VOLATILE ORGANIC COMPOUNDS
EMISSIONS COMPLIANCE TESTING
AT PAXFORD COMPOSITES LTD IN FEBRUARY 2009

FOR: Paxford Composites Ltd
2-4 Redwongs Way
Huntingdon
Cambridgeshire
PE29 7HB

FAO: MR GRAHAME BLOXHAM

Work By: K C Blakley and R E Elliott

Date of issue: **Name: Mr R Robinson** **(Authorised Signatory)**

Signed: **for Managing Director**

MCerts Level 2 Approver

Name:

Part 1: - Executive Summary –Compliance Report			
Process Operator **Paxford Composites Ltd**		LA Permit No **B01/02**	
Address **Paxford Composites Ltd** **2-4 Redwongs Way** **Huntingdon** **Cambridgeshire** **PE29 7HB**		Contact **Grahame Bloxham** Tel No **01480 453537** Email **Grahame.bloxham@paxfordcomposites.co.uk**	
Tests carried out	**Compliance VOCs of 3 Spray Booths**	Dates tests carried out **18th February 2008**	
Testing laboratory **National Physical Laboratory**		UKAS Accreditation No **0002**	
Address **Hampton Road** **Teddington** **TW11 OLW**		Contact **Kevin Blakley** Tel No **020 8943 6118** Email **kevin.blakley@npl.co.uk**	
Species to be monitored	**Volatile Organic Compounds**		
Emissions Limit Values (ELV)	**Volatile Organic Compounds - 150 mg m^{-3} (expressed as carbon)**		
Compliance with standards		**Yes**	
Deviations from standards			**No**
Corrective actions required			**No**
Test Team	**Kevin Blakley and Robert Elliott**		
Full report reference number		**PX01FEB09**	
Summary report submitted by **Robert Elliott**		Signature	MCERTs ID No: - **Level 2, TE1,2,3,4**

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1.1 MONITORING OBJECTIVES

NPL were awarded a contract by Paxford Composites Ltd to conduct emissions compliance testing at their facility located in Huntingdon, Cambridgshire. Work was conducted on the 18th February to make the necessary measurements from their spray painting enclosures, known as Spray Booth 1 (SB1), Spray Booth 2 (SB2) and Spray Booth 3 (SB3).
The requirements of the contract were to quantify volatile organic compounds (VOC's) from the sources described above on a continuous basis.

VOC concentrations are expressed as carbon at reference conditions of 273.15K, 101.325 kPa on a wet gas basis.

1.2 VOC MONITORING RESULTS

Field	Units			
Stack I.D.		**SB1**	**SB2**	**SB3**
Date		18/02/2009	18/02/2009	18/02/2009
Sample Period (GMT)	From hh:mm	12:05	14:00	15:20
	To hh:mm	12:35	14:30	15:50
Sample Duration	min	30	30	30
30-minute mean Concentration for Period	mg m^{-3}, Ref. Conditions	**181.1**	**72.3**	**28.5**
Expanded Uncertainty	mg m^{-3}, 95% conf. k=2	+/-11.3	+/-10.7	+/-1.4
Emission Limit Value (ELV)	mg m^{-3}, Ref. Conditions	150	150	150
Percentage of ELV	%	121	48	19
Reference Conditions	273.15K, 101.325 kPa, Wet Gas Basis			

Notes: -
The VOC (mg/m^3) results above are expressed as Carbon and these were calculated using the prescribed method described in the Environmental Agency Technical Guidance Note M16 for Volatile Organic Compounds.

1.3 PLANT AND EQUIPMENT OPERATING INFORMATION

1.3.1 Paxford Composites Spray Booths 1-3

The spray booths at Paxford Composites consist of three sealed rooms, approximately the size of a large household car garages. They are used as batch processes and air is pumped into the booths from outside the building and the spray painting process is carried out manually using 2 to 3 skilled workers. The air inside the booth can be heated if required for curing treatment of the components. Owing to the business requirements, many layers of paint are required to achieve the smooth finish. As a result, a typical single layer spray time would normally be approximately 20 minutes but depends on the size and type of item being sprayed. This process is then repeated after the item has been brushed down and ready for a further coating. The paint filled air inside the booths are removed via ceiling filters (which covers the entire surface areas of the ceilings) to remove particulate matter. The air is then exhausted to atmosphere.

On each spray booth, the sample position was downstream of the particulate filters. The sample points were 10mm holes, suitable for monitoring VOCs to the relevant CEN Standard, See Figures 1-3.

At the time of monitoring, spray painting workers were asked to carry out their normal task in order to create representative conditions of routine activity within the spray booths. It should be noted that at the time of monitoring, there were no items being physically sprayed, therefore all of the paint would have been expelled through the exhaust ducting rather than coating surfaces of the items. It was the site's opinion that this may lead to higher levels of VOCs being emitted than would usually be seen.

1.4 MONITORING DEVIATIONS

The testing was fully compliant with the relative standard BS EN13526: 2002. See Appendix 1 for Test Techniques and Protocols.

1.5 CONCLUSIONS

Concentrations of volatile organic compounds, measured from the three spray booths at Paxford Composites Ltd, was carried out on the 18th February 2009.

1.6 REFERENCES

1. Guidance on Assessing Measurement Uncertainty in Stack Emissions Monitoring, by Pullen J, Source Testing Association, Quality Guidance Note QGN1 and Q1035-98.

Part 2: - Supporting Information–Compliance Report			
Process Operator **Paxford Composites Ltd**		LA Permit No **B01/02**	
Address **Paxford Composites Ltd** **2-4 Redwongs Way** **Huntingdon** **Cambridgeshire** **PE29 7HB**		Contact **Grahame Bloxham** Tel No **01480 453537** Email **Grahame.bloxham@paxfordcomposites.co.uk**	
Tests carried out	**Compliance VOCs of 3 Spray Booths**	Dates tests carried out **18th February 2008**	
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Address **Hampton Road** **Teddington** **TW11 OLW**		Contact **Kevin Blakley** Tel No **020 8943 6118** Email **kevin.blakley@npl.co.uk**	
Species to be monitored	**Volatile Organic Compounds**		
Emissions Limit Values (ELV)	**Volatile Organic Compounds - 150 mg m^{-3} (expressed as carbon)**		
Compliance with standards		**Yes**	
Deviations from standards			**No**
Corrective actions required			**No**
Test Team	**Kevin Blakley and Robert Elliott**		
Full report reference number		**PX01FEB09**	
Summary report submitted by **Robert Elliott**		Signature	MCERTs ID No: - **Level 2, TE1,2,3,4**

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2.1 APPENDIX 1

2.1.1 Emission Testing Personnel Information

NAME	NPL Position	MCerts I.D. No.	Level/Endorsements	Function
Robert Elliott	HRS	MM-03-319	Level 2, TE1, TE2, TE3, TE4	Team Leader
Kevin Blakley	SRS	MM-03-317	Level 2, TE1, TE2, TE3	Team Leader

2.1.2 Test Techniques and Protocols

Date of Tests	18th February 2009
Main Pollutants Measured	1. Volatile Organic Compounds (VOCs)
Test Methods	1. Flame Ionisation Detector, Sick-Maihak. Serial No. AS0202 to BS EN 13526:2002. MCertified Instrument No – Sira MC 040037/02
Procedure	1. **QPAS B 538**:- STACK GAS SAMPLING FOR CARBON MONOXIDE, CARBON DIOXIDE, OXYGEN, SULPHUR DIOXIDE, VOLATILE ORGANIC COMPOUNDS AND NITROGEN OXIDES USING EXTRACTIVE INSTRUMENTAL TECHNIQUES.

2.2 APPENDIX 2

2.2.1 Sample Point Details

Figure 1. Spray Booth 1 Sample Position

Figure 2. Spray Booth 2 Sample Position

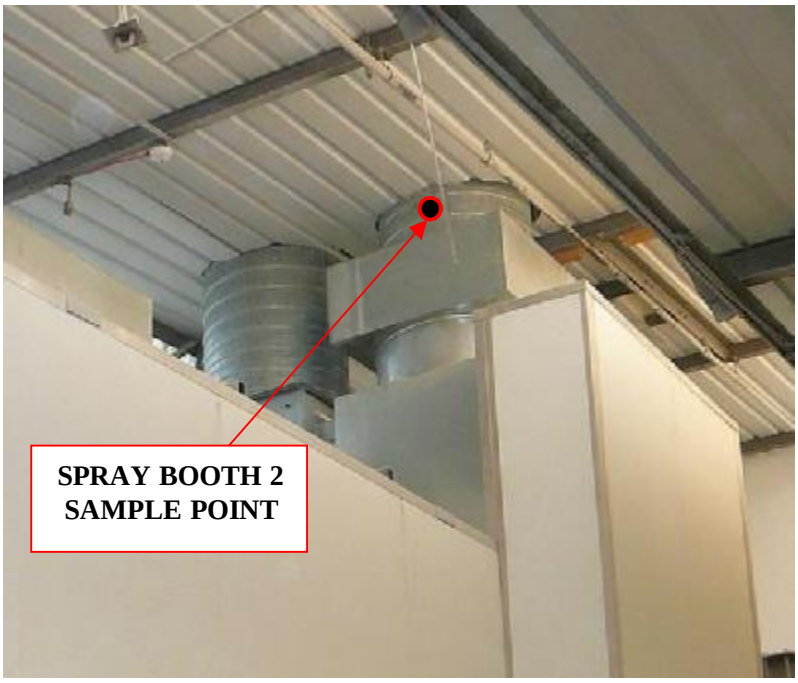
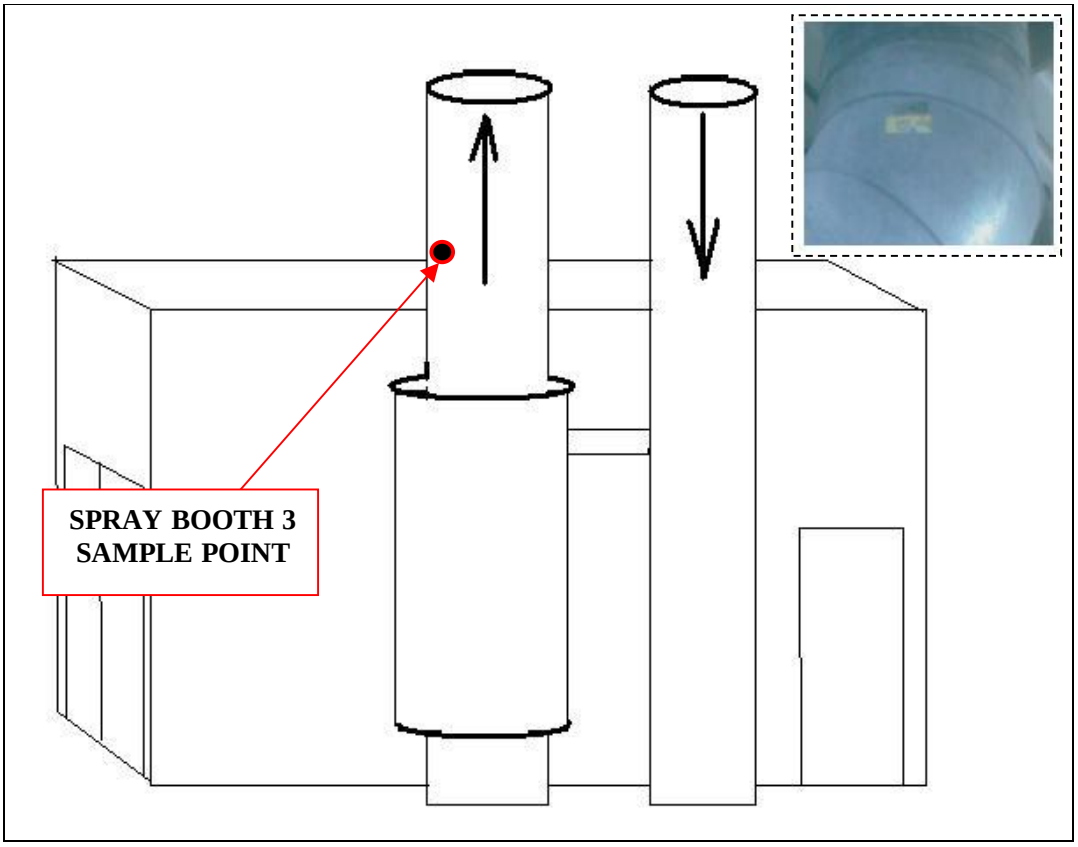
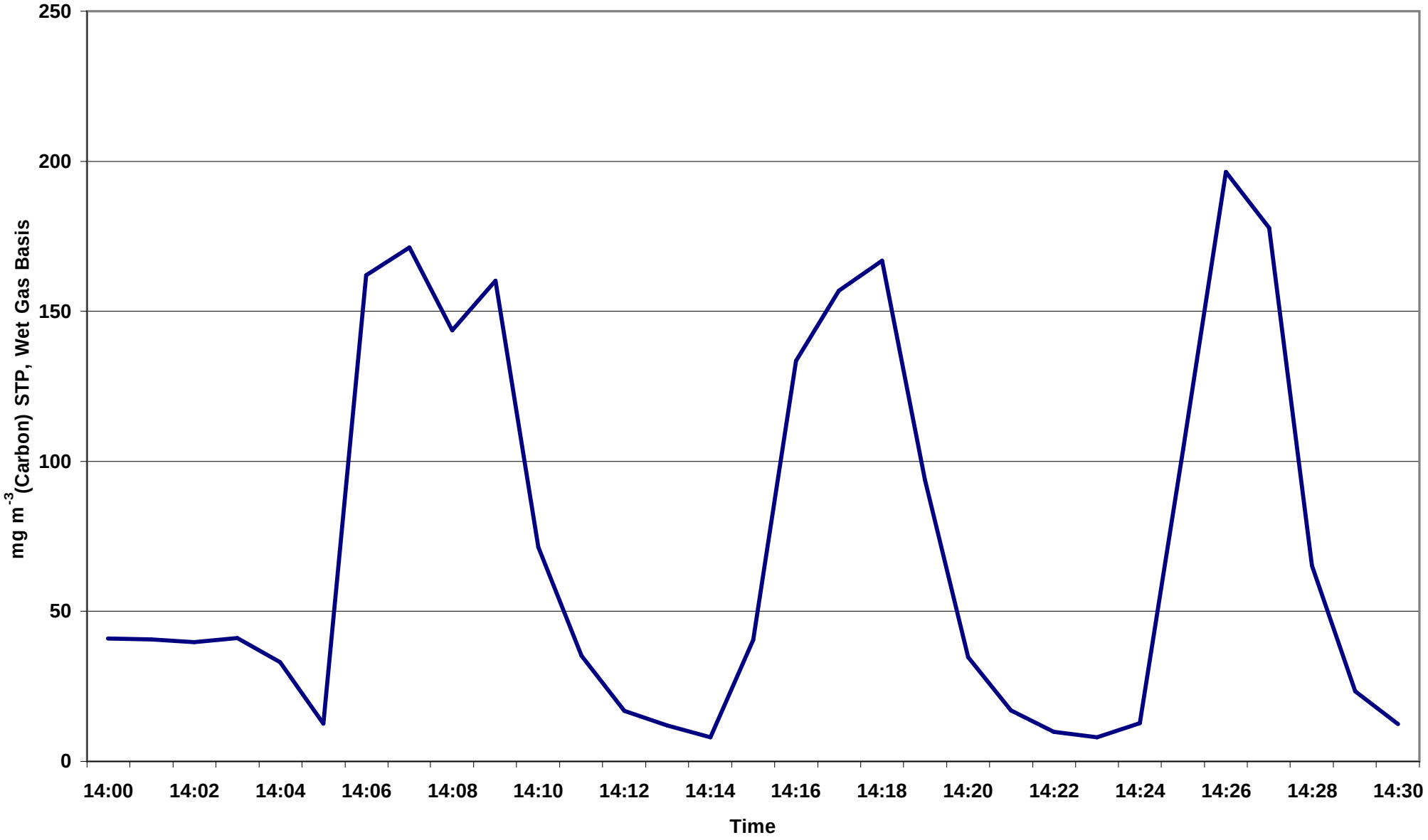


Figure 3. Spray Booth 3 Sample Position

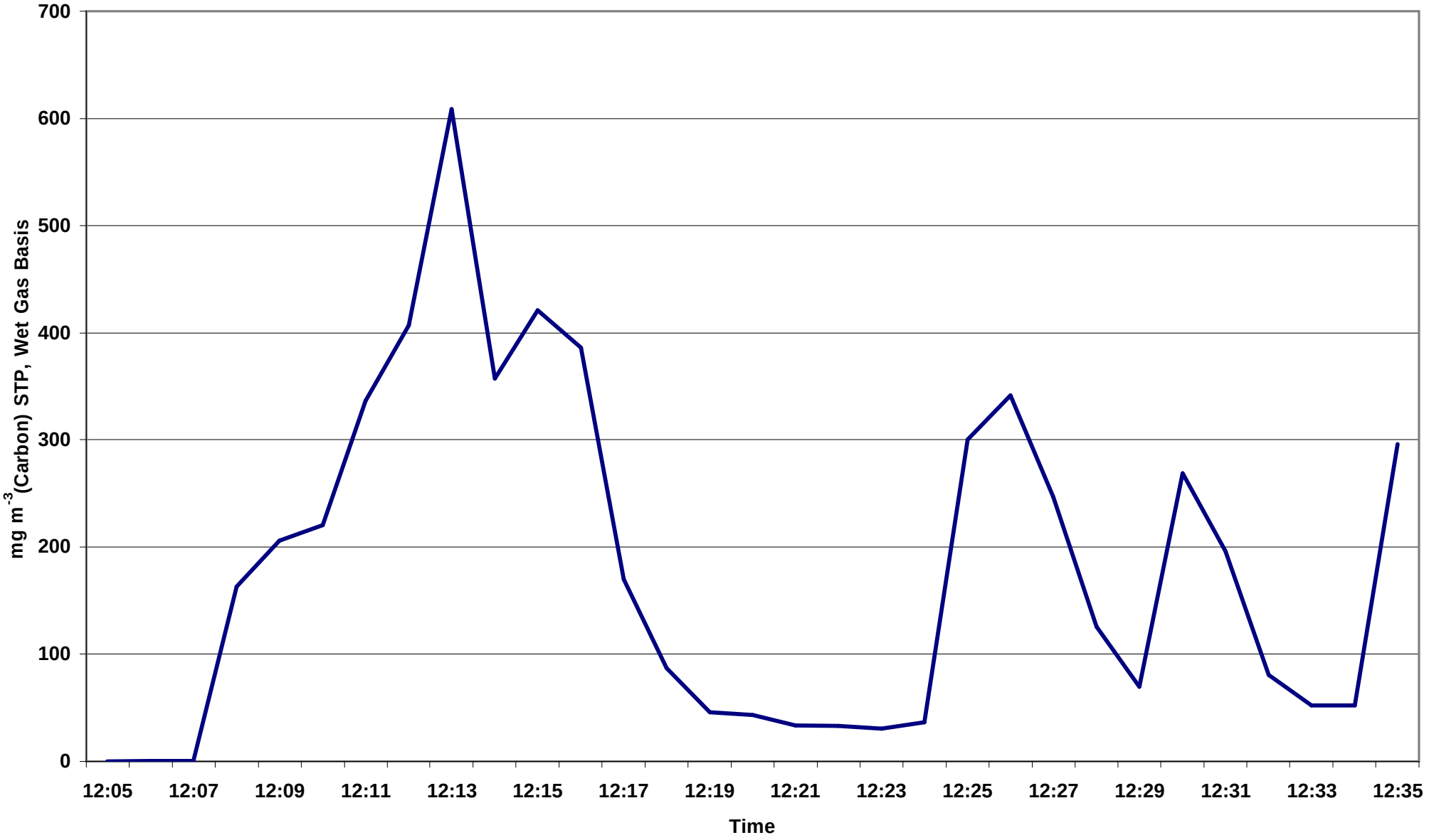


2.2.2 VOC 1 Minute Averaged Graphs

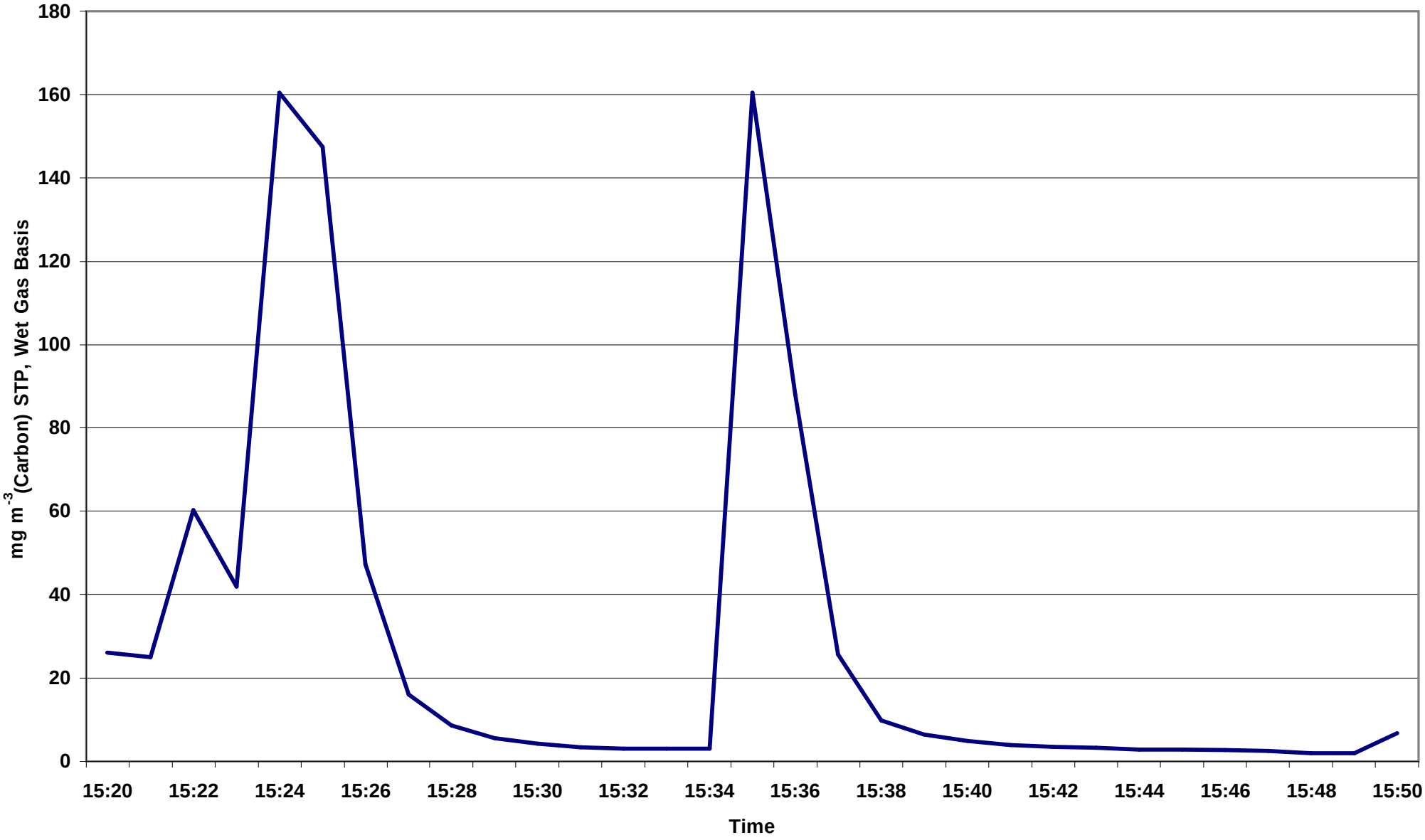
2.2.2 Figure 5. Spray Booth 2. 1-Minute Averages of Volatile Organic Compounds (VOC). Expressed as mg m^{-3} (Carbon) at 273K, 101.3kPa, Wet Gas Basis



2.2.2 Figure 4. Spray Booth 1. 1-Minute Averages of Volatile Organic Compounds (VOC). Expressed as mg m^{-3} (Carbon) at 273K, 101.3kPa, Wet Gas Basis



2.2.2 Figure 5. Spray Booth 2. 1-Minute Averages of Volatile Organic Compounds (VOC). Expressed as mg m^{-3} (Carbon) at 273K, 101.3kPa, Wet Gas Basis



2.2.3 Gas Measurements

Calibration Log

Instrument SN: AS0202	Type			TEST 12:05 - 12:40 18/2/09 SPRAY BOOTH 1	
	VOC				
Mobile Lab:	NPL				
Gas Cyl. No. NPL PROPANE	Gas Cyl Conc. 51.4 ppm propane/~~carbon~~ Delete as app.			Date. 18/2/09	Instrument Range: 0-100 ppm

Cal Type	Time (Start and Finish)	Initial Reading	Initial Gain/Setting (if app.)	Final Reading	Final Gain/Setting (if app.)	System(S) / Direct(D)	Total Regulator Pressure (bar/Psi delete as app.)	Comment	Signature
Check Zero	11:20	-0.310	3.72			D	n/a		RE
Zero Adj	11:22			0.002	4.32	D			RE
Check Span	11:30	5.346	2.08			D	200	Response Time : 9 sec	RE
Span Adj	11:35			5.141	2.80	D		Span Value: 51.4 ppm	RE
Check Zero	11:38	-0.024	4.32			D	n/a		RE
Check Zero	12:42	-0.032	"			S	n/a		RE
Check Span	12:45	5.148	"			S	n/a		RE
Zero Adj									
Span Adj									
Check Zero	12:48	-0.024	"			S	n/a		RE

Distribute to Job File

IF REGULATOR PRESSURE IS LESS THAN 500 PSI (35 bar) CONTACT SUPPLIER IMMEDIATELY

~~ACETYLENE with FGA Sign~~ Name: ~~MCETS No~~

NPL Ltd : 29 Jan 2007
Author: REE

Instrument SN: 350206 | Type: | VOC: | NPL

Mobile Lab:

Spray Booth 2 | 4400-4430

Gas Cyl. No.	Gas Cyl Conc.	ppm propane/hexane	Date: 18/2/09	Instrument Range: 0-1000 ppm
NPL 110FANE	514	Delete as appr.		

Cal Type	Time (Start and Finish)	Initial Reading	Initial Gain/Setting (if appr.)	Final Reading	Final Gain/Setting (if appr.)	System(S)/ Direct(D)	Total Regulator Pressure (bar/Psi delete as appr.)	Comment	Signature
Check Zero						P			
Zero Adj		0.043	4.32	-0.000	4.30	O	N/A		
Check Span						O		Response Time: 10 sec	
Span Adj		5.342	260	5.154	274	O	190	Span Value: 514 ppm	
Check Zero		-0.003	4.30			O	N/A		
Check Zero	14:40	0.030	—			S	N/A		
Check Span	14:43	5.095	—			S	190		
Zero Adj									
Span Adj									
Check Zero	14:48	0.308	—			S	N/A		

Distribute to Job File

IF PRESSURE IS LESS THAN 500 PSI (35 bar) CONTACT SUPPLIER IMMEDIATELY

NPL Ltd : 29 Jan 2007
Author: REE

File: \\data.npl.co.uk\Groups\CALLOC-NPL Version 2.xls

Calibration Log

	Instrument SN: #50202	Type: (VOC)			SPRAY BOOTH 3 15:20-15:50				
	Mobile Lab:		NPL						
Gas Cyl. No.	NPL PROPANE	Gas Cyl Conc.	51.4	ppm propane/~~carbon~~ Delete as app.	Date.	18/2/09	Instrument Range:	0 - 1000 ppm	

Cal Type	Time (Start and Finish)	Initial Reading	Initial Gain/Setting (if app.)	Final Reading	Final Gain/Setting (if app.)	System(S) / Direct(D)	Total Regulator Pressure (bar/Psi delete as app.)	Comment:	Signature
Check Zero	15:06	-0.068	4.26			D	100		
Zero Adj	15:08			-0.006	4.45	D			
Check Span	15:10	5.141	2.75			D	150	Response Time : 10 sec	
Span Adj	–			5.140	2.75	D		Span Value 51.4 ppm	
Check Zero	15:13	-0.012	4.45			D	100		
Check Zero	15:52	-0.021	4.45			D	100		
Check Span	15:53	5.038	2.75			D	150		
Zero Adj									
Span Adj									
Check Zero	15:54	-0.017	4.45			D	100		

Distribute to Job File

IF REGULATOR PRESSURE IS LESS THAN 500 PSI (35 bar) CONTACT SUPPLIER IMMEDIATELY

~~MCERTS LEVEL 2 with TEA Sign~~ Name: MCERTS No:

NPL Ltd : 29 Jan 2007
Author: REE

Revision 2.1
QPAS 3 536
P:\.....\stationary\ CALLOG-NPL Version 2.XLS CAL_OG NOx VOC

2.2.4 Calculations Used in Reporting Results

The following equation can be used to convert propane volume concentrations to total organic carbon mass concentrations:

$$C_m = C_v \frac{3 \text{ x } M_c}{V_m} \text{ mg/m}^3$$

where:-

C_m is the TOC concentration in milligrams per cubic metre (273 K;1013 hPa).
C_v is the volume concentration of propane in ppm (by volume).
M_c is the molar mass of carbon (=12 g/mole).
V_M is the molar volume (=22,4 l/mole).

2.2.5 Uncertainty Calculations

NATIONAL PHYSICAL LABORATORY
Continuation Sheet

Uncertainty calculation for Gaseous Measurement BS EN 13526 VOCs

SPRAY BOOTH 1

Limit value	150	**mg.m^{-3} (corrected) Carbon**	**Gas**	Propane	
			Full Scale	1000	**ppm**
Measured concentration	112.83	**ppm**	**Cal gas conc**	51.4	**ppm**
Measured concentration	181.10	**mg.m^{-3} (273K, 101.3kPa) Carbon**	**Conversion**	0.62305296	
			Full Scale	623.0529595	**mg.m^{-3} (Carbon)**
			Cal gas conc	32.02492212	**mg.m^{-3} (Carbon)**

Correction for reference conditions					
		O2, %	**Moisture, %**	**Pressure, KPa**	**Temperature, K**
	ref	21.00	0.00	101.30	**273.00**
	measured	21.00	0.00	101.30	**273.00**
Factors		1.00	1.00	1.00	1.00
Correction Factor		**1.00**			

Performance characteristics	**Value**			**specification**
Response time	10	seconds		180.000
Number of readings in measurement	30			
Repeatability at zero	0.005	% full scale		0.200
Repeatability at span level	0.083	% full scale		2.000
Deviation from linearity	-1.46	% of value		2.000
Zero drift	0	% full scale		2.000
Span drift	0	% full scale		2.000
volume or pressure flow dependence	0.02	% of full scale/kPa		0.033
atmospheric pressure dependence	0	% of value/kPa		0.750
ambient temperature dependence	0.025	% full scale/10K		0.300
NH3 (20 mg/m3)	0	mg/m3		
CO2 (15%)	0	% by vol		
H2O (30%)	0.0	% by vol		4.000
dependence on voltage	1.05	% full scale/10V		2%fs/10V
losses in the line (leak)	0	% of value		2% of value
Uncertainty of calibration gas	2	% of value		

Effect of drift	
0.00	mg/m3
0.00	% value

	ranges min	max	value at calib
flow	1.9	2.1	2
pressure	101.30	101.3	101.3
temp	289	289	289
NH3 range	0	0	0
CO2 range	0	15	0
H2O range	0	0	0
Instrument Voltage Rating			110
Voltage	104.5	115.5	110

Measurement performance related to stationary conditions

Performance characteristic		**Uncertainty**		**Value of uncertainty quantity**		
Standard deviation of repeatability at zero		u_{r0}		for mean		use rep at span
Standard deviation of repeatability at span level		u_{rs}		for mean		0.02
Lack of fit		u_{fit}				-5.25
Drift		u_{0dr}				0.00
volume or pressure flow dependence		u_{spres}				0.00
atmopsheric pressure dependence		u_{apres}				0.00
ambient temperature dependence		u_{temp}				0.00
NH3 (20 mg/m3)		u_{interf}				0.00
CO2 (15%)						0.00
H2O (30%)						0.00
Dependence on voltage		u_{volt}				0.33
losses in the line (leak)		u_{leak}				0.00
Uncertainty of calibration gas		u_{calib}				2.09

Use largest negative or positive interferent effect	
0	0.00
0	0.00
0	0.00
0	0.00
Interference uncertainty	0.00

Measurement uncertainty		Result	181.10	mg/m^3
Combined uncertainty			5.66	mg/m^3
Expanded uncertainty	k =	2	11.33	mg/m^3
Uncertainty corrected to std conds			11.33	mg.m-3 (corrected)
Expanded uncertainty	**expressed with a level of confidence of 95%**		**7.55 %ELV**	
Expanded uncertainty	**expressed with a level of confidence of 95%**		**11.33 mg.m^{-3}**	

Note: Enter values into green boxes
Dark blue boxes indicate information that can be obtained from MCERTS tests

Developed by R Robinson, NPL

NATIONAL PHYSICAL LABORATORY
Continuation Sheet

Uncertainty calculation for Gaseous Measurement BS EN 13526 VOCs

SPRAY BOOTH 2

Limit value	150	mg.m^{-3} (corrected) Carbon	**Gas**	Propane	
			Full Scale	1000	ppm
Measured concentration	45.05	ppm	**Cal gas conc**	51.4	ppm
Measured concentration	72.30	mg.m^{-3} (273K, 101.3kPa) Carbon	**Conversion**	0.62305296	
			Full Scale	623.0529595	mg.m^{-3} (Carbon)
			Cal gas conc	32.02492212	mg.m^{-3} (Carbon)

Correction for reference conditions					
		O2, %	**Moisture, %**	**Pressure, KPa**	**Temperature, K**
	ref	21.00	0.00	101.30	**273.00**
	measured	21.00	0.00	101.30	**273.00**
Factors		1.00	1.00	1.00	1.00
Correction Factor		**1.00**			

Performance characteristics	**Value**			**specification**
Response time	10	seconds		180.000
Number of readings in measurement	30			
Repeatability at zero	0.005	% full scale		0.200
Repeatability at span level	0.083	% full scale		2.000
Deviation from linearity	-1.46	% of value		2.000
Zero drift	0	% full scale		2.000
Span drift	0	% full scale		2.000
volume or pressure flow dependence	0.02	% of full scale/kPa		0.033
atmospheric pressure dependence	0	% of value/kPa		0.750
ambient temperature dependence	0.025	% full scale/10K		0.300
NH3 (20 mg/m3)	0	mg/m3		
CO2 (15%)	0	% by vol		
H2O (30%)	0.0	% by vol		4.000
dependence on voltage	1.05	% full scale/10V		2%fs/10V
losses in the line (leak)	0	% of value		2% of value
Uncertainty of calibration gas	2	% of value		

Effect of drift	
0.00	mg/m3
0.00	% value

	ranges min	max	value at calib
flow	1.9	2.1	2
pressure	101.30	101.3	101.3
temp	289	289	289
NH3 range	0	0	0
CO2 range	0	15	0
H2O range	0	0	0
Instrument Voltage Rating			110
Voltage	104.5	115.5	110

Measurement performance related to stationary conditions

Performance characteristic		**Uncertainty**		**Value of uncertainty quantity**		
Standard deviation of repeatability at zero		u_{r0}		for mean		use rep at span
Standard deviation of repeatability at span level		u_{rs}		for mean		0.02
Lack of fit		u_{fit}				-5.25
Drift		u_{ddr}				0.00
volume or pressure flow dependence		u_{spres}				0.00
atmopsheric pressure dependence		u_{apres}				0.00
ambient temperature dependence		u_{temp}				0.00
NH3 (20 mg/m3)		u_{interf}				0.00
CO2 (15%)						0.00
H2O (30%)						0.00
Dependence on voltage		u_{volt}				0.33
losses in the line (leak)		u_{leak}				0.00
Uncertainty of calibration gas		u_{calib}				0.83

Use largest negative or positive interferent effect	
0	0.00
0	0.00
0	0.00
0	0.00
Interference uncertainty	0.00

Measurement uncertainty		Result	72.30	mg/m^3
Combined uncertainty			5.33	mg/m^3
Expanded uncertainty	k =	2	10.66	mg/m^3
Uncertainty corrected to std conds			10.66	mg.m-3 (corrected)
Expanded uncertainty	**expressed with a level of confidence of 95%**		**7.10**	**% ELV**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**10.66**	**mg.m^{-3}**

Note: Enter values into green boxes
Dark blue boxes indicate information that can be obtained from MCERTS tests

Developed by R Robinson, NPL

NATIONAL PHYSICAL LABORATORY
Continuation Sheet

Uncertainty calculation for Gaseous Measurement BS EN 13526 VOCs

SPRAY BOOTH 3

Limit value	150	mg.m^{-3} (corrected) Carbon	**Gas**	Propane	
			Full Scale	100	ppm
Measured concentration	17.76	ppm	**Cal gas conc**	51.4	ppm
Measured concentration	28.50	mg.m^{-3} (273K, 101.3kPa) Carbon	**Conversion**	0.62305296	
			Full Scale	62.30529595	mg.m^{-3} (Carbon)
			Cal gas conc	32.02492212	mg.m^{-3} (Carbon)

Correction for reference conditions					
		O2, %	**Moisture, %**	**Pressure, KPa**	**Temperature, K**
	ref	21.00	0.00	101.30	**273.00**
	measured	21.00	0.00	101.30	**273.00**
Factors		1.00	1.00	1.00	1.00
Correction Factor		**1.00**			

Performance characteristics	**Value**			**specification**
Response time	10	seconds		180.000
Number of readings in measurement	30			
Repeatability at zero	0.005	% full scale		0.200
Repeatability at span level	0.083	% full scale		2.000
Deviation from linearity	-1.46	% of value		2.000
Zero drift	0	% full scale		2.000
Span drift	0	% full scale		2.000
volume or pressure flow dependence	0.02	% of full scale/kPa		0.033
atmospheric pressure dependence	0	% of value/kPa		0.750
ambient temperature dependence	0.025	% full scale/10K		0.300
NH3 (20 mg/m3)	0	mg/m3		
CO2 (15%)	0	% by vol		
H2O (30%)	0.0	% by vol		4.000
dependence on voltage	1.05	% full scale/10V		2%fs/10V
losses in the line (leak)	0	% of value		2% of value
Uncertainty of calibration gas	2	% of value		

Effect of drift	
0.00	mg/m3
0.00	% value

	ranges min	max	value at calib
flow	1.9	2.1	2
pressure	101.30	101.3	101.3
temp	289	289	289
NH3 range	0	0	0
CO2 range	0	15	0
H2O range	0	0	0
Instrument Voltage Rating			110
Voltage	104.5	115.5	110

Measurement performance related to stationary conditions

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		
Standard deviation of repeatability at zero			u_{r0}		for mean		use rep at span
Standard deviation of repeatability at span level			u_{rs}		for mean		0.02
Lack of fit			u_{fit}				-0.53
Drift			u_{0dr}				0.00
volume or pressure flow dependence			u_{spres}				0.00
atmopsheric pressure dependence			u_{apres}				0.00
ambient temperature dependence			u_{temp}				0.00
NH3 (20 mg/m3)			u_{interf}				0.00
CO2 (15%)							0.00
H2O (30%)							0.00
Dependence on voltage			u_{volt}				0.33
losses in the line (leak)			u_{leak}				0.00
Uncertainty of calibration gas			u_{calib}				0.33

Use largest negative or positive interferent effect	
0	0.00
0	0.00
0	0.00
0	0.00
Interference uncertainty	0.00

Measurement uncertainty		Result	28.50	mg/m^3
Combined uncertainty			0.70	mg/m^3
Expanded uncertainty	k =	2	1.41	mg/m^3
Uncertainty corrected to std conds			1.41	mg.m-3 (corrected)
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.94**	**% ELV**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**1.41**	**mg.m^{-3}**

Note: Enter values into green boxes
Dark blue boxes indicate information that can be obtained from MCERTS tests

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