^{-3}
Where					
Concentrations at 273k and 101.3kPa Dry Basis	=	0.6	0.8		mgm^{-3}
W _v is the water vapour content %	=	0.1	0.1		%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis					
$C_{atx\%} = C_{mgm^{-3}} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}}$	=	Blank 0.6	Test 1 0.8		mgm^{-3}
Where:					
Atmospheric oxygen concentration	=	20.9	20.9		%
O _{2ref} is the reference oxygen concentration	=	N/A	N/A		%
O _{2meas} is the measured oxygen concentration	=	N/A	N/A		%
N/A = Not Applicable - Oxygen Not Measured					
Particulate Emission Rate $E_{ghr^{-1}}$					
$E_{ghr^{-1}} = C \times Q_{std} \times \frac{60}{1000}$	=	Blank 3	Test 1 4		ghr^{-1}
Where:					
$C_{mgm^{-3}}$ is the particulate concentration, dry basis	=	0.6	0.8		mgm^{-3}
Q _{std} is the dry total flow rate of stack gas	=	74.9	74.9		$m^3 min^{-1}$
60/1000 Conversion factor	=	0.060	0.060		
Comments on Compliance with BS EN 13284:2002					
Temperature maintained above 160°C	Pass				
Isokinetic Rate 95% to 115%	Pass				
Leak Rate <2%	Pass				
Overall Blank Value <10% of the LV ^a	Pass				
Duct gas flow with regard to stack axis <15°	Pass				
Duct gas flow: negative velocity - not permitted	Pass				
Duct gas flow: differential pressure at the pitot tube >5pa	Pass				
Duct gas flow: ratio of max to min velocity <3:1	Pass				
Number of sampling points	Pass				
Were all of the requirements of BS EN 13284:2002 fulfilled during the test? ✓ Yes No					

Appendix B5.3 - Total Particulates to BS EN 13284:2002 - Stack 15 - Panstone's 3C & 3D

Uncertainty Calculations					
Measurement Data					
Measured Quantities	Symbol	Value	Standard Uncertainty		Units
Sampled Volume	V_m	1.4094	(1%) uV_m	0.01409	m^3
Sampled Gas Temperature	T_m	299.5	uT_m	3	k
Sampled Gas Pressure	p_m	102.0	up_m	0.1	kPa
Sampled Gas Humidity	H_m	0.1	uH_m	0.1	% by volume
Oxygen Content	$O_{2,m}$	N/A	$uO_{2,m}$	0.01	% by volume
Mass Particulate	m	1.14	um_m	0.06	mg
Leak	L	2	%	0.02	%
Uncollected Mass	UCM	0			mg
Intermediate Calculation to Correct for Standardisation of Conditions					
Factor for Std Conditions	fs	0.92			
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fs)	
	p_m	0.009		0.001	
	H_m	0.009		0.001	
	T_m	0.003		0.009	
	ufs			0.009	
Corrected Volume	V	1.29	uV	0.019	m^3
Intermediate Calculation to Correct for Oxygen Correction					
Factor for O_2 Correction	fc	1.00			
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fc)	
	$O_{2,m}$	1.00		0.010	
Factor for O_2 Correction	ufc	1.00		0.010	%
Calculation of Expanded Uncertainty					
Parameter		Value	Units	Sensitivity Coefficient	Uncertainty in Result
Volume (Std conditions)	V	1.29	m^3	0.63	0.01
Mass	m	1.14	mg	0.71	0.04
Factor for O_2 Correction	fc	1.00		0.81	0.01
Leak	L	0.01	$mg.m^{-3}$	1.00	0.01
Uncollected mass	UCM	0.00	mg	0.71	0.00
Combined uncertainty					0.04
Expanded Uncertainty K=2				10.87	%
Expanded Uncertainty K=2				0.09	$mg.m^{-3}$

Appendix B5.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 15 - Panstone's 3C & 3D

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley						
Site	Huntingdon	Date of Test	29 September 2014						
Plant Identification	Stack 15 - Panstone's 3C & 3D	File Name:							
Choice of Measurement Range and Span Gas Concentration									
Parameter	ELV ppm C ₃ H ₈	Ideal Range (ppm)	Actual Range (ppm)	Ideal Span Gas Value	Actual Span Gas Value	2% of Span Gas Conc.	Analysers repeatability at zero		
VOCs			100	50 - 90	75.7	1.51	0.830		
Analysers and System, Zero and Span Checks (ppm)									
Times of pre and post system calibration checks				Time	10:40	Time	17:30		
Parameter	Analysers Zero	Analysers Span	Analysers Zero Check	Pre-Test System Zero Check	Pre-Test System Span Check	Post-Test System Zero Check	Post-Test System Span Check		
VOCs	0.0	75.7	0.3	0.3	75.0	0.2	75.0		
Zero, Span and Drift Checks									
Parameter	Analysers Zero Check		Zero Drift Check		Span Drift Check		Overall Check		
VOCs	0.3	Pass	-0.1	Pass	0	Pass	Pass		
Correction of Data For Drift Effect									
Parameter	Adjustment	Check	Deviation	Drift/minute					
VOCs	Span	1.0134	1.0120	-0.0014	0.0000				
	Zero	-0.3040	-0.2024	0.1016	0.0002				
As Determined Concentrations Wet Basis (as C)									
$C_{ppm} = \frac{\sum 1 - n}{n} \times 3 = 0.7 \text{ ppm}$									
where:									
Σ 1 - n is the sum of the readings				=	81				
n is the total number of readings				=	361				
3 is the conversion factor from ppm propane to ppm carbon				=	3				
Concentrations at 273k and 101.3kPa Wet Basis									
$C_{mgm^{-3}} = C_{ppm} \times \frac{mw}{22.4} = 0.4 \text{ mgm}^{-3}$									
where:									
C _{ppm} is the average concentration				=	0.7	ppm			
mw is the molecular weight of the gas under test				=	12				
22.4 is the volume of 1 mole of gas at STP				=	22.4	litres			

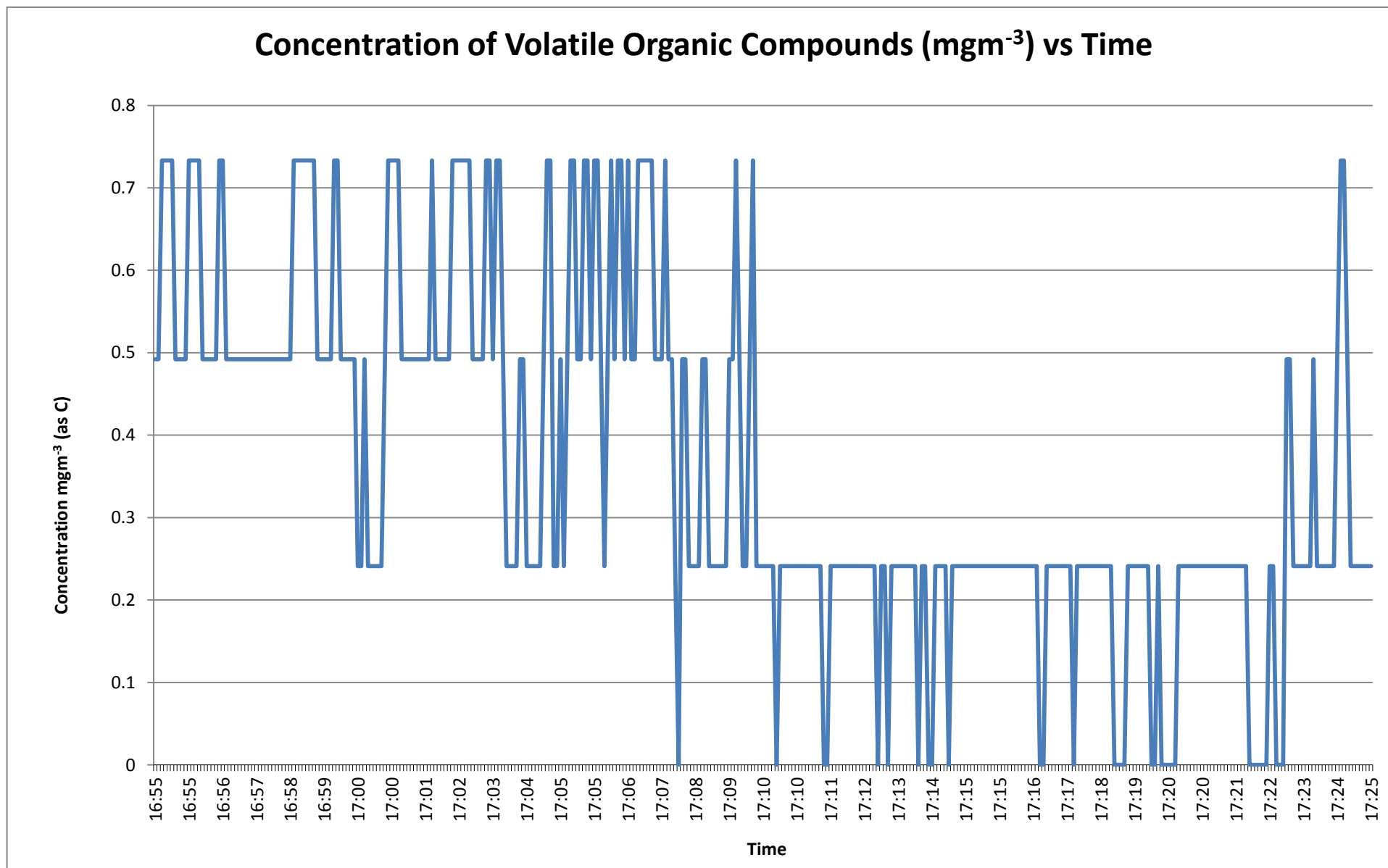
Appendix B5.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 15 - Panstone's 3C & 3D

Concentrations at 273k and 101.3kPa Dry Basis			
$C_{mgm^{-3}(wet)} = C_{mgm^{-3}} \times \frac{100}{(100 - W_v)}$		0.4	mgm ⁻³
where:			
Concentrations at 273k and 101.3kPa Dry Basis	=	0.4	mgm ⁻³
W _v is the water vapour content	=	0.1	%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis			
$C_{atX\%} = C_{mgm^{-3}} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}}$	=	0.4	mgm ⁻³
where:			
20.9 is the atmospheric concentration of oxygen	=	20.9	%
O _{2ref} is the reference concentration	=	N/A	%
O _{2meas} is the measured concentration	=	N/A	%
N/A = Oxygen Not Measured			
Actual Rates of Discharge			
$E_{g/hr} = C \times Q_{std} \times \frac{60}{1000}$	=	1.7	ghr ⁻¹
where:			
C is the dry Concentration at STP	=	0.4	
Q _{std} is the dry flow rate at STP	=	77.4	
60/1000 is the conversion factor	=	0.060	
Comments on Compliance with BS EN 12619:2001			
Temperature maintained above 180°C	Pass		
Pre-Test Analyser Zero Check	Pass		
Zero Drift Check	Pass		
Span Drift Check	Pass		
Overall Calibration Acceptability	Pass		
Were all of the requirements of BS EN 12619:2013 fulfilled during the test? ☒ ☐ Yes No			

Appendix B5.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 15 - Panstone's 3C & 3D

Uncertainty Calculation of Volatile Organic Compounds to BS EN 12619:2013							
Symbol	Source of Uncertainty	Value +/- ppm	Probability Distribution	Divisor	Ci	Ui() +/- ppm	V ₁ or V _{eff}
U _{AP}	Air Pressure	0.3785	Normal(K=2)	2	1	0.2	
U _{SP}	Sample Pressure	0.757	Normal(K=2)	2	1	0.4	
U _{T0}	Temp at 0°C	1.514	Normal(K=2)	2	1	0.8	
U _{TS}	Temp (sensitivity)	0.757	Normal(K=2)	2	1	0.4	
U _{H2O}	H2O cross-sensitivity	0.18925	Normal(K=2)	2	1	0.1	
U _{CO}	CO cross-sensitivity	0.0757	Normal(K=2)	2	1	0.0	
U _{CO2}	CO2 cross-sensitivity	0.3785	Normal(K=2)	2	1	0.2	
U _{NO}	NO cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{SO2}	SO2 cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{ZD}	Zero Drift	0.01	Normal(K=2)	2	1	0.0	
U _S	sensitivity Drift	0.3785	Normal(K=2)	2	1	0.2	
U _C	Calibration	1.514	Normal(K=2)	2	1	0.8	
U _C ()	Combined standard		normal			1.25	
U	Expanded		enter coverage	1.96		2.45	ppm
U	Expanded		enter coverage	1.96		1.31	mgm ⁻³

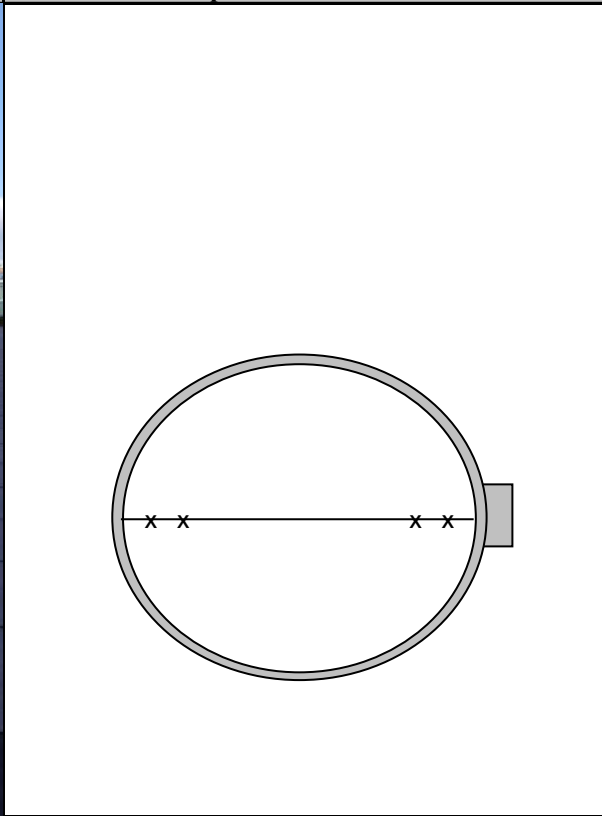
Appendix B5.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 15 - Panstone's 3C & 3D



Appendix B: Emission Information

B6 - Stack 27 - The Cooling Booth on Desma 16 Information

B6.1 Diagrams Showing the Dimensions and Monitoring Facilities of Stack 27 - The Cooling Booth on Desma 16

Photograph of Monitoring Point	Schematic of Sample Plane
	

B6.2 Preliminary Velocity and Temperature Measurement of Stack 27 - The Cooling Booth on Desma 16

Traverse Point	Sample Line A			Sample Line B			Sample Line C			Sample line D		
	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)
1	20	1.5	0									
2	20	2	0									
3	20	2	0									
4	20	2	0									
5	20	2.5	0									
6	20	2.5	0									
7	20	3	0									
8	20	3.5	0									
9	20	3.5	0									
10	20	3.5	0									
	ΣΔP _A	26		ΣΔP _B			ΣΔP _C			ΣΔP _D		

Barometric Pressure (mmHg)	760	Stack velocity (actual) ms ⁻¹	6
Static Pressure (mmH ₂ O)	2.00	Volumetric Flow (actual) m ³ min ⁻¹	27
Diameter (m)	0.32	Assumed CO ₂ (%)	0.0
---		Assumed O ₂ (%)	20.9
Stack Area (m ²)	0.080	Assumed CO (%)	0.0
Port Size (mm)	100	Assumed H ₂ O (%)	0.0

Appendix B6.3 - Particulate Site Measurements - Stack 27 - The Cooling Booth on Desma 16

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	29/09/2014
Plant Identification	Stack 27 - The Cooling Booth on Desma 16	Run Number	1

Water Vapour Measurements

Impinger	Initial Wt (g)	Final Wt (g)
1	745.6	745.8
2	781.2	781.4
3	601.2	601.2
4	932.5	934.5
5		
6		
7		

Sample Reference Information

Filter Ref.	70496-30/09/14-F11
Probe Wash Ref.	70496-30/09/14-S11
Blank Filter Ref.	70496-30/09/14-F12
Blank Probe Wash Ref.	70496-30/09/14-S12

Leak Test Results

Initial Leak Test lmin ⁻¹	0.1000
Test Vacuum ("Hg)	23
Final Leak Test lmin ⁻¹	0.10000
Test Vacuum ("Hg)	23

Sampling Measurements

Point	Start and End Times	Duration (Min)	Vac ("Hg)	Stack Temp (°C)	Velocity Head ΔP (mmH ₂ O)	√ΔP (√mm.H ₂ O)	ΔP Orifice Meter (mm H ₂ O)	DGM (litres)	DGM Temp (°C)		Temp (°C)			
									In	Out	Probe	Filter	Impinger	Resin
1	09:45	5	2	21	2	1.41	20.98	1535269	19	19	161	-	9	---
2		5	2	21	2	1.41	20.98	1535334	21	19	162	-	9	---
3		5	2	21	2	1.41	20.98	1535389	23	20	160	-	9	---
4		5	2	21	3	1.73	31.47	1535461	24	22	162	-	9	---
5		5	2	21	3	1.73	31.47	1535526	24	22	165	-	9	---
6		5	2	21	3	1.73	31.47	1535594	25	22	163	-	9	---
7		5	2	21	2.5	1.58	26.22	1535657	26	24	161	-	9	---
8		5	2	21	2.5	1.58	26.22	1535721	26	24	160	-	9	---
9		5	2	21	2.5	1.58	26.22	1535786	27	25	163	-	9	---
10		5	2	21	2	1.41	20.98	1535844	29	25	163	-	9	---
11		5	2	21	2	1.41	20.98	1535922	30	27	164	-	9	---
12	10:45	5	2	21	2	1.41	20.98	1535984	31	29	161	-	9	---
13								1536050						
14														
15														
16														
17														
18														
19														
20														
	60	60	2.00	21.00	2.38	1.54	24.91	781.00	25.42	23.17	162.08		9.00	

Appendix B6.3 - Total Particulates to BS EN 13284:2002 - Stack 27 - The Cooling Booth on Desma 16

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley			
Site	Huntingdon	Date of Test	29 September 2014			
Plant Identification	Stack 27 - The Cooling Booth or					
Volume of Water Vapour at Standard Conditions V_{wstd}						
$V_{wstd} = (0.00124) \times V_{lc}$	=	Blank	Test 1	Units		
		0.0030	0.0030	m^3		
Where:						
Constant	=	0.00124	0.00124			
V_{lc} is the mass of water collected	=	2.4	2.4		g	
Volume of Gas Metered, Standard Conditions V_{mstd}						
$V_{mstd} = \frac{(0.3592) \times V_m \times \left(P_b + \frac{\Delta H}{13.6} \right) \times Y_d}{(273 + T_m)}$	=	Blank	Test 1	Units		
		0.7326	0.7326	m^3		
Where:						
Correction for standard temperature and pressure	=	0.3592	0.3592		Kmm.Hg ⁻¹	
V_m is the volume metered	=	0.7810	0.7810		m^3	
P_b is the barometric pressure	=	760	760		mm.Hg	
ΔH_{ave} is the average meter flow	=	24.9	24.9		mm.H ₂ O	
conversion from mm.H ₂ O to mm.Hg	=	13.6	13.6			
Y_d is the meter correction factor	=	1.0190	1.0190			
$^{\circ}C$ to K conversion constant	=	273	273		K	
T_m is the meter temperature	=	24.3	24.3		$^{\circ}C$	
Moisture Content B_{wo}						
$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$	=	Blank	Test 1			
		0.004	0.004			
Where:						
V_{wstd} is the volume of water vapour at standard conditions	=	0.0030	0.0030		m^3	
V_{mstd} is the volume of gas metered, standard conditions	=	0.7326	0.7326		m^3	
Velocity of Stack Gases V_s						
$V_s = K_p \times C_p \times \sqrt{\Delta P} \times \frac{\sqrt{T_s} + 273}{\sqrt{M_s \times P_s}}$	=	Blank	Test 1	ms^{-1}		
		5.3	5.3			
Where:						
K_p is the pitot tube velocity constant	=	34.97	34.97			
C_p is the pitot coefficient	=	0.834	0.834			
$(\sqrt{\Delta P})_{ave}$ is the average square root of velocity heads	=	1.54	1.54		$\sqrt{mm.H_2O}$	
T_s is the stack temperature	=	21.0	21.0		$^{\circ}C$	
$^{\circ}C$ to K conversion constant	=	273	273		K	
M_s is the molecular weight of gas	=	28.00	28.00		g/g mole	
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg	

Appendix B6.3 - Total Particulates to BS EN 13284:2002 - Stack 27 - The Cooling Booth on Desma 16

Actual Flow Rate of Stack Gases Q_a					
$Q_a = 60 \times A_s \times V_s$	=	Blank 25.4	Test 1 25.4		$\text{m}^3 \text{min}^{-1}$
Where:					
Second to minute conversion	=	60	60		
A_s is the cross-sectional area of stack	=	0.080	0.080		m^2
V_s is the velocity of stack gases	=	5.3	5.3		ms^{-1}
Dry Total Flow Rate of Stack Gas Q_{std}					
$Q_{std} = \frac{Q_a \times P_s \times 0.3592 \times (1 - B_{wo})}{(\overline{T_s}) + 273}$	=	Blank 23.5	Test 1 23.5		$\text{m}^3 \text{min}^{-1}$
Where:					
Q_a is the actual flow rate of stack gases	=	25.4	25.4		$\text{m}^3 \text{min}^{-1}$
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg
Correction for standard temperature and pressure	=	0.3592	0.3592		Kmm.Hg ⁻¹
B_{wo} is the moisture content	=	0.004	0.004		
T_s is the stack temperature	=	21.0	21.0		°C
°C to K conversion constant	=	273	273		K
V_s is the velocity of stack gases	=	5.3	5.3		ms^{-1}
Percent Isokineticity %I					
$\%I = \frac{(4.6398 \times 10^6) \times (\overline{T_s} + 273) \times V_{mstd}}{P_s \times V_s \times A_n \times \theta \times (1 - B_{wo})}$	=	Blank 98.8	Test 1 98.8		%
Where:					
Constant	=	4.6398E+06	4.6398E+06		
T_s is the stack temperature	=	21.0	21.0		°C
°C to K conversion constant	=	273	273		K
V_{mstd} is the volume of gas metered, standard conditions	=	0.7326	0.7326		m^3
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg
V_s is the velocity of stack gases	=	5.3	5.3		ms^{-1}
A_n is the cross-sectional area of nozzle	=	42.31	42.31		mm^2
θ is the duration of test	=	60	60		minutes
B_{wo} is the moisture content	=	0.004	0.004		
Particulate Concentration $\text{C}_{\text{mgm}^{-3}}$ - Dry Basis					
$C_{\text{mgm}^{-3}} = \frac{M_n}{V_{mstd}}$	=	Blank 0.7	Test 1 1.3		mgm^{-3}
Where:					
Filter reference number		70496-30/09/14-F12	70496-30/09/14-F11		
Mn1 Particulate mass on filter.	=	0.04	0.04		mg
Probe wash reference number		70496-30/09/14-S12	70496-30/09/14-S11		
Mn2 Particulate mass in probe rinse.	=	0.5	0.9		mg
V_{mstd} is the volume of gas metered, standard conditions	=	0.7326	0.7326		m^3

Appendix B6.3 - Total Particulates to BS EN 13284:2002 - Stack 27 - The Cooling Booth on Desma 16

Particulate Concentration $C_{mgm^{-3}}$ - Wet Basis					
$C_{mgm^{-3} (wet)} = C_{mgm^{-3}} \times \frac{(100 - W_v)}{100}$	=	Blank 0.7	Test 1 1.3		mgm^{-3}
Where					
Concentrations at 273k and 101.3kPa Dry Basis	=	0.7	1.3		mgm^{-3}
W _v is the water vapour content %	=	0.4	0.4		%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis					
$C_{atx\%} = C_{mgm^{-3}} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}}$	=	Blank 0.7	Test 1 1.3		mgm^{-3}
Where:					
Atmospheric oxygen concentration	=	20.9	20.9		%
O _{2ref} is the reference oxygen concentration	=	N/A	N/A		%
O _{2meas} is the measured oxygen concentration	=	N/A	N/A		%
N/A = Not Applicable - Oxygen Not Measured					
Particulate Emission Rate $E_{ghr^{-1}}$					
$E_{ghr^{-1}} = C \times Q_{std} \times \frac{60}{1000}$	=	Blank 1	Test 1 2		ghr^{-1}
Where:					
C _{mgm⁻³} is the particulate concentration, dry basis	=	0.7	1.3		mgm^{-3}
Q _{std} is the dry total flow rate of stack gas	=	23.5	23.5		$m^3 min^{-1}$
60/1000 Conversion factor	=	0.060	0.060		
Comments on Compliance with BS EN 13284:2002					
Temperature maintained above 160°C	Pass				
Isokinetic Rate 95% to 115%	Pass				
Leak Rate <2%	Pass				
Overall Blank Value <10% of the LV ^a	Pass				
Duct gas flow with regard to stack axis <15°	Pass				
Duct gas flow: negative velocity - not permitted	Pass				
Duct gas flow: differential pressure at the pitot tube >5pa	Pass				
Duct gas flow: ratio of max to min velocity <3:1	Pass				
Number of sampling points	Pass				
Were all of the requirements of BS EN 13284:2002 fulfilled during the test? ✓ Yes No					

Appendix B6.3 - Total Particulates to BS EN 13284:2002 - Stack 27 - The Cooling Booth on Desma 16

Uncertainty Calculations					
Measurement Data					
Measured Quantities	Symbol	Value	Standard Uncertainty		Units
Sampled Volume	V_m	0.7326	(1%) uV_m	0.00733	m^3
Sampled Gas Temperature	T_m	297.3	uT_m	3	k
Sampled Gas Pressure	p_m	101.5	up_m	0.1	kPa
Sampled Gas Humidity	H_m	0.4	uH_m	0.1	% by volume
Oxygen Content	$O_{2,m}$	N/A	$uO_{2,m}$	0.01	% by volume
Mass Particulate	m	0.94	um_m	0.05	mg
Leak	L	2	%	0.02	%
Uncollected Mass	UCM	0			mg
Intermediate Calculation to Correct for Standardisation of Conditions					
Factor for Std Conditions	fs	0.92			
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fs)	
	p_m	0.009		0.001	
	H_m	0.009		0.001	
	T_m	0.003		0.009	
	ufs			0.009	
Corrected Volume	V	0.67	uV	0.010	m^3
Intermediate Calculation to Correct for Oxygen Correction					
Factor for O_2 Correction	fc	1.00			
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fc)	
	$O_{2,m}$	1.00		0.010	
Factor for O_2 Correction	ufc	1.00		0.010	%
Calculation of Expanded Uncertainty					
Parameter		Value	Units	Sensitivity Coefficient	Uncertainty in Result
Volume (Std conditions)	V	0.67	m^3	1.90	0.02
Mass	m	0.94	mg	1.36	0.06
Factor for O_2 Correction	fc	1.00		1.28	0.01
Leak	L	0.01	$mg.m^{-3}$	1.00	0.01
Uncollected mass	UCM	0.00	mg	1.36	0.00
Combined uncertainty					0.07
Expanded Uncertainty K=2				10.87	%
Expanded Uncertainty K=2				0.14	$mg.m^{-3}$

Appendix B6.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 27 - The Cooling Booth on Desma 16

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley				
Site	Huntingdon	Date of Test	30 September 2014				
Plant Identification	Stack 27 - The Cooling Booth on	File Name:					
Choice of Measurement Range and Span Gas Concentration							
Parameter	ELV ppm C ₃ H ₈	Ideal Range (ppm)	Actual Range (ppm)	Ideal Span Gas Value	Actual Span Gas Value	2% of Span Gas Conc.	Analysers repeatability at zero
VOCs			100	50 - 90	75.7	1.51	0.830
Analysers and System, Zero and Span Checks (ppm)							
Times of pre and post system calibration checks				Time	10:10	Time	17:25
Parameter	Analysers Zero	Analysers Span	Analysers Zero Check	Pre-Test System Zero Check	Pre-Test System Span Check	Post-Test System Zero Check	Post-Test System Span Check
VOCs	0.0	75.7	0.0	0.3	75.0	0.3	75.0
Zero, Span and Drift Checks							
Parameter	Analysers Zero Check		Zero Drift Check		Span Drift Check		Overall Check
VOCs	0	Pass	0	Pass	0	Pass	Pass
Correction of Data For Drift Effect							
Parameter	Adjustment	Check	Deviation	Drift/minute			
VOCs	Span	1.0134	1.0134	0.0000	0.0000		
	Zero	-0.3040	-0.3040	0.0000	0.0000		
As Determined Concentrations Wet Basis (as C)							
$C_{ppm} = \frac{\sum 1-n}{n} \times 3$				=	5.6	ppm	
where:							
Σ 1 - n is the sum of the readings				=	671		
n is the total number of readings				=	361		
3 is the conversion factor from ppm propane to ppm carbon				=	3		
Concentrations at 273k and 101.3kPa Wet Basis							
$C_{mgm-3} = C_{ppm} \times \frac{mw}{22.4}$				=	3.0	mgm ⁻³	
where:							
C _{ppm} is the average concentration				=	5.6	ppm	
mw is the molecular weight of the gas under test				=	12		
22.4 is the volume of 1 mole of gas at STP				=	22.4	litres	

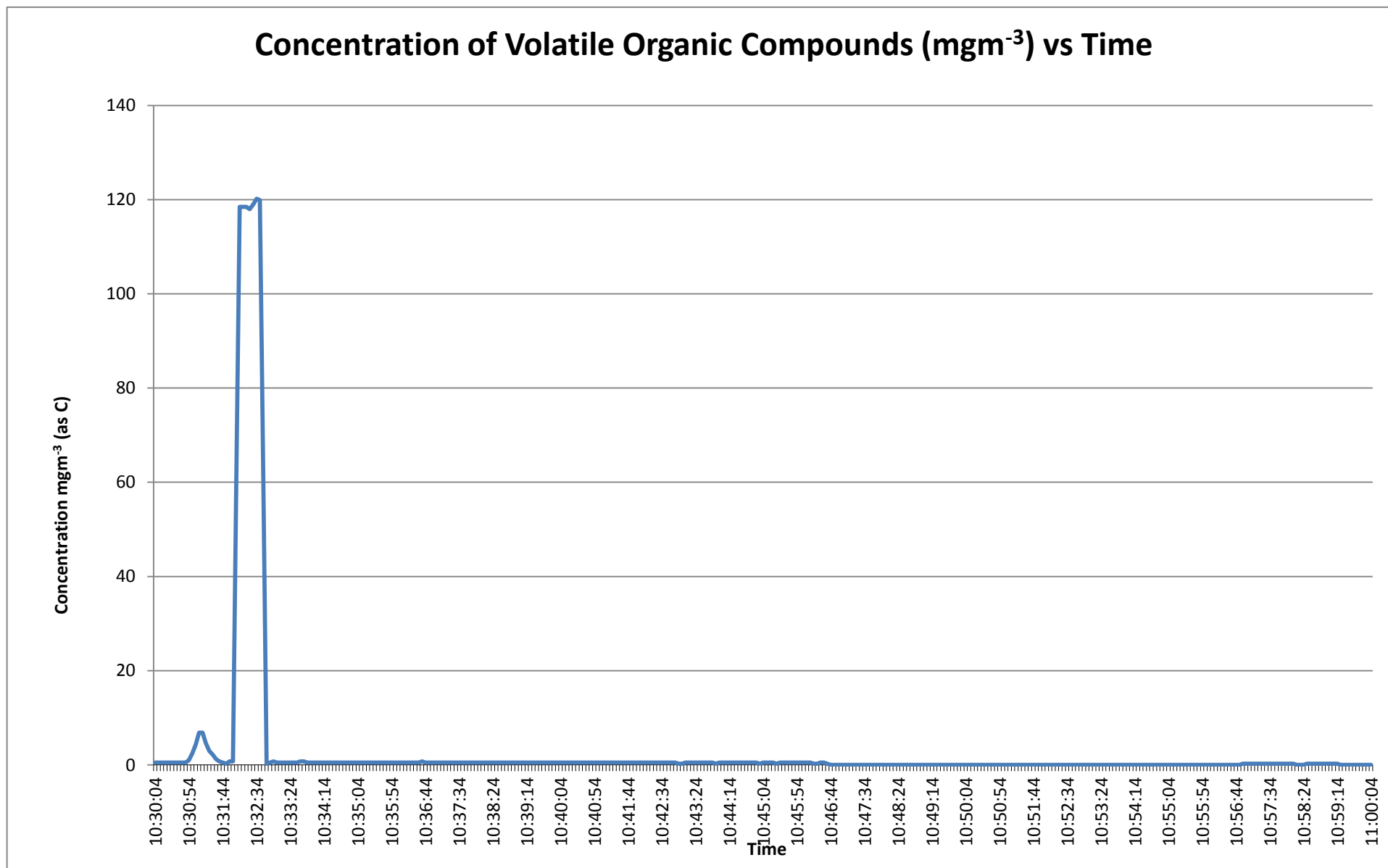
Appendix B6.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 27 - The Cooling Booth on Desma 16

Concentrations at 273k and 101.3kPa Dry Basis			
$C_{mgm-3(wet)} = C_{mgm-3} \times \frac{100}{(100 - Wv)}$	=	3.0	mgm ⁻³
where:			
Concentrations at 273k and 101.3kPa Dry Basis	=	3.0	mgm ⁻³
Wv is the water vapour content	=	0.4	%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis			
$C_{at\%} = C_{mgm-3} \times \frac{209 - O_{2ref}}{209 - O_{2meas}}$	=	3.0	mgm ⁻³
where:			
20.9 is the atmospheric concentration of oxygen	=	20.9	%
O _{2ref} is the reference concentration	=	N/A	%
O _{2meas} is the measured concentration	=	N/A	%
N/A = Oxygen Not Measured			
Actual Rates of Discharge			
$E_{g/hr} = C \times Q_{std} \times \frac{60}{1000}$	=	4.4	ghr ⁻¹
where:			
C is the dry Concentration at STP	=	3.0	
Q _{std} is the dry flow rate at STP	=	24.7	
60/1000 is the conversion factor	=	0.060	
Comments on Compliance with BS EN 12619:2001			
Temperature maintained above 180°C	Pass		
Pre-Test Analyser Zero Check	Pass		
Zero Drift Check	Pass		
Span Drift Check	Pass		
Overall Calibration Acceptability	Pass		
Were all of the requirements of BS EN 12619:2013 fulfilled during the test? ✓ Yes No			

Appendix B6.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 27 - The Cooling Booth on]

Uncertainty Calculation of Volatile Organic Compounds to BS EN 12619:2013							
Symbol	Source of Uncertainty	Value +/- ppm	Probability Distribution	Divisor	Ci	Ui() +/- ppm	V ₁ or V _{eff}
U _{AP}	Air Pressure	0.3785	Normal(K=2)	2	1	0.2	
U _{SP}	Sample Pressure	0.757	Normal(K=2)	2	1	0.4	
U _{T0}	Temp at 0°C	1.514	Normal(K=2)	2	1	0.8	
U _{TS}	Temp (sensitivity)	0.757	Normal(K=2)	2	1	0.4	
U _{H2O}	H2O cross-sensitivity	0.18925	Normal(K=2)	2	1	0.1	
U _{CO}	CO cross-sensitivity	0.0757	Normal(K=2)	2	1	0.0	
U _{CO2}	CO2 cross-sensitivity	0.3785	Normal(K=2)	2	1	0.2	
U _{NO}	NO cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{SO2}	SO2 cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{ZD}	Zero Drift	0.01	Normal(K=2)	2	1	0.0	
U _S	sensitivity Drift	0.3785	Normal(K=2)	2	1	0.2	
U _C	Calibration	1.514	Normal(K=2)	2	1	0.8	
U _C ()	Combined standard		normal			1.25	
U	Expanded		enter coverage	1.96		2.45	ppm
U	Expanded		enter coverage	1.96		1.31	mgm ⁻³

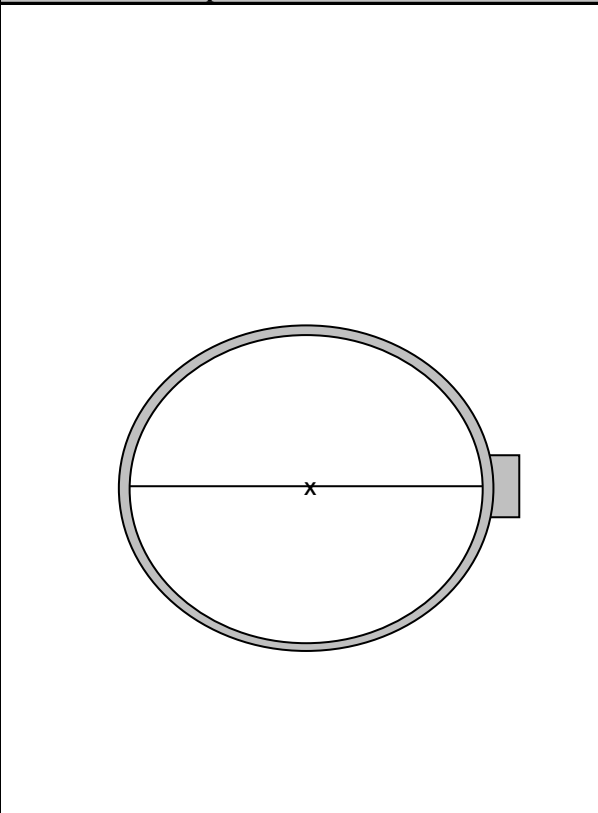
Appendix B6.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 27 - The Cooling Booth on Desma 16



Appendix B: Emission Information

B7 - Stack 26 - The Cooling Booth on MIR 13 Information

B7.1 Diagrams Showing the Dimensions and Monitoring Facilities of Stack 26 - The Cooling Booth on MIR 13

Photograph of Monitoring Point	Schematic of Sample Plane
	

B7.2 Preliminary Velocity and Temperature Measurement of Stack 26 - The Cooling Booth on MIR 13

Traverse Point	Sample Line A			Sample Line B			Sample Line C			Sample line D		
	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)
1	20	7.5	0									
2	20	9	0									
3	20	9.5	0									
4	20	9.5	0									
5	20	10.5	0									
6	20	11	0									
7	20	9.5	0									
8	20	9.5	0									
9	20	9.5	0									
10	20	9	0									
	ΣΔP _A	94.5		ΣΔP _B			ΣΔP _C			ΣΔP _D		

Barometric Pressure (mmHg)	760	Stack velocity (actual) ms ⁻¹	11
Static Pressure (mmH ₂ O)	5.50	Volumetric Flow (actual) m ³ min ⁻¹	45
Diameter (m)	0.30	Assumed CO ₂ (%)	0.0
---		Assumed O ₂ (%)	20.9
Stack Area (m ²)	0.071	Assumed CO (%)	0.0
Port Size (mm)	100	Assumed H ₂ O (%)	0.0

Appendix B7.3 - Particulate Site Measurements - Stack 26 - The Cooling Booth on MIR 13

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	30/09/2014
Plant Identification	Stack 26 - The Cooling Booth on M	Run Number	1

Water Vapour Measurements

Impinger	Initial Wt (g)	Final Wt (g)
1	745.8	746
2	781.4	781.4
3	601.2	601.2
4	934.5	934.9
5		
6		
7		

Sample Reference Information

Filter Ref.	70496-30/09/14-F13
Probe Wash Ref.	70496-30/09/14-S13
Blank Filter Ref.	70496-30/09/14-F14
Blank Probe Wash Ref.	70496-30/09/14-S14

Leak Test Results

Initial Leak Test lmin ⁻¹	0.2000
Test Vacuum ("Hg)	23
Final Leak Test lmin ⁻¹	0.20000
Test Vacuum ("Hg)	23

Sampling Measurements

Point	Start and End Times	Duration (Min)	Vac ("Hg)	Stack Temp (°C)	Velocity Head ΔP (mmH ₂ O)	√ΔP (√mm.H ₂ O)	ΔP Orifice Meter (mm H ₂ O)	DGM (litres)	DGM Temp (°C)		Temp (°C)			
								1536062	In	Out	Probe	Filter	Impinger	Resin
1	11:05	5	2	22	11	3.32	51.76	1536166	25	25	162	-	9	---
2		5	2	22	11	3.32	51.76	1536272	26	25	161	-	9	---
3		5	2	22	11	3.32	51.76	1536371	26	25	164	-	9	---
4		5	2	22	11	3.32	51.76	1536474	26	25	162	-	9	---
5		5	2	22	11	3.32	51.76	1536578	27	25	164	-	9	---
6		5	2	22	11	3.32	51.76	1536678	28	26	161	-	9	---
7		5	2	22	11	3.32	51.76	1536792	28	26	160	-	9	---
8		5	2	22	11	3.32	51.76	1536899	29	26	163	-	9	---
9		5	2	22	11	3.32	51.76	1536988	29	27	164	-	9	---
10		5	2	22	11	3.32	51.76	1537102	30	28	162	-	9	---
11		5	2	22	11	3.32	51.76	1537216	31	29	163	-	9	---
12	12:05	5	2	22	11	3.32	51.76	1537320	32	30	162	-	9	---
13														
14														
15														
16														
17														
18														
19														
20														
	60	60	2.00	22.00	11.00	3.32	51.76	1258.00	28.08	26.42	162.33		9.00	

Appendix B7.3 - Total Particulates to BS EN 13284:2002 - Stack 26 - The Cooling Booth on MIR 13

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley			
Site	Huntingdon	Date of Test	30 September 2014			
Plant Identification	Stack 26 - The Cooling Booth or					
Volume of Water Vapour at Standard Conditions V_{wstd}						
$V_{wstd} = (0.00124) \times V_{lc}$	=	Blank	Test 1	Units		
		0.0007	0.0007	m^3		
Where:						
Constant	=	0.00124	0.00124			
V_{lc} is the mass of water collected	=	0.6	0.6		g	
Volume of Gas Metered, Standard Conditions V_{mstd}						
$V_{mstd} = \frac{(0.3592) \times V_m \times \left(P_b + \frac{\Delta H}{13.6} \right) \times Y_d}{(273 + T_m)}$	=	Blank	Test 1	Units		
		1.1714	1.1714	m^3		
Where:						
Correction for standard temperature and pressure	=	0.3592	0.3592		$Kmm.Hg^{-1}$	
V_m is the volume metered	=	1.2580	1.2580		m^3	
P_b is the barometric pressure	=	760	760		mm.Hg	
ΔH_{ave} is the average meter flow	=	51.8	51.8		mm.H ₂ O	
conversion from mm.H ₂ O to mm.Hg	=	13.6	13.6			
Y_d is the meter correction factor	=	1.0190	1.0190			
$^{\circ}C$ to K conversion constant	=	273	273		K	
T_m is the meter temperature	=	27.3	27.3		$^{\circ}C$	
Moisture Content B_{wo}						
$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$	=	Blank	Test 1			
		0.001	0.001			
Where:						
V_{wstd} is the volume of water vapour at standard conditions	=	0.0007	0.0007		m^3	
V_{mstd} is the volume of gas metered, standard conditions	=	1.1714	1.1714		m^3	
Velocity of Stack Gases V_s						
$V_s = K_p \times C_p \times \sqrt{\Delta P} \times \frac{\sqrt{T_s} + 273}{\sqrt{M_s \times P_s}}$	=	Blank	Test 1	ms^{-1}		
		11.4	11.4			
Where:						
K_p is the pitot tube velocity constant	=	34.97	34.97			
C_p is the pitot coefficient	=	0.834	0.834			
$(\sqrt{\Delta P})_{ave}$ is the average square root of velocity heads	=	3.32	3.32		$\sqrt{mm.H_2O}$	
T_s is the stack temperature	=	22.0	22.0		$^{\circ}C$	
$^{\circ}C$ to K conversion constant	=	273	273		K	
M_s is the molecular weight of gas	=	28.00	28.00		g/g mole	
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg	

Appendix B7.3 - Total Particulates to BS EN 13284:2002 - Stack 26 - The Cooling Booth on MIR 13

Actual Flow Rate of Stack Gases Q_a					
$Q_a = 60 \times A_s \times V_s$	=	Blank 48.3	Test 1 48.3		$\text{m}^3 \text{min}^{-1}$
Where:					
Second to minute conversion	=	60	60		
A_s is the cross-sectional area of stack	=	0.071	0.071		m^2
V_s is the velocity of stack gases	=	11.4	11.4		ms^{-1}
Dry Total Flow Rate of Stack Gas Q_{std}					
$Q_{std} = \frac{Q_a \times P_s \times 0.3592 \times (1 - B_{wo})}{(\overline{T_s}) + 273}$	=	Blank 44.7	Test 1 44.7		$\text{m}^3 \text{min}^{-1}$
Where:					
Q_a is the actual flow rate of stack gases	=	48.3	48.3		$\text{m}^3 \text{min}^{-1}$
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg
Correction for standard temperature and pressure	=	0.3592	0.3592		Kmm.Hg ⁻¹
B_{wo} is the moisture content	=	0.001	0.001		
T_s is the stack temperature	=	22.0	22.0		°C
°C to K conversion constant	=	273	273		K
V_s is the velocity of stack gases	=	11.4	11.4		ms^{-1}
Percent Isokineticity %I					
$\%I = \frac{(4.6398 \times 10^6) \times (\overline{T_s} + 273) \times V_{mstd}}{P_s \times V_s \times A_n \times \theta \times (1 - B_{wo})}$	=	Blank 109.0	Test 1 109.0		%
Where:					
Constant	=	4.6398E+06	4.6398E+06		
T_s is the stack temperature	=	22.0	22.0		°C
°C to K conversion constant	=	273	273		K
V_{mstd} is the volume of gas metered, standard conditions	=	1.1714	1.1714		m^3
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg
V_s is the velocity of stack gases	=	11.4	11.4		ms^{-1}
A_n is the cross-sectional area of nozzle	=	28.34	28.34		mm^2
θ is the duration of test	=	60	60		minutes
B_{wo} is the moisture content	=	0.001	0.001		
Particulate Concentration $\text{C}_{\text{mgm}^{-3}}$ - Dry Basis					
$C_{\text{mgm}^{-3}} = \frac{M_n}{V_{mstd}}$	=	Blank 0.5	Test 1 0.7		mgm^{-3}
Where:					
Filter reference number		70496-30/09/14-F14	70496-30/09/14-F13		
Mn1 Particulate mass on filter.	=	0.04	0.04		mg
Probe wash reference number		70496-30/09/14-S14	70496-30/09/14-S13		
Mn2 Particulate mass in probe rinse.	=	0.5	0.8		mg
V_{mstd} is the volume of gas metered, standard conditions	=	1.1714	1.1714		m^3

Appendix B7.3 - Total Particulates to BS EN 13284:2002 - Stack 26 - The Cooling Booth on MIR 13

Particulate Concentration $\text{C}_{\text{mgm}^{-3}}$ - Wet Basis					
$C_{\text{mgm}^{-3}(\text{wet})} = C_{\text{mgm}^{-3}} \times \frac{(100 - W_v)}{100}$	=	Blank 0.5	Test 1 0.7		mgm^{-3}
Where					
Concentrations at 273k and 101.3kPa Dry Basis	=	0.5	0.7		mgm^{-3}
W _v is the water vapour content %	=	0.1	0.1		%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis					
$C_{\text{atx}\%} = C_{\text{mgm}^{-3}} \times \frac{20.9 - O_{2\text{ref}}}{20.9 - O_{2\text{meas}}}$	=	Blank 0.5	Test 1 0.7		mgm^{-3}
Where:					
Atmospheric oxygen concentration	=	20.9	20.9		%
O _{2ref} is the reference oxygen concentration	=	N/A	N/A		%
O _{2meas} is the measured oxygen concentration	=	N/A	N/A		%
N/A = Not Applicable - Oxygen Not Measured					
Particulate Emission Rate $E_{\text{ghr}^{-1}}$					
$E_{\text{ghr}^{-1}} = C \times Q_{\text{std}} \times \frac{60}{1000}$	=	Blank 1	Test 1 2		ghr^{-1}
Where:					
$C_{\text{mgm}^{-3}}$ is the particulate concentration, dry basis	=	0.5	0.7		mgm^{-3}
Q _{std} is the dry total flow rate of stack gas	=	44.7	44.7		$\text{m}^3 \text{min}^{-1}$
60/1000 Conversion factor	=	0.060	0.060		
Comments on Compliance with BS EN 13284:2002					
Temperature maintained above 160°C	Pass				
Isokinetic Rate 95% to 115%	Pass				
Leak Rate <2%	Pass				
Overall Blank Value <10% of the LV ^a	Pass				
Duct gas flow with regard to stack axis <15°	Pass				
Duct gas flow: negative velocity - not permitted	Pass				
Duct gas flow: differential pressure at the pitot tube >5pa	Pass				
Duct gas flow: ratio of max to min velocity <3:1	Pass				
Number of sampling points	Pass				
Were all of the requirements of BS EN 13284:2002 fulfilled during the test? ✓ Yes No					

Appendix B7.3 - Total Particulates to BS EN 13284:2002 - Stack 26 - The Cooling Booth on MIR 13

Uncertainty Calculations					
Measurement Data					
Measured Quantities	Symbol	Value	Standard Uncertainty		Units
Sampled Volume	V_m	1.1714	(1%) uV_m	0.01171	m^3
Sampled Gas Temperature	T_m	300.3	uT_m	3	k
Sampled Gas Pressure	p_m	101.8	up_m	0.1	kPa
Sampled Gas Humidity	H_m	0.1	uH_m	0.1	% by volume
Oxygen Content	$O_{2,m}$	N/A	$uO_{2,m}$	0.01	% by volume
Mass Particulate	m	0.84	um_m	0.04	mg
Leak	L	2	%	0.02	%
Uncollected Mass	UCM	0			mg
Intermediate Calculation to Correct for Standardisation of Conditions					
Factor for Std Conditions	fs	0.91			
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fs)	
	p_m	0.009		0.001	
	H_m	0.009		0.001	
	T_m	0.003		0.009	
	ufs			0.009	
Corrected Volume	V	1.07	uV	0.016	m^3
Intermediate Calculation to Correct for Oxygen Correction					
Factor for O_2 Correction	fc	1.00			
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fc)	
	$O_{2,m}$	1.00		0.010	
Factor for O_2 Correction	ufc	1.00		0.010	%
Calculation of Expanded Uncertainty					
Parameter		Value	Units	Sensitivity Coefficient	Uncertainty in Result
Volume (Std conditions)	V	1.07	m^3	0.67	0.01
Mass	m	0.84	mg	0.85	0.04
Factor for O_2 Correction	fc	1.00		0.72	0.01
Leak	L	0.01	$mg.m^{-3}$	1.00	0.01
Uncollected mass	UCM	0.00	mg	0.85	0.00
Combined uncertainty					0.04
Expanded Uncertainty K=2				10.87	%
Expanded Uncertainty K=2				0.08	$mg.m^{-3}$

Appendix B7.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 26 - The Cooling Booth on MIR 13

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	30 September 2014
Plant Identification	Stack 26 - The Cooling Booth on	File Name:	

Choice of Measurement Range and Span Gas Concentration							
Parameter	ELV ppm C ₃ H ₈	Ideal Range (ppm)	Actual Range (ppm)	Ideal Span Gas Value	Actual Span Gas Value	2% of Span Gas Conc.	Analysers repeatability at zero
VOCs			100	50 - 90	75.7	1.51	0.830

Analyser and System, Zero and Span Checks (ppm)							
Times of pre and post system calibration checks				Time	10:10	Time	17:25
Parameter	Analysers Zero	Analysers Span	Analysers Zero Check	Pre-Test System Zero Check	Pre-Test System Span Check	Post-Test System Zero Check	Post-Test System Span Check
VOCs	0.0	75.7	0.0	0.3	75.0	0.3	75.0

Zero, Span and Drift Checks							
Parameter	Analysers Zero Check		Zero Drift Check		Span Drift Check		Overall Check
VOCs	0	Pass	0	Pass	0	Pass	Pass

Correction of Data For Drift Effect					
Parameter	Adjustment	Check	Deviation	Drift/minute	
VOCs	Span	1.0134	1.0134	0.0000	0.0000
	Zero	-0.3040	-0.3040	0.0000	0.0000

As Determined Concentrations Wet Basis (as C)			
$C_{ppm} = \frac{\sum 1 - n}{n} \times 3$		=	0.8 ppm
where:			
Σ 1 - n is the sum of the readings		=	96
n is the total number of readings		=	361
3 is the conversion factor from ppm propane to ppm carbon		=	3

Concentrations at 273k and 101.3kPa Wet Basis			
$C_{mgm^{-3}} = C_{ppm} \times \frac{mw}{22.4}$		=	0.4 mgm ⁻³
where:			
C _{ppm} is the average concentration		=	0.8 ppm
mw is the molecular weight of the gas under test		=	12
22.4 is the volume of 1 mole of gas at STP		=	22.4 litres

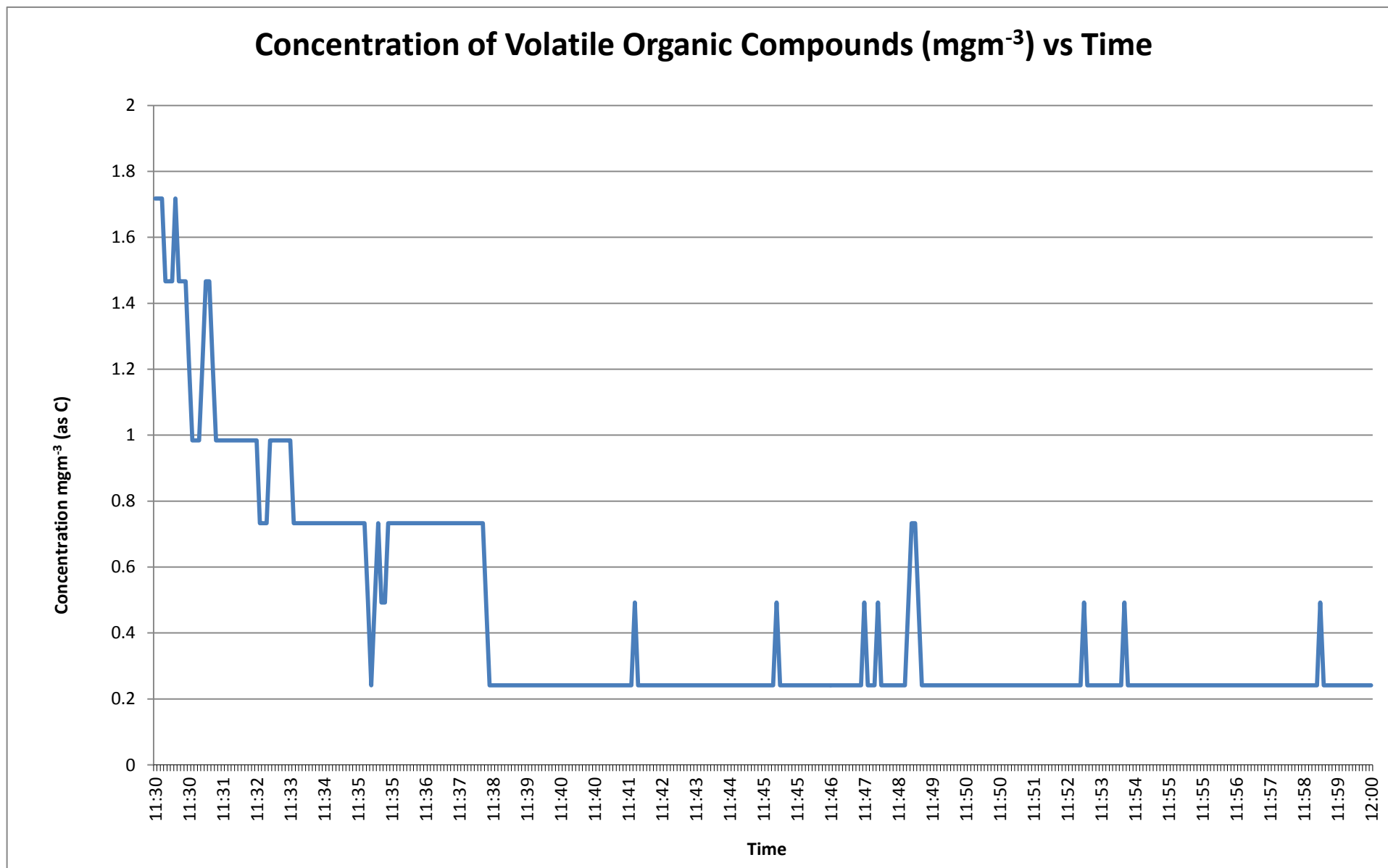
Appendix B7.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 26 - The Cooling Booth on MIR 13

Concentrations at 273k and 101.3kPa Dry Basis			
$C_{mgm^{-3}(wet)} = C_{mgm^{-3}} \times \frac{100}{(100 - Wv)}$	=	0.4	mgm ⁻³
where:			
Concentrations at 273k and 101.3kPa Dry Basis	=	0.4	mgm ⁻³
Wv is the water vapour content	=	0.1	%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis			
$C_{at\%} = C_{mgm^{-3}} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}}$	=	0.4	mgm ⁻³
where:			
20.9 is the atmospheric concentration of oxygen	=	20.9	%
O _{2ref} is the reference concentration	=	N/A	%
O _{2meas} is the measured concentration	=	N/A	%
N/A = Oxygen Not Measured			
Actual Rates of Discharge			
$E_{g/hr} = C \times Q_{std} \times \frac{60}{1000}$	=	1.1	ghr ⁻¹
where:			
C is the dry Concentration at STP	=	0.4	
Q _{std} is the dry flow rate at STP	=	41.6	
60/1000 is the conversion factor	=	0.060	
Comments on Compliance with BS EN 12619:2001			
Temperature maintained above 180°C	Pass		
Pre-Test Analyser Zero Check	Pass		
Zero Drift Check	Pass		
Span Drift Check	Pass		
Overall Calibration Acceptability	Pass		
Were all of the requirements of BS EN 12619:2013 fulfilled during the test? ✓ Yes No			

Appendix B7.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 26 - The Cooling Booth on]

Uncertainty Calculation of Volatile Organic Compounds to BS EN 12619:2013							
Symbol	Source of Uncertainty	Value +/- ppm	Probability Distribution	Divisor	Ci	Ui() +/- ppm	V ₁ or V _{eff}
U _{AP}	Air Pressure	0.3785	Normal(K=2)	2	1	0.2	
U _{SP}	Sample Pressure	0.757	Normal(K=2)	2	1	0.4	
U _{T0}	Temp at 0°C	1.514	Normal(K=2)	2	1	0.8	
U _{TS}	Temp (sensitivity)	0.757	Normal(K=2)	2	1	0.4	
U _{H2O}	H2O cross-sensitivity	0.18925	Normal(K=2)	2	1	0.1	
U _{CO}	CO cross-sensitivity	0.0757	Normal(K=2)	2	1	0.0	
U _{CO2}	CO2 cross-sensitivity	0.3785	Normal(K=2)	2	1	0.2	
U _{NO}	NO cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{SO2}	SO2 cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{ZD}	Zero Drift	0.01	Normal(K=2)	2	1	0.0	
U _S	sensitivity Drift	0.3785	Normal(K=2)	2	1	0.2	
U _C	Calibration	1.514	Normal(K=2)	2	1	0.8	
U _C ()	Combined standard		normal			1.25	
U	Expanded		enter coverage	1.96		2.45	ppm
U	Expanded		enter coverage	1.96		1.31	mgm ⁻³

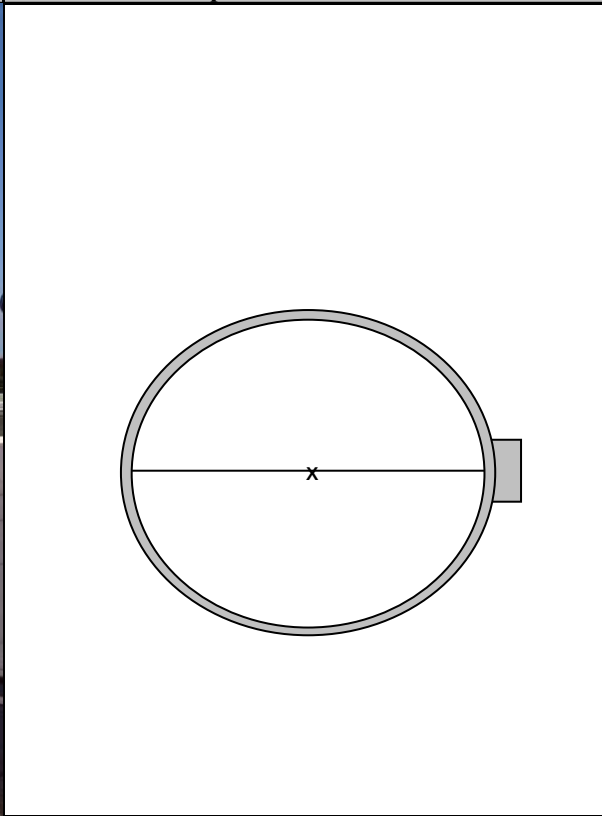
Appendix B7.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 26 - The Cooling Booth on MIR 13



Appendix B: Emission Information

B8 - Stack 24 -The Cooling Booth on Desma 14 Information

B8.1 Diagrams Showing the Dimensions and Monitoring Facilities of Stack 24 -The Cooling Booth on Desma 14

Photograph of Monitoring Point	Schematic of Sample Plane
	

B8.2 Preliminary Velocity and Temperature Measurement of Stack 24 -The Cooling Booth on Desma 14

Traverse Point	Sample Line A			Sample Line B			Sample Line C			Sample line D		
	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)
1	22	3	0									
2	22	3.5	0									
3	22	3.5	0									
4	22	4	0									
5	22	4	0									
6	22	4	0									
7	22	4	0									
8	22	4	0									
9	22	3.5	0									
10	22	3.5	0									
	ΣΔP _A	37		ΣΔP _B			ΣΔP _C			ΣΔP _D		

Barometric Pressure (mmHg)	760	Stack velocity (actual) ms ⁻¹	7
Static Pressure (mmH ₂ O)	2.00	Volumetric Flow (actual) m ³ min ⁻¹	28
Diameter (m)	0.30	Assumed CO ₂ (%)	0.0
---		Assumed O ₂ (%)	20.9
Stack Area (m ²)	0.071	Assumed CO (%)	0.0
Port Size (mm)	100	Assumed H ₂ O (%)	0.0

Appendix B8.3 - Particulate Site Measurements - Stack 24 -The Cooling Booth on Desma 14

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	30/09/2014
Plant Identification	Stack 24 -The Cooling Booth on De	Run Number	1

Water Vapour Measurements

Impinger	Initial Wt (g)	Final Wt (g)
1	746	746.2
2	781.4	781.5
3	601.2	601.4
4	934.9	935.5
5		
6		
7		

Sample Reference Information

Filter Ref.	70496-30/09/14-F15
Probe Wash Ref.	70496-30/09/14-S15
Blank Filter Ref.	70496-30/09/14-F16
Blank Probe Wash Ref.	70496-30/09/14-S16

Leak Test Results

Initial Leak Test lmin ⁻¹	0.2000
Test Vacuum ("Hg)	23
Final Leak Test lmin ⁻¹	0.20000
Test Vacuum ("Hg)	23

Sampling Measurements

Point	Start and End Times	Duration (Min)	Vac ("Hg)	Stack Temp (°C)	Velocity Head ΔP (mmH2O)	√ΔP (√mm.H2O)	ΔP Orifice Meter (mm H ₂ O)	DGM (litres)	DGM Temp (°C)		Temp (°C)			
									In	Out	Probe	Filter	Impinger	Resin
1	12:15	5	2	22	4	2.00	18.69	1537331	23	23	161	-	9	---
2		5	2	22	4	2.00	18.69	1537459	24	23	161	-	9	---
3		5	2	22	4	2.00	18.69	1537510	24	23	164	-	9	---
4		5	2	22	4	2.00	18.69	1537567	25	23	163	-	9	---
5		5	2	22	4	2.00	18.69	1537633	25	23	162	-	9	---
6		5	2	22	4	2.00	18.69	1537694	27	25	160	-	9	---
7		5	2	22	4	2.00	18.69	1537751	27	25	164	-	9	---
8		5	2	22	4	2.00	18.69	1537807	27	25	162	-	9	---
9		5	2	22	4	2.00	18.69	1537871	28	26	160	-	9	---
10		5	2	22	4	2.00	18.69	1537934	29	26	163	-	9	---
11		5	2	22	4	2.00	18.69	1537993	29	27	164	-	9	---
12	13:15	5	2	22	4	2.00	18.69	1538051	30	28	162	-	9	---
13														
14														
15														
16														
17														
18														
19														
20														
	60	60	2.00	22.00	4.00	2.00	18.69	720.00	26.50	24.75	162.17		9.00	

Appendix B8.3 - Total Particulates to BS EN 13284:2002 - Stack 24 -The Cooling Booth on Desma 14

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley			
Site	Huntingdon	Date of Test	30 September 2014			
Plant Identification	Stack 24 -The Cooling Booth on					
Volume of Water Vapour at Standard Conditions V_{wstd}						
$V_{wstd} = (0.00124) \times V_{lc}$	=	Blank	Test 1	Units		
		0.0014	0.0014	m^3		
Where:						
Constant	=	0.00124	0.00124			
V_{lc} is the mass of water collected	=	1.1	1.1		g	
Volume of Gas Metered, Standard Conditions V_{mstd}						
$V_{mstd} = \frac{(0.3592) \times V_m \times \left(P_b + \frac{\Delta H}{13.6} \right) \times Y_d}{(273 + T_m)}$	=	Blank	Test 1	Units		
		0.6719	0.6719	m^3		
Where:						
Correction for standard temperature and pressure	=	0.3592	0.3592		$Kmm.Hg^{-1}$	
V_m is the volume metered	=	0.7200	0.7200		m^3	
P_b is the barometric pressure	=	760	760		mm.Hg	
ΔH_{ave} is the average meter flow	=	18.7	18.7		mm.H ₂ O	
conversion from mm.H ₂ O to mm.Hg	=	13.6	13.6			
Y_d is the meter correction factor	=	1.0190	1.0190			
$^{\circ}C$ to K conversion constant	=	273	273		K	
T_m is the meter temperature	=	25.6	25.6		$^{\circ}C$	
Moisture Content B_{wo}						
$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$	=	Blank	Test 1			
		0.002	0.002			
Where:						
V_{wstd} is the volume of water vapour at standard conditions	=	0.0014	0.0014		m^3	
V_{mstd} is the volume of gas metered, standard conditions	=	0.6719	0.6719		m^3	
Velocity of Stack Gases V_s						
$V_s = K_p \times C_p \times \sqrt{\Delta P} \times \frac{\sqrt{T_s} + 273}{\sqrt{M_s \times P_s}}$	=	Blank	Test 1	ms^{-1}		
		6.9	6.9			
Where:						
K_p is the pitot tube velocity constant	=	34.97	34.97			
C_p is the pitot coefficient	=	0.834	0.834			
$(\sqrt{\Delta P})_{ave}$ is the average square root of velocity heads	=	2.00	2.00		$\sqrt{mm.H_2O}$	
T_s is the stack temperature	=	22.0	22.0		$^{\circ}C$	
$^{\circ}C$ to K conversion constant	=	273	273		K	
M_s is the molecular weight of gas	=	28.00	28.00		g/g mole	
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg	

Appendix B8.3 - Total Particulates to BS EN 13284:2002 - Stack 24 -The Cooling Booth on Desma 14

Actual Flow Rate of Stack Gases Q_a					
$Q_a = 60 \times A_s \times V_s$	=	Blank 29.1	Test 1 29.1		$\text{m}^3 \text{min}^{-1}$
Where:					
Second to minute conversion	=	60	60		
A_s is the cross-sectional area of stack	=	0.071	0.071		m^2
V_s is the velocity of stack gases	=	6.9	6.9		ms^{-1}
Dry Total Flow Rate of Stack Gas Q_{std}					
$Q_{std} = \frac{Q_a \times P_s \times 0.3592 \times (1 - B_{wo})}{(\overline{T_s}) + 273}$	=	Blank 26.9	Test 1 26.9		$\text{m}^3 \text{min}^{-1}$
Where:					
Q_a is the actual flow rate of stack gases	=	29.1	29.1		$\text{m}^3 \text{min}^{-1}$
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg
Correction for standard temperature and pressure	=	0.3592	0.3592		Kmm.Hg ⁻¹
B_{wo} is the moisture content	=	0.002	0.002		
T_s is the stack temperature	=	22.0	22.0		°C
°C to K conversion constant	=	273	273		K
V_s is the velocity of stack gases	=	6.9	6.9		ms^{-1}
Percent Isokineticity %I					
$\%I = \frac{(4.6398 \times 10^6) \times (\overline{T_s} + 273) \times V_{mstd}}{P_s \times V_s \times A_n \times \theta \times (1 - B_{wo})}$	=	Blank 103.8	Test 1 103.8		%
Where:					
Constant	=	4.6398E+06	4.6398E+06		
T_s is the stack temperature	=	22.0	22.0		°C
°C to K conversion constant	=	273	273		K
V_{mstd} is the volume of gas metered, standard conditions	=	0.6719	0.6719		m^3
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg
V_s is the velocity of stack gases	=	6.9	6.9		ms^{-1}
A_n is the cross-sectional area of nozzle	=	28.34	28.34		mm^2
θ is the duration of test	=	60	60		minutes
B_{wo} is the moisture content	=	0.002	0.002		
Particulate Concentration $\text{C}_{\text{mgm}^{-3}}$ - Dry Basis					
$C_{\text{mgm}^{-3}} = \frac{M_n}{V_{mstd}}$	=	Blank 0.8	Test 1 1.8		mgm^{-3}
Where:					
Filter reference number		70496-30/09/14-F16	70496-30/09/14-F15		
Mn1 Particulate mass on filter.	=	0.04	0.04		mg
Probe wash reference number		70496-30/09/14-S16	70496-30/09/14-S15		
Mn2 Particulate mass in probe rinse.	=	0.5	1.2		mg
V_{mstd} is the volume of gas metered, standard conditions	=	0.6719	0.6719		m^3

Appendix B8.3 - Total Particulates to BS EN 13284:2002 - Stack 24 -The Cooling Booth on Desma 14

Particulate Concentration $C_{mgm^{-3}}$ - Wet Basis					
$C_{mgm^{-3} (wet)} = C_{mgm^{-3}} \times \frac{(100 - W_v)}{100}$	=	Blank 0.8	Test 1 1.8		mgm^{-3}
Where					
Concentrations at 273k and 101.3kPa Dry Basis	=	0.8	1.8		mgm^{-3}
W _v is the water vapour content %	=	0.2	0.2		%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis					
$C_{atx\%} = C_{mgm^{-3}} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}}$	=	Blank 0.8	Test 1 1.8		mgm^{-3}
Where:					
Atmospheric oxygen concentration	=	20.9	20.9		%
O _{2ref} is the reference oxygen concentration	=	N/A	N/A		%
O _{2meas} is the measured oxygen concentration	=	N/A	N/A		%
N/A = Not Applicable - Oxygen Not Measured					
Particulate Emission Rate $E_{ghr^{-1}}$					
$E_{ghr^{-1}} = C \times Q_{std} \times \frac{60}{1000}$	=	Blank 1	Test 1 3		ghr^{-1}
Where:					
$C_{mgm^{-3}}$ is the particulate concentration, dry basis	=	0.8	1.8		mgm^{-3}
Q _{std} is the dry total flow rate of stack gas	=	26.9	26.9		$m^3 min^{-1}$
60/1000 Conversion factor	=	0.060	0.060		
Comments on Compliance with BS EN 13284:2002					
Temperature maintained above 160°C	Pass				
Isokinetic Rate 95% to 115%	Pass				
Leak Rate <2%	Pass				
Overall Blank Value <10% of the LV ^a	Pass				
Duct gas flow with regard to stack axis <15°	Pass				
Duct gas flow: negative velocity - not permitted	Pass				
Duct gas flow: differential pressure at the pitot tube >5pa	Pass				
Duct gas flow: ratio of max to min velocity <3:1	Pass				
Number of sampling points	Pass				
Were all of the requirements of BS EN 13284:2002 fulfilled during the test? ✓ Yes No					

Appendix B8.3 - Total Particulates to BS EN 13284:2002 - Stack 24 -The Cooling Booth on Desma 14

Uncertainty Calculations						
Measurement Data						
Measured Quantities	Symbol	Value	Standard Uncertainty			Units
Sampled Volume	V_m	0.6719	(1%) uV_m	0.00672		m^3
Sampled Gas Temperature	T_m	298.6	uT_m	3		k
Sampled Gas Pressure	p_m	101.5	up_m	0.1		kPa
Sampled Gas Humidity	H_m	0.2	uH_m	0.1		% by volume
Oxygen Content	$O_{2,m}$	N/A	$uO_{2,m}$	0.01		% by volume
Mass Particulate	m	1.24	um_m	0.06		mg
Leak	L	2	%	0.02		%
Uncollected Mass	UCM	0				mg
Intermediate Calculation to Correct for Standardisation of Conditions						
Factor for Std Conditions	fs	0.91				
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fs)		
	p_m	0.009		0.001		
	H_m	0.009		0.001		
	T_m	0.003		0.009		
	ufs			0.009		
Corrected Volume	V	0.61	uV	0.009		m^3
Intermediate Calculation to Correct for Oxygen Correction						
Factor for O_2 Correction	fc	1.00				
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fc)		
	$O_{2,m}$	1.00		0.010		
Factor for O_2 Correction	ufc	1.00		0.010		%
Calculation of Expanded Uncertainty						
Parameter		Value	Units	Sensitivity Coefficient	Uncertainty in Result	
Volume (Std conditions)	V	0.61	m^3	3.00	0.03	$mg.m^{-3}$
Mass	m	1.24	mg	1.49	0.09	$mg.m^{-3}$
Factor for O_2 Correction	fc	1.00		1.84	0.02	$mg.m^{-3}$
Leak	L	0.02	$mg.m^{-3}$	1.00	0.02	$mg.m^{-3}$
Uncollected mass	UCM	0.00	mg	1.49	0.00	$mg.m^{-3}$
Combined uncertainty					0.10	$mg.m^{-3}$
Expanded Uncertainty K=2					10.87	%
Expanded Uncertainty K=2					0.20	$mg.m^{-3}$

Appendix B8.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 24 -The Cooling Booth on Desma 14

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	30 September 2014
Plant Identification	Stack 24 -The Cooling Booth on	File Name:	

Choice of Measurement Range and Span Gas Concentration							
Parameter	ELV ppm C ₃ H ₈	Ideal Range (ppm)	Actual Range (ppm)	Ideal Span Gas Value	Actual Span Gas Value	2% of Span Gas Conc.	Analysers repeatability at zero
VOCs			100	50 - 90	75.7	1.51	0.830

Analyser and System, Zero and Span Checks (ppm)							
Times of pre and post system calibration checks				Time	10:10	Time	17:25
Parameter	Analysers Zero	Analysers Span	Analysers Zero Check	Pre-Test System Zero Check	Pre-Test System Span Check	Post-Test System Zero Check	Post-Test System Span Check
VOCs	0.0	75.7	0.0	0.3	75.0	0.3	75.0

Zero, Span and Drift Checks							
Parameter	Analysers Zero Check		Zero Drift Check		Span Drift Check		Overall Check
VOCs	0	Pass	0	Pass	0	Pass	Pass

Correction of Data For Drift Effect					
Parameter	Adjustment	Check	Deviation	Drift/minute	
VOCs	Span	1.0134	1.0134	0.0000	0.0000
	Zero	-0.3040	-0.3040	0.0000	0.0000

As Determined Concentrations Wet Basis (as C)					
$C_{ppm} = \frac{\sum 1 - n}{n} \times 3$			=	0.2	ppm
where:					
Σ 1 - n is the sum of the readings			=	29	
n is the total number of readings			=	361	
3 is the conversion factor from ppm propane to ppm carbon			=	3	

Concentrations at 273k and 101.3kPa Wet Basis					
$C_{mgm^{-3}} = C_{ppm} \times \frac{mw}{22.4}$			=	0.1	mgm ⁻³
where:					
C _{ppm} is the average concentration			=	0.2	ppm
mw is the molecular weight of the gas under test			=	12	
22.4 is the volume of 1 mole of gas at STP			=	22.4	litres

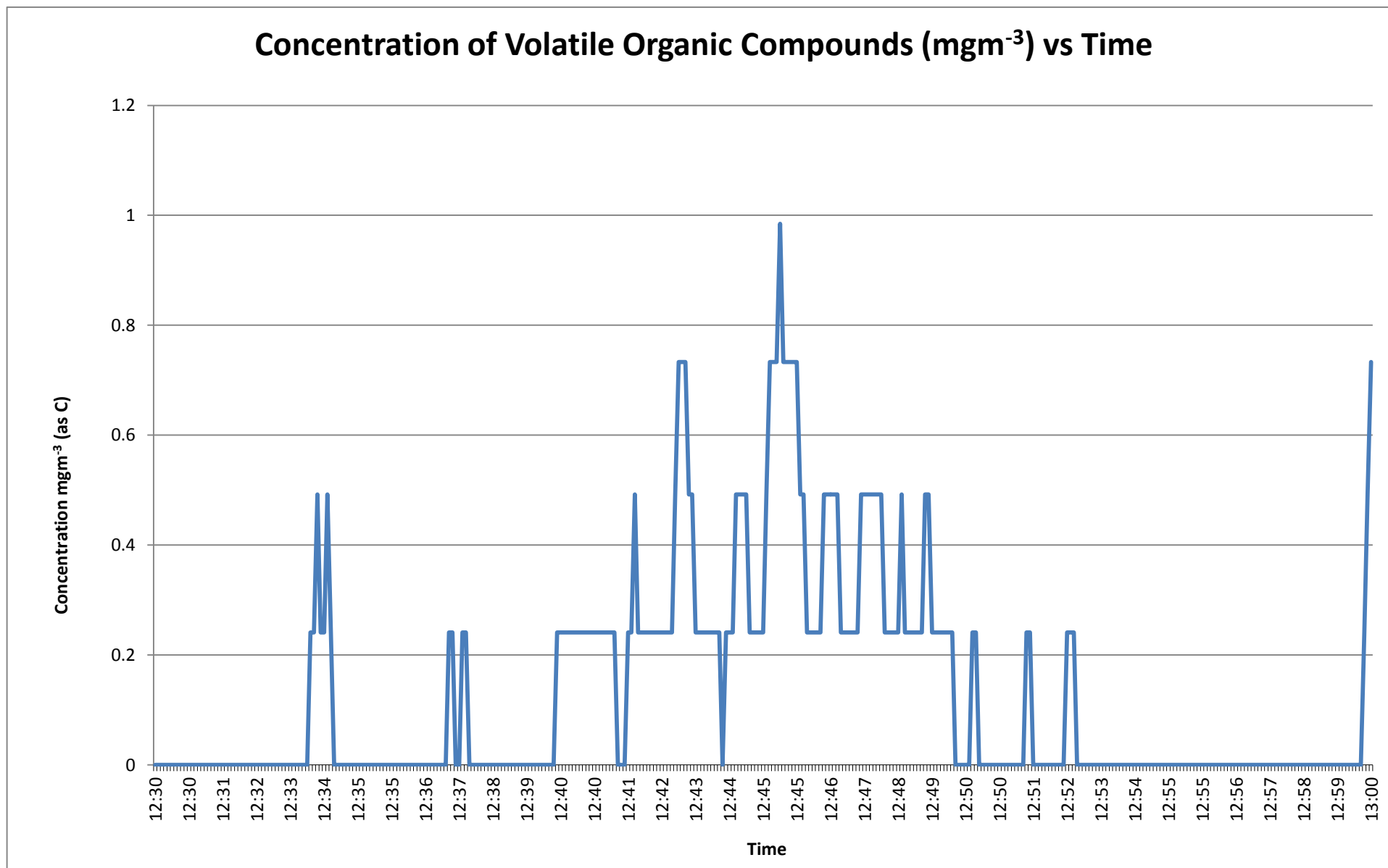
Appendix B8.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 24 -The Cooling Booth on Desma 14

Concentrations at 273k and 101.3kPa Dry Basis			
$C_{mgm^{-3} (wet)} = C_{mgm^{-3}} \times \frac{100}{(100 - W_v)}$		0.1	mgm ⁻³
where:			
Concentrations at 273k and 101.3kPa Dry Basis	=	0.1	mgm ⁻³
W _v is the water vapour content	=	0.2	%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis			
$C_{atX\%} = C_{mgm^{-3}} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}}$		0.1	mgm ⁻³
where:			
20.9 is the atmospheric concentration of oxygen	=	20.9	%
O _{2ref} is the reference concentration	=	N/A	%
O _{2 meas} is the measured concentration	=	N/A	%
N/A = Oxygen Not Measured			
Actual Rates of Discharge			
$E_{g/hr} = C \times Q_{std} \times \frac{60}{1000}$		0.2	ghr ⁻¹
where:			
C is the dry Concentration at STP	=	0.1	
Q _{std} is the dry flow rate at STP	=	25.9	
60/1000 is the conversion factor	=	0.060	
Comments on Compliance with BS EN 12619:2001			
Temperature maintained above 180°C	Pass		
Pre-Test Analyser Zero Check	Pass		
Zero Drift Check	Pass		
Span Drift Check	Pass		
Overall Calibration Acceptability	Pass		
Were all of the requirements of BS EN 12619:2013 fulfilled during the test? ✓ Yes No			

Appendix B8.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 24 -The Cooling Booth on I

Uncertainty Calculation of Volatile Organic Compounds to BS EN 12619:2013							
Symbol	Source of Uncertainty	Value +/- ppm	Probability Distribution	Divisor	Ci	Ui() +/- ppm	V ₁ or V _{eff}
U _{AP}	Air Pressure	0.3785	Normal(K=2)	2	1	0.2	
U _{SP}	Sample Pressure	0.757	Normal(K=2)	2	1	0.4	
U _{T0}	Temp at 0°C	1.514	Normal(K=2)	2	1	0.8	
U _{TS}	Temp (sensitivity)	0.757	Normal(K=2)	2	1	0.4	
U _{H2O}	H2O cross-sensitivity	0.18925	Normal(K=2)	2	1	0.1	
U _{CO}	CO cross-sensitivity	0.0757	Normal(K=2)	2	1	0.0	
U _{CO2}	CO2 cross-sensitivity	0.3785	Normal(K=2)	2	1	0.2	
U _{NO}	NO cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{SO2}	SO2 cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{ZD}	Zero Drift	0.01	Normal(K=2)	2	1	0.0	
U _S	sensitivity Drift	0.3785	Normal(K=2)	2	1	0.2	
U _C	Calibration	1.514	Normal(K=2)	2	1	0.8	
U _C ()	Combined standard		normal			1.25	
U	Expanded		enter coverage	1.96		2.45	ppm
U	Expanded		enter coverage	1.96		1.31	mgm ⁻³

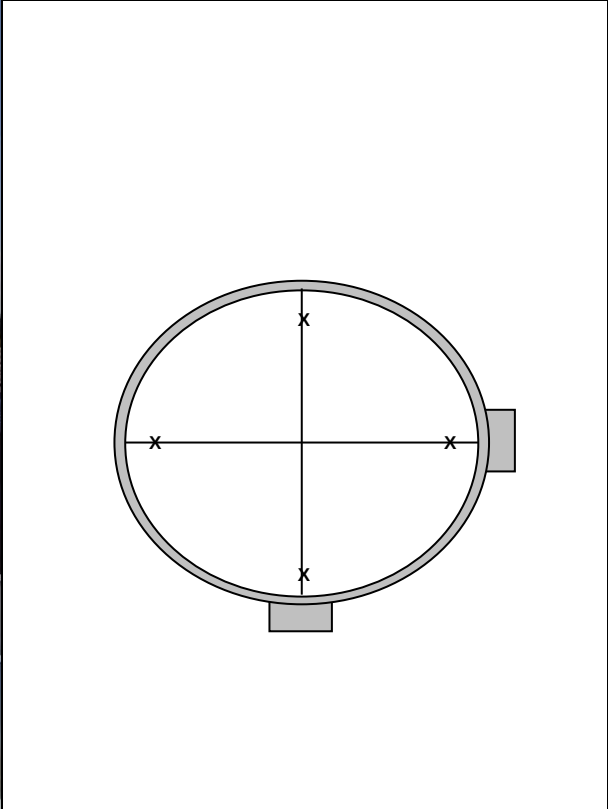
Appendix B8.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 24 -The Cooling Booth on Desma 14



Appendix B: Emission Information

B9 - Stack 44 - Carbon Black Information

B9.1 Diagrams Showing the Dimensions and Monitoring Facilities of Stack 44 - Carbon Black

Photograph of Monitoring Point	Schematic of Sample Plane
	

B9.2 Preliminary Velocity and Temperature Measurement of Stack 44 - Carbon Black

Traverse Point	Sample Line A			Sample Line B			Sample Line C			Sample line D		
	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)
1	30	24	0	30	16	0						
2	30	24	0	30	21	0						
3	30	26	0	30	23	0						
4	30	30	0	30	24	0						
5	30	30	0	30	24.5	0						
6	30	30	0	30	25	0						
7	30	30	0	30	25	0						
8	30	30	0	30	26	0						
9	30	26	0	30	26	0						
10	30	25	0	30	25	0						
	ΣΔP _A	275		ΣΔP _B	235.5		ΣΔP _C			ΣΔP _D		

Barometric Pressure (mmHg)	760	Stack velocity (actual) ms ⁻¹	18
Static Pressure (mmH ₂ O)	16.00	Volumetric Flow (actual) m ³ min ⁻¹	168
Diameter (m)	0.45	Assumed CO ₂ (%)	0.0
---		Assumed O ₂ (%)	20.9
Stack Area (m ²)	0.159	Assumed CO (%)	0.0
Port Size (mm)	100	Assumed H ₂ O (%)	0.0

Appendix B9.3 - Particulate Site Measurements - Stack 44 - Carbon Black

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	30/09/2014
Plant Identification	Stack 44 - Carbon Black	Run Number	1

Water Vapour Measurements

Impinger	Initial Wt (g)	Final Wt (g)
1	746.2	746.5
2	781.5	781.9
3	601.4	601.6
4	935.5	936
5		
6		
7		

Sample Reference Information

Filter Ref.	70496-30/09/14-F17
Probe Wash Ref.	70496-30/09/14-S17
Blank Filter Ref.	70496-30/09/14-F18
Blank Probe Wash Ref.	70496-30/09/14-S18

Leak Test Results

Initial Leak Test lmin ⁻¹	0.2000
Test Vacuum ("Hg)	23
Final Leak Test lmin ⁻¹	0.20000
Test Vacuum ("Hg)	23

Sampling Measurements

Point	Start and End Times	Duration (Min)	Vac ("Hg)	Stack Temp (°C)	Velocity Head ΔP (mmH ₂ O)	√ΔP (√mm.H ₂ O)	ΔP Orifice Meter (mm H ₂ O)	DGM (litres)	DGM Temp (°C)		Temp (°C)			
								1538259	In	Out	Probe	Filter	Impinger	Resin
1	14:00	5	2	30	26	5.10	118.43	1538421	28	28	161	-	9	---
2		5	2	30	26	5.10	118.43	1538586	28	28	162	-	10	---
3		5	2	30	26	5.10	118.43	1538734	28	28	160	-	11	---
4		5	2	30	30	5.48	136.65	1538913	29	28	165	-	12	---
5		5	2	30	30	5.48	136.65	1539060	29	28	164	-	13	---
6		5	2	30	30	5.48	136.65	1539221	29	29	162	-	14	---
7		5	2	30	26	5.10	118.43	1539377	30	29	161	-	15	---
8		5	2	30	26	5.10	118.43	1539556	30	29	160	-	16	---
9		5	2	30	26	5.10	118.43	1539718	31	30	163	-	17	---
10		5	2	30	30	5.48	136.65	1539873	31	30	163	-	18	---
11		5	2	30	30	5.48	136.65	1540030	32	30	162	-	19	---
12	15:00	5	2	30	30	5.48	136.65	1540195	32	30	163	-	20	---
13														
14														
15														
16														
17														
18														
19														
20														
	60	60	2.00	30.00	28.00	5.29	127.54	1936.00	29.75	28.92	162.17		14.50	

Appendix B9.3 - Total Particulates to BS EN 13284:2002 - Stack 44 - Carbon Black

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley			
Site	Huntingdon	Date of Test	30 September 2014			
Plant Identification	Stack 44 - Carbon Black					
Volume of Water Vapour at Standard Conditions V_{wstd}						
$V_{wstd} = (0.00124) \times V_{lc}$	=	Blank	Test 1	Units		
		0.0017	0.0017	m^3		
Where:						
Constant	=	0.00124	0.00124			
V_{lc} is the mass of water collected	=	1.4	1.4		g	
Volume of Gas Metered, Standard Conditions V_{mstd}						
$V_{mstd} = \frac{(0.3592) \times V_m \times \left(P_b + \frac{\Delta H}{13.6} \right) \times Y_d}{(273 + T_m)}$	=	Blank	Test 1	Units		
		1.8033	1.8033	m^3		
Where:						
Correction for standard temperature and pressure	=	0.3592	0.3592		$Kmm.Hg^{-1}$	
V_m is the volume metered	=	1.9360	1.9360		m^3	
P_b is the barometric pressure	=	760	760		mm.Hg	
ΔH_{ave} is the average meter flow	=	127.5	127.5		mm.H ₂ O	
conversion from mm.H ₂ O to mm.Hg	=	13.6	13.6			
Y_d is the meter correction factor	=	1.0190	1.0190			
$^{\circ}C$ to K conversion constant	=	273	273		K	
T_m is the meter temperature	=	29.3	29.3		$^{\circ}C$	
Moisture Content B_{wo}						
$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$	=	Blank	Test 1			
		0.001	0.001			
Where:						
V_{wstd} is the volume of water vapour at standard conditions	=	0.0017	0.0017		m^3	
V_{mstd} is the volume of gas metered, standard conditions	=	1.8033	1.8033		m^3	
Velocity of Stack Gases V_s						
$V_s = K_p \times C_p \times \sqrt{\Delta P} \times \frac{\sqrt{T_s} + 273}{\sqrt{M_s \times P_s}}$	=	Blank	Test 1	ms^{-1}		
		18.4	18.4			
Where:						
K_p is the pitot tube velocity constant	=	34.97	34.97			
C_p is the pitot coefficient	=	0.834	0.834			
$(\sqrt{\Delta P})_{ave}$ is the average square root of velocity heads	=	5.29	5.29		$\sqrt{mm.H_2O}$	
T_s is the stack temperature	=	30.0	30.0		$^{\circ}C$	
$^{\circ}C$ to K conversion constant	=	273	273		K	
M_s is the molecular weight of gas	=	28.00	28.00		g/g mole	
P_s is the absolute pressure of stack gas	=	761	761		mm.Hg	

Appendix B9.3 - Total Particulates to BS EN 13284:2002 - Stack 44 - Carbon Black

Actual Flow Rate of Stack Gases Q_a					
$Q_a = 60 \times A_s \times V_s$	=	Blank 175.5	Test 1 175.5		$\text{m}^3 \text{min}^{-1}$
Where:					
Second to minute conversion	=	60	60		
A_s is the cross-sectional area of stack	=	0.159	0.159		m^2
V_s is the velocity of stack gases	=	18.4	18.4		ms^{-1}
Dry Total Flow Rate of Stack Gas Q_{std}					
$Q_{std} = \frac{Q_a \times P_s \times 0.3592 \times (1 - B_{wo})}{(\overline{T_s}) + 273}$	=	Blank 158.2	Test 1 158.2		$\text{m}^3 \text{min}^{-1}$
Where:					
Q_a is the actual flow rate of stack gases	=	175.5	175.5		$\text{m}^3 \text{min}^{-1}$
P_s is the absolute pressure of stack gas	=	761	761		mm.Hg
Correction for standard temperature and pressure	=	0.3592	0.3592		Kmm.Hg ⁻¹
B_{wo} is the moisture content	=	0.001	0.001		
T_s is the stack temperature	=	30.0	30.0		°C
°C to K conversion constant	=	273	273		K
V_s is the velocity of stack gases	=	18.4	18.4		ms^{-1}
Percent Isokineticity %I					
$\%I = \frac{(4.6398 \times 10^6) \times (\overline{T_s} + 273) \times V_{mstd}}{P_s \times V_s \times A_n \times \theta \times (1 - B_{wo})}$	=	Blank 106.6	Test 1 106.6		%
Where:					
Constant	=	4.6398E+06	4.6398E+06		
T_s is the stack temperature	=	30.0	30.0		°C
°C to K conversion constant	=	273	273		K
V_{mstd} is the volume of gas metered, standard conditions	=	1.8033	1.8033		m^3
P_s is the absolute pressure of stack gas	=	761	761		mm.Hg
V_s is the velocity of stack gases	=	18.4	18.4		ms^{-1}
A_n is the cross-sectional area of nozzle	=	28.34	28.34		mm^2
θ is the duration of test	=	60	60		minutes
B_{wo} is the moisture content	=	0.001	0.001		
Particulate Concentration $\text{C}_{\text{mgm}^{-3}}$ - Dry Basis					
$C_{\text{mgm}^{-3}} = \frac{M_n}{V_{mstd}}$	=	Blank 0.4	Test 1 0.9		mgm^{-3}
Where:					
Filter reference number		70496-30/09/14-F18	70496-30/09/14-F17		
Mn1 Particulate mass on filter.	=	0.04	0.04		mg
Probe wash reference number		70496-30/09/14-S18	70496-30/09/14-S17		
Mn2 Particulate mass in probe rinse.	=	0.7	1.5		mg
V_{mstd} is the volume of gas metered, standard conditions	=	1.8033	1.8033		m^3

Appendix B9.3 - Total Particulates to BS EN 13284:2002 - Stack 44 - Carbon Black

Particulate Concentration $C_{mgm^{-3}}$ - Wet Basis					
$C_{mgm^{-3} (wet)} = C_{mgm^{-3}} \times \frac{(100 - W_v)}{100}$	=	Blank 0.4	Test 1 0.9		mgm^{-3}
Where					
Concentrations at 273k and 101.3kPa Dry Basis	=	0.4	0.9		mgm^{-3}
W _v is the water vapour content %	=	0.1	0.1		%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis					
$C_{atx\%} = C_{mgm^{-3}} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}}$	=	Blank 0.4	Test 1 0.9		mgm^{-3}
Where:					
Atmospheric oxygen concentration	=	20.9	20.9		%
O _{2ref} is the reference oxygen concentration	=	N/A	N/A		%
O _{2meas} is the measured oxygen concentration	=	N/A	N/A		%
N/A = Not Applicable - Oxygen Not Measured					
Particulate Emission Rate $E_{ghr^{-1}}$					
$E_{ghr^{-1}} = C \times Q_{std} \times \frac{60}{1000}$	=	Blank 4	Test 1 8		ghr^{-1}
Where:					
$C_{mgm^{-3}}$ is the particulate concentration, dry basis	=	0.4	0.9		mgm^{-3}
Q _{std} is the dry total flow rate of stack gas	=	158.2	158.2		$m^3 min^{-1}$
60/1000 Conversion factor	=	0.060	0.060		
Comments on Compliance with BS EN 13284:2002					
Temperature maintained above 160°C	Pass				
Isokinetic Rate 95% to 115%	Pass				
Leak Rate <2%	Pass				
Overall Blank Value <10% of the LV ^a	Pass				
Duct gas flow with regard to stack axis <15°	Pass				
Duct gas flow: negative velocity - not permitted	Pass				
Duct gas flow: differential pressure at the pitot tube >5pa	Pass				
Duct gas flow: ratio of max to min velocity <3:1	Pass				
Number of sampling points	Pass				
Were all of the requirements of BS EN 13284:2002 fulfilled during the test? ☒ Yes ☐ No					

Appendix B9.3 - Total Particulates to BS EN 13284:2002 - Stack 44 - Carbon Black

Uncertainty Calculations					
Measurement Data					
Measured Quantities	Symbol	Value	Standard Uncertainty		Units
Sampled Volume	V_m	1.8033	(1%) uV_m	0.01803	m^3
Sampled Gas Temperature	T_m	302.3	uT_m	3	k
Sampled Gas Pressure	p_m	102.5	up_m	0.1	kPa
Sampled Gas Humidity	H_m	0.1	uH_m	0.1	% by volume
Oxygen Content	$O_{2,m}$	N/A	$uO_{2,m}$	0.01	% by volume
Mass Particulate	m	1.54	um_m	0.08	mg
Leak	L	2	%	0.02	%
Uncollected Mass	UCM	0			mg
Intermediate Calculation to Correct for Standardisation of Conditions					
Factor for Std Conditions	fs	0.91			
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fs)	
	p_m	0.009		0.001	
	H_m	0.009		0.001	
	T_m	0.003		0.009	
	ufs			0.009	
Corrected Volume	V	1.65	uV	0.024	m^3
Intermediate Calculation to Correct for Oxygen Correction					
Factor for O_2 Correction	fc	1.00			
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fc)	
	$O_{2,m}$	1.00		0.010	
Factor for O_2 Correction	ufc	1.00		0.010	%
Calculation of Expanded Uncertainty					
Parameter		Value	Units	Sensitivity Coefficient	Uncertainty in Result
Volume (Std conditions)	V	1.65	m^3	0.52	0.01
Mass	m	1.54	mg	0.55	0.04
Factor for O_2 Correction	fc	1.00		0.85	0.01
Leak	L	0.01	$mg.m^{-3}$	1.00	0.01
Uncollected mass	UCM	0.00	mg	0.55	0.00
Combined uncertainty					0.05
Expanded Uncertainty K=2				10.87	%
Expanded Uncertainty K=2				0.09	$mg.m^{-3}$

Appendix B9.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 44 - Carbon Black

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	30 September 2014
Plant Identification	Stack 44 - Carbon Black	File Name:	

Choice of Measurement Range and Span Gas Concentration							
Parameter	ELV ppm C ₃ H ₈	Ideal Range (ppm)	Actual Range (ppm)	Ideal Span Gas Value	Actual Span Gas Value	2% of Span Gas Conc.	Analysers repeatability at zero
VOCs			100	50 - 90	75.7	1.51	0.830

Analyser and System, Zero and Span Checks (ppm)							
Times of pre and post system calibration checks				Time	10:10	Time	17:25
Parameter	Analysers Zero	Analysers Span	Analysers Zero Check	Pre-Test System Zero Check	Pre-Test System Span Check	Post-Test System Zero Check	Post-Test System Span Check
VOCs	0.0	75.7	0.0	0.3	75.0	0.3	75.0

Zero, Span and Drift Checks							
Parameter	Analysers Zero Check		Zero Drift Check		Span Drift Check		Overall Check
VOCs	0	Pass	0	Pass	0	Pass	Pass

Correction of Data For Drift Effect					
Parameter	Adjustment	Check	Deviation	Drift/minute	
VOCs	Span	1.0134	1.0134	0.0000	0.0000
	Zero	-0.3040	-0.3040	0.0000	0.0000

As Determined Concentrations Wet Basis (as C)			
$C_{ppm} = \frac{\sum 1-n}{n} \times 3$		=	5.3 ppm
where:			
Σ 1 - n is the sum of the readings		=	634
n is the total number of readings		=	361
3 is the conversion factor from ppm propane to ppm carbon		=	3

Concentrations at 273k and 101.3kPa Wet Basis			
$C_{mgm-3} = C_{ppm} \times \frac{mw}{22.4}$		=	2.8 mgm ⁻³
where:			
C _{ppm} is the average concentration		=	5.3 ppm
mw is the molecular weight of the gas under test		=	12
22.4 is the volume of 1 mole of gas at STP		=	22.4 litres

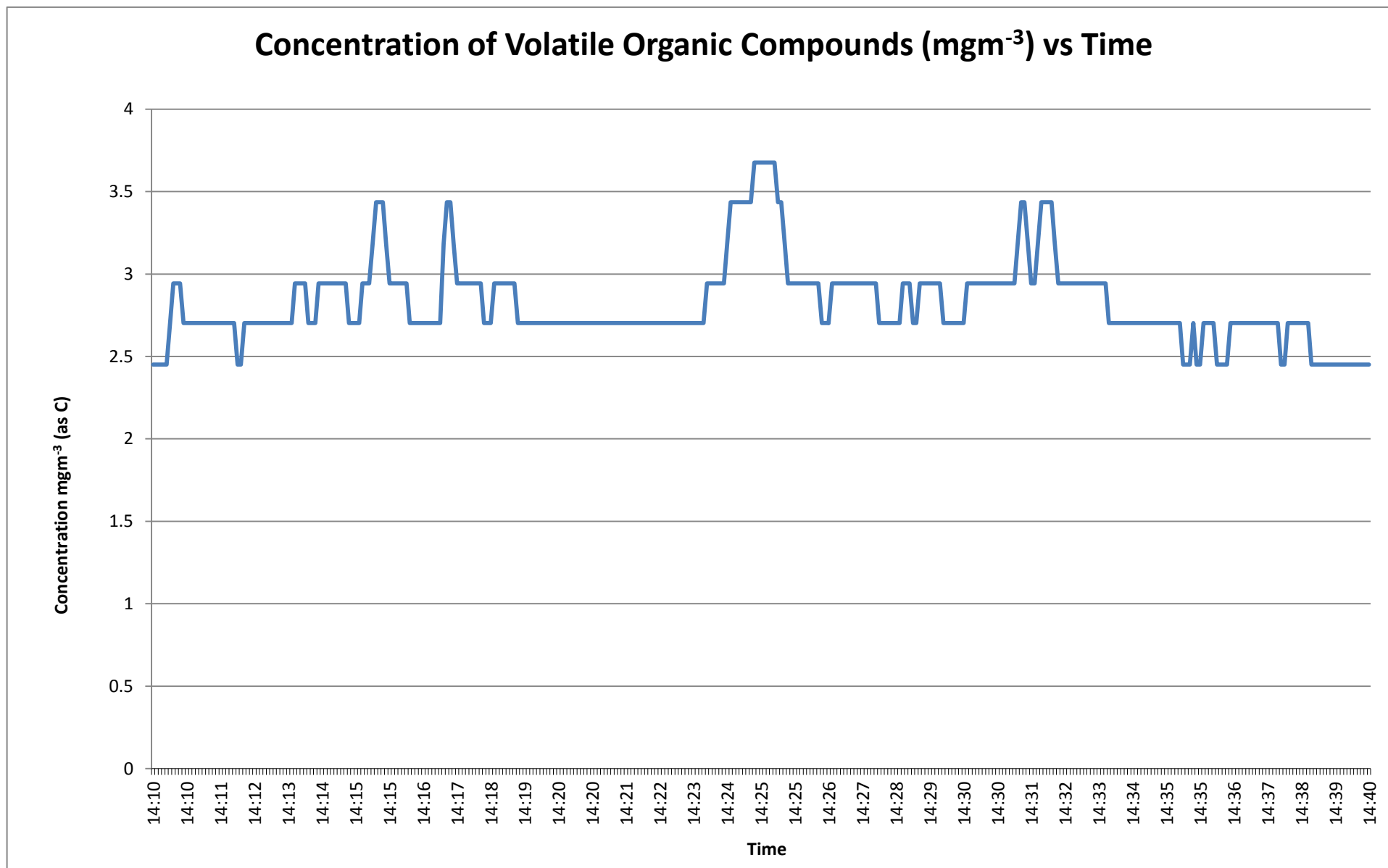
Appendix B9.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 44 - Carbon Black

Concentrations at 273k and 101.3kPa Dry Basis			
$C_{mgm-3(wet)} = C_{mgm-3} \times \frac{100}{(100 - Wv)}$	=	2.8	mgm ⁻³
where:			
Concentrations at 273k and 101.3kPa Dry Basis	=	2.8	mgm ⁻³
Wv is the water vapour content	=	0.1	%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis			
$C_{at\%} = C_{mgm-3} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}}$	=	2.8	mgm ⁻³
where:			
20.9 is the atmospheric concentration of oxygen	=	20.9	%
O _{2ref} is the reference concentration	=	N/A	%
O _{2meas} is the measured concentration	=	N/A	%
N/A = Oxygen Not Measured			
Actual Rates of Discharge			
$E_{g/hr} = C \times Q_{std} \times \frac{60}{1000}$	=	25.6	ghr ⁻¹
where:			
C is the dry Concentration at STP	=	2.8	
Q _{std} is the dry flow rate at STP	=	151.1	
60/1000 is the conversion factor	=	0.060	
Comments on Compliance with BS EN 12619:2001			
Temperature maintained above 180°C	Pass		
Pre-Test Analyser Zero Check	Pass		
Zero Drift Check	Pass		
Span Drift Check	Pass		
Overall Calibration Acceptability	Pass		
Were all of the requirements of BS EN 12619:2013 fulfilled during the test? ✓ Yes No			

Appendix B9.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 44 - Carbon Black

Uncertainty Calculation of Volatile Organic Compounds to BS EN 12619:2013							
Symbol	Source of Uncertainty	Value +/- ppm	Probability Distribution	Divisor	Ci	Ui() +/- ppm	V ₁ or V _{eff}
U _{AP}	Air Pressure	0.3785	Normal(K=2)	2	1	0.2	
U _{SP}	Sample Pressure	0.757	Normal(K=2)	2	1	0.4	
U _{T0}	Temp at 0°C	1.514	Normal(K=2)	2	1	0.8	
U _{TS}	Temp (sensitivity)	0.757	Normal(K=2)	2	1	0.4	
U _{H2O}	H2O cross-sensitivity	0.18925	Normal(K=2)	2	1	0.1	
U _{CO}	CO cross-sensitivity	0.0757	Normal(K=2)	2	1	0.0	
U _{CO2}	CO2 cross-sensitivity	0.3785	Normal(K=2)	2	1	0.2	
U _{NO}	NO cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{SO2}	SO2 cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{ZD}	Zero Drift	0.01	Normal(K=2)	2	1	0.0	
U _S	sensitivity Drift	0.3785	Normal(K=2)	2	1	0.2	
U _C	Calibration	1.514	Normal(K=2)	2	1	0.8	
U _C ()	Combined standard		normal			1.25	
U	Expanded		enter coverage	1.96		2.45	ppm
U	Expanded		enter coverage	1.96		1.31	mgm ⁻³

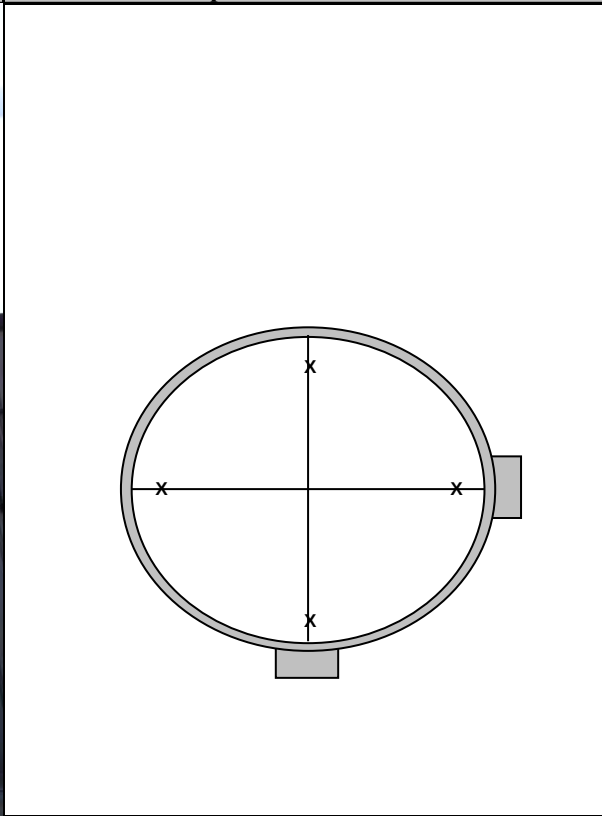
Appendix B9.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 44 - Carbon Black



Appendix B: Emission Information

B10 - Stack 46 - Spray booth Information

B10.1 Diagrams Showing the Dimensions and Monitoring Facilities of Stack 46 - Spray booth

Photograph of Monitoring Point	Schematic of Sample Plane
	

B10.2 Preliminary Velocity and Temperature Measurement of Stack 46 - Spray booth

Traverse Point	Sample Line A			Sample Line B			Sample Line C			Sample line D		
	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)	Stack Temp. (°C)	ΔP (mmH2O)	Swirl Angle (°)
1	21	12.5	0	21	3.5	0						
2	21	11.5	0	21	3.5	0						
3	21	10	0	21	3.5	0						
4	21	8	0	21	3.5	0						
5	21	6.5	0	21	3.5	0						
6	21	5.5	0	21	2.5	0						
7	21	4.5	0	21	4	0						
8	21	4	0	21	4.5	0						
9	21	4	0	21	5	0						
10	21	4	0	21	6	0						
	ΣΔP _A	70.5		ΣΔP _B	39.5		ΣΔP _C			ΣΔP _D		

Barometric Pressure (mmHg)	760	Stack velocity (actual) ms ⁻¹	8
Static Pressure (mmH ₂ O)	3.00	Volumetric Flow (actual) m ³ min ⁻¹	202
Diameter (m)	0.73	Assumed CO ₂ (%)	0.0
---		Assumed O ₂ (%)	20.9
Stack Area (m ²)	0.419	Assumed CO (%)	0.0
Port Size (mm)	100	Assumed H ₂ O (%)	0.0

Appendix B10.3 - Particulate Site Measurements - Stack 46 - Spray booth

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley
Site	Huntingdon	Date of Test	30/09/2014
Plant Identification	Stack 46 - Spray booth	Run Number	1

Water Vapour Measurements

Impinger	Initial Wt (g)	Final Wt (g)
1	746.5	747
2	781.9	782.2
3	601.6	601.8
4	936	936.2
5		
6		
7		

Sample Reference Information

Filter Ref.	70496-30/09/14-F19
Probe Wash Ref.	70496-30/09/14-S19
Blank Filter Ref.	70496-30/09/14-F20
Blank Probe Wash Ref.	70496-30/09/14-S20

Leak Test Results

Initial Leak Test lmin ⁻¹	0.2000
Test Vacuum ("Hg)	23
Final Leak Test lmin ⁻¹	0.20000
Test Vacuum ("Hg)	23

Sampling Measurements

Point	Start and End Times	Duration (Min)	Vac ("Hg)	Stack Temp (°C)	Velocity Head ΔP (mmH ₂ O)	√ΔP (√mm.H ₂ O)	ΔP Orifice Meter (mm H ₂ O)	DGM (litres)	DGM Temp (°C)		Temp (°C)			
								1540199	In	Out	Probe	Filter	Impinger	Resin
1	16:20	5	2	21	10	3.16	46.89	1540268	25	25	161	-	9	---
2		5	2	21	10	3.16	46.89	1540337	26	26	162	-	9	---
3		5	2	21	10	3.16	46.89	1540401	26	26	165	-	9	---
4		5	2	21	4	2.00	18.75	1540478	27	26	163	-	9	---
5		5	2	21	4	2.00	18.75	1540541	27	26	162	-	9	---
6		5	2	21	4	2.00	18.75	1540618	28	26	160	-	9	---
7		5	2	21	3.5	1.87	16.41	1540681	28	27	162	-	9	---
8		5	2	21	3.5	1.87	16.41	1540755	29	27	163	-	9	---
9		5	2	21	3.5	1.87	16.41	1540818	29	27	164	-	9	---
10		5	2	21	4.5	2.12	21.10	1540878	30	28	161	-	9	---
11		5	2	21	4.5	2.12	21.10	1540958	31	29	163	-	9	---
12	17:25	5	2	21	4.5	2.12	21.10	1541032	32	30	163	-	9	---
13														
14														
15														
16														
17														
18														
19														
20														
	65	60	2.00	21.00	5.50	2.29	25.79	833.00	28.17	26.92	162.42		9.00	

Appendix B10.3 - Total Particulates to BS EN 13284:2002 - Stack 46 - Spray booth

Company	VIP Polymers Ltd	Test Conducted by	N Teixeira & P Soley			
Site	Huntingdon	Date of Test	30 September 2014			
Plant Identification	Stack 46 - Spray booth					
Volume of Water Vapour at Standard Conditions V_{wstd}						
$V_{wstd} = (0.00124) \times V_{lc}$	=	Blank	Test 1	Units		
		0.0015	0.0015	m^3		
Where:						
Constant	=	0.00124	0.00124			
V_{lc} is the mass of water collected	=	1.2	1.2		g	
Volume of Gas Metered, Standard Conditions V_{mstd}						
$V_{mstd} = \frac{(0.3592) \times V_m \times \left(P_b + \frac{\Delta H}{13.6} \right) \times Y_d}{(273 + T_m)}$	=	Blank	Test 1	Units		
		0.7729	0.7729	m^3		
Where:						
Correction for standard temperature and pressure	=	0.3592	0.3592		$Kmm.Hg^{-1}$	
V_m is the volume metered	=	0.8330	0.8330		m^3	
P_b is the barometric pressure	=	760	760		mm.Hg	
ΔH_{ave} is the average meter flow	=	25.8	25.8		mm.H ₂ O	
conversion from mm.H ₂ O to mm.Hg	=	13.6	13.6			
Y_d is the meter correction factor	=	1.0190	1.0190			
$^{\circ}C$ to K conversion constant	=	273	273		K	
T_m is the meter temperature	=	27.5	27.5		$^{\circ}C$	
Moisture Content B_{wo}						
$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$	=	Blank	Test 1			
		0.002	0.002			
Where:						
V_{wstd} is the volume of water vapour at standard conditions	=	0.0015	0.0015		m^3	
V_{mstd} is the volume of gas metered, standard conditions	=	0.7729	0.7729		m^3	
Velocity of Stack Gases V_s						
$V_s = K_p \times C_p \times \sqrt{\Delta P} \times \frac{\sqrt{T_s} + 273}{\sqrt{M_s \times P_s}}$	=	Blank	Test 1	ms^{-1}		
		7.8	7.8			
Where:						
K_p is the pitot tube velocity constant	=	34.97	34.97			
C_p is the pitot coefficient	=	0.834	0.834			
$(\sqrt{\Delta P})_{ave}$ is the average square root of velocity heads	=	2.29	2.29		$\sqrt{mm.H_2O}$	
T_s is the stack temperature	=	21.0	21.0		$^{\circ}C$	
$^{\circ}C$ to K conversion constant	=	273	273		K	
M_s is the molecular weight of gas	=	28.00	28.00		g/g mole	
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg	

Appendix B10.3 - Total Particulates to BS EN 13284:2002 - Stack 46 - Spray booth

Actual Flow Rate of Stack Gases Q_a					
$Q_a = 60 \times A_s \times V_s$	=	Blank 197.0	Test 1 197.0		$\text{m}^3 \text{min}^{-1}$
Where:					
Second to minute conversion	=	60	60		
A_s is the cross-sectional area of stack	=	0.419	0.419		m^2
V_s is the velocity of stack gases	=	7.8	7.8		ms^{-1}
Dry Total Flow Rate of Stack Gas Q_{std}					
$Q_{std} = \frac{Q_a \times P_s \times 0.3592 \times (1 - B_{wo})}{(\overline{T_s}) + 273}$	=	Blank 182.6	Test 1 182.6		$\text{m}^3 \text{min}^{-1}$
Where:					
Q_a is the actual flow rate of stack gases	=	197.0	197.0		$\text{m}^3 \text{min}^{-1}$
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg
Correction for standard temperature and pressure	=	0.3592	0.3592		Kmm.Hg $^{-1}$
B_{wo} is the moisture content	=	0.002	0.002		
T_s is the stack temperature	=	21.0	21.0		$^{\circ}\text{C}$
$^{\circ}\text{C}$ to K conversion constant	=	273	273		K
V_s is the velocity of stack gases	=	7.8	7.8		ms^{-1}
Percent Isokineticity %I					
$\%I = \frac{(4.6398 \times 10^6) \times (\overline{T_s} + 273) \times V_{mstd}}{P_s \times V_s \times A_n \times \theta \times (1 - B_{wo})}$	=	Blank 104.2	Test 1 104.2		%
Where:					
Constant	=	4.6398E+06	4.6398E+06		
T_s is the stack temperature	=	21.0	21.0		$^{\circ}\text{C}$
$^{\circ}\text{C}$ to K conversion constant	=	273	273		K
V_{mstd} is the volume of gas metered, standard conditions	=	0.7729	0.7729		m^3
P_s is the absolute pressure of stack gas	=	760	760		mm.Hg
V_s is the velocity of stack gases	=	7.8	7.8		ms^{-1}
A_n is the cross-sectional area of nozzle	=	28.34	28.34		mm^2
θ is the duration of test	=	60	60		minutes
B_{wo} is the moisture content	=	0.002	0.002		
Particulate Concentration $\text{C}_{\text{mgm}^{-3}}$ - Dry Basis					
$C_{\text{mgm}^{-3}} = \frac{M_n}{V_{mstd}}$	=	Blank 0.7	Test 1 0.8		mgm^{-3}
Where:					
Filter reference number		70496-30/09/14-F20	70496-30/09/14-F19		
Mn1 Particulate mass on filter.	=	0.04	0.04		mg
Probe wash reference number		70496-30/09/14-S20	70496-30/09/14-S19		
Mn2 Particulate mass in probe rinse.	=	0.5	0.6		mg
V_{mstd} is the volume of gas metered, standard conditions	=	0.7729	0.7729		m^3

Appendix B10.3 - Total Particulates to BS EN 13284:2002 - Stack 46 - Spray booth

Particulate Concentration $C_{mgm^{-3}}$ - Wet Basis					
$C_{mgm^{-3} (wet)} = C_{mgm^{-3}} \times \frac{(100 - W_v)}{100}$	=	Blank 0.7	Test 1 0.8		mgm^{-3}
Where					
Concentrations at 273k and 101.3kPa Dry Basis	=	0.7	0.8		mgm^{-3}
W _v is the water vapour content %	=	0.2	0.2		%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis					
$C_{atx\%} = C_{mgm^{-3}} \times \frac{20.9 - O_{2ref}}{20.9 - O_{2meas}}$	=	Blank 0.7	Test 1 0.8		mgm^{-3}
Where:					
Atmospheric oxygen concentration	=	20.9	20.9		%
O _{2ref} is the reference oxygen concentration	=	N/A	N/A		%
O _{2meas} is the measured oxygen concentration	=	N/A	N/A		%
N/A = Not Applicable - Oxygen Not Measured					
Particulate Emission Rate $E_{ghr^{-1}}$					
$E_{ghr^{-1}} = C \times Q_{std} \times \frac{60}{1000}$	=	Blank 8	Test 1 9		ghr^{-1}
Where:					
$C_{mgm^{-3}}$ is the particulate concentration, dry basis	=	0.7	0.8		mgm^{-3}
Q _{std} is the dry total flow rate of stack gas	=	182.6	182.6		$m^3 min^{-1}$
60/1000 Conversion factor	=	0.060	0.060		
Comments on Compliance with BS EN 13284:2002					
Temperature maintained above 160°C	Pass				
Isokinetic Rate 95% to 115%	Pass				
Leak Rate <2%	Pass				
Overall Blank Value <10% of the LV ^a	Pass				
Duct gas flow with regard to stack axis <15°	Pass				
Duct gas flow: negative velocity - not permitted	Pass				
Duct gas flow: differential pressure at the pitot tube >5pa	Pass				
Duct gas flow: ratio of max to min velocity <3:1	Pass				
Number of sampling points	Pass				
Were all of the requirements of BS EN 13284:2002 fulfilled during the test? ✓ Yes No					

Appendix B10.3 - Total Particulates to BS EN 13284:2002 - Stack 46 - Spray booth

Uncertainty Calculations						
Measurement Data						
Measured Quantities	Symbol	Value	Standard Uncertainty			Units
Sampled Volume	V_m	0.7729	(1%) uV_m	0.00773		m^3
Sampled Gas Temperature	T_m	300.5	uT_m	3		k
Sampled Gas Pressure	p_m	101.6	up_m	0.1		kPa
Sampled Gas Humidity	H_m	0.2	uH_m	0.1		% by volume
Oxygen Content	$O_{2,m}$	N/A	$uO_{2,m}$	0.01		% by volume
Mass Particulate	m	0.64	um_m	0.03		mg
Leak	L	2	%	0.02		%
Uncollected Mass	UCM	0				mg
Intermediate Calculation to Correct for Standardisation of Conditions						
Factor for Std Conditions	fs	0.91				
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fs)		
	p_m	0.009		0.001		
	H_m	0.009		0.001		
	T_m	0.003		0.009		
	ufs			0.009		
Corrected Volume	V	0.70	uV	0.010		m^3
Intermediate Calculation to Correct for Oxygen Correction						
Factor for O_2 Correction	fc	1.00				
Uncertainty Components	symbol	Sensitivity Coefficient		u (in units of fc)		
	$O_{2,m}$	1.00		0.010		
Factor for O_2 Correction	ufc	1.00		0.010		%
Calculation of Expanded Uncertainty						
Parameter		Value	Units	Sensitivity Coefficient	Uncertainty in Result	
Volume (Std conditions)	V	0.70	m^3	1.18	0.01	$mg.m^{-3}$
Mass	m	0.64	mg	1.29	0.04	$mg.m^{-3}$
Factor for O_2 Correction	fc	1.00		0.83	0.01	$mg.m^{-3}$
Leak	L	0.01	$mg.m^{-3}$	1.00	0.01	$mg.m^{-3}$
Uncollected mass	UCM	0.00	mg	1.29	0.00	$mg.m^{-3}$
Combined uncertainty					0.04	$mg.m^{-3}$
Expanded Uncertainty K=2					10.87	%
Expanded Uncertainty K=2					0.09	$mg.m^{-3}$

Appendix B10.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 46 - Spray booth

Company	VIP Polymers Ltd			Test Conducted by	N Teixeira & P Soley		
Site	Huntingdon			Date of Test	30 September 2014		
Plant Identification	Stack 46 - Spray booth			File Name:			
Choice of Measurement Range and Span Gas Concentration							
Parameter	ELV ppm C ₃ H ₈	Ideal Range (ppm)	Actual Range (ppm)	Ideal Span Gas Value	Actual Span Gas Value	2% of Span Gas Conc.	Analysers repeatability at zero
VOCs			100	50 - 90	75.7	1.51	0.830
Analyser and System, Zero and Span Checks (ppm)							
Times of pre and post system calibration checks				Time	10:10	Time	17:25
Parameter	Analysers Zero	Analysers Span	Analysers Zero Check	Pre-Test System Zero Check	Pre-Test System Span Check	Post-Test System Zero Check	Post-Test System Span Check
VOCs	0.0	75.7	0.0	0.3	75.0	0.3	75.0
Zero, Span and Drift Checks							
Parameter	Analysers Zero Check		Zero Drift Check		Span Drift Check		Overall Check
VOCs	0	Pass	0	Pass	0	Pass	Pass
Correction of Data For Drift Effect							
Parameter		Adjustment	Check	Deviation		Drift/minute	
VOCs	Span	1.0134	1.0134	0.0000		0.0000	
	Zero	-0.3040	-0.3040	0.0000		0.0000	
As Determined Concentrations Wet Basis (as C)							
$C_{ppm} = \frac{\sum 1-n}{n} \times 3$				=	157.1 ppm		
where:							
Σ 1 - n is the sum of the readings				=	18907		
n is the total number of readings				=	361		
3 is the conversion factor from ppm propane to ppm carbon				=	3		
Concentrations at 273k and 101.3kPa Wet Basis							
$C_{mgm-3} = C_{ppm} \times \frac{mw}{22.4}$				=	84.2 mgm ⁻³		
where:							
C _{ppm} is the average concentration				=	157.1		ppm
mw is the molecular weight of the gas under test				=	12		
22.4 is the volume of 1 mole of gas at STP				=	22.4		litres

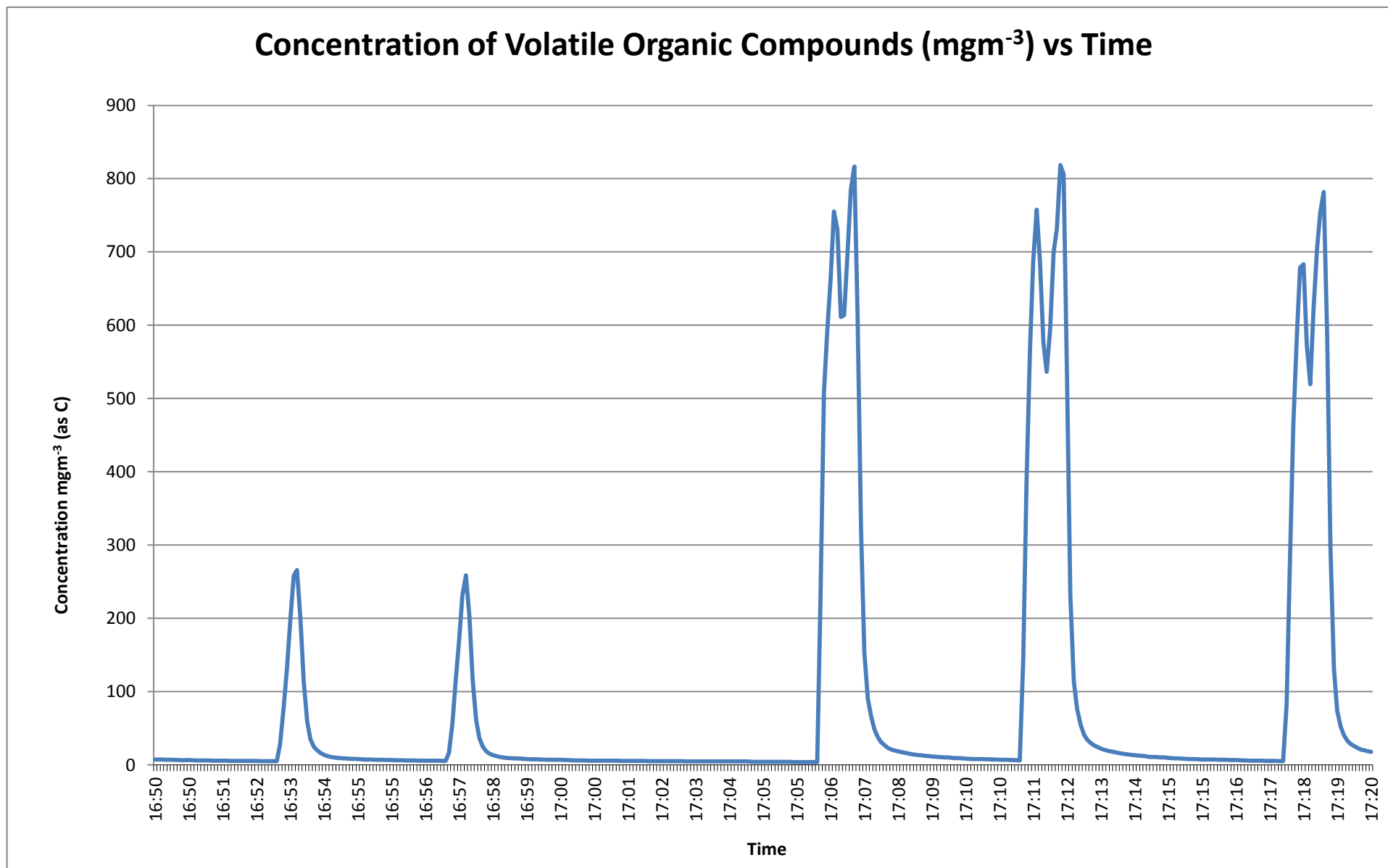
Appendix B10.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 46 - Spray booth

Concentrations at 273k and 101.3kPa Dry Basis			
$C_{mgm-3(wet)} = C_{mgm-3} \times \frac{100}{(100 - Wv)}$	=	84.3	mgm ⁻³
where:			
Concentrations at 273k and 101.3kPa Dry Basis	=	84.2	mgm ⁻³
Wv is the water vapour content	=	0.2	%
Concentration at 273k and 101.3kPa, Uncorrected for Oxygen, Wet Basis			
$C_{at\%} = C_{mgm-3} \times \frac{209 - O_{2ref}}{209 - O_{2meas}}$	=	84.2	mgm ⁻³
where:			
20.9 is the atmospheric concentration of oxygen	=	20.9	%
O _{2ref} is the reference concentration	=	N/A	%
O _{2 meas} is the measured concentration	=	N/A	%
N/A = Oxygen Not Measured			
Actual Rates of Discharge			
$E_{g/hr} = C \times Q_{std} \times \frac{60}{1000}$	=	946.9	ghr ⁻¹
where:			
C is the dry Concentration at STP	=	84.3	
Q _{std} is the dry flow rate at STP	=	187.1	
60/1000 is the conversion factor	=	0.060	
Comments on Compliance with BS EN 12619:2001			
Temperature maintained above 180°C	Pass		
Pre-Test Analyser Zero Check	Pass		
Zero Drift Check	Pass		
Span Drift Check	Pass		
Overall Calibration Acceptability	Pass		
Were all of the requirements of BS EN 12619:2013 fulfilled during the test? ☒ Yes ☐ No			

Appendix B10.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 46 - Spray booth

Uncertainty Calculation of Volatile Organic Compounds to BS EN 12619:2013							
Symbol	Source of Uncertainty	Value +/- ppm	Probability Distribution	Divisor	Ci	Ui() +/- ppm	V ₁ or V _{eff}
U _{AP}	Air Pressure	0.3785	Normal(K=2)	2	1	0.2	
U _{SP}	Sample Pressure	0.757	Normal(K=2)	2	1	0.4	
U _{T0}	Temp at 0°C	1.514	Normal(K=2)	2	1	0.8	
U _{TS}	Temp (sensitivity)	0.757	Normal(K=2)	2	1	0.4	
U _{H2O}	H2O cross-sensitivity	0.18925	Normal(K=2)	2	1	0.1	
U _{CO}	CO cross-sensitivity	0.0757	Normal(K=2)	2	1	0.0	
U _{CO2}	CO2 cross-sensitivity	0.3785	Normal(K=2)	2	1	0.2	
U _{NO}	NO cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{SO2}	SO2 cross-sensitivity	0.1514	Normal(K=2)	2	1	0.1	
U _{ZD}	Zero Drift	0.01	Normal(K=2)	2	1	0.0	
U _S	sensitivity Drift	0.3785	Normal(K=2)	2	1	0.2	
U _C	Calibration	1.514	Normal(K=2)	2	1	0.8	
U _C ()	Combined standard		normal			1.25	
U	Expanded		enter coverage	1.96		2.45	ppm
U	Expanded		enter coverage	1.96		1.31	mgm ⁻³

Appendix B10.4 - Volatile Organic Compounds to BS EN 12619:2013 - Stack 46 - Spray booth



Test Certificates



Test Certificate

Date 09/10/2014

Client
 Environmental Evaluation Ltd
 10 Greenwood Court
 Ramridge Road
 Luton
 LU2 0TN

Order No. STA14530NT
Certificate No. WK14-6357
Issue No. 1

Contact Neil Teixeira
Description 20 filters & 20 washes for TPM

Date Received 02/10/2014
Technique Gravimetric Stack

Sample No.	810217	70496/290914/F1	Method
Total particulate matter	<0.04 mg		D9(U)
Sample No.	810218	70496/290914/F2	Method
Total particulate matter	<0.04 mg		D9(U)
Sample No.	810219	70496/290914/F3	Method
Total particulate matter	<0.04 mg		D9(U)
Sample No.	810220	70496/290914/F4	Method
Total particulate matter	<0.04 mg		D9(U)
Sample No.	810221	70496/290914/F5	Method
Total particulate matter	<0.04 mg		D9(U)
Sample No.	810222	70496/290914/F6	Method
Total particulate matter	<0.04 mg		D9(U)
Sample No.	810223	70496/290914/F7	Method
Total particulate matter	<0.04 mg		D9(U)
Sample No.	810224	70496/290914/F8	Method
Total particulate matter	<0.04 mg		D9(U)

Page 1 of 5

RPS Laboratories Ltd, Unit 12, Waters Edge Business Park, Modwen Road, Salford, M5 3EZ
 Tel: (0161) 872 2443 Fax: (0161) 877 3959



Test Certificate

Date 09/10/2014

Client	Environmental Evaluation Ltd		Certificate No.	WK14-6357
			Issue No.	1
Sample No.	810225	70496/290914/F9	Method	
Total particulate matter	<0.04 mg		D9(U)	
Sample No.	810226	70496/290914/F10	Method	
Total particulate matter	<0.04 mg		D9(U)	
Sample No.	810227	70496/290914/S1	Method	
Total particulate matter	<0.5 mg		D9(U)	
Sample No.	810228	70496/290914/S2	Method	
Total particulate matter	<0.5 mg		D9(U)	
Sample No.	810229	70496/290914/S3	Method	
Total particulate matter	1.4 mg		D9(U)	
Sample No.	810230	70496/290914/S4	Method	
Total particulate matter	<0.5 mg		D9(U)	
Sample No.	810231	70496/290914/S5	Method	
Total particulate matter	0.6 mg		D9(U)	
Sample No.	810232	70496/290914/S6	Method	
Total particulate matter	0.8 mg		D9(U)	
Sample No.	810233	70496/290914/S7	Method	
Total particulate matter	<0.5 mg		D9(U)	
Sample No.	810234	70496/290914/S8	Method	
Total particulate matter	<0.5 mg		D9(U)	
Sample No.	810235	70496/290914/S9	Method	
Total particulate matter	1.1 mg		D9(U)	

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RPS Laboratories Ltd. Unit 12. Waters Edge Business Park. Modwen Road. Salford, M5 3EZ
 Tel: (0161) 872 2443 Fax: (0161) 877 3959



Test Certificate

Date 09/10/2014

Client	Environmental Evaluation Ltd		Certificate No.	WK14-6357
			Issue No.	1
Sample No.	810236	70496/290914/S10	Method	
Total particulate matter	0.8 mg		D9(U)	
Sample No.	810237	70496/300914/F11	Method	
Total particulate matter	<0.04 mg		D9(U)	
Sample No.	810238	70496/300914/F12	Method	
Total particulate matter	<0.04 mg		D9(U)	
Sample No.	810239	70496/300914/F13	Method	
Total particulate matter	<0.04 mg		D9(U)	
Sample No.	810240	70496/300914/F14	Method	
Total particulate matter	<0.04 mg		D9(U)	
Sample No.	810241	70496/300914/F15	Method	
Total particulate matter	<0.04 mg		D9(U)	
Sample No.	810242	70496/300914/F16	Method	
Total particulate matter	<0.04 mg		D9(U)	
Sample No.	810243	70496/300914/F17	Method	
Total particulate matter	<0.04 mg		D9(U)	
Sample No.	810244	70496/300914/F18	Method	
Total particulate matter	<0.04 mg		D9(U)	
Sample No.	810245	70496/300914/F19	Method	
Total particulate matter	<0.04 mg		D9(U)	
Sample No.	810246	70496/300914/F20	Method	
Total particulate matter	<0.04 mg		D9(U)	

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Test Certificate

Date 09/10/2014

Client	Environmental Evaluation Ltd		Certificate No.	WK14-6357
			Issue No.	1
Sample No.	810247	70496/300914/S11	Method	
Total particulate matter	0.9 mg		D9(U)	
Sample No.	810248	70496/300914/S12	Method	
Total particulate matter	<0.5 mg		D9(U)	
Sample No.	810249	70496/300914/S13	Method	
Total particulate matter	0.8 mg		D9(U)	
Sample No.	810250	70496/300914/S14	Method	
Total particulate matter	<0.5 mg		D9(U)	
Sample No.	810251	70496/300914/S15	Method	
Total particulate matter	1.2 mg		D9(U)	
Sample No.	810252	70496/300914/S16	Method	
Total particulate matter	<0.5 mg		D9(U)	
Sample No.	810253	70496/300914/S17	Method	
Total particulate matter	1.5 mg		D9(U)	
Sample No.	810254	70496/300914/S18	Method	
Total particulate matter	0.7 mg		D9(U)	
Sample No.	810255	70496/300914/S19	Method	
Total particulate matter	0.6 mg		D9(U)	
Sample No.	810256	70496/300914/S20	Method	
Total particulate matter	<0.5 mg		D9(U)	

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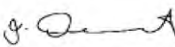


Test Certificate

Date 09/10/2014

Client	Environmental Evaluation Ltd	Certificate No.	WK14-6357
		Issue No.	1

Tested By	Kirstie Davenport	Date	07/10/2014
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Approved By		Date	09/10/2014
	Joanne Dewhurst		
	Laboratory Manager		

For and on authority of RPS Laboratories Ltd.

Method Symbols (U) Analysis is UKAS Accredited
(N) Analysis is not UKAS Accredited

Concentration values (mg/m³ and ppm) are calculated on the basis of information provided by the customer.
Results stated as ml are referring to the sample volume.

RPS Laboratories terms and conditions apply - a copy is available on request.

Analysis carried out on samples 'as received'

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MCERTS Certificates



Certificate of Personnel Competence

This is to certify that

Neil Teixeira

has been assessed by Sira Certification Service and
has demonstrated competence to the required standard of

Level 2 (team leader)

as defined in

**MCERTS Personnel Competency Standard
for Manual Stack-Emission Monitoring : April 2011, Version 7.2**

For the following Technical Endorsements:

TE1 - Particulate monitoring by isokinetic sampling techniques	expires Jun 2016
TE2 - Multi-phase sampling techniques	expires Jun 2016
TE3 - Gases/vapours by manual techniques	expires Jun 2017
TE4 - Gases/vapours by instrumental techniques	expires Mar 2017

Level 2 personnel may be required to retake the oral examination if the MCERTS Examination Board receives and upholds a complaint about them of a serious nature. The use of this certificate and the Sira Certification Mark are subject to the Regulations Applicable to Holders of Sira Certificates. The certificate holder agrees to comply with the MCERTS Code of Conduct. This certificate remains valid until the expiry date shown below.

Certificate issued : Dec 2011

Level 2 renewal date : Jun 2016

H&S renewal date : Sep 2015

Certificate expiry date : Sep 2015

Certificate No : Sira MP05 333 /5

Registration No : MN05 583


R. Cooper Eng MInstMC
Technical Director

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For further information contact Sira on 01477 838888 or visit our website at www.sira.co.uk

Sira Certification Service

Unit 10, The Old Mill, 1000 Old Mill Lane, Lutterworth, Leics, LE15 8YU
Tel: 01477 838888 Fax: 01477 838889 Email: info@sira.co.uk



Certificate of Personnel Competence

This is to certify that

Phillip Soley

has been assessed by Sira Certification Service and
has demonstrated competence to the required standard of

Level 1 (technician)

as defined in

**MCERTS Personnel Competency Standard
for Manual Stack-Emission Monitoring : October 2012, Version 8.1**

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Certificate issued : Dec 2012
Level 1 renewal date : Dec 2017
H&S renewal date : May 2017

Certificate expiry date : Dec 2017

Certificate No : Sira-692 /
Registration No : MM12 1187


R Cooper Eng MInstMC
Technical Director

MCERTS is operated on behalf on the Environment Agency by



Sira Certification Service

12 Acorn Industrial Park, Crayford Road,
Crayford, Dartford, Kent DA1 4AL
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End of Report