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REPORT FOR THE MONITORING OF EMISSIONS TO AIR FROM BAE SYSTEMS MARITIME - SUBMARINES, BARROW-IN-FURNESS, CUMBRIA, LA14 1AF

Part 1: Executive Summary

Permit /Authorisation Number:	PPC/B/05-V2016A
Operator:	BAE Systems
Installation:	Maritime – Submarines, Barrow-In-Furness
Monitoring Dates:	15th May – 22nd May 2017
Project Number:	EPA/JBN/17/511
For The Attention of:	Mr Terry Hughes
Client:	Leck Construction
Client Address:	Site Engineering Services Dept., Central Area, Barrow-In-Furness, Cumbria, LA14 1AF
Report Date:	29/06/17
Version:	1
Report Author:	T Dodds
Report Approved By:	T Dodds
MCERTS Number:	MM 03 414
MCERTS Qualifications	Level 2 TE1, TE2, TE3 & TE4
Position:	Director
Signature:	

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS TESTING
4039

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1.1 Monitoring Objectives

EPA Limited were commissioned by Leck Construction to carry out emissions monitoring to determine the release of prescribed pollutants from varying release points (refer to Table 1) under normal operating conditions.

Table 1: Determinants to be Monitored From Varying Facilities

Emission Point Identification	Substances to be Monitored	
	Particulates	Total VOC's
RIF Hand Paint Enclosure Area D16	✓	✓
RIF Spray Paint Enclosure Area D16	✓	✓
Paint Shop Oven Vent Area D13	✓	✓
Paint Shop Spray Area D13	✓	✓
Paint Shop Shot Blast Area D13	✓	-
Paint Shop Dryer Area D13	✓	✓
DDH Paint Extraction Area D34	✓	✓
DDH Tile Adhesive Facility Area D34	✓	✓
NAS Annex Area A69	✓	✓
Tile Cutting Facility	✓	-
Paint Mixing Facility Area D24	✓	✓
Tile Facility Area C10	✓	✓

1.2 Monitoring Results

Emission Point Reference	Substance to be Monitored	Emission Limit Value (30 min mean)	Periodic Monitoring Result (30 min mean)	Uncertainty	Units	Reference Conditions	Date of Sampling	Start and Stop Time	Monitoring Method Reference	Accreditation for use of Method	Operating Status
RIF Hand Paint Enclosure Area D16	Particulates	50mg/Nm^3	1.1	± 0.18	mgm^{-3}	STP (101.3kPa, 273K)	15/05/17	13:13 – 13:43	BS EN 13284-1	UKAS/ MCERTS	Normal
	Total VOC's	N/A	17.5	± 3.56	mgm^{-3}	STP (101.3kPa, 273K)			BS EN 12619	UKAS/ MCERTS	Normal
RIF Spray Paint Enclosure Area D16	Particulates	50mg/Nm^3	5.0	± 0.71	mgm^{-3}	STP (101.3kPa, 273K)	15/05/17	15:12 – 15:42	BS EN 13284-1	UKAS/ MCERTS	Normal
	Total VOC's	N/A	1440.6	± 34.18	mgm^{-3}	STP (101.3kPa, 273K)			BS EN 12619	UKAS/ MCERTS	Normal
Paint Shop Oven Vent Area D13	Particulates	50mg/Nm^3	1.1	± 0.15	mgm^{-3}	STP (101.3kPa, 273K)	16/05/17	13:54 – 14:24	BS EN 13284-1	UKAS/ MCERTS	Normal
	Total VOC's	N/A	13.5	± 0.38	mgm^{-3}	STP (101.3kPa, 273K)			BS EN 12619	UKAS/ MCERTS	Normal
Paint Shop Spray Area D13	Particulates	50mg/Nm^3	9.4	± 1.34	mgm^{-3}	STP (101.3kPa, 273K)	16/05/17	12:39 – 13:13	BS EN 13284-1	UKAS/ MCERTS	Normal
	Total VOC's	N/A	3.8	± 0.38	mgm^{-3}	STP (101.3kPa, 273K)			BS EN 12619	UKAS/ MCERTS	Normal

Emission Point Reference	Substance to be Monitored	Emission Limit Value (30 min mean)	Periodic Monitoring Result (30 min mean)	Uncertainty	Units	Reference Conditions	Date of Sampling	Start and Stop Time	Monitoring Method Reference	Accreditation for use of Method	Operating Status
Paint Shop Shot Blast Area D13	Particulates	50mg/Nm^3	<0.67	± 0.08	mgm^{-3}	STP (101.3kPa, 273K)	16/05/17	10:25 – 10:57	BS EN 13284-1	UKAS/ MCERTS	Normal
Paint Shop Dryer Area D13	Particulates	50mg/Nm^3	<0.75	± 0.11	mgm^{-3}	STP (101.3kPa, 273K)	16/05/17	15:04 – 15:34	BS EN 13284-1	UKAS/ MCERTS	Normal
	Total VOC's	N/A	10.0	± 0.38	mgm^{-3}	STP (101.3kPa, 273K)			BS EN 12619	UKAS/ MCERTS	Normal
DDH Paint Extraction Area D34	Particulates	50mg/Nm^3	1.8	± 0.21	mgm^{-3}	STP (101.3kPa, 273K)	22/05/17	13:06 – 13:40	BS EN 13284-1	UKAS/ MCERTS	Normal
	Total VOC's	N/A	331.7	± 34.20	mgm^{-3}	STP (101.3kPa, 273K)			BS EN 12619	UKAS/ MCERTS	Normal
DDH Tile Adhesive Facility Area D34	Particulates	50mg/Nm^3	0.8	± 0.08	mgm^{-3}	STP (101.3kPa, 273K)	17/05/17	14:10 – 14:40	BS EN 13284-1	UKAS/ MCERTS	Normal
	Total VOC's	N/A	18.8	± 3.57	mgm^{-3}	STP (101.3kPa, 273K)			BS EN 12619	UKAS/ MCERTS	Normal
NAS Annex Paint Extraction Area A69	Particulates	50mg/Nm^3	0.5	± 0.05	mgm^{-3}	STP (101.3kPa, 273K)	19/05/17	09:53 – 10:27	BS EN 13284-1	UKAS/ MCERTS	Normal
	Total VOC's	N/A	175.8	± 25.38	mgm^{-3}	STP (101.3kPa, 273K)			BS EN 12619	UKAS/ MCERTS	Normal

Emission Point Reference	Substance to be Monitored	Emission Limit Value (30 min mean)	Periodic Monitoring Result (30 min mean)	Uncertainty	Units	Reference Conditions	Date of Sampling	Start and Stop Time	Monitoring Method Reference	Accreditation for use of Method	Operating Status
DDH Tile Cutting Facility	Particulates	50mg/Nm^3	0.8	± 0.08	mgm^{-3}	STP (101.3kPa, 273K)	18/05/17	10:06 – 10:36	BS EN 13284-1	UKAS/ MCERTS	Normal
Paint Mixing Facility	Particulates	50mg/Nm^3	0.7	± 0.10	mgm^{-3}	STP (101.3kPa, 273K)	18/05/17	11:52 – 12:26	BS EN 13284-1	UKAS/ MCERTS	Normal
	Total VOC's	N/A	38.2	± 3.48	mgm^{-3}	STP (101.3kPa, 273K)			BS EN 12619	UKAS/ MCERTS	Normal
C10 Tile Facility	Particulates	50mg/Nm^3	0.6	± 0.07	mgm^{-3}	STP (101.3kPa, 273K)	18/05/17	15:07 – 15:41	BS EN 13284-1	UKAS/ MCERTS	Normal
	Total VOC's	N/A	13.2	± 3.47	mgm^{-3}	STP (101.3kPa, 273K)			BS EN 12619	UKAS/ MCERTS	Normal

1.3 Operating Information

Emission Point Reference	Continuous or Batch Process	Details of Batch during Sampling (Type of paint used)	Feedstock	Abatement	Comparison of Operator CEMS and periodic Monitoring Results			
					Substance	CEM Results	Periodic Monitoring Results	Units
RIF Hand Paint Enclosure Area D16	Batch	L524 L574, 524	Various Parts	N/A	N/A	N/A	N/A	N/A
RIF Spray Paint Enclosure Area D16	Batch	L574	N/A	N/A	N/A	N/A	N/A	N/A
Paint Shop Oven Vent Area D13	Batch	Epoxy P8000	Various Parts	N/A	N/A	N/A	N/A	N/A
Paint Shop Spray Area D13	Batch	Epoxy P8000	Various Parts	Filter System	N/A	N/A	N/A	N/A
Paint Shop Shot Blast Area D13	Batch	N/A	N/A	Bag Filter	N/A	N/A	N/A	N/A
Paint Shop Dryer Area D13	Batch	524, 574, M922, G218	Various Parts	Bag Filter	N/A	N/A	N/A	N/A
DDH Paint Extraction Area D34	Batch	L572	N/A	N/A	N/A	N/A	N/A	N/A
DDH Tile Adhesive Facility Area D34	Batch	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NAS Annex Area A69	Batch	L574	MDF	Bag Filter	N/A	N/A	N/A	N/A

Emission Point Reference	Continuous or Batch Process	Details of Batch during Sampling (Type of paint used)	Feedstock	Abatement	Comparison of Operator CEMS and periodic Monitoring Results			
					Substance	CEM Results	Periodic Monitoring Results	Units
DDH Tile Cutting Facility	Batch	N/A	CTL 2Tiles	Bag Filter	N/A	N/A	N/A	N/A
Paint Mixing. Area D24	Batch	L574	Mix Tank	Carbon Filter	N/A	N/A	N/A	N/A
C10 Tile Facility	Batch	n/a	CTL Tiles	Bag Filter	N/A	N/A	N/A	N/A

1.4 Monitoring Deviations

Emission Point Reference	Substances Not Monitored (including explanation)	Monitoring Deviations (including explanation)	Other Relevant Issues
Paint Shop Shot Blast	-	Only one sample line, number of sample points doubled Blank test slightly higher concentration than actual test	-
Paint Shop Dryer Area D13	-	Blank test slightly higher concentration than actual test	-
NAS Annex Area A69	-	Blank test slightly higher concentration than actual test	-
DDH Tile Cutting Facility	-	Blank test slightly higher concentration than actual test	-
C10 Tile Facility	-	Blank test slightly higher concentration than actual test	-

Part 2: Supporting Information

2.1 Appendix 1: General Information

2.1.1 Emissions Monitoring Team

Consultant	Charles Bell
MCERTS Accreditation	Level 2 TE1
MCERTS Number	MM 02 015
Degree	BSc Hons Energy Technology Management

Project Manager	Tracy Dodds
MCERTS Accreditation	Level 2 TE1, 2, 3 & 4
MCERTS Number	MM 03 414
Degree	BSc Hons Environmental Management & Technology

2.1.2 Substances Monitored

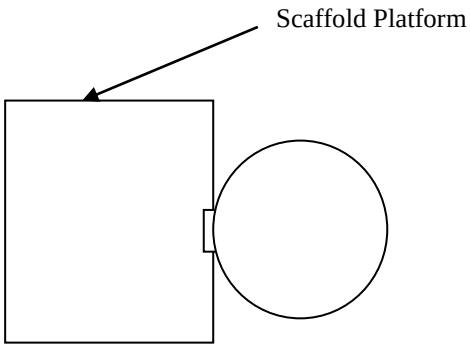
Substances Monitored	Standard Reference Method	EPA Method
Flow	BS EN 16911	EPA Method 19
Particulate	BS EN 13284-1	EPA Method 1
Total VOCs by FID	BS EN 12619	EPA Method 6

2.1.3 Site Equipment Log

Equipment Description	EPA Reference Number
Heated Line	EPA/HEAT/04, 05, 06 09
Pitot Tube	EPA/PITOT/10,11
Thermocouple Probe	EPA/TCP/55, 65
Thermocouple Reader	EPA/MAN/07
Measuring Tape	EPA/TAPE/14
Vion Site Barometer	EPA/BAR/04
Sampling Probe	EPA/PROBE/08, 09
Dry Gas Meter	EPA/DGM/09
Site Balance	EPA/MASS/02
Sampling Nozzle	EPA/N/6, 14, 30, 36,
Sick 3006 FID	EPA/FID/01
Sample Box	EPA/SAMP/09A, 01A

2.2 Appendix 2: RIF Hand Paint Enclosure

2.2.1 Sampling Location



Duct Characteristics

	Value	Units
Type of Duct	Circular	-
Diameter / Depth	0.285	m
Width	N/A	m
Area	0.064	m^2
Port Size	4	inch
Port Depth	70	mm
Orientation	Vertical	-

Sampling Platform

General Platform Information	
Permanent / Temporary	Temporary
Inside / Outside	Inside
Height of Platform from Ground Level	~7m
Size of Platform	1.0m x 1.5m
Does the Platform have a weather cover (roof)	N/A
Platform has 2 hand rails (approx 0.5m and 1.0m high)	Yes
Platform has vertical base boards (approx 0.25m high)	Yes
Platform has removable chains / self closing gates at the top of the ladder	Yes
Platform positioned relative to the access ports (free from obstruction that would hamper insertion and removal of the sampling equipment)	Yes
Depth of platform (length of probe + 1m)	No

2.2.2 Flow Criteria Measurements

Traverse Point	**A1**		
Pressure (mm H_2O)	8.5	8.5	8.5
√ΔP	2.92	2.92	2.92
Temperature (ºC)	27	27	27

Static Pressure (mmH_2O)	12.0	**Barometric Pressure (mm Hg)**	751.0	**Duct Dimensions (m)**	0.285

Velocity (m/s) average	10.2	**Actual Flow of stack gas (m^3/hr)**	2332.1
Stack Geometry	Circular	**Flow (wet) at STP (m^3/hr)**	2099.5
Dimensions (m)	0.285	**Flow (dry) at STP (m^3/hr)**	2052.8
Area (m^2)	0.064		

	Average	**Max**	**Min**	**Ratio Max/Min**	**Compliance**
Pressure (mm H_2O)	8.5	8.5	8.5	1.0	Yes
√ΔP (mm H_2O)^{½}	2.92	2.92	2.92	1.0	Yes
Temperature (ºC)	27.0	27.0	27.0	1.0	Yes
Angle of flow	<15º				Yes
Local Negative Flow	No				Yes

2.2.3 Gas Measurements

	Mean
Oxygen (%)	20.90
Carbon Monoxide (ppm)	0
Carbon Dioxide (%)	0.03

2.2.4 Manual Method Calculations

Test Dates	15/05/17		
Company	Leck Construction (BAE Systems)		
Contact	T Hughes		
Stack	RIF Hand		
	Blank	Test 1	Units
Sample Ref	epa.17.511.01	epa.17.511.02	-
Start Time	12:52	13:13	hr:mm
Stop Time	12:57	13:43	hr:mm
% O_2	20.90	20.90	%
% CO_2	0.03	0.03	%
%N_2	-	79.07	%
V_{lc}	-	12.1	ml
B_{wo}	0.02	0.022	-
P_b	-	751.0	mm Hg
St	-	12	mm H_2O
T_s	-	27.00	ºC
$\sqrt{\Delta P}$	-	2.92	$(mm\ H_2O)^{½}$
Yd	-	1.036	-
Test Time	5	30	min
T_m	-	17.50	ºC
C_p	-	0.827	-
As	-	0.064	m^2
D_n	-	7.20	mm
ΔH ave	-	47.65	mm H_20
V_{mstd}	0.6620	0.6620	m^3
V_{wstd}	0.0151	0.0151	m^3
$Q_{std,wet}$	-	2059.1	Nm^3/h
Q_{act}	-	2287.2	Nm^3/h
Isokinetic Rate	-	103.0	%
Vs	-	9.96	m/s
Washings			
Sample Ref	epa.17.511.01W	epa.17.511.02W	-
Weight	<0.5	<0.5	mg
Filter			
Sample Ref	epa.17.511.01F	epa.17.511.02F	-
Weight	<0.1	0.24	mg
Particulate Concentration (Dry, No O_2 Correction)	<0.91	1.1	mg/Nm^3
Particulate Concentration (at Ref Water and Oxygen)	<0.89	1.1	mg/Nm^3
Particulate Release Rate	-	2.25	g/hr
Reference Temp	273		K
Reference Pressure	101.3		kPa
Reference Moisture	No correction for moisture		-
Reference Oxygen	No correction for Oxygen		%

Particulates

	Filter (mg)	Washings (mg)
Blank	<0.1	<0.5
Run 1	0.24	<0.5

2.2.5 Sampling Measurements

Date	15-05-17		Impinger	Initial Wt (g)	Final Wt (g)	Wt Gained (g)			l/min	Vac (in Hg)			
Start Time	13:13		1	782.8	785.6	2.8		Leak Check (Pre)	0.11	10			
End Time	13:43		2	792.6	793.4	0.8		Leak Check (Post)	0.1	10			
Duration (mm.ss)	30.00		3	677.6	679.0	1.4							
Stack	RIF Hand Paint		4	871.0	878.1	7.1		Pitot ID	Pitot 06			Velocity Head	
Run	1		5	247.4	247.4	0.0		DGM ID	DGM 09			Min	8.5
												Max	8.5
												Max:Min	1.00
								Nozzle ID	n36				
			Sample Ref	epa.17.511.02				Nozzle Diameter (mm)	7.20				
K Factor	5.61		Filter Number	epa.17.511.02F									
Stack Diameter (m)	0.29		Probe Washing No	epa.17.511.02W									
							ΔH across orifice meter (mm H_2O)	DGM (litres)	DGM Temp (ºC)		Temp (ºC)		
Point	Time	Vac	Stack Temp	Prelim		Actual		6489.24	In	Out	Probe	Filter	Impinger
a1	0 5	3	27	8.5		2.92	47.65	6605	17	16	160	160	
a1	5 10	3	27	8.5		2.92	47.65	6722	17	16	160	160	
a1	10 15	3	27	8.5		2.92	47.65	6844	18	17	160	160	
a1	15 20	3	27	8.5		2.92	47.65	6949	18	17	160	160	
a1	20 25	3	27	8.5		2.92	47.65	7060	19	18	160	160	
a1	25 30	3	27	8.5		2.92	47.65	7174.16	19	18	160	160	
Total / Average		3.00	27.00	8.50		2.92	47.65	684.92	18.00	17.00	160.00	160.00	

2.2.6 Instrumental Gas Analyser Site Calibration Measurements

Zero Point

				Pre Test			Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Pre Span	Post Span	System	System	Zero Drift
VOC (ppm)	100	Ambient Air	0.00	0.00	0.00	0.00	0.00	0.00

Span Gas

				Pre Test		Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Analyser	System	System	Span Drift
VOC (ppm)	100	EPA/CGAS/103	80.40	80.02	80.25	81.15	0.90

2.2.7 Instrumental Gas Analyser Results

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
15.05.2017	13:13:14	4.8	7.6	7.6
15.05.2017	13:13:29	5.7	9.1	9.1
15.05.2017	13:13:44	5.7	9.1	9.1
15.05.2017	13:13:59	8.0	12.8	12.8
15.05.2017	13:14:14	7.6	12.3	12.3
15.05.2017	13:14:29	8.0	12.8	12.8
15.05.2017	13:14:44	8.3	13.4	13.4
15.05.2017	13:14:59	9.1	14.6	14.6
15.05.2017	13:15:14	9.7	15.7	15.7
15.05.2017	13:15:29	10.4	16.7	16.7
15.05.2017	13:15:44	10.5	16.8	16.8
15.05.2017	13:15:59	11.5	18.4	18.4
15.05.2017	13:16:14	12.3	19.8	19.8
15.05.2017	13:16:29	15.3	24.6	24.6
15.05.2017	13:16:44	19.2	30.9	30.9
15.05.2017	13:16:59	21.2	34.1	34.1
15.05.2017	13:17:14	22.3	35.9	35.9
15.05.2017	13:17:29	22.7	36.4	36.4
15.05.2017	13:17:44	21.3	34.2	34.2
15.05.2017	13:17:59	18.2	29.3	29.3
15.05.2017	13:18:14	15.3	24.6	24.6
15.05.2017	13:18:29	10.3	16.6	16.6
15.05.2017	13:18:44	7.6	12.1	12.1
15.05.2017	13:18:59	9.7	15.7	15.7
15.05.2017	13:19:14	11.2	18.0	18.0
15.05.2017	13:19:29	12.4	19.9	19.9
15.05.2017	13:19:44	15.3	24.6	24.6
15.05.2017	13:19:59	22.3	35.9	35.9
15.05.2017	13:20:14	24.3	39.1	39.1
15.05.2017	13:20:29	15.3	24.6	24.6
15.05.2017	13:20:44	18.3	29.3	29.3

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
15.05.2017	13:20:59	11.3	18.1	18.1
15.05.2017	13:21:14	10.3	16.5	16.5
15.05.2017	13:21:29	11.2	18.0	18.0
15.05.2017	13:21:44	12.7	20.3	20.3
15.05.2017	13:21:59	11.3	18.2	18.2
15.05.2017	13:22:14	10.5	16.8	16.8
15.05.2017	13:22:29	9.9	15.9	15.9
15.05.2017	13:22:44	9.5	15.3	15.3
15.05.2017	13:22:59	9.9	15.8	15.8
15.05.2017	13:23:14	8.7	14.0	14.0
15.05.2017	13:23:29	8.9	14.3	14.3
15.05.2017	13:23:44	8.9	14.3	14.3
15.05.2017	13:23:59	9.0	14.4	14.4
15.05.2017	13:24:14	8.3	13.4	13.4
15.05.2017	13:24:29	9.2	14.7	14.7
15.05.2017	13:24:44	10.2	16.4	16.4
15.05.2017	13:24:59	10.5	16.8	16.8
15.05.2017	13:25:14	10.3	16.5	16.5
15.05.2017	13:25:29	10.3	16.5	16.5
15.05.2017	13:25:44	10.2	16.5	16.5
15.05.2017	13:25:59	10.3	16.5	16.5
15.05.2017	13:26:14	10.2	16.5	16.5
15.05.2017	13:26:29	11.2	18.0	18.0
15.05.2017	13:26:44	12.6	20.2	20.2
15.05.2017	13:26:59	13.3	21.3	21.3
15.05.2017	13:27:14	14.2	22.9	22.9
15.05.2017	13:27:29	12.3	19.8	19.8
15.05.2017	13:27:44	11.3	18.1	18.1
15.05.2017	13:27:59	10.2	16.4	16.4
15.05.2017	13:28:14	9.3	14.9	14.9
15.05.2017	13:28:29	6.2	10.0	10.0
15.05.2017	13:28:44	6.0	9.7	9.7
15.05.2017	13:28:59	7.0	11.3	11.3
15.05.2017	13:29:14	7.1	11.3	11.3
15.05.2017	13:29:29	7.3	11.8	11.8
15.05.2017	13:29:44	5.7	9.2	9.2
15.05.2017	13:29:59	6.0	9.6	9.6
15.05.2017	13:30:14	8.9	14.4	14.4
15.05.2017	13:30:29	9.4	15.0	15.0
15.05.2017	13:30:44	10.8	17.3	17.3
15.05.2017	13:30:59	2.6	4.2	4.2
15.05.2017	13:31:14	15.2	24.5	24.5
15.05.2017	13:31:29	20.3	32.7	32.7
15.05.2017	13:31:44	20.2	32.4	32.4
15.05.2017	13:31:59	18.2	29.3	29.3
15.05.2017	13:32:14	15.2	24.5	24.5
15.05.2017	13:32:29	18.2	29.3	29.3
15.05.2017	13:32:44	22.0	35.4	35.4

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
15.05.2017	13:32:59	24.1	38.7	38.7
15.05.2017	13:33:14	17.0	27.4	27.4
15.05.2017	13:33:29	17.1	27.5	27.5
15.05.2017	13:33:44	18.3	29.4	29.4
15.05.2017	13:33:59	15.2	24.5	24.5
15.05.2017	13:34:14	14.2	22.9	22.9
15.05.2017	13:34:29	12.3	19.8	19.8
15.05.2017	13:34:44	9.5	15.2	15.2
15.05.2017	13:34:59	8.1	13.1	13.1
15.05.2017	13:35:14	7.9	12.7	12.7
15.05.2017	13:35:29	7.8	12.5	12.5
15.05.2017	13:35:44	7.6	12.2	12.2
15.05.2017	13:35:59	7.5	12.1	12.1
15.05.2017	13:36:14	7.3	11.8	11.8
15.05.2017	13:36:29	7.3	11.8	11.8
15.05.2017	13:36:44	7.8	12.6	12.6
15.05.2017	13:36:59	7.5	12.1	12.1
15.05.2017	13:37:14	7.4	11.8	11.8
15.05.2017	13:37:29	7.6	12.2	12.2
15.05.2017	13:37:44	7.6	12.2	12.2
15.05.2017	13:37:59	7.2	11.5	11.5
15.05.2017	13:38:14	7.4	11.9	11.9
15.05.2017	13:38:29	7.6	12.2	12.2
15.05.2017	13:38:44	7.8	12.5	12.5
15.05.2017	13:38:59	7.9	12.8	12.8
15.05.2017	13:39:14	8.0	12.8	12.8
15.05.2017	13:39:29	8.4	13.5	13.5
15.05.2017	13:39:44	9.3	14.9	14.9
15.05.2017	13:39:59	10.2	16.4	16.4
15.05.2017	13:40:14	10.3	16.5	16.5
15.05.2017	13:40:29	10.2	16.4	16.4
15.05.2017	13:40:44	7.6	12.1	12.1
15.05.2017	13:40:59	7.5	12.0	12.0
15.05.2017	13:41:14	7.0	11.3	11.3
15.05.2017	13:41:29	6.8	11.0	11.0
15.05.2017	13:41:44	7.9	12.8	12.8
15.05.2017	13:41:59	8.1	13.0	13.0
15.05.2017	13:42:14	8.1	13.0	13.0
15.05.2017	13:42:29	7.9	12.6	12.6
15.05.2017	13:42:44	7.5	12.0	12.0
15.05.2017	13:42:59	7.7	12.3	12.3
15.05.2017	13:43:14	7.4	11.8	11.8
15.05.2017	13:43:29	7.3	11.7	11.7
15.05.2017	13:43:44	6.9	11.0	11.0
15.05.2017	13:43:59	7.2	11.6	11.6
Mean		10.9	17.5	17.5
Max		24.3	39.1	39.1
Min		2.6	4.2	4.2

2.2.8 Uncertainty Calculations

Particulates

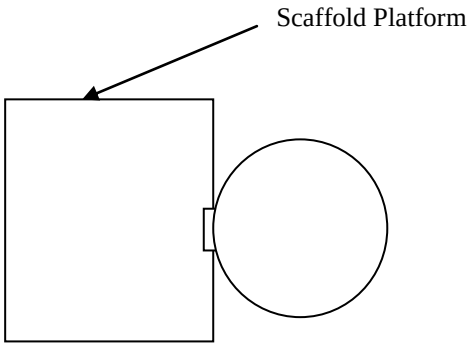
Source of uncertainty	Estimate of Component (1 SD) (± %)	Combined Uncertainty (± %)	Expanded Uncertainty (95% Confidence limit) (± %)
Pressure	7.87	8.25	As % of result 16.01
Gas Volume	2.33		
Gas Temperature	0.70		
Humidity	0.50		
Washing Weighing	0.02		As % of ELV 0.36
Filter Weighing	0.01		
Leak	0.00		As mg/m^3 0.18
O_2 Concentration	0.00		

Total VOC's

Source of uncertainty	Estimate of Component (1 SD) ppm	Combined Uncertainty ppm	Expanded Uncertainty (95% Confidence limit) ppm
Linearity	0.80	1.14	2.21
Temperature effect (zero)	0.46		
Barometric Pressure	0.40		
Span gas	0.39		
Span drift	0.26		
Temperature effect (span)	0.23		
Repeatability	0.07		**Expanded Uncertainty (95% Confidence limit) %**
Zero drift	0.00		
Cross sensitivity CO (1.2 % vol)	0.00		
Cross sensitivity NO (127 mgm^{-3})	0.00		As % of Result 20.29
Cross sensitivity H_2O (sat 325K)	0.00		
Cross sensitivity SO_2 (2767 mgm^{-3})	0.00		As mg/m^3 at ref conditions 3.56
Cross sensitivity CO_2 (15.2 % vol)	0.00		

2.3 Appendix 3: RIF Spray Paint Enclosure

2.3.1 Sampling Location



Duct Characteristics

	Value	Units
Type of Duct	Circular	-
Diameter / Depth	0.295	m
Width	N/A	m
Area	0.068	m^2
Port Size	4	inch
Port Depth	70	mm
Orientation	Vertical	-

Sampling Platform

General Platform Information	
Permanent / Temporary	Temporary
Inside / Outside	Outside
Height of Platform from Ground Level	~12m
Size of Platform	1.5m x 2.0m
Does the Platform have a weather cover (roof)	No
Platform has 2 hand rails (approx 0.5m and 1.0m high)	Yes
Platform has vertical base boards (approx 0.25m high)	Yes
Platform has removable chains / self closing gates at the top of the ladder	Yes
Platform positioned relative to the access ports (free from obstruction that would hamper insertion and removal of the sampling equipment)	Yes
Depth of platform (length of probe + 1m)	Yes

2.3.2 Flow Criteria Measurements

Traverse Point	**A1**		
Pressure (mm H_2O)	18.0	18.0	18.0
$\sqrt{\Delta P}$	4.24	4.24	4.24
Temperature (ºC)	22	22	22

Static Pressure (mmH_2O)	3.0	**Barometric Pressure (mm Hg)**	751.0	**Duct Dimensions (m)**	0.295

Velocity (m/s) average	14.7	**Actual Flow of stack gas (m^3/hr)**	3624.3
Stack Geometry	Circular	**Flow (wet) at STP (m^3/hr)**	3315.3
Dimensions (m)	0.295	**Flow (dry) at STP (m^3/hr)**	3279.4
Area (m^2)	0.068		

	Average	**Max**	**Min**	**Ratio Max/Min**	**Compliance**
Pressure (mm H_2O)	18.0	18.0	18.0	1.0	Yes
$\sqrt{\Delta P}$ (mm H_2O)^{½}	4.24	4.24	4.24	1.0	Yes
Temperature (ºC)	22.0	22.0	22.0	1.0	Yes
Angle of flow	<15º				Yes
Local Negative Flow	No				Yes

2.3.3 Gas Measurements

	Mean
Oxygen (%)	20.90
Carbon Monoxide (ppm)	0
Carbon Dioxide (%)	0.03

2.3.4 Manual Method Calculations

Test Dates	15/05/17		
Company	Leck Construction (BAE Systems)		
Contact	T Hughes		
Stack	RIF Spray		
	Blank	Test 1	Units
Sample Ref	epa.17.511.03	epa.17.511.04	-
Start Time	14:50	15:12	hr:mm
Stop Time	14:55	15:42	hr:mm
% O_2	20.90	20.90	%
% CO_2	0.03	0.03	%
%N_2	-	79.07	%
V_{lc}	-	6.2	ml
B_{wo}	0.01	0.011	-
P_b	-	751.0	mm Hg
St	-	3	mm H_2O
T_s	-	22.00	ºC
$\sqrt{\Delta P}$	-	3.88	$(mm\ H_2O)^{½}$
Yd	-	1.036	-
Test Time	5	30	min
T_m	-	16.33	ºC
C_p	-	0.828	-
As	-	0.068	m^2
D_n	-	6.47	mm
ΔH ave	-	55.21	mm H_20
V_{mstd}	0.7064	0.7064	m^3
V_{wstd}	0.0077	0.0077	m^3
$Q_{std,wet}$	-	2956.8	Nm^3/h
Q_{act}	-	3232.4	Nm^3/h
Isokinetic Rate	-	100.4	%
Vs	-	13.14	m/s
Washings			
Sample Ref	epa.17.511.03W	epa.17.511.04W	-
Weight	<0.5	<0.5	mg
Filter			
Sample Ref	epa.17.511.03F	epa.17.511.04F	-
Weight	0.7	3.07	mg
Particulate Concentration (Dry, No O_2 Correction)	1.7	5.1	mg/Nm^3
Particulate Concentration (at Ref Water and Oxygen)	1.7	5.0	mg/Nm^3
Particulate Release Rate	-	14.78	g/hr
Reference Temp	273		K
Reference Pressure	101.3		kPa
Reference Moisture	No correction for moisture		-
Reference Oxygen	No correction for Oxygen		%

Particulates

	Filter (mg)	Washings (mg)
Blank	0.7	<0.5
Run 1	3.07	<0.5

2.3.5 Sampling Measurements

Date	15-05-17		Impinger	Initial Wt (g)	Final Wt (g)	Wt Gained (g)			l/min	Vac (in Hg)			
Start Time	15:12		1	785.6	786.2	0.6		Leak Check (Pre)	0.09	10			
End Time	15:42		2	793.4	793.6	0.2		Leak Check (Post)	0.07	7			
Duration (mm.ss)	30.00		3	679.0	679.1	0.1							
Stack	RIF Spray Paint		4	878.1	883.4	5.3		Pitot ID	pitot 06			Velocity Head	
Run	1		5	247.4	247.4	0.0		DGM ID	dgm 09			Min	14
												Max	17.5
												Max:Min	1.25
								n14	n14	n14			
			Sample Ref	epa.17.511.04				Nozzle Diameter (mm)	6.47	6.47	6.47		
K Factor	3.66		Filter Number	epa.17.511.04F									
Stack Diameter (m)	0.30		Probe Washing No	epa.17.511.04W									
							ΔH across orifice meter (mm H_2O)	DGM (litres)	DGM Temp (ºC)		Temp (ºC)		
Point	Time	Vac	Stack Temp	Prelim		Actual		7198.72	In	Out	Probe	Filter	Impinger
a1	0 5	4	22	17.5		4.18	64.06	7329	16	16	70		
a1	5 10	4	22	16		4.00	58.57	7470	16	16	70		
a1	10 15	4	22	15		3.87	54.91	7577	17	16	70		
a1	15 20	4	22	14		3.74	51.25	7685	17	16	70		
a1	20 25	4	22	14		3.74	51.25	7809	17	16	70		
a1	25 30	4	22	14		3.74	51.25	7926.12	17	16	70		
Total / Average		4.00	22.00	15.08		3.88	55.21	727.40	16.67	16.00	70		

2.3.6 Instrumental Gas Analyser Site Calibration Measurements

Zero Point

				Pre Test			Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Pre Span	Post Span	System	System	Zero Drift
VOC (ppm)	1000	Ambient Air	0.00	0.00	0.00	0.00	0.02	0.02

Span Gas

				Pre Test		Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Analyser	System	System	Span Drift
VOC (ppm)	1000	EPA/CGAS/97	802.0	804.39	805.62	804.65	-0.97

2.3.7 Instrumental Gas Analyser Results

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
15.05.2017	15:12:14	524.8	843.4	843.4
15.05.2017	15:12:29	644.3	1035.5	1035.5
15.05.2017	15:12:44	629.7	1012.0	1012.0
15.05.2017	15:12:59	722.3	1160.8	1160.8
15.05.2017	15:13:14	710.2	1141.4	1141.4
15.05.2017	15:13:29	832.7	1338.3	1338.3
15.05.2017	15:13:44	846.3	1360.1	1360.1
15.05.2017	15:13:59	812.3	1305.5	1305.5
15.05.2017	15:14:14	837.6	1346.1	1346.1
15.05.2017	15:14:29	623.6	1002.2	1002.2
15.05.2017	15:14:44	476.3	765.5	765.5
15.05.2017	15:14:59	485.7	780.6	780.6
15.05.2017	15:15:14	585.3	940.7	940.7
15.05.2017	15:15:29	602.3	968.0	968.0
15.05.2017	15:15:44	676.2	1086.8	1086.8
15.05.2017	15:15:59	595.3	956.7	956.7
15.05.2017	15:16:14	662.0	1063.9	1063.9
15.05.2017	15:16:29	1113.0	1788.8	1788.8
15.05.2017	15:16:44	986.3	1585.1	1585.1
15.05.2017	15:16:59	876.2	1408.2	1408.2
15.05.2017	15:17:14	622.3	1000.1	1000.1
15.05.2017	15:17:29	556.3	894.1	894.1
15.05.2017	15:17:44	632.5	1016.5	1016.5
15.05.2017	15:17:59	816.3	1311.9	1311.9
15.05.2017	15:18:14	1216.0	1954.3	1954.3
15.05.2017	15:18:29	1192.0	1915.7	1915.7
15.05.2017	15:18:44	865.3	1390.7	1390.7
15.05.2017	15:18:59	812.3	1305.5	1305.5
15.05.2017	15:19:14	982.0	1578.2	1578.2
15.05.2017	15:19:29	1141.0	1833.8	1833.8

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
15.05.2017	15:19:44	1153.0	1853.0	1853.0
15.05.2017	15:19:59	1095.0	1759.8	1759.8
15.05.2017	15:20:14	957.2	1538.4	1538.4
15.05.2017	15:20:29	847.3	1361.7	1361.7
15.05.2017	15:20:44	537.3	863.5	863.5
15.05.2017	15:20:59	607.2	975.9	975.9
15.05.2017	15:21:14	912.3	1466.2	1466.2
15.05.2017	15:21:29	1099.0	1766.3	1766.3
15.05.2017	15:21:44	959.6	1542.2	1542.2
15.05.2017	15:21:59	861.2	1384.1	1384.1
15.05.2017	15:22:14	588.3	945.5	945.5
15.05.2017	15:22:29	468.6	753.1	753.1
15.05.2017	15:22:44	471.5	757.8	757.8
15.05.2017	15:22:59	456.6	733.8	733.8
15.05.2017	15:23:14	518.5	833.3	833.3
15.05.2017	15:23:29	617.7	992.7	992.7
15.05.2017	15:23:44	740.6	1190.3	1190.3
15.05.2017	15:23:59	997.3	1602.8	1602.8
15.05.2017	15:24:14	1085.0	1743.8	1743.8
15.05.2017	15:24:29	1156.0	1857.9	1857.9
15.05.2017	15:24:44	1141.0	1833.8	1833.8
15.05.2017	15:24:59	1167.0	1875.5	1875.5
15.05.2017	15:25:14	1263.0	2029.8	2029.8
15.05.2017	15:25:29	1160.0	1864.3	1864.3
15.05.2017	15:25:44	868.3	1395.5	1395.5
15.05.2017	15:25:59	708.2	1138.2	1138.2
15.05.2017	15:26:14	681.5	1095.3	1095.3
15.05.2017	15:26:29	598.3	961.6	961.6
15.05.2017	15:26:44	981.2	1576.9	1576.9
15.05.2017	15:26:59	1071.0	1721.3	1721.3
15.05.2017	15:27:14	826.3	1328.0	1328.0
15.05.2017	15:27:29	654.5	1051.9	1051.9
15.05.2017	15:27:44	1121.0	1801.6	1801.6
15.05.2017	15:27:59	1236.0	1986.4	1986.4
15.05.2017	15:28:14	1298.0	2086.1	2086.1
15.05.2017	15:28:29	1189.0	1910.9	1910.9
15.05.2017	15:28:44	1142.0	1835.4	1835.4
15.05.2017	15:28:59	941.5	1513.1	1513.1
15.05.2017	15:29:14	915.3	1471.0	1471.0
15.05.2017	15:29:29	685.3	1101.4	1101.4
15.05.2017	15:29:44	666.5	1071.2	1071.2
15.05.2017	15:29:59	728.3	1170.5	1170.5
15.05.2017	15:30:14	881.3	1416.4	1416.4
15.05.2017	15:30:29	678.6	1090.6	1090.6
15.05.2017	15:30:44	875.3	1406.7	1406.7
15.05.2017	15:30:59	1121.0	1801.6	1801.6
15.05.2017	15:31:14	842.3	1353.7	1353.7
15.05.2017	15:31:29	1180.0	1896.4	1896.4

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
15.05.2017	15:31:44	1214.0	1951.1	1951.1
15.05.2017	15:31:59	1102.0	1771.1	1771.1
15.05.2017	15:32:14	1053.0	1692.3	1692.3
15.05.2017	15:32:29	945.3	1519.2	1519.2
15.05.2017	15:32:44	1265.0	2033.0	2033.0
15.05.2017	15:32:59	1026.0	1648.9	1648.9
15.05.2017	15:33:14	1105.0	1775.9	1775.9
15.05.2017	15:33:29	842.6	1354.2	1354.2
15.05.2017	15:33:44	1028.0	1652.1	1652.1
15.05.2017	15:33:59	1078.0	1732.5	1732.5
15.05.2017	15:34:14	882.9	1418.9	1418.9
15.05.2017	15:34:29	1278.0	2053.9	2053.9
15.05.2017	15:34:44	1139.0	1830.5	1830.5
15.05.2017	15:34:59	1016.0	1632.9	1632.9
15.05.2017	15:35:14	926.3	1488.7	1488.7
15.05.2017	15:35:29	1152.0	1851.4	1851.4
15.05.2017	15:35:44	958.3	1540.1	1540.1
15.05.2017	15:35:59	823.2	1323.0	1323.0
15.05.2017	15:36:14	851.2	1368.0	1368.0
15.05.2017	15:36:29	1028.0	1652.1	1652.1
15.05.2017	15:36:44	1002.0	1610.4	1610.4
15.05.2017	15:36:59	986.3	1585.1	1585.1
15.05.2017	15:37:14	892.3	1434.1	1434.1
15.05.2017	15:37:29	990.2	1591.4	1591.4
15.05.2017	15:37:44	1065.0	1711.6	1711.6
15.05.2017	15:37:59	1095.0	1759.8	1759.8
15.05.2017	15:38:14	914.3	1469.4	1469.4
15.05.2017	15:38:29	907.4	1458.3	1458.3
15.05.2017	15:38:44	972.3	1562.6	1562.6
15.05.2017	15:38:59	1025.0	1647.3	1647.3
15.05.2017	15:39:14	1125.0	1808.0	1808.0
15.05.2017	15:39:29	1251.0	2010.5	2010.5
15.05.2017	15:39:44	903.5	1452.1	1452.1
15.05.2017	15:39:59	881.2	1416.2	1416.2
15.05.2017	15:40:14	785.3	1262.1	1262.1
15.05.2017	15:40:29	685.3	1101.4	1101.4
15.05.2017	15:40:44	795.3	1278.2	1278.2
15.05.2017	15:40:59	852.6	1370.3	1370.3
15.05.2017	15:41:14	798.5	1283.3	1283.3
15.05.2017	15:41:29	823.2	1323.0	1323.0
15.05.2017	15:41:44	952.3	1530.5	1530.5
15.05.2017	15:41:59	846.2	1360.0	1360.0
15.05.2017	15:42:14	983.3	1580.3	1580.3
15.05.2017	15:42:29	1028.0	1652.1	1652.1
15.05.2017	15:42:44	1024.0	1645.7	1645.7
15.05.2017	15:42:59	1026.0	1648.9	1648.9
Mean		896.4	1440.6	1440.6
Max		1298.0	2086.1	2086.1

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
Min		456.6	733.8	733.8

2.3.8 Uncertainty Calculations

Particulates

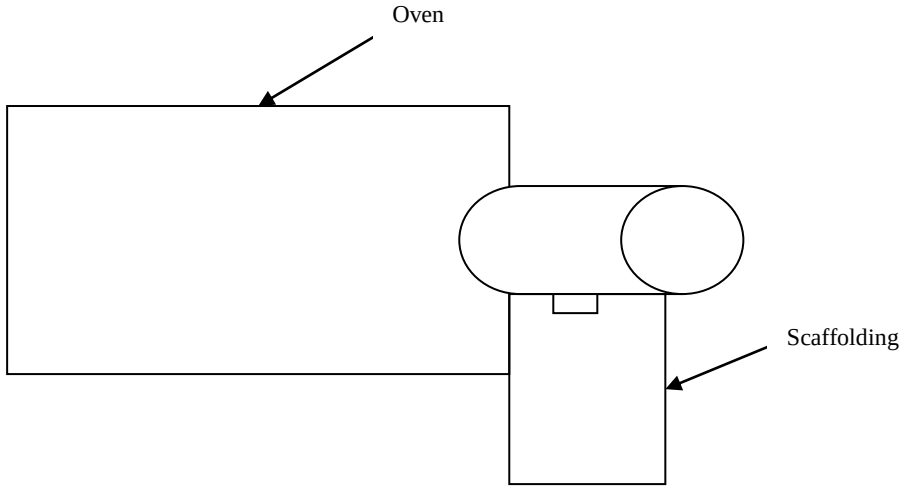
Source of uncertainty	Estimate of Component (1 SD) (± %)	Combined Uncertainty (± %)	Expanded Uncertainty (95% Confidence limit) (± %)
Pressure	6.79		
Gas Volume	2.47		As % of result
Gas Temperature	0.70		14.13
Humidity	0.50		
Filter Weighing	0.13	7.28	As % of ELV
Washing Weighing	0.02		1.43
Leak	0.01		As mg/m^3
O_2 Concentration	0.00		0.71

Total VOC's

Source of uncertainty	Estimate of Component (1 SD) ppm	Combined Uncertainty ppm	Expanded Uncertainty (95% Confidence limit) ppm
Linearity	8.02		
Temperature effect (zero)	4.63		
Barometric Pressure	4.01		21.27
Span gas	3.52		
Temperature effect (span)	2.32		
Repeatability	0.69	10.96	
Span drift	0.28		**Expanded Uncertainty (95% Confidence limit) %**
Zero drift	0.00		
Cross sensitivity CO (1.2 % vol)	0.00		
Cross sensitivity NO (127 mgm^{-3})	0.00		As % of Result
Cross sensitivity H_2O (sat 325K)	0.00		2.37
Cross sensitivity SO_2 (2767 mgm^{-3})	0.00		As mg/m^3 at ref conditions
Cross sensitivity CO_2 (15.2 % vol)	0.00		34.18

2.4 Appendix 4: Paint Shop Oven Vent

2.4.1 Sampling Location



Duct Characteristics

	Value	Units
Type of Duct	Circular	-
Diameter / Depth	0.19	m
Width	N/A	m
Area	0.028	m^2
Port Size	4	inch
Port Depth	40	mm
Orientation	Horizontal	-

Sampling Platform

General Platform Information	
Permanent / Temporary	Temporary
Inside / Outside	Inside
Height of Platform from Ground Level	~4m
Size of Platform	1.5m x 1.5m
Does the Platform have a weather cover (roof)	N/A
Platform has 2 hand rails (approx 0.5m and 1.0m high)	Yes
Platform has vertical base boards (approx 0.25m high)	Yes
Platform has removable chains / self closing gates at the top of the ladder	Yes
Platform positioned relative to the access ports (free from obstruction that would hamper insertion and removal of the sampling equipment)	Yes
Depth of platform (length of probe + 1m)	Yes

2.4.2 Flow Criteria Measurements

Traverse Point	**A1**		
Pressure (mm H_2O)	5.5	5.5	5.5
$\sqrt{\Delta P}$	2.35	2.35	2.35
Temperature (ºC)	245	245	245

Static Pressure (mmH_2O)	7.0	**Barometric Pressure (mm Hg)**	760.8	**Duct Dimensions (m)**	0.19

Velocity (m/s) average	10.6	**Actual Flow of stack gas (m^3/hr)**	1083.6
Stack Geometry	Circular	**Flow (wet) at STP (m^3/hr)**	572.0
Dimensions (m)	0.19	**Flow (dry) at STP (m^3/hr)**	549.5
Area (m^2)	0.028		

	Average	**Max**	**Min**	**Ratio Max/Min**	**Compliance**
Pressure (mm H_2O)	5.5	5.5	5.5	1.0	Yes
$\sqrt{\Delta P}$ (mm H_2O)^{½}	2.35	2.35	2.35	1.0	Yes
Temperature (ºC)	245.0	245.0	245.0	1.0	Yes
Angle of flow	<15º				Yes
Local Negative Flow	No				Yes

2.3.3 Gas Measurements

	Mean
Oxygen (%)	20.90
Carbon Monoxide (ppm)	0
Carbon Dioxide (%)	0.03

2.4.4 Manual Method Calculations

Test Dates	16/05/17		
Company	Leck Construction (BAE Systems)		
Contact	T Hughes		
Stack	Paint Oven Shop		
	Blank	Test 1	Units
Sample Ref	epa.17.511.09	epa.17.511.10	-
Start Time	13:40	13:54	hr:mm
Stop Time	13:45	14:24	hr:mm
% O_2	20.90	20.90	%
% CO_2	0.03	0.03	%
%N_2	-	79.07	%
V_{lc}	-	24.5	ml
B_{wo}	0.04	0.039	-
P_b	-	760.8	mm Hg
St	-	7	mm H_2O
T_s	-	235.00	ºC
$\sqrt{\Delta P}$	-	2.35	$(mm\ H_2O)^{½}$
Yd	-	1.036	-
Test Time	5	30	min
T_m	-	27.00	ºC
C_p	-	0.829	-
As	-	0.028	m^2
D_n	-	9.72	mm
ΔH ave	-	60.57	mm H_20
V_{mstd}	0.7415	0.7415	m^3
V_{wstd}	0.0305	0.0305	m^3
$Q_{std,wet}$	-	572.5	Nm^3/h
Q_{act}	-	1063.5	Nm^3/h
Isokinetic Rate	-	103.0	%
Vs	-	10.42	m/s
Washings			
Sample Ref	epa.17.511.09W	epa.17.511.10W	-
Weight	0.8	<0.5	mg
Filter			
Sample Ref	epa.17.511.09F	epa.17.511.10F	-
Weight	<0.1	0.37	mg
Particulate Concentration (Dry, No O_2 Correction)	1.2	1.2	mg/Nm^3
Particulate Concentration (at Ref Water and Oxygen)	1.2	1.1	mg/Nm^3
Particulate Release Rate	-	0.65	g/hr
Reference Temp	273		K
Reference Pressure	101.3		kPa
Reference Moisture	No correction for moisture		-
Reference Oxygen	No correction for Oxygen		%

Particulates

	Filter (mg)	Washings (mg)
Blank	<0.1	0.8
Run 1	0.37	<0.5

2.4.5 Sampling Measurements

Date	16-05-17		Impinger	Initial Wt (g)	Final Wt (g)	Wt Gained (g)			l/min	Vac (in Hg)			
Start Time	13:54		1	771.6	784.0	12.4		Leak Check (Pre)	0.11	10			
End Time	14:24		2	792.4	797.1	4.7		Leak Check (Post)	0.11	10			
Duration (mm.ss)	30.00		3	677.8	680.9	3.1							
Stack	Paint Oven		4	835.6	839.9	4.3		Pitot ID	Pitot 06			Velocity Head	
Run	1		5	247.4	247.4	0.0		DGM ID	DGM 09			Min	5.5
												Max	5.5
												Max:Min	1.00
								Nozzle ID	n6				
			Sample Ref	epa.17.511.10				Nozzle Diameter (mm)	9.72				
K Factor	11.01		Filter Number	epa.17.511.10F									
Stack Diameter (m)	0.19		Probe Washing No	epa.17.511.10W									
							ΔH across orifice meter (mm H_2O)	DGM (litres)	DGM Temp (ºC)		Temp (ºC)		
Point	Time	Vac	Stack Temp	Prelim		Actual		9707.58	In	Out	Probe	Filter	Impinger
a1	0 5	4	246	5.5		2.35	60.57	9835	27	26	160	160	
a1	5 10	4	244	5.5		2.35	60.57	9989	27	26	160	160	
a1	10 15	4	242	5.5		2.35	60.57	10087	27	26	160	160	
a1	15 20	4	225	5.5		2.35	60.57	10217	29	26	160	160	
a1	20 25	4	227	5.5		2.35	60.57	10345	29	26	160	160	
a1	25 30	4	226	5.5		2.35	60.57	10488.75	29	26	160	160	
Total / Average		4.00	235.00	5.5		2.35	60.57	781.17	28.00	26.00	160.00	160	

2.4.6 Instrumental Gas Analyser Site Calibration Measurements

Zero Point

				Pre Test			Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Pre Span	Post Span	System	System	Zero Drift
VOC (ppm)	10	Ambient Air	0.00	0.00	0.00	0.01	0.01	0.00

Span Gas

				Pre Test		Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Analyser	System	System	Span Drift
VOC (ppm)	10	EPA/CGAS/101	7.93	7.95	7.94	7.92	-0.02

2.4.7 Instrumental Gas Analyser Results

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
16.05.2017	13:54:05	10.6	17.0	17.0
16.05.2017	13:54:20	6.4	10.2	10.2
16.05.2017	13:54:35	5.9	9.5	9.5
16.05.2017	13:54:50	6.0	9.6	9.6
16.05.2017	13:55:05	6.0	9.6	9.6
16.05.2017	13:55:20	6.2	10.0	10.0
16.05.2017	13:55:35	10.4	16.7	16.7
16.05.2017	13:55:50	10.2	16.4	16.4
16.05.2017	13:56:05	10.6	17.0	17.0
16.05.2017	13:56:20	10.5	16.9	16.9
16.05.2017	13:56:35	10.4	16.7	16.7
16.05.2017	13:56:50	11.2	18.0	18.0
16.05.2017	13:57:05	12.3	19.8	19.8
16.05.2017	13:57:20	11.2	18.0	18.0
16.05.2017	13:57:35	10.8	17.4	17.4
16.05.2017	13:57:50	10.1	16.2	16.2
16.05.2017	13:58:05	10.1	16.2	16.2
16.05.2017	13:58:20	10.0	16.0	16.0
16.05.2017	13:58:35	9.9	15.9	15.9
16.05.2017	13:58:50	10.0	16.0	16.0
16.05.2017	13:59:05	9.9	16.0	16.0
16.05.2017	13:59:20	10.1	16.2	16.2
16.05.2017	13:59:35	9.9	16.0	16.0
16.05.2017	13:59:50	10.0	16.0	16.0
16.05.2017	14:00:05	10.0	16.0	16.0
16.05.2017	14:00:20	10.1	16.2	16.2
16.05.2017	14:00:35	10.1	16.2	16.2
16.05.2017	14:00:50	10.0	16.0	16.0

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
16.05.2017	14:01:05	10.0	16.0	16.0
16.05.2017	14:01:20	10.0	16.0	16.0
16.05.2017	14:01:35	10.0	16.0	16.0
16.05.2017	14:01:50	10.0	16.0	16.0
16.05.2017	14:02:05	10.0	16.0	16.0
16.05.2017	14:02:20	9.9	15.9	15.9
16.05.2017	14:02:35	9.8	15.8	15.8
16.05.2017	14:02:50	9.7	15.6	15.6
16.05.2017	14:03:05	9.8	15.8	15.8
16.05.2017	14:03:20	9.8	15.8	15.8
16.05.2017	14:03:35	9.7	15.6	15.6
16.05.2017	14:03:50	9.6	15.5	15.5
16.05.2017	14:04:05	10.0	16.0	16.0
16.05.2017	14:04:20	10.1	16.2	16.2
16.05.2017	14:04:35	10.2	16.4	16.4
16.05.2017	14:04:50	10.0	16.0	16.0
16.05.2017	14:05:05	9.9	15.9	15.9
16.05.2017	14:05:20	9.9	16.0	16.0
16.05.2017	14:05:35	9.5	15.3	15.3
16.05.2017	14:05:50	9.2	14.8	14.8
16.05.2017	14:06:05	9.3	15.0	15.0
16.05.2017	14:06:20	8.8	14.2	14.2
16.05.2017	14:06:35	8.5	13.6	13.6
16.05.2017	14:06:50	8.7	13.9	13.9
16.05.2017	14:07:05	8.4	13.5	13.5
16.05.2017	14:07:20	8.2	13.2	13.2
16.05.2017	14:07:35	8.3	13.4	13.4
16.05.2017	14:07:50	7.3	11.8	11.8
16.05.2017	14:08:05	7.3	11.8	11.8
16.05.2017	14:08:20	7.3	11.8	11.8
16.05.2017	14:08:35	7.2	11.6	11.6
16.05.2017	14:08:50	7.0	11.3	11.3
16.05.2017	14:09:05	7.0	11.2	11.2
16.05.2017	14:09:20	7.2	11.6	11.6
16.05.2017	14:09:35	7.6	12.2	12.2
16.05.2017	14:09:50	7.2	11.5	11.5
16.05.2017	14:10:05	8.3	13.3	13.3
16.05.2017	14:10:20	9.2	14.8	14.8
16.05.2017	14:10:35	8.2	13.2	13.2
16.05.2017	14:10:50	7.3	11.8	11.8
16.05.2017	14:11:05	7.7	12.3	12.3
16.05.2017	14:11:20	7.7	12.3	12.3
16.05.2017	14:11:35	7.7	12.4	12.4
16.05.2017	14:11:50	8.3	13.3	13.3
16.05.2017	14:12:05	8.3	13.3	13.3
16.05.2017	14:12:20	7.3	11.8	11.8
16.05.2017	14:12:35	7.9	12.7	12.7
16.05.2017	14:12:50	8.0	12.8	12.8

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
16.05.2017	14:13:05	8.3	13.3	13.3
16.05.2017	14:13:20	8.2	13.2	13.2
16.05.2017	14:13:35	8.2	13.2	13.2
16.05.2017	14:13:50	7.3	11.8	11.8
16.05.2017	14:14:05	7.3	11.8	11.8
16.05.2017	14:14:20	5.3	8.6	8.6
16.05.2017	14:14:35	5.4	8.6	8.6
16.05.2017	14:14:50	5.4	8.6	8.6
16.05.2017	14:15:05	6.3	10.0	10.0
16.05.2017	14:15:20	6.2	10.0	10.0
16.05.2017	14:15:35	6.3	10.0	10.0
16.05.2017	14:15:50	7.5	12.1	12.1
16.05.2017	14:16:05	7.3	11.7	11.7
16.05.2017	14:16:20	8.3	13.3	13.3
16.05.2017	14:16:35	8.3	13.3	13.3
16.05.2017	14:16:50	8.3	13.4	13.4
16.05.2017	14:17:05	8.3	13.3	13.3
16.05.2017	14:17:20	8.2	13.2	13.2
16.05.2017	14:17:35	8.5	13.6	13.6
16.05.2017	14:17:50	9.1	14.7	14.7
16.05.2017	14:18:05	9.1	14.7	14.7
16.05.2017	14:18:20	7.2	11.6	11.6
16.05.2017	14:18:35	7.3	11.8	11.8
16.05.2017	14:18:50	7.6	12.2	12.2
16.05.2017	14:19:05	7.3	11.8	11.8
16.05.2017	14:19:20	7.6	12.2	12.2
16.05.2017	14:19:35	7.2	11.6	11.6
16.05.2017	14:19:50	7.6	12.3	12.3
16.05.2017	14:20:05	7.6	12.2	12.2
16.05.2017	14:20:20	7.3	11.7	11.7
16.05.2017	14:20:35	7.6	12.2	12.2
16.05.2017	14:20:50	7.0	11.2	11.2
16.05.2017	14:21:05	6.9	11.1	11.1
16.05.2017	14:21:20	6.2	10.0	10.0
16.05.2017	14:21:35	5.9	9.4	9.4
16.05.2017	14:21:50	5.7	9.2	9.2
16.05.2017	14:22:05	6.7	10.8	10.8
16.05.2017	14:22:20	8.8	14.1	14.1
16.05.2017	14:22:35	8.8	14.1	14.1
16.05.2017	14:22:50	9.8	15.7	15.7
16.05.2017	14:23:05	9.9	15.9	15.9
16.05.2017	14:23:20	9.9	15.9	15.9
16.05.2017	14:23:35	5.2	8.4	8.4
16.05.2017	14:23:50	7.3	11.8	11.8
16.05.2017	14:24:05	7.3	11.8	11.8
16.05.2017	14:24:20	7.3	11.7	11.7
16.05.2017	14:24:35	6.3	10.0	10.0
16.05.2017	14:24:50	6.3	10.0	10.0
Mean		8.4	13.5	13.5

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
Max		12.3	19.8	19.8
Min		5.2	8.4	8.4

2.4.8 Uncertainty Calculations

Particulates

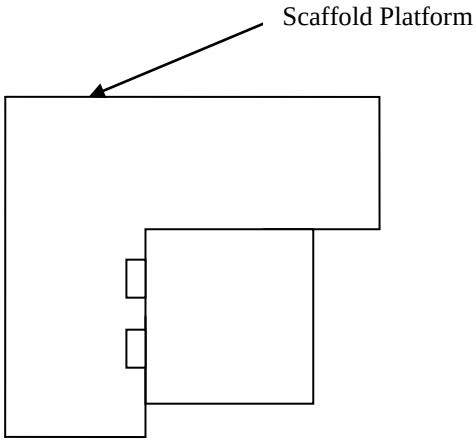
Source of uncertainty	Estimate of Component (1 SD) (± %)	Combined Uncertainty (± %)	Expanded Uncertainty (95% Confidence limit) (± %)
Pressure	6.19	6.79	As % of result 13.17
Gas Volume	2.66		
Gas Temperature	0.67		
Humidity	0.50		As % of ELV 0.31
Washing Weighing	0.02		
Filter Weighing	0.02		
Leak	0.00		As mg/m^3 0.15
O_2 Concentration	0.00		

Total VOC's

Source of uncertainty	Estimate of Component (1 SD) ppm	Combined Uncertainty ppm	Expanded Uncertainty (95% Confidence limit) ppm
Span gas	0.08	0.12	0.24
Linearity	0.06		
Temperature effect (zero)	0.05		
Barometric Pressure	0.04		
Temperature effect (span)	0.02		
Repeatability	0.01		
Span drift	0.01		**Expanded Uncertainty (95% Confidence limit) %**
Zero drift	0.00		
Cross sensitivity CO (1.2 % vol)	0.00		
Cross sensitivity NO (127 mgm^{-3})	0.00		As % of Result 2.81
Cross sensitivity H_2O (sat 325K)	0.00		
Cross sensitivity SO_2 (2767 mgm^{-3})	0.00		As mg/m^3 at ref conditions 0.38
Cross sensitivity CO_2 (15.2 % vol)	0.00		

2.5 Appendix 5: Paint Shop Spray Area

2.5.1 Sampling Location



Duct Characteristics

	Value	Units
Type of Duct	Rectangular	-
Diameter / Depth	0.74	m
Width	0.74	m
Area	0.548	m^2
Port Size	4	inch
Port Depth	90	mm
Orientation	Vertical	-

Sampling Platform

General Platform Information	
Permanent / Temporary	Temporary
Inside / Outside	Outside
Height of Platform from Ground Level	~ 10m
Size of Platform	2m x 1.5m
Does the Platform have a weather cover (roof)	No
Platform has 2 hand rails (approx 0.5m and 1.0m high)	Yes
Platform has vertical base boards (approx 0.25m high)	Yes
Platform has removable chains / self closing gates at the top of the ladder	Yes
Platform positioned relative to the access ports (free from obstruction that would hamper insertion and removal of the sampling equipment)	Yes
Depth of platform (length of probe + 1m)	Yes

2.5.2 Flow Criteria Measurements

Traverse Point	**A1**			**A2**		
Pressure (mm H_2O)	10.5	10.5	10.5	10.0	10.0	10.0
$\sqrt{\Delta P}$	3.24	3.24	3.24	3.16	3.16	3.16
Temperature (ºC)	27	27	27	27	27	27
Traverse Point	**B1**			**B2**		
Pressure (mm H_2O)	10.0	10.0	10.0	10.0	10.0	10.0
$\sqrt{\Delta P}$	3.16	3.16	3.16	3.16	3.16	3.16
Temperature (ºC)	27	27	27	27	27	27

Static Pressure (mmH_2O)	17	**Barometric Pressure (mm Hg)**	754.0	**Duct Dimensions (m)**	0.74 x 0.74

Velocity (m/s) average	11.0	**Actual Flow of stack gas (m^3/hr)**	22291.9
Stack Geometry	Rectangular	**Flow (wet) at STP (m^3/hr)**	20339.0
Dimensions (m)	0.74 x 0.74	**Flow (dry) at STP (m^3/hr)**	20081.7
Area (m^2)	0.548		

	Average	**Max**	**Min**	**Ratio Max/Min**	**Compliance**
Pressure (mm H_2O)	10.1	10.5	10.0	1.1	Yes
$\sqrt{\Delta P}$ (mm $H_2O)^{½}$	3.18	3.24	3.16	1.0	Yes
Temperature (ºC)	27.0	27.0	27.0	1.0	Yes
Angle of flow	<15º				Yes
Local Negative Flow	No				Yes

2.5.3 Gas Measurements

	Mean
Oxygen (%)	20.90
Carbon Monoxide (ppm)	0
Carbon Dioxide (%)	0.03

2.5.4 Manual Method Calculations

Test Dates	16/05/17		
Company	Leck Construction (BAE Systems)		
Contact	T Hughes		
Stack	Paint Shop Spray Area		
	Blank	Test 1	Units
Sample Ref	epa.17.511.07	epa.17.511.08	-
Start Time	12:05	12:39	hr:mm
Stop Time	12:10	13:13	hr:mm
% O_2	20.90	20.90	%
% CO_2	0.03	0.03	%
%N_2	-	79.07	%
V_{lc}	-	7.8	ml
B_{wo}	0.01	0.013	-
P_b	-	760.8	mm Hg
St	-	17	mm H_2O
T_s	-	27.00	ºC
$\sqrt{\Delta P}$	-	3.16	$(mm\ H_2O)^{½}$
Yd	-	1.036	-
Test Time	5	32	min
T_m	-	23.63	ºC
C_p	-	0.830	-
As	-	0.563	m^2
D_n	-	7.20	mm
ΔH ave	-	56.49	mm H_20
V_{mstd}	0.7576	0.7576	m^3
V_{wstd}	0.0097	0.0097	m^3
$Q_{std,wet}$	-	19860.8	Nm^3/h
Q_{act}	-	21767.7	Nm^3/h
Isokinetic Rate	-	100.1	%
Vs	-	10.75	m/s
Washings			
Sample Ref	epa.17.511.07W	epa.17.511.08W	-
Weight	<0.5	<0.5	mg
Filter			
Sample Ref	epa.17.511.07F	epa.17.511.08F	-
Weight	0.06	6.73	mg
Particulate Concentration (Dry, No O_2 Correction)	0.7	9.5	mg/Nm^3
Particulate Concentration (at Ref Water and Oxygen)	0.7	9.4	mg/Nm^3
Particulate Release Rate	-	187.15	g/hr
Reference Temp	273		K
Reference Pressure	101.3		kPa
Reference Moisture	No correction for moisture		-
Reference Oxygen	No correction for Oxygen		%

Particulates

	Filter (mg)	Washings (mg)
Blank	0.06	<0.5
Run 1	6.73	<0.5

2.5.5 Sampling Measurements

Date	16-05-17		Impinger	Initial Wt (g)	Final Wt (g)	Wt Gained (g)			l/min	Vac (in Hg)			
Start Time	12:39		1	779.3	781.6	2.3		Leak Check (Pre)	0.09	10			
End Time	13:13		2	793.7	793.8	0.1		Leak Check (Post)	0.07	10			
Duration (mm.ss)	32.00		3	679.7	679.8	0.1							
Stack	Paint Spray		4	830.3	835.6	5.3		Pitot ID	pitot 12			Velocity Head	
Run	1		5	247.4	247.4	0.0		DGM ID	dgm 09			Min	10
												Max	10
												Max:Min	1.00
								Nozzle ID	n36				
			Sample Ref	epa.17.511.08				Nozzle Diameter (mm)	7.20				
K Factor	5.65		Filter Number	epa.17.511.08F									
Stack Diameter (m)	0.75		Probe Washing No	epa.17.511.08W									
							ΔH across orifice meter (mm H_2O)	DGM (litres)	DGM Temp (ºC)		Temp (ºC)		
Point	Time	Vac	Stack Temp	Prelim		Actual		8887.76	In	Out	Probe	Filter	Impinger
a1	0 4	4	27	10		3.16	56.49	8987	23	22	70		
a2	4 8	4	27	10		3.16	56.49	9084	23	22	70		
a3	8 12	4	27	10		3.16	56.49	9180	23	22	70		
a4	12 16	4	27	10		3.16	56.49	9287	24	23	70		
a5	16 20	4	27	10		3.16	56.49	9379	25	24	70		
a6	20 24	4	27	10		3.16	56.49	9495	25	24	70		
a7	24 28	4	27	10		3.16	56.49	9583	25	24	70		
a8	28 32	4	27	10		3.16	56.49	9677.22	25	24	70		
Total / Average		4.00	27.00	10.00		3.16	56.49	789.46	24.13	23.13	70.00		

2.5.6 Instrumental Gas Analyser Site Calibration Measurements

Zero Point

				Pre Test			Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Pre Span	Post Span	System	System	Zero Drift
VOC (ppm)	10	Ambient Air	0.00	0.00	0.00	0.01	0.01	0.00

Span Gas

				Pre Test		Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Analyser	System	System	Span Drift
VOC (ppm)	10	EPA/CGAS /101	7.93	7.95	7.94	7.92	-0.02

2.5.7 Instrumental Gas Analyser Results

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
16.05.2017	12:39:05	2.1	3.3	3.3
16.05.2017	12:39:20	2.7	4.3	4.3
16.05.2017	12:39:35	2.7	4.3	4.3
16.05.2017	12:39:50	2.5	3.9	3.9
16.05.2017	12:40:05	2.7	4.3	4.3
16.05.2017	12:40:20	2.9	4.6	4.6
16.05.2017	12:40:35	2.1	3.4	3.4
16.05.2017	12:40:50	2.7	4.3	4.3
16.05.2017	12:41:05	2.5	3.9	3.9
16.05.2017	12:41:20	2.3	3.7	3.7
16.05.2017	12:41:35	3.2	5.1	5.1
16.05.2017	12:41:50	3.0	4.9	4.9
16.05.2017	12:42:05	3.0	4.8	4.8
16.05.2017	12:42:20	2.9	4.6	4.6
16.05.2017	12:42:35	2.9	4.6	4.6
16.05.2017	12:42:50	2.5	3.9	3.9
16.05.2017	12:43:05	2.7	4.3	4.3
16.05.2017	12:43:20	3.0	4.8	4.8
16.05.2017	12:43:35	2.2	3.6	3.6
16.05.2017	12:43:50	2.2	3.5	3.5
16.05.2017	12:44:05	2.3	3.7	3.7
16.05.2017	12:44:20	2.1	3.4	3.4
16.05.2017	12:44:35	2.7	4.3	4.3
16.05.2017	12:44:50	2.6	4.1	4.1
16.05.2017	12:45:05	2.5	4.1	4.1
16.05.2017	12:45:20	2.9	4.6	4.6
16.05.2017	12:45:35	2.5	4.1	4.1
16.05.2017	12:45:50	2.5	3.9	3.9
16.05.2017	12:46:05	2.2	3.6	3.6
16.05.2017	12:46:20	2.1	3.4	3.4

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
16.05.2017	12:46:35	2.0	3.2	3.2
16.05.2017	12:46:50	2.0	3.3	3.3
16.05.2017	12:47:05	2.1	3.3	3.3
16.05.2017	12:47:20	2.1	3.3	3.3
16.05.2017	12:47:35	2.5	3.9	3.9
16.05.2017	12:47:50	1.3	2.0	2.0
16.05.2017	12:48:05	2.0	3.2	3.2
16.05.2017	12:48:20	2.3	3.6	3.6
16.05.2017	12:48:35	2.1	3.4	3.4
16.05.2017	12:48:50	2.2	3.5	3.5
16.05.2017	12:49:05	2.2	3.5	3.5
16.05.2017	12:49:20	2.2	3.5	3.5
16.05.2017	12:49:35	2.0	3.2	3.2
16.05.2017	12:49:50	2.1	3.3	3.3
16.05.2017	12:50:05	2.7	4.3	4.3
16.05.2017	12:50:20	2.6	4.1	4.1
16.05.2017	12:50:35	2.2	3.5	3.5
16.05.2017	12:50:50	2.5	4.1	4.1
16.05.2017	12:51:05	2.2	3.5	3.5
16.05.2017	12:51:20	2.5	4.1	4.1
16.05.2017	12:51:35	2.6	4.1	4.1
16.05.2017	12:51:50	2.3	3.7	3.7
16.05.2017	12:52:05	2.2	3.6	3.6
16.05.2017	12:52:20	2.3	3.6	3.6
16.05.2017	12:52:35	2.3	3.7	3.7
16.05.2017	12:52:50	2.3	3.7	3.7
16.05.2017	12:53:05	2.2	3.6	3.6
16.05.2017	12:53:20	2.4	3.8	3.8
16.05.2017	12:53:35	2.4	3.8	3.8
16.05.2017	12:53:50	2.5	4.1	4.1
16.05.2017	12:54:05	2.9	4.7	4.7
16.05.2017	12:54:20	3.0	4.9	4.9
16.05.2017	12:54:35	3.0	4.7	4.7
16.05.2017	12:54:50	2.7	4.3	4.3
16.05.2017	12:55:05	2.2	3.5	3.5
16.05.2017	12:55:20	2.1	3.3	3.3
16.05.2017	12:55:35	2.6	4.2	4.2
16.05.2017	12:55:50	2.5	4.1	4.1
16.05.2017	12:56:05	2.1	3.4	3.4
16.05.2017	12:56:20	2.2	3.5	3.5
16.05.2017	12:56:35	2.9	4.6	4.6
16.05.2017	12:56:50	2.5	3.9	3.9
16.05.2017	12:57:05	2.7	4.3	4.3
16.05.2017	12:57:20	2.6	4.1	4.1
16.05.2017	12:57:35	2.5	4.1	4.1
16.05.2017	12:57:50	2.9	4.6	4.6
16.05.2017	12:58:05	2.6	4.1	4.1
16.05.2017	12:58:20	2.6	4.1	4.1

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
16.05.2017	12:58:35	2.7	4.3	4.3
16.05.2017	12:58:50	2.7	4.3	4.3
16.05.2017	12:59:05	2.6	4.2	4.2
16.05.2017	12:59:20	2.6	4.1	4.1
16.05.2017	12:59:35	2.5	4.0	4.0
16.05.2017	12:59:50	2.2	3.6	3.6
16.05.2017	13:00:05	2.4	3.8	3.8
16.05.2017	13:00:20	2.2	3.5	3.5
16.05.2017	13:00:35	2.0	3.2	3.2
16.05.2017	13:00:50	2.0	3.3	3.3
16.05.2017	13:01:05	2.3	3.7	3.7
16.05.2017	13:01:20	2.5	4.0	4.0
16.05.2017	13:01:35	2.0	3.2	3.2
16.05.2017	13:01:50	2.1	3.4	3.4
16.05.2017	13:02:05	2.0	3.2	3.2
16.05.2017	13:02:20	2.0	3.2	3.2
16.05.2017	13:02:35	2.1	3.3	3.3
16.05.2017	13:02:50	2.1	3.3	3.3
16.05.2017	13:03:05	2.2	3.5	3.5
16.05.2017	13:03:20	2.1	3.3	3.3
16.05.2017	13:03:35	2.5	4.0	4.0
16.05.2017	13:03:50	2.6	4.1	4.1
16.05.2017	13:04:05	2.7	4.3	4.3
16.05.2017	13:04:20	2.5	4.1	4.1
16.05.2017	13:04:35	2.5	4.1	4.1
16.05.2017	13:04:50	2.5	4.1	4.1
16.05.2017	13:05:05	2.5	4.1	4.1
16.05.2017	13:05:20	2.6	4.1	4.1
16.05.2017	13:05:35	2.5	4.1	4.1
16.05.2017	13:05:50	2.7	4.3	4.3
16.05.2017	13:06:05	2.6	4.2	4.2
16.05.2017	13:06:20	2.7	4.3	4.3
16.05.2017	13:06:35	2.7	4.3	4.3
16.05.2017	13:06:50	2.5	4.1	4.1
16.05.2017	13:07:05	2.6	4.1	4.1
16.05.2017	13:07:20	2.4	3.8	3.8
16.05.2017	13:07:35	2.4	3.8	3.8
16.05.2017	13:07:50	2.6	4.1	4.1
16.05.2017	13:08:05	2.2	3.6	3.6
16.05.2017	13:08:20	2.3	3.7	3.7
16.05.2017	13:08:35	2.5	4.1	4.1
16.05.2017	13:08:50	2.3	3.7	3.7
16.05.2017	13:09:05	2.1	3.4	3.4
16.05.2017	13:09:20	2.3	3.7	3.7
16.05.2017	13:09:35	2.2	3.5	3.5
16.05.2017	13:09:50	2.3	3.7	3.7
16.05.2017	13:10:05	2.2	3.5	3.5
16.05.2017	13:10:20	2.2	3.5	3.5

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
16.05.2017	13:10:35	2.3	3.6	3.6
16.05.2017	13:10:50	2.3	3.7	3.7
16.05.2017	13:11:05	2.2	3.6	3.6
16.05.2017	13:11:20	2.1	3.4	3.4
16.05.2017	13:11:35	2.1	3.4	3.4
16.05.2017	13:11:50	2.1	3.4	3.4
16.05.2017	13:12:05	1.3	2.1	2.1
16.05.2017	13:12:20	1.6	2.6	2.6
16.05.2017	13:12:35	1.7	2.7	2.7
16.05.2017	13:12:50	1.7	2.7	2.7
16.05.2017	13:13:05	1.7	2.7	2.7
16.05.2017	13:13:20	1.8	2.9	2.9
16.05.2017	13:13:35	1.9	3.1	3.1
16.05.2017	13:13:50	1.6	2.5	2.5
Mean		2.4	3.8	3.8
Max		3.2	5.1	5.1
Min		1.3	2.0	2.0

2.5.8 Uncertainty Calculations

Particulates

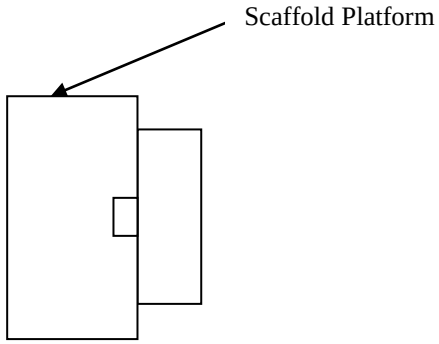
Source of uncertainty	Estimate of Component (1 SD) (± %)	Combined Uncertainty (± %)	Expanded Uncertainty (95% Confidence limit) (± %)
Pressure	6.64		
Gas Volume	2.68		As % of result
Gas Temperature	0.68		14.00
Humidity	0.50		
Filter Weighing	0.29	7.22	As % of ELV
Washing Weighing	0.02		2.67
Leak	0.02		
O_2 Concentration	0.00		As mg/m^3
			1.34

Total VOC's

Source of uncertainty	Estimate of Component (1 SD) ppm	Combined Uncertainty ppm	Expanded Uncertainty (95% Confidence limit) ppm
Span gas	0.08		
Linearity	0.06		
Temperature effect (zero)	0.05		0.24
Barometric Pressure	0.04		
Temperature effect (span)	0.02		
Repeatability	0.01	0.12	
Span drift	0.01		**Expanded Uncertainty (95% Confidence limit) %**
Zero drift	0.00		
Cross sensitivity CO (1.2 % vol)	0.00		
Cross sensitivity NO (127 mgm^{-3})	0.00		As % of Result
Cross sensitivity H_2O (sat 325K)	0.00		10.06
Cross sensitivity SO_2 (2767 mgm^{-3})	0.00		As mg/m^3 at ref conditions
Cross sensitivity CO_2 (15.2 % vol)	0.00		0.38

2.6 Appendix 6: Paint Shop Shot Blast

2.6.1 Sampling Location



Duct Characteristics

	Value	Units
Type of Duct	Rectangular	-
Diameter / Depth	0.25	m
Width	0.85	m
Area	0.213	m^2
Port Size	4	inch
Port Depth	90	mm
Orientation	Vertical	-

Sampling Platform

General Platform Information	
Permanent / Temporary	Temporary
Inside / Outside	Outside
Height of Platform from Ground Level	~5m
Size of Platform	2.5m x 1.5m
Does the Platform have a weather cover (roof)	No
Platform has 2 hand rails (approx 0.5m and 1.0m high)	Yes
Platform has vertical base boards (approx 0.25m high)	Yes
Platform has removable chains / self closing gates at the top of the ladder	Yes
Platform positioned relative to the access ports (free from obstruction that would hamper insertion and removal of the sampling equipment)	Yes
Depth of platform (length of probe + 1m)	Yes

2.6.2 Flow Criteria Measurements

Traverse Point	**A1**			**A2**			**A3**			**A4**		
Pressure (mm H_2O)	4.0	4.0	4.0	4.0	4.0	4.0	4.5	4.5	4.5	4.0	4.0	4.0
√ΔP	2.00	2.00	2.00	2.00	2.00	2.00	2.12	2.12	2.12	2.00	2.00	2.00
Temperature (ºC)	24	24	24	24	24	24	24	24	24	24	24	24
Traverse Point	**A5**			**A6**			**A7**			**A8**		
Pressure (mm H_2O)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
√ΔP	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Temperature (ºC)	24	24	24	24	24	24	24	24	24	24	24	24

Static Pressure (mmH_2O)	2.0	**Barometric Pressure (mm Hg)**	760.8	**Duct Dimensions (m)**	0.25 x 0.85

Velocity (m/s) average	6.9	**Actual Flow of stack gas (m^3/hr)**	5285.5
Stack Geometry	Rectangular	**Flow (wet) at STP (m^3/hr)**	4864.1
Dimensions (m)	0.25 x 0.85	**Flow (dry) at STP (m^3/hr)**	4790.8
Area (m^2)	0.213		

	Average	**Max**	**Min**	**Ratio Max/Min**	**Compliance**
Pressure (mm H_2O)	4.1	4.5	4.0	1.1	Yes
√ΔP (mm H_2O)^{½}	2.02	2.12	2.00	1.1	Yes
Temperature (ºC)	24.0	24.0	24.0	1.0	Yes
Angle of flow	<15º				Yes
Local Negative Flow	No				Yes

2.6.3 Gas Measurements

	Mean
Oxygen (%)	20.90
Carbon Monoxide (ppm)	0
Carbon Dioxide (%)	0.03

2.6.4 Manual Method Calculations

Test Dates	16.05.17		
Company	Leack Construction (BAE Systems)		
Contact	T Hughes		
Stack	Shot Blast		
	Blank	Test 1	Units
Sample Ref	epa.17.511.05	epa.17.511.06	-
Start Time	9:40	10:25	hr:mm
Stop Time	9:45	10:57	hr:mm
% O_2	20.90	20.90	%
% CO_2	0.03	0.03	%
%N_2	-	79.07	%
V_{lc}	-	10.9	ml
B_{wo}	0.02	0.015	-
P_b	-	760.8	mm Hg
St	-	2	mm H_2O
T_s	-	24.00	ºC
$\sqrt{\Delta P}$	-	2.00	$(mm\ H_2O)^{½}$
Yd	-	1.036	-
Test Time	5	32	min
T_m	-	15.38	ºC
C_p	-	0.829	-
As	-	0.213	m^2
D_n	-	9.72	mm
ΔH ave	-	75.52	mm H_20
V_{mstd}	0.8865	0.8865	m^3
V_{wstd}	0.0136	0.0136	m^3
$Q_{std,wet}$	-	4762.2	Nm^3/h
Q_{act}	-	5174.7	Nm^3/h
Isokinetic Rate	-	101.5	%
Vs	-	6.76	m/s
Washings			
Sample Ref	epa.17.511.05W	epa.17.511.06W	-
Weight	0.9	<0.5	mg
Filter			
Sample Ref	epa.17.511.05F	epa.17.511.06F	-
Weight	<0.1	<0.1	mg
Particulate Concentration (Dry, No O_2 Correction)	1.1	<0.68	mg/Nm^3
Particulate Concentration (at Ref Water and Oxygen)	1.1	<0.67	mg/Nm^3
Particulate Release Rate	-	<3	g/hr
Reference Temp	273		K
Reference Pressure	101.3		kPa
Reference Moisture	No correction for moisture		-
Reference Oxygen	No correction for Oxygen		%

Particulates

	Filter (mg)	Washings (mg)
Blank	<0.1	0.9
Run 1	<0.1	<0.5

2.6.5 Sampling Measurements

Date	16-05-17		Impinger	Initial Wt (g)	Final Wt (g)	Wt Gained (g)			l/min	Vac (in Hg)			
Start Time	10:25		1	776.2	779.3	3.1		Leak Check (Pre)	0.12	10			
End Time	10:57		2	793.7	793.7	0.0		Leak Check (Post)	0.11	10			
Duration (mm.ss)	32.00		3	679.1	679.7	0.6							
Stack	Shot Blast		4	883.5	890.7	7.2		Pitot ID	pitot 06			Velocity Head	
Run	1		5	247.4	247.4	0.0		DGM ID	dgm 09			Min	4
												Max	4
												Max:Min	1.00
								Nozzle ID	n6				
			Sample Ref	epa.17.511.06				Nozzle Diameter (mm)	9.72				
K Factor	18.88		Filter Number	epa.17.511.06F									
Stack Diameter (m)	0.25		Probe Washing No	epa.17.511.06W									
							ΔH across orifice meter (mm H_2O)	DGM (litres)	DGM Temp (ºC)		Temp (ºC)		
Point	Time	Vac	Stack Temp	Prelim		Actual		7974.59	In	Out	Probe	Filter	Impinger
a1	0 4	4	24	4		2.00	75.52	8085	15	15	160	160	
a2	4 8	4	24	4		2.00	75.52	8202	15	15	160	160	
a3	8 12	4	24	4		2.00	75.52	8335	16	15	160	160	
a4	12 16	4	24	4		2.00	75.52	8432	16	15	160	160	
a5	16 20	4	24	4		2.00	75.52	8534	16	15	160	160	
a6	20 24	4	24	4		2.00	75.52	8646	16	15	160	160	
a7	24 28	4	24	4		2.00	75.52	8759	16	15	160	160	
a8	28 32	4	24	4		2.00	75.52	8871.11	16	15	160	160	
Total / Average		4.00	24.00	4.00		2.00	75.52	896.52	15.75	15.00	160.00	160.00	

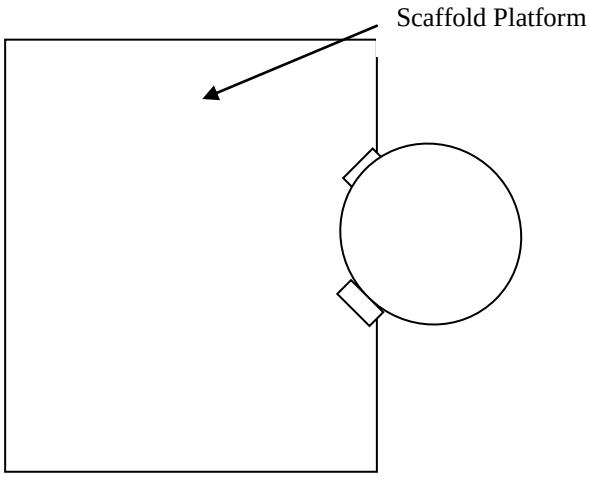
2.6.6 Uncertainty Calculations

Particulates

Source of uncertainty	Estimate of Component (1 SD) (± %)	Combined Uncertainty (± %)	Expanded Uncertainty (95% Confidence limit) (± %)
Pressure	4.97		
Gas Volume	3.05		As % of result
Gas Temperature	0.70		11.43
Humidity	0.5		
Washing Weighing	0.02	5.89	As % of ELV
Leak	0.00		0.16
Filter Weighing	0.00		As mg/m^3
O_2 Concentration	0.00		0.08

Ge2.7 Appendix 7: Paint Shop Dryer

2.7.1 Sampling Location



Duct Characteristics

	Value	Units
Type of Duct	Circular	-
Diameter / Depth	0.35	m
Area	0.096	m^2
Port Size	4	inch
Port Depth	70	mm
Orientation	Vertical	-

Sampling Platform

General Platform Information	
Permanent / Temporary	Temporary
Inside / Outside	Outside
Height of Platform from Ground Level	~1.5m
Size of Platform	$2.5m^2$
Does the Platform have a weather cover (roof)	No
Platform has 2 hand rails (approx 0.5m and 1.0m high)	Yes
Platform has vertical base boards (approx 0.25m high)	Yes
Platform has removable chains / self closing gates at the top of the ladder	Yes
Platform positioned relative to the access ports (free from obstruction that would hamper insertion and removal of the sampling equipment)	Yes
Depth of platform (length of probe + 1m)	Yes

2.7.2 Flow Criteria Measurements

Traverse Point	**A1**		
Pressure (mm H_2O)	10.0	10.0	10.0
$\sqrt{\Delta P}$	3.16	3.16	3.16
Temperature (ºC)	30	30	30

Static Pressure (mmH_2O)	17	**Barometric Pressure (mm Hg)**	760.8	**Duct Dimensions (m)**	0.35

Velocity (m/s) average	11.0	**Actual Flow of stack gas (m^3/hr)**	3808.4
Stack Geometry	Circular	**Flow (wet) at STP (m^3/hr)**	3440.3
Dimensions (m)	0.35	**Flow (dry) at STP (m^3/hr)**	3410.0
Area (m^2)	0.096		

	Average	**Max**	**Min**	**Ratio Max/Min**	**Compliance**
Pressure (mm H_2O)	10.0	10.0	10.0	1.0	Yes
$\sqrt{\Delta P}$ (mm H_2O)^{½}	3.16	3.16	3.16	1.0	Yes
Temperature (ºC)	30.0	30.0	30.0	1.0	Yes
Angle of flow	<15º				Yes
Local Negative Flow	No				Yes

2.7.3 Gas Measurements

	Mean
Oxygen (%)	20.90
Carbon Monoxide (ppm)	0
Carbon Dioxide (%)	0.03

2.7.4 Manual Method Calculations

Test Dates	16.05.17		
Company	Leck Construction (BAE Systems)		
Contact	T Hughes		
Stack	Paint Shop Dryer		
	Blank	Test 1	Units
Sample Ref	epa.17.511.11	epa.17.511.12	-
Start Time	14:50	15:04	hr:mm
Stop Time	14:55	15:34	hr:mm
% O_2	20.90	20.90	%
% CO_2	0.03	0.03	%
%N_2	-	79.07	%
V_{lc}	-	5.1	ml
B_{wo}	0.01	0.009	-
P_b	-	760.8	mm Hg
St	-	17	mm H_2O
T_s	-	30.00	ºC
√ΔP	-	3.16	$(mm\ H_2O)^{½}$
Yd	-	1.036	-
Test Time	5	30	min
T_m	-	26.67	ºC
C_p	-	0.830	-
As	-	0.096	m^2
D_n	-	7.20	mm
ΔH ave	-	56.87	mm H_20
V_{mstd}	0.7142	0.7142	m^3
V_{wstd}	0.0063	0.0063	m^3
$Q_{std,wet}$	-	3377.7	Nm^3/h
Q_{act}	-	3739.1	Nm^3/h
Isokinetic Rate	-	100.8	%
Vs	-	10.80	m/s
Washings			
Sample Ref	epa.17.511.11W	epa.17.511.12W	-
Weight	0.7	<0.5	mg
Filter			
Sample Ref	epa.17.511.11F	epa.17.511.12F	-
Weight	0.07	<0.04	mg
Particulate Concentration (Dry, No O_2 Correction)	1.1	<0.76	mg/Nm^3
Particulate Concentration (at Ref Water and Oxygen)	1.1	<0.75	mg/Nm^3
Particulate Release Rate	-	<3	g/hr
Reference Temp	273		K
Reference Pressure	101.3		kPa
Reference Moisture	No correction for moisture		-
Reference Oxygen	No correction for Oxygen		%

Particulates

	Filter (mg)	Washings (mg)
Blank	0.07	0.7
Run 1	<0.04	<0.5

2.7.5 Sampling Measurements

Date	16-05-17		Impinger	Initial Wt (g)	Final Wt (g)	Wt Gained (g)			**l/min**	**Vac (in Hg)**			
Start Time	15:04		1	784.0	785.4	1.4		**Leak Check (Pre)**	0.09	10			
End Time	15:34		2	797.1	797.5	0.4		**Leak Check (Post)**	0.09	10			
Duration (mm.ss)	30.00		3	680.9	680.9	0.0							
Stack	Paint Dryer / General		4	839.9	843.2	3.3		**Pitot ID**	pitot 12			Velocity Head	
Run	1		5	247.4	247.4	0.0		**DGM ID**	dgm 09			Min	10
												Max	10
												Max:Min	1.00
								Nozzle ID	n36				
			Sample Ref	epa.17.511.12				**Nozzle Diameter (mm)**	7.20				
K Factor	5.69		**Filter Number**	epa.17.511.12F									
Stack Diameter (m)	0.35		**Probe Washing No**	epa.17.511.12W									
							ΔH across orifice meter (mm H_2O)	**DGM (litres)**	**DGM Temp (ºC)**		**Temp (ºC)**		
Point	Time	Vac	Stack Temp	Prelim		Actual		512.76	In	Out	Probe	**Filter**	**Impinger**
a1	0 5	4	30	10		3.16	56.87	650	27	26	70		
a1	5 10	4	30	10		3.16	56.87	769	27	26	70		
a1	10 15	4	30	10		3.16	56.87	889	27	26	70		
a1	15 20	4	30	10		3.16	56.87	1014	27	26	70		
a1	20 25	4	30	10		3.16	56.87	1138	27	26	70		
a1	25 30	4	30	10		3.16	56.87	1264.6	28	27	70		
Total / Average		4.00	30.00	10.00		3.16	56.87	751.84	27.17	26.17	70.00		

2.7.6 Instrumental Gas Analyser Site Calibration Measurements

Zero Point

				Pre Test			Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Pre Span	Post Span	System	System	Zero Drift
VOC (ppm)	10	Ambient Air	0.00	0.00	0.00	0.01	0.01	0.00

Span Gas

				Pre Test		Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Analyser	System	System	Span Drift
VOC (ppm)	10	EPA/CGAS/101	7.93	7.95	7.94	7.92	-0.02

2.7.7 Instrumental Gas Analyser Results

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
16.05.2017	15:04:05	3.6	5.7	5.7
16.05.2017	15:04:20	5.4	8.6	8.6
16.05.2017	15:04:35	5.0	8.0	8.0
16.05.2017	15:04:50	5.7	9.1	9.1
16.05.2017	15:05:05	6.5	10.5	10.5
16.05.2017	15:05:20	6.3	10.0	10.0
16.05.2017	15:05:35	7.7	12.3	12.3
16.05.2017	15:05:50	7.9	12.6	12.6
16.05.2017	15:06:05	7.7	12.3	12.3
16.05.2017	15:06:20	8.2	13.2	13.2
16.05.2017	15:06:35	8.2	13.2	13.2
16.05.2017	15:06:50	8.3	13.3	13.3
16.05.2017	15:07:05	8.4	13.4	13.4
16.05.2017	15:07:20	9.7	15.5	15.5
16.05.2017	15:07:35	9.4	15.1	15.1
16.05.2017	15:07:50	9.0	14.5	14.5
16.05.2017	15:08:05	9.0	14.5	14.5
16.05.2017	15:08:20	9.0	14.5	14.5
16.05.2017	15:08:35	9.1	14.6	14.6
16.05.2017	15:08:50	10.0	16.0	16.0
16.05.2017	15:09:05	10.0	16.0	16.0
16.05.2017	15:09:20	8.6	13.8	13.8
16.05.2017	15:09:35	8.5	13.7	13.7
16.05.2017	15:09:50	8.3	13.3	13.3
16.05.2017	15:10:05	6.1	9.8	9.8
16.05.2017	15:10:20	4.3	6.9	6.9
16.05.2017	15:10:35	4.7	7.5	7.5
16.05.2017	15:10:50	4.7	7.5	7.5
16.05.2017	15:11:05	4.3	6.8	6.8
16.05.2017	15:11:20	4.3	6.9	6.9
16.05.2017	15:11:35	5.7	9.1	9.1

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
16.05.2017	15:11:50	5.7	9.1	9.1
16.05.2017	15:12:05	6.2	10.0	10.0
16.05.2017	15:12:20	6.2	10.0	10.0
16.05.2017	15:12:35	5.2	8.4	8.4
16.05.2017	15:12:50	4.2	6.8	6.8
16.05.2017	15:13:05	4.6	7.4	7.4
16.05.2017	15:13:20	4.5	7.2	7.2
16.05.2017	15:13:35	5.3	8.5	8.5
16.05.2017	15:13:50	5.2	8.4	8.4
16.05.2017	15:14:05	5.2	8.3	8.3
16.05.2017	15:14:20	5.5	8.8	8.8
16.05.2017	15:14:35	5.6	9.0	9.0
16.05.2017	15:14:50	4.5	7.3	7.3
16.05.2017	15:15:05	3.3	5.3	5.3
16.05.2017	15:15:20	3.9	6.3	6.3
16.05.2017	15:15:35	4.0	6.4	6.4
16.05.2017	15:15:50	4.1	6.6	6.6
16.05.2017	15:16:05	4.1	6.6	6.6
16.05.2017	15:16:20	4.3	6.9	6.9
16.05.2017	15:16:35	4.1	6.6	6.6
16.05.2017	15:16:50	5.3	8.5	8.5
16.05.2017	15:17:05	5.6	9.0	9.0
16.05.2017	15:17:20	6.2	10.0	10.0
16.05.2017	15:17:35	6.6	10.6	10.6
16.05.2017	15:17:50	6.5	10.4	10.4
16.05.2017	15:18:05	6.5	10.4	10.4
16.05.2017	15:18:20	7.6	12.2	12.2
16.05.2017	15:18:35	7.8	12.5	12.5
16.05.2017	15:18:50	7.9	12.6	12.6
16.05.2017	15:19:05	7.9	12.6	12.6
16.05.2017	15:19:20	8.0	12.8	12.8
16.05.2017	15:19:35	7.9	12.7	12.7
16.05.2017	15:19:50	7.8	12.6	12.6
16.05.2017	15:20:05	7.7	12.3	12.3
16.05.2017	15:20:20	7.5	12.1	12.1
16.05.2017	15:20:35	7.2	11.6	11.6
16.05.2017	15:20:50	6.2	10.0	10.0
16.05.2017	15:21:05	6.3	10.0	10.0
16.05.2017	15:21:20	6.3	10.0	10.0
16.05.2017	15:21:35	5.2	8.4	8.4
16.05.2017	15:21:50	5.6	9.0	9.0
16.05.2017	15:22:05	5.5	8.9	8.9
16.05.2017	15:22:20	5.7	9.1	9.1
16.05.2017	15:22:35	5.2	8.3	8.3
16.05.2017	15:22:50	5.3	8.4	8.4
16.05.2017	15:23:05	5.3	8.6	8.6
16.05.2017	15:23:20	5.3	8.6	8.6
16.05.2017	15:23:35	5.6	9.0	9.0

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
16.05.2017	15:23:50	5.5	8.9	8.9
16.05.2017	15:24:05	5.7	9.1	9.1
16.05.2017	15:24:20	5.8	9.3	9.3
16.05.2017	15:24:35	5.6	9.0	9.0
16.05.2017	15:24:50	5.8	9.3	9.3
16.05.2017	15:25:05	5.9	9.4	9.4
16.05.2017	15:25:20	4.4	7.0	7.0
16.05.2017	15:25:35	4.3	6.9	6.9
16.05.2017	15:25:50	4.7	7.5	7.5
16.05.2017	15:26:05	4.3	6.9	6.9
16.05.2017	15:26:20	3.6	5.8	5.8
16.05.2017	15:26:35	3.6	5.9	5.9
16.05.2017	15:26:50	4.6	7.3	7.3
16.05.2017	15:27:05	5.6	8.9	8.9
16.05.2017	15:27:20	6.3	10.0	10.0
16.05.2017	15:27:35	6.3	10.0	10.0
16.05.2017	15:27:50	6.6	10.6	10.6
16.05.2017	15:28:05	6.6	10.6	10.6
16.05.2017	15:28:20	6.6	10.6	10.6
16.05.2017	15:28:35	6.9	11.0	11.0
16.05.2017	15:28:50	6.9	11.1	11.1
16.05.2017	15:29:05	6.8	10.9	10.9
16.05.2017	15:29:20	6.9	11.1	11.1
16.05.2017	15:29:35	7.1	11.4	11.4
16.05.2017	15:29:50	7.3	11.7	11.7
16.05.2017	15:30:05	7.3	11.7	11.7
16.05.2017	15:30:20	7.3	11.7	11.7
16.05.2017	15:30:35	7.3	11.7	11.7
16.05.2017	15:30:50	6.9	11.1	11.1
16.05.2017	15:31:05	6.7	10.8	10.8
16.05.2017	15:31:20	6.7	10.8	10.8
16.05.2017	15:31:35	6.7	10.8	10.8
16.05.2017	15:31:50	6.5	10.5	10.5
16.05.2017	15:32:05	6.5	10.5	10.5
16.05.2017	15:32:20	6.5	10.4	10.4
16.05.2017	15:32:35	5.6	9.0	9.0
16.05.2017	15:32:50	5.6	9.0	9.0
16.05.2017	15:33:05	5.5	8.8	8.8
16.05.2017	15:33:20	5.5	8.9	8.9
16.05.2017	15:33:35	5.1	8.2	8.2
16.05.2017	15:33:50	5.6	9.0	9.0
16.05.2017	15:34:05	5.3	8.6	8.6
16.05.2017	15:34:20	6.3	10.1	10.1
16.05.2017	15:34:35	6.3	10.0	10.0
16.05.2017	15:34:50	6.2	10.0	10.0
Mean		6.2	10.0	10.0
Max		10.0	16.0	16.0
Min		3.3	5.3	5.3

2.7.8 Uncertainty Calculations

Particulates

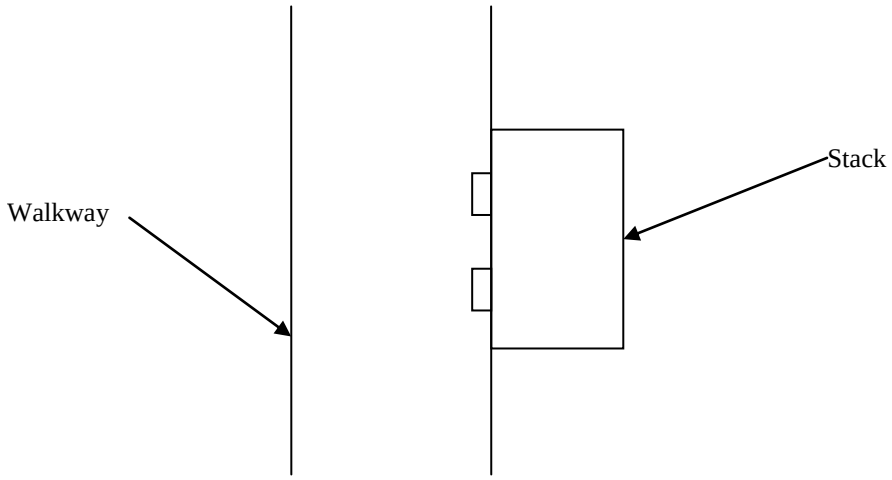
Source of uncertainty	Estimate of Component (1 SD) (± %)	Combined Uncertainty (± %)	Expanded Uncertainty (95% Confidence limit) (± %)
Pressure	6.60	7.12	As % of result 13.82
Gas Volume	2.56		
Gas Temperature	0.67		
Humidity	0.50		
Washing Weighing	0.02		As % of ELV 0.21
Leak	0.00		
Filter Weighing	0.00		As mg/m^3 0.11
O_2 Concentration	0.00		

Total VOC's

Source of uncertainty	Estimate of Component (1 SD) ppm	Combined Uncertainty ppm	Expanded Uncertainty (95% Confidence limit) ppm
Span gas	0.08	0.12	0.24
Linearity	0.06		
Temperature effect (zero)	0.05		
Barometric Pressure	0.04		
Temperature effect (span)	0.02		
Repeatability	0.01		
Span drift	0.01		**Expanded Uncertainty (95% Confidence limit) %**
Zero drift	0.00		
Cross sensitivity CO (1.2 % vol)	0.00		
Cross sensitivity NO (127 mgm^{-3})	0.00		As % of Result 3.82
Cross sensitivity H_2O (sat 325K)	0.00		
Cross sensitivity SO_2 (2767 mgm^{-3})	0.00		As mg/m^3 at ref conditions 0.38
Cross sensitivity CO_2 (15.2 % vol)	0.00		

2.8 Appendix 8: DDH Hall Paint Extract

2.8.1 Sampling Location



Duct Characteristics

	Value	Units
Type of Duct	Rectangular	-
Diameter / Depth	0.40	m
Width	0.59	m
Area	0.236	m^2
Port Size	4	inch
Port Depth	40	mm
Orientation	Vertical	-

Sampling Platform

General Platform Information	
Permanent / Temporary	Permament
Inside / Outside	Inside
Height of Platform from Ground Level	~35m
Size of Platform	N/A
Does the Platform have a weather cover (roof)	N/A
Platform has 2 hand rails (approx 0.5m and 1.0m high)	Yes
Platform has vertical base boards (approx 0.25m high)	Yes
Platform has removable chains / self closing gates at the top of the ladder	N/A
Platform positioned relative to the access ports (free from obstruction that would hamper insertion and removal of the sampling equipment)	Yes
Depth of platform (length of probe + 1m)	Yes

2.8.2 Flow Criteria Measurements

Traverse Point	**A1**			**A2**		
Pressure (mm H_2O)	4.0	4.0	4.0	4.0	4.0	4.0
$\sqrt{\Delta P}$	2.00	2.00	2.00	2.00	2.00	2.00
Temperature (ºC)	23.0	23.0	23.0	23.0	23.0	23.0
Traverse Point	**B1**			**B2**		
Pressure (mm H_2O)	4.0	4.0	4.0	4.0	4.0	4.0
$\sqrt{\Delta P}$	2.00	2.00	2.00	2.00	2.00	2.00
Temperature (ºC)	23	23	23	23	23	23

Static Pressure (mmH_2O)	5.5	**Barometric Pressure (mm Hg)**	759.2	**Duct Dimensions (m)**	0.40 x 0.65

Velocity (m/s) average	6.9	**Actual Flow of stack gas (m^3/hr)**	5820.8
Stack Geometry	Rectangular	**Flow (wet) at STP (m^3/hr)**	5366.0
Dimensions (m)	0.40 x 0.59	**Flow (dry) at STP (m^3/hr)**	5271.9
Area (m^2)	0.236		

	Average	**Max**	**Min**	**Ratio Max/Min**	**Compliance**
Pressure (mm H_2O)	4.0	4.0	4.0	1.0	Yes
$\sqrt{\Delta P}$ (mm $H_2O)^{½}$	2.00	2.00	2.00	1.0	Yes
Temperature (ºC)	23.0	23.0	23.0	1.0	Yes
Angle of flow	<15º				Yes
Local Negative Flow	No				Yes

2.8.3 Gas Measurements

	Mean
Oxygen (%)	20.90
Carbon Monoxide (ppm)	0
Carbon Dioxide (%)	0.03

2.8.4 Manual Method Calculations

Test Dates	22.05.17		
Company	Leck Construction (BAE Systems)		
Contact	T Hughes		
Stack	DDH Paint Extract		
	Blank	Test 1	Units
Sample Ref	epa.17.511.23	epa.17.511.24	-
Start Time	11:53	13:06	hr:mm
Stop Time	11:58	13:40	hr:mm
% O_2	20.90	20.90	%
% CO_2	0.03	0.03	%
%N_2	-	79.07	%
V_{lc}	-	12.9	ml
B_{wo}	0.02	0.018	-
P_b	-	759.2	mm Hg
St	-	5.5	mm H_2O
T_s	-	23.00	ºC
√ΔP	-	2.00	$(mm\ H_2O)^{½}$
Yd	-	1.036	-
Test Time	-	32	min
T_m	-	22.19	ºC
C_p	-	0.829	-
As	-	0.236	m^2
D_n	-	9.72	mm
ΔH ave	-	77.07	mm H_20
V_{mstd}	0.8988	0.8988	m^3
V_{wstd}	0.0161	0.0161	m^3
$Q_{std,wet}$	-	5295.9	Nm^3/h
Q_{act}	-	5744.7	Nm^3/h
Isokinetic Rate	-	103.0	%
Vs	-	6.76	m/s
Washings			
Sample Ref	epa.17.511.23W	epa.17.511.24W	-
Weight	<0.5	<0.5	mg
Filter			
Sample Ref	epa.17.511.23F	epa.17.511.24F	-
Weight	<0.04	1.17	mg
Particulate Concentration (Dry, No O_2 Correction)	<0.6	1.9	mg/Nm^3
Particulate Concentration (at Ref Water and Oxygen)	<0.59	1.8	mg/Nm^3
Particulate Release Rate	-	9.67	g/hr
Reference Temp	273		K
Reference Pressure	101.3		kPa
Reference Moisture	No correction for moisture		-
Reference Oxygen	No correction for Oxygen		%

Particulates

	Filter (mg)	Washings (mg)
Blank	<0.04	<0.5
Run 1	1.17	<0.5

2.8.5 Sampling Measurements

Date	22-05-17		Impinger	Initial Wt (g)	Final Wt (g)	Wt Gained (g)			**l/min**	**Vac (in Hg)**			
Start Time	13:06		1	764.6	769.3	4.7		**Leak Check (Pre)**	0.09	10			
End Time	13:40		2	789.9	789.9	0.0		**Leak Check (Post)**	0.09	10			
Duration (mm.ss)	32.00		3	730.3	730.2	-0.1							
Stack	DDH spray		4	792.8	801.1	8.3		**Pitot ID**	pitot 06			Velocity Head	
Run	1		5	247.4	247.4	0.0		**DGM ID**	dgm 09			Min	4
												Max	4
												Max:Min	1.00
								Nozzle ID	N6				
			Sample Ref	epa.17.511.24				**Nozzle Diameter (mm)**	9.72				
K Factor	19.27		**Filter Number**	epa.17.511.24F									
Stack Diameter (m)	0.40		**Probe Washing No**	epa.17.511.24W									
							ΔH across orifice meter (mm H_2O)	**DGM (litres)**	**DGM Temp (ºC)**		**Temp (ºC)**		
Point	Time	Vac	Stack Temp	Prelim		Actual		6172.55	In	**Out**	Probe	**Filter**	**Impinger**
a1	0 4	5	23	4		2.00	77.07	6287	21	21	70		
a1	4 8	5	23	4		2.00	77.07	6402	21	21	70		
a2	8 12	5	23	4		2.00	77.07	6519	21	21	70		
a2	12 16	5	23	4		2.00	77.07	6640	22	21	70		
b1	16 20	5	23	4		2.00	77.07	6757	23	22	70		
b1	20 24	5	23	4		2.00	77.07	6879	23	22	70		
b2	24 28	5	23	4		2.00	77.07	6994	24	23	70		
b2	28 32	5	23	4		2.00	77.07	7104.67	25	24	70		
Total / Average		5.00	23.00	4.00		2.00	77.07	932.12	22.50	21.88	70.00		

2.8.6 Instrumental Gas Analyser Site Calibration Measurements

Zero Point

				Pre Test			Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Pre Span	Post Span	System	System	Zero Drift
VOC (ppm)	1000	Ambient Air	0.00	0.00	0.00	0.01	0.01	0.00

Span Gas

				Pre Test		Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Analyser	System	System	Span Drift
VOC (ppm)	1000	EPA/CGAS/97	802.0	805.37	808.06	806.35	-1.71

2.8.7 Instrumental Gas Analyser Results

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
22.05.2017	13:06:28	134.6	216.3	216.3
22.05.2017	13:06:43	292.6	470.3	470.3
22.05.2017	13:06:58	268.9	432.2	432.2
22.05.2017	13:07:13	307.7	494.5	494.5
22.05.2017	13:07:28	275.2	442.3	442.3
22.05.2017	13:07:43	290.8	467.4	467.4
22.05.2017	13:07:58	304.8	489.9	489.9
22.05.2017	13:08:13	389.0	625.2	625.2
22.05.2017	13:08:28	371.2	596.6	596.6
22.05.2017	13:08:43	307.4	494.0	494.0
22.05.2017	13:08:58	270.3	434.4	434.4
22.05.2017	13:09:13	215.4	346.2	346.2
22.05.2017	13:09:28	282.8	454.5	454.5
22.05.2017	13:09:43	279.6	449.4	449.4
22.05.2017	13:09:58	277.7	446.3	446.3
22.05.2017	13:10:13	251.3	403.9	403.9
22.05.2017	13:10:28	262.0	421.1	421.1
22.05.2017	13:10:43	244.7	393.3	393.3
22.05.2017	13:10:58	240.0	385.7	385.7
22.05.2017	13:11:13	252.7	406.1	406.1
22.05.2017	13:11:28	266.7	428.6	428.6
22.05.2017	13:11:43	195.4	314.0	314.0
22.05.2017	13:11:58	197.8	317.9	317.9
22.05.2017	13:12:13	191.0	307.0	307.0
22.05.2017	13:12:28	136.8	219.9	219.9
22.05.2017	13:12:43	246.2	395.7	395.7
22.05.2017	13:12:58	290.6	467.0	467.0
22.05.2017	13:13:13	295.5	474.9	474.9
22.05.2017	13:13:28	217.8	350.0	350.0
22.05.2017	13:13:43	220.3	354.1	354.1

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
22.05.2017	13:13:58	244.2	392.5	392.5
22.05.2017	13:14:13	277.2	445.5	445.5
22.05.2017	13:14:28	280.3	450.5	450.5
22.05.2017	13:14:43	273.5	439.6	439.6
22.05.2017	13:14:58	278.6	447.8	447.8
22.05.2017	13:15:13	234.7	377.2	377.2
22.05.2017	13:15:28	210.7	338.6	338.6
22.05.2017	13:15:43	240.0	385.7	385.7
22.05.2017	13:15:58	233.9	375.9	375.9
22.05.2017	13:16:13	267.4	429.8	429.8
22.05.2017	13:16:28	226.9	364.7	364.7
22.05.2017	13:16:43	208.5	335.1	335.1
22.05.2017	13:16:58	201.7	324.2	324.2
22.05.2017	13:17:13	185.3	297.8	297.8
22.05.2017	13:17:28	206.6	332.0	332.0
22.05.2017	13:17:43	190.7	306.5	306.5
22.05.2017	13:17:58	192.4	309.2	309.2
22.05.2017	13:18:13	248.6	399.5	399.5
22.05.2017	13:18:28	269.1	432.5	432.5
22.05.2017	13:18:43	76.2	122.5	122.5
22.05.2017	13:18:58	12.2	19.6	19.6
22.05.2017	13:19:13	127.2	204.4	204.4
22.05.2017	13:19:28	126.0	202.5	202.5
22.05.2017	13:19:43	133.3	214.2	214.2
22.05.2017	13:19:58	182.4	293.1	293.1
22.05.2017	13:20:13	285.7	459.2	459.2
22.05.2017	13:20:28	350.2	562.8	562.8
22.05.2017	13:20:43	268.6	431.7	431.7
22.05.2017	13:20:58	353.1	567.5	567.5
22.05.2017	13:21:13	237.1	381.1	381.1
22.05.2017	13:21:28	155.1	249.3	249.3
22.05.2017	13:21:43	213.2	342.6	342.6
22.05.2017	13:21:58	220.8	354.9	354.9
22.05.2017	13:22:13	189.0	303.8	303.8
22.05.2017	13:22:28	141.9	228.1	228.1
22.05.2017	13:24:28	128.4	206.4	206.4
22.05.2017	13:24:43	178.3	286.6	286.6
22.05.2017	13:24:58	165.6	266.1	266.1
22.05.2017	13:25:13	167.0	268.4	268.4
22.05.2017	13:25:28	142.4	228.9	228.9
22.05.2017	13:25:43	95.5	153.5	153.5
22.05.2017	13:25:58	226.1	363.4	363.4
22.05.2017	13:26:13	175.8	282.5	282.5
22.05.2017	13:26:28	234.2	376.4	376.4
22.05.2017	13:26:43	224.4	360.6	360.6
22.05.2017	13:26:58	169.7	272.7	272.7
22.05.2017	13:27:13	150.7	242.2	242.2
22.05.2017	13:27:28	177.5	285.3	285.3

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
22.05.2017	13:27:43	209.0	335.9	335.9
22.05.2017	13:27:58	228.1	366.6	366.6
22.05.2017	13:28:13	231.3	371.7	371.7
22.05.2017	13:28:28	219.0	352.0	352.0
22.05.2017	13:28:43	201.0	323.0	323.0
22.05.2017	13:28:58	191.7	308.1	308.1
22.05.2017	13:29:13	151.6	243.6	243.6
22.05.2017	13:29:28	158.2	254.3	254.3
22.05.2017	13:29:43	195.6	314.4	314.4
22.05.2017	13:29:58	238.6	383.5	383.5
22.05.2017	13:30:13	221.2	355.5	355.5
22.05.2017	13:30:28	192.2	308.9	308.9
22.05.2017	13:30:43	142.6	229.2	229.2
22.05.2017	13:30:58	156.0	250.7	250.7
22.05.2017	13:31:13	172.6	277.4	277.4
22.05.2017	13:31:28	173.6	279.0	279.0
22.05.2017	13:31:43	137.2	220.5	220.5
22.05.2017	13:31:58	20.5	32.9	32.9
22.05.2017	13:32:13	24.7	39.7	39.7
22.05.2017	13:32:28	125.5	201.7	201.7
22.05.2017	13:32:43	196.1	315.2	315.2
22.05.2017	13:32:58	171.2	275.1	275.1
22.05.2017	13:33:13	185.1	297.5	297.5
22.05.2017	13:33:28	190.0	305.4	305.4
22.05.2017	13:33:43	189.7	304.9	304.9
22.05.2017	13:33:58	199.0	319.8	319.8
22.05.2017	13:34:13	160.4	257.8	257.8
22.05.2017	13:34:28	147.3	236.7	236.7
22.05.2017	13:34:43	162.4	261.0	261.0
22.05.2017	13:34:58	197.6	317.6	317.6
22.05.2017	13:35:13	178.3	286.6	286.6
22.05.2017	13:35:28	170.5	274.0	274.0
22.05.2017	13:35:43	168.3	270.5	270.5
22.05.2017	13:35:58	196.3	315.5	315.5
22.05.2017	13:36:13	241.8	388.6	388.6
22.05.2017	13:36:28	200.2	321.8	321.8
22.05.2017	13:36:43	173.9	279.5	279.5
22.05.2017	13:36:58	171.2	275.1	275.1
22.05.2017	13:37:13	188.5	302.9	302.9
22.05.2017	13:37:28	189.0	303.8	303.8
22.05.2017	13:37:43	171.4	275.5	275.5
22.05.2017	13:37:58	183.4	294.8	294.8
22.05.2017	13:38:13	210.5	338.3	338.3
22.05.2017	13:38:28	196.3	315.5	315.5
22.05.2017	13:38:43	148.0	237.9	237.9
22.05.2017	13:38:58	221.0	355.2	355.2
22.05.2017	13:39:13	196.6	316.0	316.0
22.05.2017	13:39:28	134.1	215.5	215.5

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
22.05.2017	13:39:43	196.3	315.5	315.5
22.05.2017	13:39:58	241.5	388.1	388.1
22.05.2017	13:40:13	212.2	341.0	341.0
22.05.2017	13:40:28	198.3	318.7	318.7
22.05.2017	13:40:43	147.2	236.6	236.6
Mean	13:40:58	167.2	268.7	268.7
Max		206.4	331.7	331.7
Min		389.0	625.2	625.2
		12.2	19.6	19.6

2.8.8 Uncertainty Calculations

Particulates

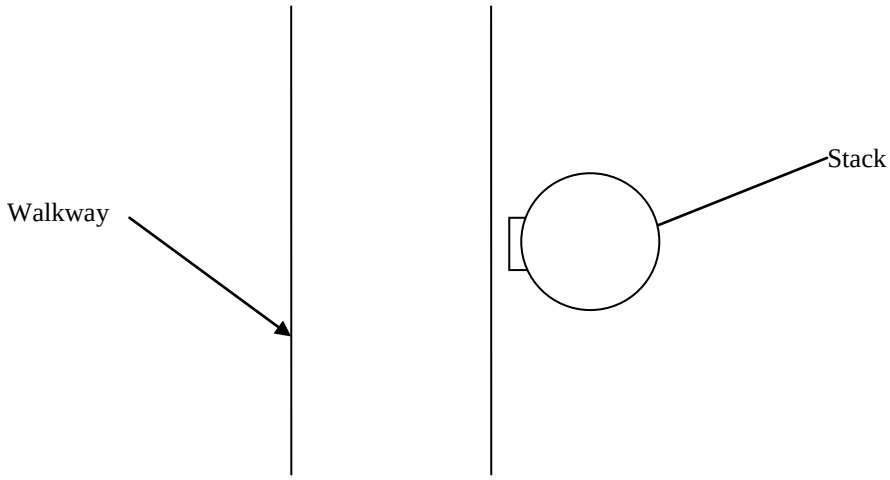
Source of uncertainty	Estimate of Component (1 SD) (± %)	Combined Uncertainty (± %)	Expanded Uncertainty (95% Confidence limit) (± %)
Pressure	4.87		
Gas Volume	3.17		As % of result
Gas Temperature	0.68		11.39
Humidity	0.50		
Filter Weighing	0.05	5.87	As % of ELV
Washing Weighing	0.02		0.42
Leak	0.00		
O_2 Concentration	0.00		As mg/m^3
			0.21

Total VOC's

Source of uncertainty	Estimate of Component (1 SD) ppm	Combined Uncertainty ppm	Expanded Uncertainty (95% Confidence limit) ppm
Linearity	8.02		
Temperature effect (zero)	4.63		
Barometric Pressure	4.01		21.38
Span gas	3.52		
Temperature effect (span)	2.32		
Repeatability	0.69	10.97	
Span drift	0.49		**Expanded Uncertainty (95% Confidence limit) %**
Zero drift	0.00		
Cross sensitivity CO (1.2 % vol)	0.00		
Cross sensitivity NO (127 mgm^{-3})	0.00		As % of Result
Cross sensitivity H_2O (sat 325K)	0.00		10.31
Cross sensitivity SO_2 (2767 mgm^{-3})	0.00		As mg/m^3 at ref conditions
Cross sensitivity CO_2 (15.2 % vol)	0.00		34.20

2.9 Appendix 9: DDH Hall Tile Adhesive

2.9.1 Sampling Location



Duct Characteristics

	Value	Units
Type of Duct	Circular	-
Diameter / Depth	0.29	m
Area	0.066	m^2
Port Size	4	inch
Port Depth	50	mm
Orientation	Vertical	-

Sampling Platform

General Platform Information	
Permanent / Temporary	Permament
Inside / Outside	Inside
Height of Platform from Ground Level	~25m
Size of Platform	N/A
Does the Platform have a weather cover (roof)	N/A
Platform has 2 hand rails (approx 0.5m and 1.0m high)	Yes
Platform has vertical base boards (approx 0.25m high)	Yes
Platform has removable chains / self closing gates at the top of the ladder	N/A
Platform positioned relative to the access ports (free from obstruction that would hamper insertion and removal of the sampling equipment)	Yes
Depth of platform (length of probe + 1m)	Yes

2.9.2 Flow Criteria Measurements

Traverse Point	**A1**		
Pressure (mm H_2O)	28.0	28.0	28.0
$\sqrt{\Delta P}$	5.29	5.29	5.29
Temperature (ºC)	25	25	25

Static Pressure (mmH_2O)	-100.0	**Barometric Pressure (mm Hg)**	751.7	**Duct Dimensions (m)**	0.29

Velocity (m/s) average	18.5	**Actual Flow of stack gas (m^3/hr)**	4388.6
Stack Geometry	Circular	**Flow (wet) at STP (m^3/hr)**	3977.5
Dimensions (m)	0.29	**Flow (dry) at STP (m^3/hr)**	3891.8
Area (m^2)	0.066		

	Average	**Max**	**Min**	**Ratio Max/Min**	**Compliance**
Pressure (mm H_2O)	28.0	28.0	28.0	1.0	Yes
$\sqrt{\Delta P}$ (mm H_2O)^{½}	5.29	5.29	5.29	1.0	Yes
Temperature (ºC)	25.0	25.0	25.0	1.0	Yes
Angle of flow	<15º				Yes
Local Negative Flow	No				Yes

2.9.3 Gas Measurements

	Mean
Oxygen (%)	20.90
Carbon Monoxide (ppm)	0
Carbon Dioxide (%)	0.03

2.9.4 Manual Method Calculations

Test Dates	17/05/17		
Company	Leck Construction (BAE Systems)		
Contact	T Hughes		
Stack	DDH Tile Adhesive		
	Blank	Test 1	Units
Sample Ref	epa.17.511.13	epa.17.511.14	-
Start Time	13:52	14:10	hr:mm
Stop Time	13:57	14:40	hr:mm
% O_2	20.90	20.90	%
% CO_2	0.03	0.03	%
%N_2	-	79.07	%
V_{lc}	-	16.4	ml
B_{wo}	0.02	0.022	-
P_b	-	759.2	mm Hg
St	-	-100	mm H_2O
T_s	-	23.00	ºC
$\sqrt{\Delta P}$	-	5.29	$(mm\ H_2O)^{½}$
Yd	-	1.036	-
Test Time	-	30	min
T_m	-	21.17	ºC
C_p	-	0.828	-
As	-	0.066	m^2
D_n	-	6.27	mm
ΔH ave	-	91.62	mm H_20
V_{mstd}	0.9263	0.9263	m^3
V_{wstd}	0.0204	0.0204	m^3
$Q_{std,wet}$	-	3899.8	Nm^3/h
Q_{act}	-	4273.9	Nm^3/h
Isokinetic Rate	-	103.9	%
Vs	-	17.97	m/s
Washings			
Sample Ref	epa.17.511.13W	epa.17.511.14W	-
Weight	<0.5	<0.5	mg
Filter			
Sample Ref	epa.17.511.13F	epa.17.511.14F	-
Weight	<0.1	0.23	mg
Particulate Concentration (Dry, No O_2 Correction)	<0.65	0.8	mg/Nm^3
Particulate Concentration (at Ref Water and Oxygen)	<0.64	0.8	mg/Nm^3
Particulate Release Rate	-	3.01	g/hr
Reference Temp	273		K
Reference Pressure	101.3		kPa
Reference Moisture	No correction for moisture		-
Reference Oxygen	No correction for Oxygen		%

Particulates

	Filter (mg)	Washings (mg)
Blank	<0.1	<0.5
Run 1	0.23	<0.5

2.9.5 Sampling Measurements

Date	17-05-17		Impinger	Initial Wt (g)	Final Wt (g)	Wt Gained (g)			l/min	Vac (in Hg)			
Start Time	14:10		1	784.5	785.1	0.6		Leak Check (Pre)	0.09	10			
End Time	14:40		2	795.6	797.4	1.8		Leak Check (Post)	0.09	10			
Duration (mm.ss)	30.00		3	677.1	681.4	4.3							
Stack	DDH Tile Adhesive		4	868.3	878.0	9.7		Pitot ID	pitot 06			Velocity Head	
Run	1		5	247.4	247.4	0.0		DGM ID	dgm 09			Min	28
												Max	28
												Max:Min	1.00
								Nozzle ID	N30				
			Sample Ref	epa.17.511.14				Nozzle Diameter (mm)	6.27				
K Factor	3.27		Filter Number	epa.17.511.14F									
Stack Diameter (m)	0.29		Probe Washing No	epa.17.511.14W									
							ΔH across orifice meter (mm H_2O)	DGM (litres)	DGM Temp (ºC)		Temp (ºC)		
Point	Time	Vac	Stack Temp	Prelim		Actual		1382.21	In	Out	Probe	Filter	Impinger
a1	0 5	4	23	28		5.29	91.62	1540	21	21	160	160	
a1	5 10	4	23	28		5.29	91.62	1709	21	21	160	160	
a1	10 15	4	23	28		5.29	91.62	1883	21	21	160	160	
a1	15 20	4	23	28		5.29	91.62	2038	21	21	160	160	
a1	20 25	4	23	28		5.29	91.62	2197	22	21	160	160	
a1	25 30	4	23	28		5.29	91.62	2338.18	22	21	160	160	
Total / Average		4.00	23.00	28.00		5.29	91.62	955.97	21.33	21.00	160.00	160.00	

2.9.6 Instrumental Gas Analyser Site Calibration Measurements

Zero Point

				Pre Test			Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Pre Span	Post Span	System	System	Zero Drift
VOC (ppm)	100	Ambient Air	0.00	0.00	0.00	0.00	0.00	0.00

Span Gas

				Pre Test		Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Analyser	System	System	Span Drift
VOC (ppm)	100	EPA/CGAS/103	80.40	80.37	80.59	79.66	-0.93

2.9.7 Instrumental Gas Analyser Results

Date	Time	VOC ppm	VOC as C mg/^{m3}	Ref VOC as C mg/m^3
17.05.2017	14:10:03	12.1	19.4	19.4
17.05.2017	14:10:18	12.3	19.8	19.8
17.05.2017	14:10:33	12.2	19.6	19.6
17.05.2017	14:10:48	12.0	19.3	19.3
17.05.2017	14:11:03	14.4	23.1	23.1
17.05.2017	14:11:18	14.4	23.1	23.1
17.05.2017	14:11:33	17.9	28.8	28.8
17.05.2017	14:11:48	12.1	19.4	19.4
17.05.2017	14:12:03	11.4	18.3	18.3
17.05.2017	14:12:18	9.4	15.1	15.1
17.05.2017	14:12:33	8.6	13.9	13.9
17.05.2017	14:12:48	7.0	11.2	11.2
17.05.2017	14:13:03	5.6	9.0	9.0
17.05.2017	14:13:18	8.0	12.9	12.9
17.05.2017	14:13:33	7.0	11.2	11.2
17.05.2017	14:13:48	7.2	11.6	11.6
17.05.2017	14:14:03	11.7	18.8	18.8
17.05.2017	14:14:18	9.4	15.1	15.1
17.05.2017	14:14:33	8.5	13.6	13.6
17.05.2017	14:14:48	6.8	11.0	11.0
17.05.2017	14:15:03	10.4	16.7	16.7
17.05.2017	14:15:18	16.4	26.4	26.4
17.05.2017	14:15:33	14.1	22.7	22.7
17.05.2017	14:15:48	13.0	20.9	20.9
17.05.2017	14:16:03	12.8	20.6	20.6
17.05.2017	14:16:18	12.7	20.4	20.4
17.05.2017	14:16:33	11.4	18.3	18.3
17.05.2017	14:16:48	9.6	15.4	15.4
17.05.2017	14:17:03	14.7	23.6	23.6
17.05.2017	14:17:18	34.7	55.8	55.8

Date	Time	VOC ppm	VOC as C mg/^{m3}	Ref VOC as C mg/m^3
17.05.2017	14:17:33	52.0	83.6	83.6
17.05.2017	14:17:48	48.3	77.6	77.6
17.05.2017	14:18:03	27.3	43.9	43.9
17.05.2017	14:18:18	20.9	33.6	33.6
17.05.2017	14:18:33	18.6	29.9	29.9
17.05.2017	14:18:48	16.0	25.7	25.7
17.05.2017	14:19:03	14.7	23.6	23.6
17.05.2017	14:19:18	13.2	21.2	21.2
17.05.2017	14:19:33	11.5	18.5	18.5
17.05.2017	14:19:48	10.0	16.1	16.1
17.05.2017	14:20:03	8.9	14.4	14.4
17.05.2017	14:20:18	8.3	13.3	13.3
17.05.2017	14:20:33	8.0	12.8	12.8
17.05.2017	14:20:48	7.2	11.5	11.5
17.05.2017	14:21:03	6.5	10.4	10.4
17.05.2017	14:21:18	8.3	13.3	13.3
17.05.2017	14:21:33	6.4	10.2	10.2
17.05.2017	14:21:48	6.0	9.6	9.6
17.05.2017	14:22:03	6.2	10.0	10.0
17.05.2017	14:22:18	5.5	8.9	8.9
17.05.2017	14:22:33	6.7	10.8	10.8
17.05.2017	14:22:48	5.2	8.3	8.3
17.05.2017	14:23:03	4.4	7.1	7.1
17.05.2017	14:23:18	5.3	8.5	8.5
17.05.2017	14:23:33	5.2	8.4	8.4
17.05.2017	14:23:48	4.8	7.8	7.8
17.05.2017	14:24:03	4.3	6.9	6.9
17.05.2017	14:24:18	5.3	8.4	8.4
17.05.2017	14:24:33	5.1	8.1	8.1
17.05.2017	14:24:48	4.9	7.9	7.9
17.05.2017	14:25:03	4.7	7.6	7.6
17.05.2017	14:25:18	4.7	7.6	7.6
17.05.2017	14:25:33	4.6	7.4	7.4
17.05.2017	14:25:48	4.8	7.7	7.7
17.05.2017	14:26:03	4.5	7.3	7.3
17.05.2017	14:26:18	4.1	6.6	6.6
17.05.2017	14:26:33	4.1	6.5	6.5
17.05.2017	14:26:48	3.8	6.1	6.1
17.05.2017	14:27:03	3.6	5.8	5.8
17.05.2017	14:27:18	3.6	5.8	5.8
17.05.2017	14:27:33	3.6	5.8	5.8
17.05.2017	14:27:48	6.0	9.6	9.6
17.05.2017	14:28:03	6.5	10.5	10.5
17.05.2017	14:28:18	7.6	12.1	12.1
17.05.2017	14:28:33	7.6	12.2	12.2
17.05.2017	14:28:48	6.0	9.6	9.6
17.05.2017	14:29:03	5.5	8.8	8.8
17.05.2017	14:29:18	5.1	8.1	8.1

Date	Time	VOC ppm	VOC as C mg/^{m3}	Ref VOC as C mg/m^3
17.05.2017	14:29:33	4.6	7.4	7.4
17.05.2017	14:29:48	3.8	6.1	6.1
17.05.2017	14:30:03	4.3	6.9	6.9
17.05.2017	14:30:18	4.5	7.3	7.3
17.05.2017	14:30:33	10.5	16.9	16.9
17.05.2017	14:30:48	57.8	92.9	92.9
17.05.2017	14:31:03	44.1	70.9	70.9
17.05.2017	14:31:18	35.7	57.4	57.4
17.05.2017	14:31:33	31.2	50.1	50.1
17.05.2017	14:31:48	30.3	48.7	48.7
17.05.2017	14:32:03	24.2	38.9	38.9
17.05.2017	14:32:18	23.0	37.0	37.0
17.05.2017	14:32:33	19.8	31.8	31.8
17.05.2017	14:32:48	19.1	30.7	30.7
17.05.2017	14:33:03	16.9	27.2	27.2
17.05.2017	14:33:18	17.1	27.5	27.5
17.05.2017	14:33:33	18.2	29.3	29.3
17.05.2017	14:33:48	13.5	21.7	21.7
17.05.2017	14:34:03	11.7	18.8	18.8
17.05.2017	14:34:18	11.0	17.7	17.7
17.05.2017	14:34:33	11.4	18.3	18.3
17.05.2017	14:34:48	11.1	17.8	17.8
17.05.2017	14:35:03	10.9	17.5	17.5
17.05.2017	14:35:18	9.4	15.1	15.1
17.05.2017	14:35:33	8.0	12.8	12.8
17.05.2017	14:35:48	7.2	11.6	11.6
17.05.2017	14:36:03	7.6	12.1	12.1
17.05.2017	14:36:18	6.5	10.5	10.5
17.05.2017	14:36:33	6.3	10.2	10.2
17.05.2017	14:36:48	6.3	10.2	10.2
17.05.2017	14:37:03	5.4	8.6	8.6
17.05.2017	14:37:18	5.8	9.3	9.3
17.05.2017	14:37:33	5.8	9.3	9.3
17.05.2017	14:37:48	5.2	8.4	8.4
17.05.2017	14:38:03	4.3	6.9	6.9
17.05.2017	14:38:18	5.7	9.2	9.2
17.05.2017	14:38:33	4.8	7.7	7.7
17.05.2017	14:38:48	7.7	12.4	12.4
17.05.2017	14:39:03	6.1	9.8	9.8
17.05.2017	14:39:18	2.7	4.3	4.3
17.05.2017	14:39:33	16.7	26.8	26.8
17.05.2017	14:39:48	18.9	30.4	30.4
17.05.2017	14:40:03	29.5	47.4	47.4
17.05.2017	14:40:18	20.2	32.5	32.5
17.05.2017	14:40:33	13.6	21.9	21.9
17.05.2017	14:40:48	10.2	16.4	16.4
Mean		11.7	18.8	18.8
Max		57.8	92.9	92.9

Date	Time	VOC ppm	VOC as C mg/^{m3}	Ref VOC as C mg/m^3
Min		2.7	4.3	4.3

2.9.8 Uncertainty Calculations

Particulates

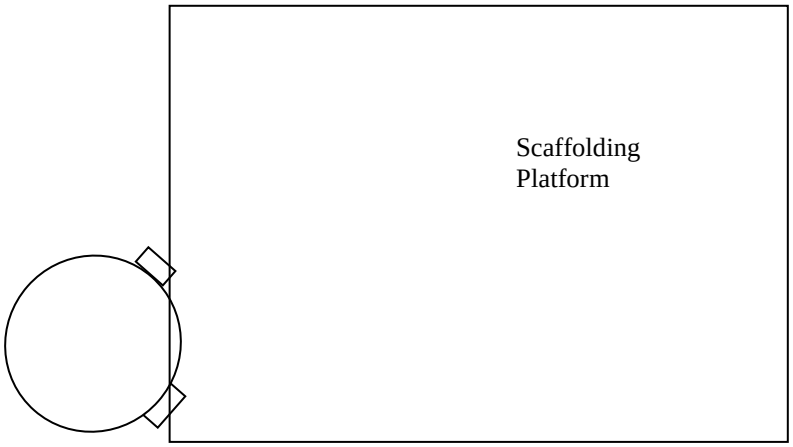
Source of uncertainty	Estimate of Component (1 SD) (± %)	Combined Uncertainty (± %)	Expanded Uncertainty (95% Confidence limit) (± %)
Gas Volume	4.09	5.30	As % of result 10.27
Pressure	3.25		
Gas Temperature	0.69		
Humidity	0.50		
Washing Weighing	0.02		As % of ELV 0.16
Filter Weighing	0.01		
Leak	0.00		As mg/m^3 0.08
O_2 Concentration	0.00		

Total VOC's

Source of uncertainty	Estimate of Component (1 SD) ppm	Combined Uncertainty ppm	Expanded Uncertainty (95% Confidence limit) ppm
Linearity	0.80	1.14	2.22
Temperature effect (zero)	0.46		
Barometric Pressure	0.40		
Span gas	0.39		
Span drift	0.27		
Temperature effect (span)	0.23		
Repeatability	0.07		**Expanded Uncertainty (95% Confidence limit) %**
Zero drift	0.00		
Cross sensitivity CO (1.2 % vol)	0.00		
Cross sensitivity NO (127 mgm^{-3})	0.00		As % of Result 18.95
Cross sensitivity H_2O (sat 325K)	0.00		
Cross sensitivity SO_2 (2767 mgm^{-3})	0.00		As mg/m^3 at ref conditions 3.57
Cross sensitivity CO_2 (15.2 % vol)	0.00		

2.10 Appendix 8: NAS Annex

2.10.1 Sampling Location



Duct Characteristics

	Value	Units
Type of Duct	Circular	-
Diameter / Depth	0.45	m
Width	-	m
Area	0.159	m^2
Port Size	4	inch
Port Depth	50	mm
Orientation	Vertical	-

Sampling Platform

General Platform Information	
Permanent / Temporary	Temporary
Inside / Outside	Inside
Height of Platform from Ground Level	~8m
Size of Platform	2.5m x 2.5m
Does the Platform have a weather cover (roof)	Yes
Platform has 2 hand rails (approx 0.5m and 1.0m high)	Yes
Platform has vertical base boards (approx 0.25m high)	Yes
Platform has removable chains / self closing gates at the top of the ladder	Yes
Platform positioned relative to the access ports (free from obstruction that would hamper insertion and removal of the sampling equipment)	Yes
Depth of platform (length of probe + 1m)	Yes

2.10.2 Flow Criteria Measurements

Traverse Point	**A1**			**A2**		
Pressure (mm H_2O)	26.0	26.0	26.0	26.0	26.0	26.0
√ΔP	5.10	5.10	5.10	5.10	5.10	5.10
Temperature (ºC)	26	26	26	26	26	26
Traverse Point	**A5**			**A6**		
Pressure (mm H_2O)	26.0	26.0	26.0	25.0	25.0	25.0
√ΔP	5.10	5.10	5.10	5.00	5.00	5.00
Temperature (ºC)	26	26	26	26	26	26

Static Pressure (mmH_2O)	-70	**Barometric Pressure (mm Hg)**	759.2	**Duct Dimensions (m)**	0.43

Velocity (m/s) average	17.7	**Actual Flow of stack gas (m^3/hr)**	9254.4
Stack Geometry	Circular	**Flow (wet) at STP (m^3/hr)**	8384.1
Dimensions (m)	0.43	**Flow (dry) at STP (m^3/hr)**	8288.4
Area (m^2)	0.145		

	Average	**Max**	**Min**	**Ratio Max/Min**	**Compliance**
Pressure (mm H_2O)	25.8	26.0	25.0	1.0	Yes
√ΔP (mm $H_2O)^{½}$	5.07	5.10	5.00	1.0	Yes
Temperature (ºC)	26.0	26.0	26.0	1.0	Yes
Angle of flow	<15º				Yes
Local Negative Flow	No				Yes

2.10.3 Gas Measurements

	Mean
Oxygen (%)	20.90
Carbon Monoxide (ppm)	0
Carbon Dioxide (%)	0.03

2.10.4 Manual Method Calculations

Test Dates	19.05.17		
Company	Leck Construction (BAE Systems)		
Contact	T Hughes		
Stack	NAS Annex		
	Blank	Test 1	Units
Sample Ref	9:35	9:53	-
Start Time	9:40	10:27	hr:mm
Stop Time	20.90	20.90	hr:mm
% O_2	0.03	0.03	%
% CO_2	-	79.07	%
%N_2	-	9.3	%
V_{lc}	0.01	0.011	ml
B_{wo}	9:35	9:53	-
P_b	-	759.2	mm Hg
St	-	-70	mm H_2O
T_s	-	24.00	ºC
$\sqrt{\Delta P}$	-	5.10	$(mm\ H_2O)^{½}$
Yd	-	1.036	-
Test Time	5	32	min
T_m	-	18.06	ºC
C_p	-	0.832	-
As	-	0.145	m^2
D_n	-	6.47	mm
ΔH ave	-	97.35	mm H_20
V_{mstd}	1.0021	1.0021	m^3
V_{wstd}	0.0116	0.0116	m^3
$Q_{std,wet}$	-	8284.2	Nm^3/h
Q_{act}	-	9083.0	Nm^3/h
Isokinetic Rate	-	101.3	%
Vs	-	17.37	m/s
Washings			
Sample Ref	epa.17.511.21W	epa.17.511.22W	-
Weight	0.6	<0.5	mg
Filter			
Sample Ref	epa.17.511.21F	epa.17.511.22F	-
Weight	<0.04	0.04	mg
Particulate Concentration (Dry, No O_2 Correction)	0.6	0.5	mg/Nm^3
Particulate Concentration (at Ref Water and Oxygen)	0.6	0.5	mg/Nm^3
Particulate Release Rate	-	4.41	g/hr
Reference Temp	273		K
Reference Pressure	101.3		kPa
Reference Moisture	No correction for moisture		-
Reference Oxygen	No correction for Oxygen		%

Particulates

	Filter (mg)	Washings (mg)
Blank	<0.04	0.6
Run 1	0.04	<0.5

2.10.5 Sampling Measurements

Date	19.05.17		Impinger	Initial Wt (g)	Final Wt (g)	Wt Gained (g)			l/min	Vac (in Hg)			
Start Time	9:53		1	769.9	770.2	0.3		Leak Check (Pre)	0.09	10			
End Time	10:27		2	791.4	790.4	-1.0		Leak Check (Post)	0.08	10			
Duration (mm.ss)	32.00		3	678.4	679.4	1.0							
Stack	NAS Bay 2		4	784.4	793.4	9.0		Pitot ID	pitot 12			Velocity Head	
Run	1		5	247.4	247.4	0.0		DGM ID	dgm 09			Min	26
												Max	26
												Max:Min	1.00
								Nozzle ID	N14				
			Sample Ref	epa.17.511.22				Nozzle Diameter (mm)	6.47				
K Factor	3.74		Filter Number	epa.17.511.22F									
Stack Diameter (m)	0.43		Probe Washing No	epa.17.511.22W									
							ΔH across orifice meter (mm H_2O)	DGM (litres)	DGM Temp (ºC)		Temp (ºC)		
Point	Time	Vac	Stack Temp	Prelim		Actual		5139.68	In	Out	Probe	Filter	Impinger
a1	0 4	7	24	26		5.10	97.35	5267	16	16	70		
a1	4 8	7	24	26		5.10	97.35	5395	17	16	70		
a2	8 12	7	24	26		5.10	97.35	5525	17	16	70		
a2	12 16	7	24	26		5.10	97.35	5656	18	17	70		
b1	16 20	7	24	26		5.10	97.35	5790	19	18	70		
b1	20 24	7	24	26		5.10	97.35	5918	20	19	70		
b2	24 28	7	24	26		5.10	97.35	6035	20	19	70		
b2	28 32	7	24	26		5.10	97.35	6162.32	21	20	70		
Total / Average		7.00	24.00	26.00		5.10	97.35	1022.64	18.50	17.63	70.00		

2.10.6 Instrumental Gas Analyser Site Calibration Measurements

Zero Point

				Pre Test			Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Pre Span	Post Span	System	System	Zero Drift
VOC (ppm)	1000	Ambient Air	0.00	0.00	0.00	0.00	0.03	0.03

Span Gas

				Pre Test		Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Analyser	System	System	Span Drift
VOC (ppm)	1000	EPA/CGAS/97	802.0	806.11	804.32	805.86	1.54

2.10.7 Instrumental Gas Analyser Results

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
19.05.2017	9:53:06	22.6	36.3	36.3
19.05.2017	9:53:21	22.3	35.8	35.8
19.05.2017	9:53:36	26.3	42.3	42.3
19.05.2017	9:53:51	85.7	137.7	137.7
19.05.2017	9:54:06	114.0	183.2	183.2
19.05.2017	9:54:21	74.7	120.1	120.1
19.05.2017	9:54:36	88.2	141.8	141.8
19.05.2017	9:54:51	82.1	131.9	131.9
19.05.2017	9:55:06	86.0	138.2	138.2
19.05.2017	9:55:21	73.0	117.3	117.3
19.05.2017	9:55:36	73.5	118.1	118.1
19.05.2017	9:55:51	94.0	151.1	151.1
19.05.2017	9:56:06	81.6	131.1	131.1
19.05.2017	9:56:21	94.0	151.1	151.1
19.05.2017	9:56:36	83.5	134.2	134.2
19.05.2017	9:56:51	105.7	169.9	169.9
19.05.2017	9:57:06	106.0	170.4	170.4
19.05.2017	9:57:21	128.7	206.8	206.8
19.05.2017	9:57:36	79.9	128.4	128.4
19.05.2017	9:57:51	124.5	200.1	200.1
19.05.2017	9:58:06	98.7	158.6	158.6
19.05.2017	9:58:21	119.2	191.6	191.6
19.05.2017	9:58:36	106.0	170.4	170.4
19.05.2017	9:58:51	102.8	165.2	165.2
19.05.2017	9:59:06	80.3	129.1	129.1
19.05.2017	9:59:21	100.1	160.9	160.9
19.05.2017	9:59:36	97.9	157.3	157.3
19.05.2017	9:59:51	90.6	145.6	145.6
19.05.2017	10:00:06	70.3	113.0	113.0
19.05.2017	10:00:21	112.1	180.2	180.2

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
19.05.2017	10:00:36	96.7	155.4	155.4
19.05.2017	10:00:51	139.4	224.0	224.0
19.05.2017	10:01:06	141.1	226.8	226.8
19.05.2017	10:01:21	82.5	132.6	132.6
19.05.2017	10:01:36	94.3	151.6	151.6
19.05.2017	10:01:51	92.6	148.8	148.8
19.05.2017	10:02:06	87.2	140.1	140.1
19.05.2017	10:02:21	72.0	115.7	115.7
19.05.2017	10:02:36	88.9	142.9	142.9
19.05.2017	10:02:51	111.6	179.4	179.4
19.05.2017	10:03:06	99.9	160.6	160.6
19.05.2017	10:03:21	122.6	197.0	197.0
19.05.2017	10:03:36	109.6	176.1	176.1
19.05.2017	10:03:51	112.8	181.3	181.3
19.05.2017	10:04:06	123.6	198.6	198.6
19.05.2017	10:04:21	112.1	180.2	180.2
19.05.2017	10:04:36	100.9	162.2	162.2
19.05.2017	10:04:51	96.5	155.1	155.1
19.05.2017	10:05:06	110.6	177.8	177.8
19.05.2017	10:05:21	125.5	201.7	201.7
19.05.2017	10:05:36	119.9	192.7	192.7
19.05.2017	10:05:51	130.9	210.4	210.4
19.05.2017	10:06:06	119.9	192.7	192.7
19.05.2017	10:06:21	104.5	167.9	167.9
19.05.2017	10:06:36	99.4	159.8	159.8
19.05.2017	10:06:51	115.8	186.1	186.1
19.05.2017	10:07:06	75.5	121.3	121.3
19.05.2017	10:07:21	113.6	182.6	182.6
19.05.2017	10:07:36	137.5	221.0	221.0
19.05.2017	10:07:51	97.4	156.5	156.5
19.05.2017	10:08:06	125.3	201.4	201.4
19.05.2017	10:08:21	124.8	200.6	200.6
19.05.2017	10:08:36	105.3	169.2	169.2
19.05.2017	10:08:51	98.9	158.9	158.9
19.05.2017	10:09:06	89.1	143.2	143.2
19.05.2017	10:09:21	66.4	106.7	106.7
19.05.2017	10:09:36	69.8	112.2	112.2
19.05.2017	10:11:36	63.2	101.6	101.6
19.05.2017	10:11:51	102.1	164.1	164.1
19.05.2017	10:12:06	82.1	131.9	131.9
19.05.2017	10:12:21	101.6	163.3	163.3
19.05.2017	10:12:36	90.1	144.8	144.8
19.05.2017	10:12:51	101.1	162.5	162.5
19.05.2017	10:13:06	87.2	140.1	140.1
19.05.2017	10:13:21	91.8	147.5	147.5
19.05.2017	10:13:36	108.2	173.9	173.9
19.05.2017	10:13:51	110.6	177.8	177.8
19.05.2017	10:14:06	103.8	166.8	166.8

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
19.05.2017	10:14:21	117.5	188.8	188.8
19.05.2017	10:14:36	91.1	146.4	146.4
19.05.2017	10:14:51	91.6	147.2	147.2
19.05.2017	10:15:06	110.9	178.2	178.2
19.05.2017	10:15:21	116.7	187.6	187.6
19.05.2017	10:15:36	103.1	165.7	165.7
19.05.2017	10:15:51	119.9	192.7	192.7
19.05.2017	10:16:06	120.4	193.5	193.5
19.05.2017	10:16:21	114.5	184.0	184.0
19.05.2017	10:16:36	94.7	152.2	152.2
19.05.2017	10:16:51	98.2	157.8	157.8
19.05.2017	10:17:06	102.1	164.1	164.1
19.05.2017	10:17:21	111.6	179.4	179.4
19.05.2017	10:17:36	127.0	204.1	204.1
19.05.2017	10:17:51	121.1	194.6	194.6
19.05.2017	10:18:06	120.6	193.8	193.8
19.05.2017	10:18:21	119.7	192.4	192.4
19.05.2017	10:18:36	114.3	183.7	183.7
19.05.2017	10:18:51	77.9	125.2	125.2
19.05.2017	10:19:06	26.6	42.8	42.8
19.05.2017	10:19:21	34.7	55.8	55.8
19.05.2017	10:19:36	174.6	280.6	280.6
19.05.2017	10:19:51	171.9	276.3	276.3
19.05.2017	10:20:06	189.0	303.8	303.8
19.05.2017	10:20:21	170.9	274.7	274.7
19.05.2017	10:20:36	167.8	269.7	269.7
19.05.2017	10:20:51	157.3	252.8	252.8
19.05.2017	10:21:06	171.9	276.3	276.3
19.05.2017	10:21:21	162.6	261.3	261.3
19.05.2017	10:21:36	111.6	179.4	179.4
19.05.2017	10:21:51	125.5	201.7	201.7
19.05.2017	10:22:06	87.4	140.5	140.5
19.05.2017	10:22:21	184.9	297.2	297.2
19.05.2017	10:22:36	200.7	322.6	322.6
19.05.2017	10:22:51	175.1	281.4	281.4
19.05.2017	10:23:06	152.4	244.9	244.9
19.05.2017	10:23:21	150.9	242.5	242.5
19.05.2017	10:23:36	130.6	209.9	209.9
19.05.2017	10:23:51	138.5	222.6	222.6
19.05.2017	10:24:06	146.8	235.9	235.9
19.05.2017	10:24:21	131.9	212.0	212.0
19.05.2017	10:24:36	138.5	222.6	222.6
19.05.2017	10:24:51	105.7	169.9	169.9
19.05.2017	10:25:06	126.3	203.0	203.0
19.05.2017	10:25:21	125.5	201.7	201.7
19.05.2017	10:25:36	112.3	180.5	180.5
19.05.2017	10:25:51	129.2	207.6	207.6
19.05.2017	10:26:06	114.8	184.5	184.5

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
19.05.2017	10:26:21	109.6	176.1	176.1
19.05.2017	10:26:36	137.5	221.0	221.0
19.05.2017	10:26:51	144.6	232.4	232.4
19.05.2017	10:27:06	114.8	184.5	184.5
19.05.2017	10:27:21	128.2	206.0	206.0
19.05.2017	10:27:36	134.8	216.6	216.6
Mean		109.4	175.8	175.8
Max		200.7	322.6	322.6
Min		22.3	35.8	35.8

2.10.8 Uncertainty Calculations

Particulates

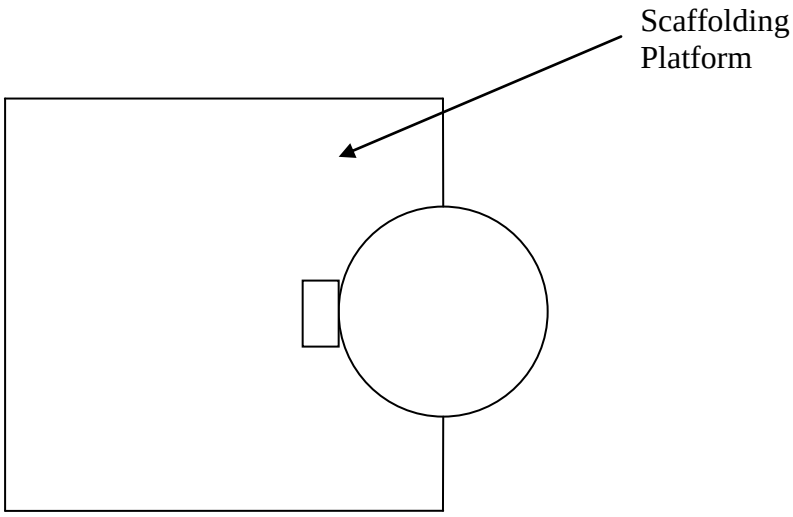
Source of uncertainty	Estimate of Component (1 SD) (± %)	Combined Uncertainty (± %)	Expanded Uncertainty (95% Confidence limit) (± %)
Pressure	3.85	5.26	As % of Result 10.20
Gas Volume	3.48		
Gas Temperature	0.69		
Humidity	0.50		As % of ELV 0.11
Washing Weighing	0.02		
Leak	0.00		As mg/m^3 0.05
Filter Weighing	0.00		
O_2 Concentration	0.00		

Total VOC's

Source of uncertainty	Estimate of Component (1 SD) ppm	Combined Uncertainty ppm	Expanded Uncertainty (95% Confidence limit) ppm
Temperature effect (zero)	4.63	8.14	15.79
Barometric Pressure	4.01		
Span gas	3.52		
Linearity	3.21		
Temperature effect (span)	2.32		
Repeatability	0.69		
Span drift	0.44		**Expanded Uncertainty (95% Confidence limit) %**
Zero drift	0.01		
Cross sensitivity CO (1.2 % vol)	0.00		
Cross sensitivity NO (127 mgm^{-3})	0.00		As % of Result 14.44
Cross sensitivity H_2O (sat 325K)	0.00		
Cross sensitivity SO_2 (2767 mgm^{-3})	0.00		As mg/m^3 at ref conditions 25.38
Cross sensitivity CO_2 (15.2 % vol)	0.00		

2.11 Appendix 11: DDH Tile Cutting Facility

2.11.1 Sampling Location



Duct Characteristics

	Value	Units
Type of Duct	Circular	-
Diameter / Depth	0.245	m
Width	-	m
Area	0.047	m^2
Port Size	4	inch
Port Depth	45	mm
Orientation	Vertical	-

Sampling Platform

General Platform Information	
Permanent / Temporary	Temporary
Inside / Outside	Outside
Height of Platform from Ground Level	~8m
Size of Platform	2.5m x 2.5m
Does the Platform have a weather cover (roof)	No
Platform has 2 hand rails (approx 0.5m and 1.0m high)	Yes
Platform has vertical base boards (approx 0.25m high)	Yes
Platform has removable chains / self closing gates at the top of the ladder	Yes
Platform positioned relative to the access ports (free from obstruction that would hamper insertion and removal of the sampling equipment)	Yes
Depth of platform (length of probe + 1m)	Yes

2.11.2 Flow Criteria Measurements

Traverse Point	**A1**		
Pressure (mm H_2O)	15.0	15.0	15.0
$\sqrt{\Delta P}$	3.87	3.87	3.87
Temperature (ºC)	21	21	21

Static Pressure (mmH_2O)	17.0	**Barometric Pressure (mm Hg)**	751.7	**Duct Dimensions (m)**	0.245

Velocity (m/s) average	13.4	**Actual Flow of stack gas (m^3/hr)**	2281.8
Stack Geometry	Circular	**Flow (wet) at STP (m^3/hr)**	2122.3
Dimensions (m)	0.245	**Flow (dry) at STP (m^3/hr)**	2101.2
Area (m^2)	0.047		

	Average	**Max**	**Min**	**Ratio Max/Min**	**Compliance**
Pressure (mm H_2O)	15.0	15.0	15.0	1.0	Yes
$\sqrt{\Delta P}$ (mm H_2O)^{½}	3.87	3.87	3.87	1.0	Yes
Temperature (ºC)	21.0	21.0	21.0	1.0	Yes
Angle of flow	<15º				Yes
Local Negative Flow	No				Yes

2.11.3 Gas Measurements

	Mean
Oxygen (%)	20.90
Carbon Monoxide (ppm)	0
Carbon Dioxide (%)	0.03

2.11.4 Manual Method Calculations

Test Dates	18.05.17		
Company	Leck Construction (BAE Systems)		
Contact	T Hughes		
Stack	Tile Cutting Facility		
	Blank	Test 1	Units
Sample Ref	epa.17.511.15	epa.17.511.16	-
Start Time	9:04	10:06	hr:mm
Stop Time	9:09	10:36	hr:mm
% O_2	20.90	20.90	%
% CO_2	0.03	0.03	%
%N_2	-	79.07	%
V_{lc}	-	7.3	ml
B_{wo}	0.01	0.010	-
P_b	-	760.0	mm Hg
St	-	17	mm H_2O
T_s	-	21.00	^oC
$\sqrt{\Delta P}$	-	3.87	$(mm\ H_2O)^{½}$
Yd	-	1.036	-
Test Time	-	30	min
T_m	-	17.58	^oC
C_p	-	0.828	-
As	-	0.047	m^2
D_n	-	7.20	mm
ΔH ave	-	86.05	mm H_20
V_{mstd}	0.9027	0.9027	m^3
V_{wstd}	0.0091	0.0091	m^3
$Q_{std,wet}$	-	2052.3	Nm^3/h
Q_{act}	-	2206.6	Nm^3/h
Isokinetic Rate	-	102.9	%
Vs	-	13.00	m/s
Washings			
Sample Ref	epa.17.511.15W	epa.17.511.16W	-
Weight	<0.5	<0.5	mg
Filter			
Sample Ref	epa.17.511.15F	epa.17.511.16F	-
Weight	0.33	0.2	mg
Particulate Concentration (Dry, No O_2 Correction)	0.9	0.8	mg/Nm^3
Particulate Concentration (at Ref Water and Oxygen)	0.9	0.8	mg/Nm^3
Particulate Release Rate	-	1.58	g/hr
Reference Temp	273		K
Reference Pressure	101.3		kPa
Reference Moisture	No correction for moisture		-
Reference Oxygen	No correction for Oxygen		%

Particulates

	Filter (mg)	Washings (mg)
Blank	0.33	<0.5
Run 1	0.2	<0.5

2.11.5 Sampling Measurements

Date	18.05.17		Impinger	Initial Wt (g)	Final Wt (g)	Wt Gained (g)			l/min	Vac (in Hg)			
Start Time	10:06		1	785.1	786.1	1.0		Leak Check (Pre)	0.11	10			
End Time	10:36		2	796.7	796.8	0.1		Leak Check (Post)	0.11	10			
Duration (mm.ss)	30.00		3	679.1	679.1	0.0							
Stack	Tile Cutting		4	874.6	880.8	6.2		Pitot ID	Pitot 06			Velocity Head	
Run	1		5	247.4	247.4	0.0		DGM ID	DGM 09			Min	15
												Max	15
												Max:Min	1.00
								Nozzle ID	N36				
			Sample Ref	epa.17.511.16				Nozzle Diameter (mm)	7.20				
K Factor	5.74		Filter Number	epa.17.511.16F									
Stack Diameter (m)	0.25		Probe Washing No	epa.17.511.16W									
							ΔH across orifice meter (mm H_2O)	DGM (litres)	DGM Temp (ºC)		Temp (ºC)		
Point	Time	Vac	Stack Temp	Prelim		Actual		2354.21	In	Out	Probe	Filter	Impinger
a1	0 5	4	21	15		3.87	86.05	2507	18	18	160	160	
a1	5 10	4	21	15		3.87	86.05	2660	18	17	160	160	
a1	10 15	4	21	15		3.87	86.05	2814	18	17	160	160	
a1	15 20	4	21	15		3.87	86.05	2977	18	17	160	160	
a1	20 25	4	21	15		3.87	86.05	3122	18	17	160	160	
a1	25 30	4	21	15		3.87	86.05	3274.05	18	17	160	160	
Total / Average		4.00	21.00	15.00		3.87	86.05	919.84	18.00	17.17	160.00	160.00	

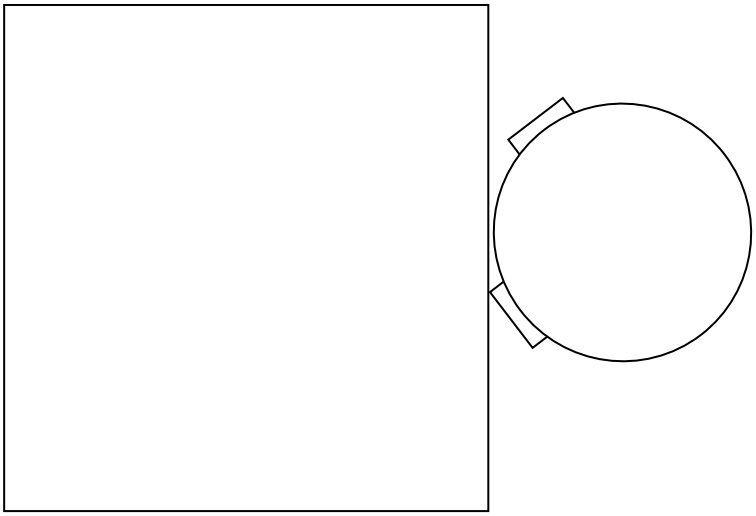
2.11.6 Uncertainty Calculations

Particulates

Source of uncertainty	Estimate of Component (1 SD) (± %)	Combined Uncertainty (± %)	Expanded Uncertainty (95% Confidence limit) (± %)
Pressure	4.36	5.43	As % of result 10.54
Gas Volume	3.13		
Gas Temperature	0.70		
Humidity	0.50		As % of ELV 0.16
Washing Weighing	0.02		
Filter Weighing	0.01		
Leak	0.00		As mg/m^3 0.08
O_2 Concentration	0.00		

2.12 Appendix 12: Paint Mixing Facility

2.12.1 Sampling Location



Duct Characteristics

	Value	Units
Type of Duct	Circular	-
Diameter / Depth	0.56	m
Width	-	m
Area	0.246	m^2
Port Size	4	inch
Port Depth	80	mm
Orientation	Vertical	-

Sampling Platform

General Platform Information	
Permanent / Temporary	Temporary
Inside / Outside	Outside
Height of Platform from Ground Level	~ 5m
Size of Platform	~ 6m x 3m
Does the Platform have a weather cover (roof)	No
Platform has 2 hand rails (approx 0.5m and 1.0m high)	Yes
Platform has vertical base boards (approx 0.25m high)	Yes
Platform has removable chains / self closing gates at the top of the ladder	Yes
Platform positioned relative to the access ports (free from obstruction that would hamper insertion and removal of the sampling equipment)	Yes
Depth of platform (length of probe + 1m)	Yes

2.12.2 Flow Criteria Measurements

Traverse Point	**A1**			**A2**		
Pressure (mm H_2O)	7.0	7.0	7.0	11.0	11.0	11.0
$\sqrt{\Delta P}$	2.65	2.65	2.65	3.32	3.32	3.32
Temperature (ºC)	24	24	24	24	24	24
Traverse Point	**B1**			**B2**		
Pressure (mm H_2O)	9.0	9.0	9.0	12.0	12.0	12.0
$\sqrt{\Delta P}$	3.00	3.00	3.00	3.46	3.46	3.46
Temperature (ºC)	24	24	24	24	24	24

Static Pressure (mmH_2O)	-32.0	**Barometric Pressure (mm Hg)**	760.0	**Duct Dimensions (m)**	0.56

Velocity (m/s) average	10.7	**Actual Flow of stack gas (m^3/hr)**	9509.7
Stack Geometry	Circular	**Flow (wet) at STP (m^3/hr)**	8714.2
Dimensions (m)	0.56	**Flow (dry) at STP (m^3/hr)**	8865.3
Area (m^2)	0.246		

	Average	**Max**	**Min**	**Ratio Max/Min**	**Compliance**
Pressure (mm H_2O)	9.8	12.0	7.0	1.7	Yes
$\sqrt{\Delta P}$ (mm $H_2O)^{½}$	3.11	3.46	2.65	1.3	Yes
Temperature (ºC)	24.0	24.0	24.0	1.0	Yes
Angle of flow	<15º				Yes
Local Negative Flow	No				Yes

2.12.3 Gas Measurements

	Mean
Oxygen (%)	20.90
Carbon Monoxide (ppm)	0
Carbon Dioxide (%)	0.03

2.12.4 Manual Method Calculations

Test Dates	18.05.17		
Company	Leck Construction (BAE Systems)		
Contact	T Hughes		
Stack	Paint Mixing Facility		
	Blank	Test 1	Units
Sample Ref	epa.17.511.17	epa.17.511.18	-
Start Time	11:31	11:52	hr:mm
Stop Time	11:36	12:26	hr:mm
% O_2	20.90	20.90	%
% CO_2	0.03	0.03	%
%N_2	-	79.07	%
V_{lc}	-	16.4	ml
B_{wo}	0.03	0.026	-
P_b	-	760.0	mm Hg
St	-	-32	mm H_2O
T_s	-	24.00	ºC
$\sqrt{\Delta P}$	-	3.11	$(mm\ H_2O)^{½}$
Yd	-	1.036	-
Test Time	5	32	min
T_m	-	16.75	ºC
C_p	-	0.830	-
As	-	0.246	m^2
D_n	-	7.20	mm
ΔH ave	-	58.93	mm H_20
V_{mstd}	0.7742	0.7742	m^3
V_{wstd}	0.0204	0.0204	m^3
$Q_{std,wet}$	-	8583.0	Nm^3/h
Q_{act}	-	9366.5	Nm^3/h
Isokinetic Rate	-	105.0	%
Vs	-	10.56	m/s
Washings			
Sample Ref	epa.17.511.17W	epa.17.511.18W	-
Weight	<0.5	<0.5	mg
Filter			
Sample Ref	epa.17.511.17F	epa.17.511.18F	-
Weight	<0.04	0.07	mg
Particulate Concentration (Dry, No O_2 Correction)	<0.7	0.7	mg/Nm^3
Particulate Concentration (at Ref Water and Oxygen)	<0.68	0.7	mg/Nm^3
Particulate Release Rate	-	6.16	g/hr
Reference Temp	273		K
Reference Pressure	101.3		kPa
Reference Moisture	No correction for moisture		-
Reference Oxygen	No correction for Oxygen		%

Particulates

	Filter (mg)	Washings (mg)
Blank	<0.04	<0.5
Run 1	0.07	<0.5

2.12.5 Sampling Measurements

Date	18.05.17		Impinger	Initial Wt (g)	Final Wt (g)	Wt Gained (g)			l/min	Vac (in Hg)			
Start Time	11:52		1	784.5	785.1	0.6		Leak Check (Pre)	0.09	10			
End Time	12:26		2	795.6	797.4	1.8		Leak Check (Post)	0.09	10			
Duration (mm.ss)	32.00		3	677.1	681.4	4.3							
Stack	Mix Room		4	868.3	878.0	9.7		Pitot ID	Pitot 12			Velocity Head	
Run	1		5	247.4	247.4	0.0		DGM ID	DGM 09			Min	17
												Max	21
												Max:Min	1.71
								Nozzle ID	N36				
			Sample Ref	epa.17.511.18				Nozzle Diameter (mm)	7.20				
K Factor	6.04		Filter Number	epa.17.511.18F									
Stack Diameter (m)	0.56		Probe Washing No	epa.17.511.18W									
							ΔH across orifice meter (mm H_2O)	DGM (litres)	DGM Temp (ºC)		Temp (ºC)		
Point	Time	Vac	Stack Temp	Velocity Head (mmH_2O)		√ΔP		3294.11	In	Out	Probe	Filter	Impinger
a1	0 4	4	24	7		2.65	42.31	3398	16	15	70		
a1	4 8	4	24	7		2.65	42.31	3460	16	15	70		
a2	9 12	4	24	11		3.32	66.48	3560	16	15	70		
a2	12 16	4	24	11		3.32	66.48	3671	17	16	70		
b1	16 20	4	24	9		3.00	54.40	3766	17	16	70		
b1	20 24	4	24	9		3.00	54.40	3860	18	17	70		
b2	24 28	4	24	12		3.46	72.53	3968	19	18	70		
b2	28 32	4	24	12		3.46	72.53	4082.75	19	18	70		
Total / Average		4.00	24.00	9.75		3.11	58.93	788.64	17.25	16.25	70.00		

2.12.6 Instrumental Gas Analyser Site Calibration Measurements

Zero Point

				Pre Test			Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Pre Span	Post Span	System	System	Zero Drift
VOC (ppm)	100	Ambient Air	0.00	0.00	0.00	0.07	0.02	-0.05

Span Gas

				Pre Test		Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Analyser	System	System	Span Drift
VOC (ppm)	100	EPA/CGAS /103	80.40	80.62	80.27	80.64	0.37

2.12.7 Instrumental Gas Analyser Results

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
18.05.2017	11:52:13	27.7	44.5	44.5
18.05.2017	11:52:28	27.8	44.7	44.7
18.05.2017	11:52:43	29.0	46.6	46.6
18.05.2017	11:52:58	27.0	43.4	43.4
18.05.2017	11:53:13	26.9	43.2	43.2
18.05.2017	11:53:28	24.9	40.0	40.0
18.05.2017	11:53:43	26.0	41.8	41.8
18.05.2017	11:53:58	23.9	38.4	38.4
18.05.2017	11:54:13	24.3	39.1	39.1
18.05.2017	11:54:28	28.8	46.3	46.3
18.05.2017	11:54:43	26.8	43.1	43.1
18.05.2017	11:54:58	25.4	40.8	40.8
18.05.2017	11:55:13	26.3	42.3	42.3
18.05.2017	11:55:28	26.4	42.4	42.4
18.05.2017	11:55:43	25.3	40.7	40.7
18.05.2017	11:55:58	26.0	41.8	41.8
18.05.2017	11:56:13	26.0	41.8	41.8
18.05.2017	11:56:28	23.8	38.3	38.3
18.05.2017	11:56:43	24.7	39.7	39.7
18.05.2017	11:56:58	24.7	39.7	39.7
18.05.2017	11:57:13	24.2	38.9	38.9
18.05.2017	11:57:28	24.1	38.7	38.7
18.05.2017	11:57:43	24.4	39.2	39.2
18.05.2017	11:57:58	24.3	39.1	39.1
18.05.2017	11:58:13	26.6	42.8	42.8
18.05.2017	11:58:28	24.9	40.0	40.0
18.05.2017	11:58:43	25.3	40.7	40.7
18.05.2017	11:58:58	27.2	43.7	43.7
18.05.2017	11:59:13	24.8	39.9	39.9
18.05.2017	11:59:28	24.1	38.7	38.7

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
18.05.2017	11:59:43	24.5	39.4	39.4
18.05.2017	11:59:58	23.9	38.4	38.4
18.05.2017	12:00:13	24.3	39.1	39.1
18.05.2017	12:00:28	23.8	38.3	38.3
18.05.2017	12:00:43	24.9	40.0	40.0
18.05.2017	12:00:58	24.2	38.9	38.9
18.05.2017	12:01:13	24.8	39.9	39.9
18.05.2017	12:01:28	26.8	43.1	43.1
18.05.2017	12:01:43	26.3	42.3	42.3
18.05.2017	12:01:58	27.9	44.8	44.8
18.05.2017	12:02:13	25.0	40.2	40.2
18.05.2017	12:02:28	25.1	40.3	40.3
18.05.2017	12:02:43	24.6	39.5	39.5
18.05.2017	12:02:58	24.3	39.1	39.1
18.05.2017	12:03:13	24.2	38.9	38.9
18.05.2017	12:03:28	23.9	38.4	38.4
18.05.2017	12:03:43	24.2	38.9	38.9
18.05.2017	12:03:58	22.5	36.2	36.2
18.05.2017	12:04:13	23.3	37.4	37.4
18.05.2017	12:04:28	22.3	35.8	35.8
18.05.2017	12:04:43	22.4	36.0	36.0
18.05.2017	12:04:58	22.7	36.5	36.5
18.05.2017	12:05:13	23.6	37.9	37.9
18.05.2017	12:05:28	23.3	37.4	37.4
18.05.2017	12:05:43	24.0	38.6	38.6
18.05.2017	12:05:58	22.7	36.5	36.5
18.05.2017	12:06:13	21.8	35.0	35.0
18.05.2017	12:06:28	21.4	34.4	34.4
18.05.2017	12:06:43	22.6	36.3	36.3
18.05.2017	12:06:58	22.4	36.0	36.0
18.05.2017	12:07:13	23.5	37.8	37.8
18.05.2017	12:07:28	23.4	37.6	37.6
18.05.2017	12:07:43	23.5	37.8	37.8
18.05.2017	12:07:58	23.9	38.4	38.4
18.05.2017	12:08:13	23.5	37.8	37.8
18.05.2017	12:08:28	23.9	38.4	38.4
18.05.2017	12:10:43	22.7	36.5	36.5
18.05.2017	12:10:58	23.6	37.9	37.9
18.05.2017	12:11:13	23.7	38.1	38.1
18.05.2017	12:11:28	23.6	37.9	37.9
18.05.2017	12:11:43	23.6	37.9	37.9
18.05.2017	12:11:58	23.3	37.4	37.4
18.05.2017	12:12:13	23.5	37.8	37.8
18.05.2017	12:12:28	24.0	38.6	38.6
18.05.2017	12:12:43	23.8	38.3	38.3
18.05.2017	12:12:58	21.7	34.9	34.9
18.05.2017	12:13:13	21.4	34.4	34.4
18.05.2017	12:13:28	21.3	34.2	34.2

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
18.05.2017	12:13:43	21.2	34.1	34.1
18.05.2017	12:13:58	21.4	34.4	34.4
18.05.2017	12:14:13	20.8	33.4	33.4
18.05.2017	12:14:28	21.2	34.1	34.1
18.05.2017	12:14:43	22.0	35.4	35.4
18.05.2017	12:14:58	22.4	36.0	36.0
18.05.2017	12:15:13	22.9	36.8	36.8
18.05.2017	12:15:28	23.0	37.0	37.0
18.05.2017	12:15:43	22.6	36.3	36.3
18.05.2017	12:15:58	23.5	37.8	37.8
18.05.2017	12:16:13	24.0	38.6	38.6
18.05.2017	12:16:28	23.2	37.3	37.3
18.05.2017	12:16:43	23.3	37.4	37.4
18.05.2017	12:16:58	23.0	37.0	37.0
18.05.2017	12:17:13	21.5	34.6	34.6
18.05.2017	12:17:28	22.1	35.5	35.5
18.05.2017	12:17:43	22.9	36.8	36.8
18.05.2017	12:17:58	23.2	37.3	37.3
18.05.2017	12:18:13	22.8	36.6	36.6
18.05.2017	12:18:28	22.8	36.6	36.6
18.05.2017	12:18:43	22.2	35.7	35.7
18.05.2017	12:18:58	22.3	35.8	35.8
18.05.2017	12:19:13	21.5	34.6	34.6
18.05.2017	12:19:28	21.9	35.2	35.2
18.05.2017	12:19:43	22.2	35.7	35.7
18.05.2017	12:19:58	24.3	39.1	39.1
18.05.2017	12:20:13	24.3	39.1	39.1
18.05.2017	12:20:28	24.2	38.9	38.9
18.05.2017	12:20:43	24.1	38.7	38.7
18.05.2017	12:20:58	24.0	38.6	38.6
18.05.2017	12:21:13	23.7	38.1	38.1
18.05.2017	12:21:28	24.0	38.6	38.6
18.05.2017	12:21:43	24.3	39.1	39.1
18.05.2017	12:21:58	23.7	38.1	38.1
18.05.2017	12:22:13	23.5	37.8	37.8
18.05.2017	12:22:28	23.6	37.9	37.9
18.05.2017	12:22:43	25.1	40.3	40.3
18.05.2017	12:22:58	24.5	39.4	39.4
18.05.2017	12:23:13	24.3	39.1	39.1
18.05.2017	12:23:28	23.5	37.8	37.8
18.05.2017	12:23:43	23.0	37.0	37.0
18.05.2017	12:23:58	22.9	36.8	36.8
18.05.2017	12:24:13	22.8	36.6	36.6
18.05.2017	12:24:28	23.4	37.6	37.6
18.05.2017	12:24:43	23.8	38.3	38.3
18.05.2017	12:24:58	24.5	39.4	39.4
18.05.2017	12:25:13	26.8	43.1	43.1
18.05.2017	12:25:28	27.6	44.4	44.4

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
18.05.2017	12:25:43	26.2	42.1	42.1
18.05.2017	12:25:58	24.9	40.0	40.0
18.05.2017	12:26:13	24.3	39.1	39.1
18.05.2017	12:26:28	24.3	39.1	39.1
18.05.2017	12:26:43	9.0	14.5	14.5
18.05.2017	12:26:58	1.2	2.0	2.0
Mean		23.8	38.2	38.2
Max		29.0	46.6	46.6
Min		1.2	2.0	2.0

2.12.8 Uncertainty Calculations

Particulates

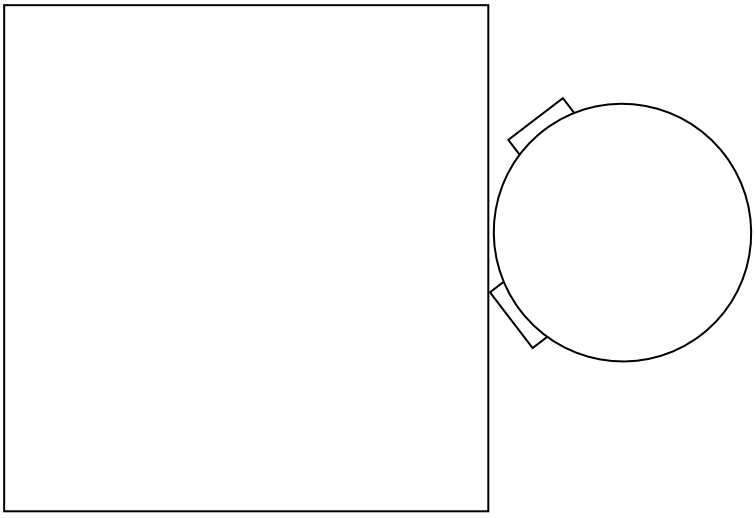
Source of uncertainty	Estimate of Component (1 SD) (± %)	Combined Uncertainty (± %)	Expanded Uncertainty (95% Confidence limit) (± %)
Pressure	6.37	6.96	As % of result 13.50
Gas Volume	2.68		
Gas Temperature	0.70		
Humidity	0.50		
Washing Weighing	0.02		As % of ELV 0.20
Leak	0.00		
Filter Weighing	0.00		As mg/m^3 0.10
O_2 Concentration	0.00		

Total VOC's

Source of uncertainty	Estimate of Component (1 SD) ppm	Combined Uncertainty ppm	Expanded Uncertainty (95% Confidence limit) ppm
Linearity	0.80	1.12	2.17
Temperature effect (zero)	0.46		
Barometric Pressure	0.40		
Span gas	0.39		
Temperature effect (span)	0.23		
Span drift	0.11		
Repeatability	0.07		**Expanded Uncertainty (95% Confidence limit) %**
Zero drift	0.01		
Cross sensitivity CO (1.2 % vol)	0.00		
Cross sensitivity NO ($127\ mgm^{-3}$)	0.00		As % of Result 9.12
Cross sensitivity H_2O (sat 325K)	0.00		
Cross sensitivity SO_2 ($2767\ mgm^{-3}$)	0.00		As mg/m^3 at ref conditions 3.48
Cross sensitivity CO_2 (15.2 % vol)	0.00		

2.13 Appendix 13: C10 Tile Facility

2.13.1 Sampling Location



Duct Characteristics

	Value	Units
Type of Duct	Circular	-
Diameter / Depth	0.5	m
Width	-	m
Area	0.246	m^2
Port Size	4	inch
Port Depth	80	mm
Orientation	Vertical	-

Sampling Platform

General Platform Information	
Permanent / Temporary	Temporary
Inside / Outside	Outside
Height of Platform from Ground Level	~ 5m
Size of Platform	~ 6m x 3m
Does the Platform have a weather cover (roof)	No
Platform has 2 hand rails (approx 0.5m and 1.0m high)	Yes
Platform has vertical base boards (approx 0.25m high)	Yes
Platform has removable chains / self closing gates at the top of the ladder	Yes
Platform positioned relative to the access ports (free from obstruction that would hamper insertion and removal of the sampling equipment)	Yes
Depth of platform (length of probe + 1m)	Yes

2.13.2 Flow Criteria Measurements

Traverse Point	**A1**			**A2**		
Pressure (mm H_2O)	24.0	24.0	24.0	23.0	23.0	23.0
√ΔP	4.90	4.90	4.90	4.80	4.80	4.80
Temperature (ºC)	24	24	24	24	24	24
Traverse Point	**B1**			**B2**		
Pressure (mm H_2O)	24.0	24.0	24.0	23.0	23.0	23.0
√ΔP	4.90	4.90	4.90	4.80	4.80	4.80
Temperature (ºC)	24	24	24	24	24	24

Static Pressure (mmH_2O)	-30.0	**Barometric Pressure (mm Hg)**	760.0	**Duct Dimensions (m)**	0.56

Velocity (m/s) average	16.8	**Actual Flow of stack gas (m^3/hr)**	11884.2
Stack Geometry	Circular	**Flow (wet) at STP (m^3/hr)**	10892.1
Dimensions (m)	0.5	**Flow (dry) at STP (m^3/hr)**	10771.5
Area (m^2)	0.196		

	Average	**Max**	**Min**	**Ratio Max/Min**	**Compliance**
Pressure (mm H_2O)	23.5	24.0	23.0	1.0	Yes
√ΔP (mm $H_2O)^{½}$	4.85	4.90	4.80	1.0	Yes
Temperature (ºC)	24.0	24.0	24.0	1.0	Yes
Angle of flow	<15º				Yes
Local Negative Flow	No				Yes

2.13.3 Gas Measurements

	Mean
Oxygen (%)	20.90
Carbon Monoxide (ppm)	0
Carbon Dioxide (%)	0.03

2.13.4 Manual Method Calculations

Test Dates	18.05.17		
Company	Leck Construction (BAE Systems)		
Contact	T Hughes		
Stack	C10 Tile Facility		
	Blank	Test 1	Units
Sample Ref	epa.17.511.19	epa.17.511.20	-
Start Time	14:51	15:07	hr:mm
Stop Time	14:56	15:41	hr:mm
% O_2	20.90	20.90	%
% CO_2	0.03	0.03	%
%N_2	-	79.07	%
V_{lc}	-	8.5	ml
B_{wo}	0.01	0.011	-
P_b	-	760.0	mm Hg
St	-	-30	mm H_2O
T_s	-	24.00	ºC
$\sqrt{\Delta P}$	-	4.83	$(mm\ H_2O)^{½}$
Yd	-	1.036	-
Test Time	5	32	min
T_m	-	27.75	ºC
C_p	-	0.832	-
As	-	0.196	m^2
D_n	-	6.47	mm
ΔH ave	-	88.46	mm H_20
V_{mstd}	0.9444	0.9444	m^3
V_{wstd}	0.0106	0.0106	m^3
$Q_{std,wet}$	-	10644.7	Nm^3/h
Q_{act}	-	11614.2	Nm^3/h
Isokinetic Rate	-	100.5	%
Vs	-	16.43	m/s
Washings			
Sample Ref	epa.17.511.19W	epa.17.511.20W	-
Weight	<0.5	<0.5	mg
Filter			
Sample Ref	epa.17.511.19F	epa.17.511.20F	-
Weight	0.2	0.1	mg
Particulate Concentration (Dry, No O_2 Correction)	0.7	0.6	mg/Nm^3
Particulate Concentration (at Ref Water and Oxygen)	0.7	0.6	mg/Nm^3
Particulate Release Rate	-	6.69	g/hr
Reference Temp	273		K
Reference Pressure	101.3		kPa
Reference Moisture	No correction for moisture		-
Reference Oxygen	No correction for Oxygen		%

Particulates

	Filter (mg)	Washings (mg)
Blank	0.2	<0.5
Run 1	0.1	<0.5

2.13.5 Sampling Measurements

Date	18.05.17		Impinger	Initial Wt (g)	Final Wt (g)	Wt Gained (g)			l/min	Vac (in Hg)			
Start Time	15:07		1	778.5	778.8	0.3		Leak Check (Pre)	0.09	10			
End Time	15:41		2	794.4	794.5	0.1		Leak Check (Post)	0.09	10			
Duration (mm.ss)	32.00		3	678.2	678.2	0.0							
Stack	C10 Tile Facility		4	787.1	795.2	8.1		Pitot ID	Pitot 12			Velocity Head	
Run	1		5	247.4	247.4	0.0		DGM ID	DGM 09			Min	22.5
												Max	24
												Max:Min	1.07
								Nozzle ID	N14				
			Sample Ref	epa.17.511.20				Nozzle Diameter (mm)	6.47				
K Factor	3.78		Filter Number	epa.17.511.20F									
Stack Diameter (m)	0.50		Probe Washing No	epa.17.511.20W									
							ΔH across orifice meter (mm H_2O)	DGM (litres)	DGM Temp (ºC)		Temp (ºC)		
Point	Time	Vac	Stack Temp	Velocity Head (mmH_2O)		√ΔP		4082.82	In	Out	Probe	Filter	Impinger
a1	0 4	4	24	24		4.90	90.82	4218	27	27	70		
a1	4 8	4	24	24		4.90	90.82	4332	27	27	70		
a2	8 12	4	24	23		4.80	87.04	4456	27	28	70		
a2	12 16	4	24	23		4.80	87.04	4574	28	28	70		
b1	16 20	4	24	24		4.90	90.82	4705	28	28	70		
b1	20 24	4	24	24		4.90	90.82	4837	28	28	70		
b2	24 28	4	24	22.5		4.74	85.15	4998	28	28	70		
b2	28 32	4	24	22.5		4.74	85.15	5078.52	29	28	70		
Total / Average		4.00	24.00	23.38		4.83	88.46	995.70	27.75	27.75	70.00		

2.13.6 Instrumental Gas Analyser Site Calibration Measurements

Zero Point

				Pre Test			Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Pre Span	Post Span	System	System	Zero Drift
VOC (ppm)	100	Ambient Air	0.00	0.00	0.00	0.07	0.02	-0.05

Span Gas

				Pre Test		Post Test	
Gas	Analyser Range	Gas Cylinder ID	Gas Conc.	Analyser	System	System	Span Drift
VOC (ppm)	100	EPA/CGAS /103	80.40	80.62	80.27	80.64	0.37

2.13.7 Instrumental Gas Analyser Results

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
18.05.2017	15:07:12	8.0	12.9	12.9
18.05.2017	15:07:27	8.6	13.7	13.7
18.05.2017	15:07:42	8.7	14.0	14.0
18.05.2017	15:07:57	8.8	14.1	14.1
18.05.2017	15:08:12	8.6	13.8	13.8
18.05.2017	15:08:27	8.4	13.4	13.4
18.05.2017	15:08:42	8.3	13.3	13.3
18.05.2017	15:08:57	8.3	13.3	13.3
18.05.2017	15:09:12	8.2	13.1	13.1
18.05.2017	15:09:27	8.3	13.4	13.4
18.05.2017	15:09:42	8.6	13.8	13.8
18.05.2017	15:09:57	8.6	13.9	13.9
18.05.2017	15:10:12	8.7	14.0	14.0
18.05.2017	15:10:27	8.7	14.0	14.0
18.05.2017	15:10:42	8.9	14.3	14.3
18.05.2017	15:10:57	9.1	14.6	14.6
18.05.2017	15:11:12	9.2	14.8	14.8
18.05.2017	15:11:27	9.0	14.4	14.4
18.05.2017	15:11:42	8.6	13.9	13.9
18.05.2017	15:11:57	8.3	13.4	13.4
18.05.2017	15:12:12	8.1	13.0	13.0
18.05.2017	15:12:27	8.0	12.9	12.9
18.05.2017	15:12:42	8.0	12.9	12.9
18.05.2017	15:12:57	8.1	13.0	13.0
18.05.2017	15:13:12	8.3	13.4	13.4
18.05.2017	15:13:27	8.7	14.0	14.0
18.05.2017	15:13:42	8.9	14.4	14.4
18.05.2017	15:13:57	8.9	14.4	14.4
18.05.2017	15:14:12	8.9	14.3	14.3
18.05.2017	15:14:27	8.8	14.1	14.1

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
18.05.2017	15:14:42	8.6	13.9	13.9
18.05.2017	15:14:57	8.6	13.7	13.7
18.05.2017	15:15:12	8.4	13.5	13.5
18.05.2017	15:15:27	8.3	13.3	13.3
18.05.2017	15:15:42	8.3	13.3	13.3
18.05.2017	15:15:57	8.4	13.5	13.5
18.05.2017	15:16:12	8.6	13.9	13.9
18.05.2017	15:16:27	8.8	14.2	14.2
18.05.2017	15:16:42	8.9	14.3	14.3
18.05.2017	15:16:57	8.7	14.0	14.0
18.05.2017	15:17:12	8.6	13.7	13.7
18.05.2017	15:17:27	8.5	13.7	13.7
18.05.2017	15:17:42	8.5	13.6	13.6
18.05.2017	15:17:57	8.4	13.4	13.4
18.05.2017	15:18:12	8.4	13.4	13.4
18.05.2017	15:18:27	8.4	13.5	13.5
18.05.2017	15:18:42	8.3	13.3	13.3
18.05.2017	15:18:57	8.2	13.1	13.1
18.05.2017	15:19:12	8.1	13.1	13.1
18.05.2017	15:19:27	8.2	13.2	13.2
18.05.2017	15:19:42	8.3	13.4	13.4
18.05.2017	15:19:57	8.8	14.1	14.1
18.05.2017	15:20:12	9.1	14.6	14.6
18.05.2017	15:20:27	9.2	14.8	14.8
18.05.2017	15:20:42	9.2	14.8	14.8
18.05.2017	15:20:57	9.1	14.6	14.6
18.05.2017	15:21:12	8.9	14.3	14.3
18.05.2017	15:21:27	8.7	14.0	14.0
18.05.2017	15:21:42	8.7	14.0	14.0
18.05.2017	15:21:57	8.7	13.9	13.9
18.05.2017	15:22:12	8.8	14.1	14.1
18.05.2017	15:22:27	8.6	13.8	13.8
18.05.2017	15:22:42	8.3	13.4	13.4
18.05.2017	15:22:57	8.2	13.1	13.1
18.05.2017	15:23:12	8.0	12.9	12.9
18.05.2017	15:23:27	7.8	12.5	12.5
18.05.2017	15:25:42	7.3	11.7	11.7
18.05.2017	15:25:57	7.3	11.7	11.7
18.05.2017	15:26:12	7.2	11.6	11.6
18.05.2017	15:26:27	7.2	11.6	11.6
18.05.2017	15:26:42	7.3	11.8	11.8
18.05.2017	15:26:57	7.5	12.0	12.0
18.05.2017	15:27:12	7.6	12.2	12.2
18.05.2017	15:27:27	7.5	12.1	12.1
18.05.2017	15:27:42	7.4	11.8	11.8
18.05.2017	15:27:57	7.3	11.7	11.7
18.05.2017	15:28:12	7.3	11.8	11.8
18.05.2017	15:28:27	7.4	11.9	11.9

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
18.05.2017	15:28:42	7.7	12.4	12.4
18.05.2017	15:28:57	8.3	13.3	13.3
18.05.2017	15:29:12	8.7	14.0	14.0
18.05.2017	15:29:27	8.9	14.3	14.3
18.05.2017	15:29:42	8.9	14.3	14.3
18.05.2017	15:29:57	8.6	13.8	13.8
18.05.2017	15:30:12	8.5	13.7	13.7
18.05.2017	15:30:27	8.3	13.3	13.3
18.05.2017	15:30:42	7.9	12.6	12.6
18.05.2017	15:30:57	7.9	12.7	12.7
18.05.2017	15:31:12	8.1	13.1	13.1
18.05.2017	15:31:27	8.3	13.3	13.3
18.05.2017	15:31:42	8.5	13.6	13.6
18.05.2017	15:31:57	8.7	13.9	13.9
18.05.2017	15:32:12	8.6	13.8	13.8
18.05.2017	15:32:27	8.4	13.5	13.5
18.05.2017	15:32:42	8.2	13.2	13.2
18.05.2017	15:32:57	8.2	13.1	13.1
18.05.2017	15:33:12	8.4	13.4	13.4
18.05.2017	15:33:27	8.6	13.9	13.9
18.05.2017	15:33:42	8.9	14.4	14.4
18.05.2017	15:33:57	8.8	14.2	14.2
18.05.2017	15:34:12	8.5	13.7	13.7
18.05.2017	15:34:27	8.2	13.2	13.2
18.05.2017	15:34:42	8.1	13.0	13.0
18.05.2017	15:34:57	8.0	12.9	12.9
18.05.2017	15:35:12	7.9	12.7	12.7
18.05.2017	15:35:27	7.9	12.8	12.8
18.05.2017	15:35:42	8.1	13.0	13.0
18.05.2017	15:35:57	8.1	13.0	13.0
18.05.2017	15:36:12	7.9	12.8	12.8
18.05.2017	15:36:27	7.7	12.4	12.4
18.05.2017	15:36:42	7.7	12.4	12.4
18.05.2017	15:36:57	7.7	12.4	12.4
18.05.2017	15:37:12	7.8	12.6	12.6
18.05.2017	15:37:27	8.0	12.8	12.8
18.05.2017	15:37:42	7.8	12.6	12.6
18.05.2017	15:37:57	7.7	12.4	12.4
18.05.2017	15:38:12	7.7	12.4	12.4
18.05.2017	15:38:27	7.8	12.5	12.5
18.05.2017	15:38:42	7.8	12.6	12.6
18.05.2017	15:38:57	7.8	12.6	12.6
18.05.2017	15:39:12	7.8	12.5	12.5
18.05.2017	15:39:27	7.8	12.5	12.5
18.05.2017	15:39:42	7.7	12.3	12.3
18.05.2017	15:39:57	7.5	12.1	12.1
18.05.2017	15:40:12	7.4	11.9	11.9
18.05.2017	15:40:27	6.9	11.2	11.2

Date	Time	VOC ppm	VOC as C mg/m^3	Ref VOC as C mg/m^3
18.05.2017	15:40:42	6.8	10.9	10.9
18.05.2017	15:40:57	6.8	10.9	10.9
18.05.2017	15:41:12	6.8	10.9	10.9
18.05.2017	15:41:27	6.6	10.6	10.6
18.05.2017	15:41:42	6.5	10.5	10.5
18.05.2017	15:41:57	6.6	10.6	10.6
Mean		8.2	13.2	13.2
Max		9.2	14.8	14.8
Min		6.5	10.5	10.5

2.13.8 Uncertainty Calculations

Particulates

Source of uncertainty	Estimate of Component (1 SD) (± %)	Combined Uncertainty (± %)	Expanded Uncertainty (95% Confidence limit) (± %)
Pressure	4.24	5.49	As % of result 10.65
Gas Volume	3.39		
Gas Temperature	0.67		
Humidity	0.50		As % of ELV 0.14
Washing Weighing	0.02		
Leak	0.00		
Filter Weighing	0.00		As mg/m^3 0.07
O_2 Concentration	0.00		

Total VOC's

Source of uncertainty	Estimate of Component (1 SD) ppm	Combined Uncertainty ppm	Expanded Uncertainty (95% Confidence limit) ppm
Linearity	0.80	1.11	2.16
Temperature effect (zero)	0.46		
Barometric Pressure	0.40		
Span gas	0.39		
Temperature effect (span)	0.23		
Repeatability	0.07		
Zero drift	0.01		**Expanded Uncertainty (95% Confidence limit) %**
Span drift	0.00		
Cross sensitivity CO (1.2 % vol)	0.00		
Cross sensitivity NO (127 mgm^{-3})	0.00		As % of Result 26.33
Cross sensitivity H_2O (sat 325K)	0.00		
Cross sensitivity SO_2 (2767 mgm^{-3})	0.00		As mg/m^3 at ref conditions 3.47
Cross sensitivity CO_2 (15.2 % vol)	0.00		

2.14 Certificates of Analysis

RPS

UKAS TESTING 0605

Test Certificate

Date 13/06/2017

Client	EPA Union Street Hetton Le Hole Sunderland Tyne & Wear DH5 9HU	Order No.	EPA.17.020
		Certificate No.	WK17-3935
		Issue No.	1
Contact	Tracy Dodds	Date Received	05/06/2017
Description	24 filters & 25 washes for TPM	Technique	Gravimetric Stack

Sample No.	939088	EPA.17.511/01F	Method
Total particulate matter	<0.1 mg		D9(U)
Sample No.	939089	EPA.17.511/02F	Method
Total particulate matter	0.24 mg		D9(U)
Sample No.	939090	EPA.17.511/03F	Method
Total particulate matter	0.07 mg		D9(U)
Sample No.	939091	EPA.17.511/04F	Method
Total particulate matter	3.07 mg		D9(U)
Sample No.	939092	EPA.17.511/05F	Method
Total particulate matter	<0.1 mg		D9(U)
Sample No.	939093	EPA.17.511/06F	Method
Total particulate matter	<0.1 mg		D9(U)
Sample No.	939094	EPA.17.511/07F	Method
Total particulate matter	0.06 mg		D9(U)
Sample No.	939095	EPA.17.511/08F	Method
Total particulate matter	6.73 mg		D9(U)

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

UKAS TESTING 0605

Test Certificate

Date 13/06/2017

Client EPA Certificate No. WK17-3935
Issue No. 1

Sample No.	939096	EPA.17.511/09F	Method
Total particulate matter	<0.1 mg		D9(U)
Sample No.	939097	EPA.17.511/10F	Method
Total particulate matter	0.37 mg		D9(U)
Sample No.	939098	EPA.17.511/11F	Method
Total particulate matter	0.07 mg		D9(U)
Sample No.	939099	EPA.17.511/12F	Method
Total particulate matter	<0.04 mg		D9(U)
Sample No.	939100	EPA.17.511/13F	Method
Total particulate matter	<0.1 mg		D9(U)
Sample No.	939101	EPA.17.511/14F	Method
Total particulate matter	0.23 mg		D9(U)
Sample No.	939102	EPA.17.511/15F	Method
Total particulate matter	0.33 mg		D9(U)
Sample No.	939103	EPA.17.511/16F	Method
Total particulate matter	0.20 mg		D9(U)
Sample No.	939104	EPA.17.511/17F	Method
Total particulate matter	<0.04 mg		D9(U)
Sample No.	939105	EPA.17.511/18F	Method
Total particulate matter	0.07 mg		D9(U)
Sample No.	939106	EPA.17.511/19F	Method
Total particulate matter	0.20 mg		D9(U)

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Sample No.	939107	EPA.17.511/20F	Method
Total particulate matter	0.10 mg		D9(U)
Sample No.	939108	EPA.17.511/21F	Method
Total particulate matter	<0.04 mg		D9(U)
Sample No.	939109	EPA.17.511/22F	Method
Total particulate matter	0.04 mg		D9(U)
Sample No.	939110	EPA.17.511/23F	Method
Total particulate matter	<0.04 mg		D9(U)
Sample No.	939111	EPA.17.511/24F	Method
Total particulate matter	1.17 mg		D9(U)
Sample No.	939113	EPA.17.511/01W	Method
Total particulate matter	<0.5 mg		D9(U)
Sample No.	939114	EPA.17.511/02W	Method
Total particulate matter	<0.5 mg		D9(U)
Sample No.	939115	EPA.17.511/03W	Method
Total particulate matter	<0.5 mg		D9(U)
Sample No.	939116	EPA.17.511/04W	Method
Total particulate matter	<0.5 mg		D9(U)
Sample No.	939117	EPA.17.511/05W	Method
Total particulate matter	0.9 mg		D9(U)
Sample No.	939118	EPA.17.511/06W	Method
Total particulate matter	<0.5 mg		D9(U)

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Sample No.	939119	EPA.17.511/07W	Method
Total particulate matter	<0.5 mg		D9(U)
Sample No.	939120	EPA.17.511/08W	Method
Total particulate matter	<0.5 mg		D9(U)
Sample No.	939121	EPA.17.511/09W	Method
Total particulate matter	0.8 mg		D9(U)
Sample No.	939122	EPA.17.511/10W	Method
Total particulate matter	<0.5 mg		D9(U)
Sample No.	939123	EPA.17.511/11W	Method
Total particulate matter	0.7 mg		D9(U)
Sample No.	939124	EPA.17.511/12W	Method
Total particulate matter	<0.5 mg		D9(U)
Sample No.	939125	EPA.17.511/13W	Method
Total particulate matter	<0.5 mg		D9(U)
Sample No.	939126	EPA.17.511/14W	Method
Total particulate matter	<0.5 mg		D9(U)
Sample No.	939127	EPA.17.511/15W	Method
Total particulate matter	<0.5 mg		D9(U)
Sample No.	939128	EPA.17.511/16W	Method
Total particulate matter	<0.5 mg		D9(U)
Sample No.	939129	EPA.17.511/17W	Method
Total particulate matter	<0.5 mg		D9(U)

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Sample No.	939130	EPA.17.511/18W	Method
Total particulate matter		<0.5 mg	D9(U)
Sample No.	939131	EPA.17.511/19W	Method
Total particulate matter		<0.5 mg	D9(U)
Sample No.	939132	EPA.17.511/20W	Method
Total particulate matter		<0.5 mg	D9(U)
Sample No.	939133	EPA.17.511/21W	Method
Total particulate matter		0.6 mg	D9(U)
Sample No.	939134	EPA.17.511/22W	Method
Total particulate matter		<0.5 mg	D9(U)
Sample No.	939135	EPA.17.511/23W	Method
Total particulate matter		<0.5 mg	D9(U)
Sample No.	939136	EPA.17.511/24W	Method
Total particulate matter			D9(U)
Total particulate matter			D9(U)
Sample No.	939246	EPA.17.511/25W	Method
Total particulate matter		<0.5 mg	D9(U)

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Date 13/06/2017

Client EPA

Certificate No. WK17-3935
Issue No. 1

Tested By	Kirstie Davenport	Date	12/06/2017
	Kirstie Davenport		13/06/2017
Approved By		Date	13/06/2017

Joanne Dewhurst
Operational 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 refering 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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2.15 Calibration Certificates

CERTIFIED REFERENCE MATERIAL
CERTIFICATE OF CALIBRATION

Component	Nominal Concentration	Certified Concentration	Absolute Uncertainty	Relative Uncertainty	Analysis Technique
PROPANE	80 ppm	80.4 ppm	+/-0.8 ppm	1.0 %	FID
SYNTHETIC AIR	Balance				

All concentrations are molar

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Cylinder Number: 232200
Production Order Number: 2631935
Issuing Laboratory: UKAS Accredited Calibration Laboratory 0408 & Reference Material Producer 4183

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CERTIFIED REFERENCE MATERIAL
CERTIFICATE OF CALIBRATION

Component	Nominal Concentration	Certified Concentration	Absolute Uncertainty	Relative Uncertainty	Analysis Technique
PROPANE	8 ppm	7.93 ppm	+/-0.16 ppm	2.1 %	FID
SYNTHETIC AIR	Balance				

All concentrations are molar

EPA/CGAS/101

Cylinder Number: 216684
Production Order Number: 2616300
Issuing Laboratory: UKAS Accredited Calibration Laboratory 0408 & Reference Material Producer 4183

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UKAS: 13162753 HIQ/308860/APUK/0611/10M

CERTIFIED REFERENCE MATERIAL
CERTIFICATE OF CALIBRATION

Component	Nominal Concentration	Certified Concentration	Absolute Uncertainty	Relative Uncertainty	Analysis Technique
PROPANE	800 ppm	802 ppm	+/-7 ppm	0.9 %	FID
SYNTHETIC AIR	Balance				

All concentrations are molar

EPA JC GAS 197

Cylinder Number: 244929 Production Order Number: 2556462
Issuing Laboratory: UKAS Accredited Calibration Laboratory 0408 & Reference Material Producer 4183

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UKAS: 1816/753 HSQ/388860/AR/UK/0911/NM

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