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

Reference:105435\QE8400\PX	Page 1 of 23			
Date of issue:	Name: Mr R Robinson	(Authorised Signatory		
	Signed:	for Managing Director		
MCerts Level 2 Approver				

Name:

	Par	t 1: - Executive	Summary –Co	mpliance Report		
Process Operator			LA Permit No	<u> </u>		
Paxford Compo			B01/02			
Address	~		Contact Grahame Bloxham Tel No			
	Composites I	Ltd				
2-4 Ked Hunting	wongs Way don					
Cambrid			01480 453537			
PE29 7H			Email			
			Grahame.bloxham@paxfordcomposites.co.uk			
Tests carried	Complianc	e VOCs of 3	Dates tests carrie	ed out		
out	Spray Boo	ths	18 th February 2	008		
				/* NT		
Testing laborator			UKAS Accredita	ation No		
National Physics	al Laborator	y	0002			
Address			Contact			
Hampton Road			Kevin Blakley			
Teddington						
TW11 OLW			Tel No			
			020 8943 6118			
			Email			
			kevin.blakley@npl.co.uk			
Species to be mo	nitored	Volatile Organ	ic Compounds			
Emissions Lin	nit Values	Volatile Organ	ic Compounds - 1	50 mg m ⁻³ (expressed as carbon)		
(ELV)						
Compliance with	standards		Yes			
Deviations from	etandarde			No		
	stanuarus					
Corrective action	s required			No		
Test Team	Kevin Rlak	dey and Robert	 Elliott			
Full report refere		ing and Robert		PX01FEB09		
Summary report	submitted by		Signature	MCERTs ID No: -		
Robert Elliott				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.

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
Sample Ferrou (GWFF)	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, 101.3	325 kPa, Wet	Gas Basis	

1.2 VOC MONITORING RESULTS

Notes: -

The VOC (mg/m³) 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.

		Information_Col	<u>mpliance Report</u>		
tes Ltd	. Supporting	LA Permit No B01/02			
Address Paxford Composites Ltd 2-4 Redwongs Way Huntingdon Cambridgeshire PE29 7HB Tests carried Compliance VOCs of 3			n n@paxfordcomposites.co.uk		
		Dates tests carried out 18 th February 2008 UKAS Accreditation No 0002			
Laborator	y				
Address Hampton Road Teddington TW11 OLW			Contact Kevin Blakley Tel No 020 8943 6118 Email kevin.blakley@npl.co.uk		
tored	Volatile Organi	ic Compounds			
Values	Volatile Organi	ic Compounds - 150	mg m ⁻³ (expressed as carbon)		
tandards		Yes			
andards			No		
required			No		
Kevin Blak	ley and Robert l	Elliott			
ce number			PX01FEB09		
abmitted by		Signature	MCERTs ID No: - Level 2, TE1,2,3,4		
	omposites I ngs Way n sshire Compliance Spray Boot Laborator Laborator Values andards andards required Kevin Blak re number	omposites Ltd ngs Way n shire Compliance VOCs of 3 Spray Booths Laboratory Laboratory Volatile Organ Values Volatile Organ andards undards required Kevin Blakley and Robert 1 e number	tes Ltd B01/02 Contact Grahame Bloxhar Tel No 01480 453537 Email Grahame.bloxhar Tel No 01480 453537 Email Grahame.bloxhar Compliance VOCs of 3 Spray Booths Dates tests carried 18 th February 200 Laboratory Cost 3 Spray Booths Contact Kevin Blakley Tel No 020 8943 6118 Email kevin.blaklev@np tored Volatile Organic Compounds - 150 andards Yes undards Yes		

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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

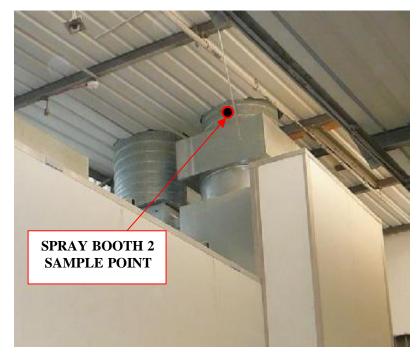
Date of Tests	18 th February 2009
Main	
Pollutants	1. Volatile Organic Compounds (VOCs)
Measured	
Test Methods	1. Flame Ionisation Detector, Sick-Maihak. Serial No. AS0202 to BS EN 13526:2002. MCertified Instrument No – Sira MC 040037/02
Procedure	1. QPAS B 538 :- STACK GAS SAMPLING FOR CARBON MONOXIDE, 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



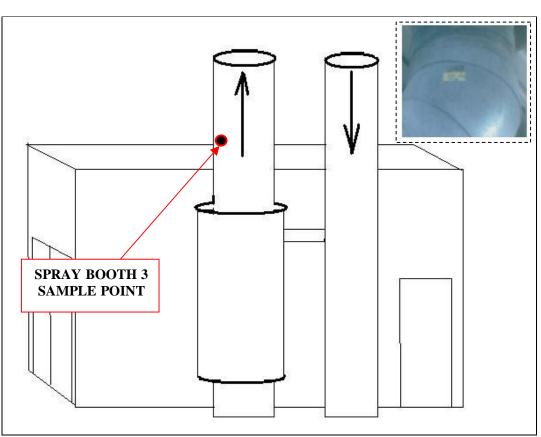


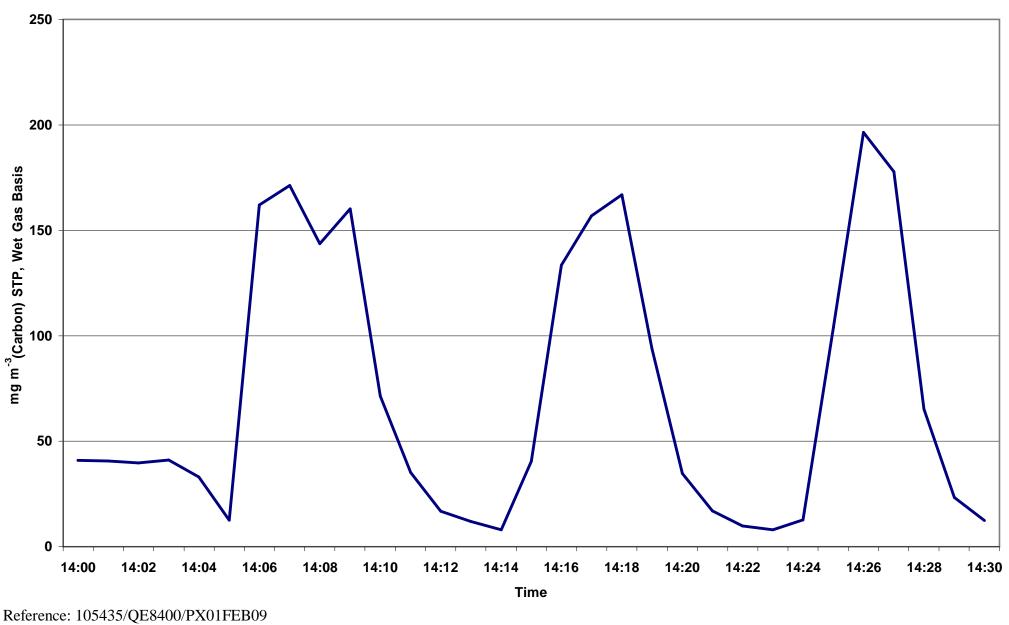
Figure 3. Spray Booth 3 Sample Position

2.2.2 VOC 1 Minute Averaged Graphs

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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



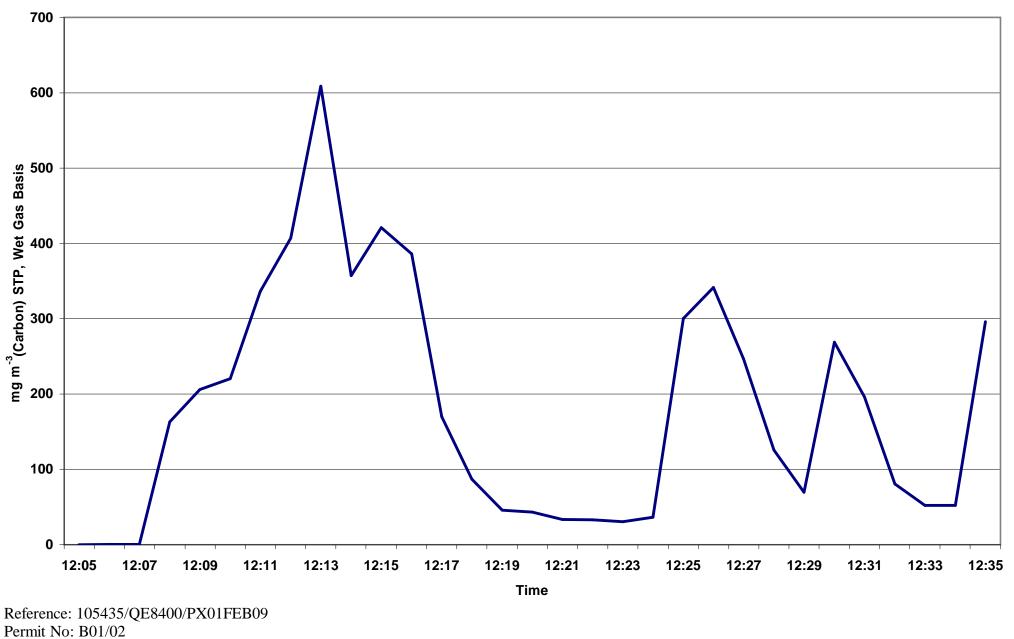
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2.2.2 Figure 4. Spray Booth 1. 1-Minute Averages of Volatile Organic Compounds (VOC). Expressed as mg m⁻³ (Carbon) at 273K, 101.3kPa, Wet Gas Basis

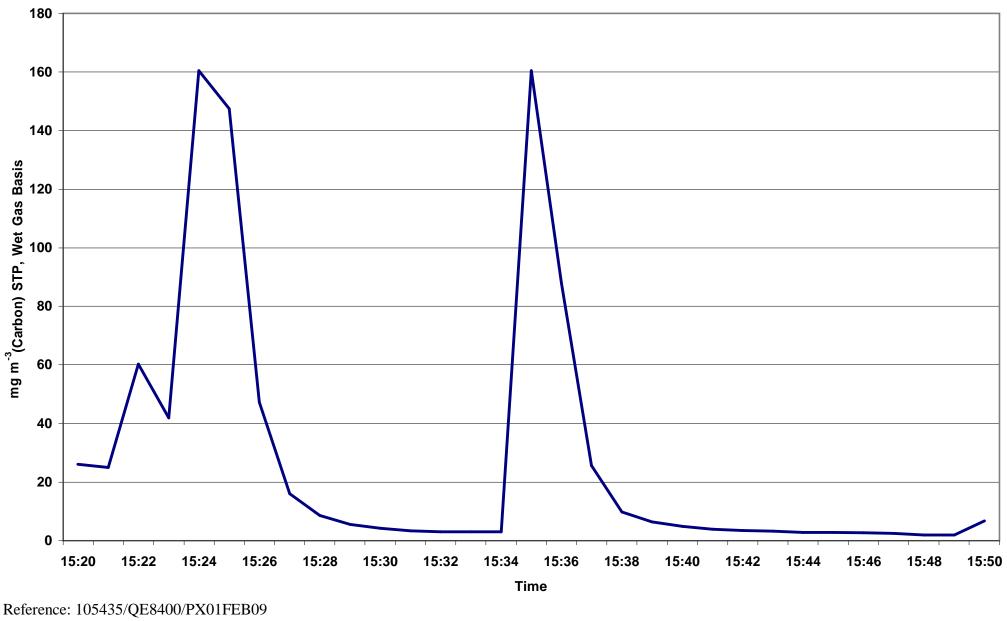


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2.2.2 Figure 5. Spray Booth 2. 1-Minute Averages of Volatile Organic Compounds (VOC). Expressed as mg m⁻³ (Carbon) at 273K, 101.3kPa, Wet Gas Basis



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2.2.3 Gas Measurements

NPL Ltd : 29 Jan 2007 Author: REE

Reference: 105435/QE8400/PX01FEB09 Permit No: B01/02 Checked by:

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ALC BERT	Check Zero Distribute to Job File	Span Adj	Zero Adj	Chock Span	Check Zero	Check Zero	Span Adj	Check Span	Zero Adj	Check Zero	Cal Type	Gas Cyl. No.			
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Calibration Log

Version 1

NPL Ltd : 29 Jan 2007 Author: REE

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Gas Cyl. No. In REFELLENTOR, BREESS URF. IS LESS THAN 500 PSI (.35 bar) CONTAGT SUPPLIER IMMEDIATELY Distribute to Job Check Zerd Check Spar Cal Type Check Zero Span Adi Zuro Adj Check Zerc Check Span Check Zero Spon Adj Zero Adl Instrument SN: Mobile Lab: NEL TROPANE Time (Start and Finish) Ę, 70202V 88 ʰ, 6 -і-СЭ 242.3 COO. G~ 0.043 Initial Reading \odot 020 ୍ଦ୍ୱ S. LO اءاتها Gain/Setting (if app.) 092 525 5 Gas Cyl Чyрe ð ۵ \bigcirc Ñ が ഗ Final Reading F Ó 0000 CÚ **₽**∿ R. ppm propertexe Final Gain/Setting (if app.) Delete 32 SPP しもく e ŝ Date. System(S)/ Direct(D) SPRAY BOTH 6 Õ 5 6 \bigcirc Õ \mathbf{t} *7*. 3 Total Regulator Pressurs (bonPe) delete as app.) ŝ й О ŝ N. 2 $\sum_{i=1}^{N}$ Ş ð p Instrument Range: Response Time : Span Values St. i.e. 1990 14100-1413O 6 Comment ŝ, O 10000 R ŝ nolo 1 Ì $\widehat{\mathcal{A}}$ Ē Signature \$ Ò Œ

Reference: 105435/QE8400/PX01FEB09 Permit No: B01/02 Checked by:

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Reference: 105435/QE8400/PX01FEB09 Permit No: B01/02 Checked by:

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NPL Ltd : 29 Jan 2007 Author: REE

ICEEFILENTOR, REFERENCES LESS THAN 500 PSI/135 bar) CONTAGT, SHIPPHER IMMEDIATELY

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Distribute to Job File	Check Zero	Span Adj	Zero Adj	Check Span	Check Zero	Check Zero	Span Adj	Chock Span	Zero Adj	Check Zero	Cel Type	Gaș Cyl, No.			
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Calibration Log

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:

$$C_{\rm m} = C_v \frac{3 \,\mathrm{x} \,\mathrm{M_c}}{\mathrm{V_m}} \,\mathrm{mg/m^3}$$

where:-

 $C_{\rm m}$ is the TOC concentration in milligrams per cubic metre (273 K;1013 hPa). $C_{\rm v}$ is the volume concentration of propane in ppm (by volume). $M_{\rm c}$ is the molar mass of carbon (=12 g/mole). $V_{\rm M}$ is the molar volume (=22,4 l/mole).

2.2.5 Uncertainty Calculations

Uncertainty calculation for Gaseous Measurement BS EN 13526 VOCs

SPRAY BOOTH 1

Limit value	150	mg.m ³ (corrected) Carbon	Gas	Propane	J I	Correction for refe	rence conditio	ns			
•			Full Scale	1000	ppm			02, %	Moisture, %	Pressure, KPa	ľ
Measured concentration	112.83	ppm	Cal gas conc	51.4	ppm		ref	21.00	0.00) 101	1.30
Measured concentration	181.10	mg.m ⁻³ (273K, 101.3kPa) Carbon	Conversion	0.62305296			measured	21.00	0.00) 101	1.30
			Full Scale	623.0529595	mg.m⁻³ (Carbon)	Factors		1.00	1.00) 1	1.00
			Cal gas conc		mg.m ⁻³ (Carbon)	Correction Factor		1.00			
Performance characteristics		Value			specification			1			
Response time		10 value	seconds		180.000	Effect of drift	mg/m3				
Number of readings in measurement		30	Seconds		160.000		% value				
Repeatability at zero		0.005	% full scale		0.200	0.00	70 value				
Repeatability at span level		0.083	% full scale		2.000						
Deviation from linearity		-1.46	% of value		2.000		ranges				
Zero drift		0	% full scale		2.000		min		alue at calib		
Span drift		0	% full scale		2.000	flow	1.9		2		
volume or pressure flow dependence		0.02	% of full scale/kPa		0.033	pressure	101.30		101.3		
atmospheric pressure dependence		0	% of value/kPa		0.750	temp	289		289		
ambient temperature dependence		0.025	% full scale/10K		0.300	NH3 range	0	-	(
NH3 (20 mg/m3)		0	mg/m3			CO2 range	0		(,	
CO2 (15%)			% by vol		4.000	H2O range	-	0	110		
H2O (30%)		0.0	% by vol		2%fs/10V	Instrument Voltage R	ating 104.5	115.5	110		
dependence on voltage		1.05 0	% full scale/10V			Voltage	104.5	115.5	110)	
losses in the line (leak) Uncertainty of calibration gas		2	% of value % of value		2% of value						
Differentiation gas		Measurement performa		any conditions			1				
Performance characteristic			Uncertainty		Value of uno	certainty quantity					
Standard deviation of repeatability at a	zero		u _{r0}		for mean	use rep at span					
Standard deviation of repeatability at a			Urs		for mean	0.02		Use largest nega	tive or positive i	nterferent effect	
Lack of fit	spanioroi		U _{fit}		loi mouri	-5.25		0	0.00		
Drift			U _{Odr}			0.00		0	0.00		
volume or pressure flow dependence						0.00		0	0.00		
			U _{spres}				-	0			
atmopsheric pressure dependence			Uapres			0.00			0.00	-	
ambient temperature dependence			U _{temp}			0.00		Interference unce	rtainty	0	0.00
NH3 (20 mg/m3)			Uinterf			0.00					
			Uinterf								
CO2 (15%)			Ginterf			0.00					
CO2 (15%) H2O (30%)						0.00					
CO2 (15%)			Uinterf Uvolt			0.00 0.33					
CO2 (15%) H2O (30%)						0.00					
CO2 (15%) H2O (30%) Dependence on voltage			u _{volt}			0.00 0.33					
CO2 (15%) H2O (30%) Dependence on voltage Iosses in the line (leak) Uncertainty of calibration gas		Pecult	U _{volt} U _{leak} U _{caib}	mo/m ³		0.00 0.33 0.00					
CO2 (15%) H2O (30%) Dependence on voltage losses in the line (leak) Uncertainty of calibration gas Measurement uncertainty		Result	U _{volt} U _{leak} U _{caib} 181.10	mg/m ³		0.00 0.33 0.00					
CO2 (15%) H2O (30%) Dependence on voltage losses in the line (leak) Uncertainty of calibration gas Measurement uncertainty Combined uncertainty		Result	u _{vot} U _{leak} U _{calb} 181.10 5.66	mg/m ³		0.00 0.33 0.00					
CO2 (15%) H2O (30%) Dependence on voltage losses in the line (leak) Uncertainty of calibration gas Measurement uncertainty	k =	Result 2	U _{volt} U _{leak} U _{caib} 181.10	· · · ·		0.00 0.33 0.00					
CO2 (15%) H2O (30%) Dependence on voltage losses in the line (leak) Uncertainty of calibration gas Measurement uncertainty Combined uncertainty		Result 2	Uvot Uleak Ucalb 181.10 5.66 11.33 11.33	mg/m ³		0.00 0.33 0.00					

11.33 mg.m⁻³

Note:

Enter values into green boxes

expressed with a level of confidence of 95%

Dark blue boxes indicate information that can be obtained from MCERTS tests

Developed by R Robinson, NPL

Expanded uncertainty

Temperature, K

273.00

273.00

1.00

Uncertainty calculation for Gaseous Measurement BS EN 13526 VOCs

Limitvalue 150		mg.m ^{-s} (corrected)Carbon	Gas	Propane		Correctionforreferenceconditions						
			FullScale	1000) ppm				02, %	Moisture,%	Pressure,KPa	
Measuredconcentration		ppm	Cal gas conc	51.4	ppm			ref	21.00	0.00	101	
Measuredconcentration		mg.m ⁻³ (273K, 101.3kPa) Carbon	Conversion	0.62305296				measured	21.00	0.00	101	
			FullScale	623.0529595	mg.m ⁻³ (Carbon)	F	actors		1.00	1.00) 1	
			Cal gas conc	32.02492212	mg.m ⁻³ (Carbon)	C	Correction Factor		1.00			
Performancecharacteristics		Value			specification		Effect of drift		1			
Responsetime		10	seconds		180.000		0.00	mg/m3	1			
Numberofreadingsinmeasurement		30					0.00	% value				
Repeatability at zero		0.005	% full scale		0.200							
Repeatability at spanlevel		0.083	% full scale		2.000				4			
Deviation from linearity		-1.46	% of value		2.000			ranges				
Zero drift		0	%fullscale		2.000			min	max	valueatcalib		
Span drift		0	%fullscale		2.000	fl	low	1.9	2.1	2	2	
volume or pressure flow dependence)	0.02	% of full scale/kPa		0.033	p	oressure	101.30	101.3	101.3	3	
atmosphericpressuredependence		0	% of value/kPa		0.750	te	emp	289	289	289)	
ambienttemperaturedependence		0.025	%fullscale/10K		0.300	N	NH3 range	0	0	0)	
NH3 (20 mg/m3)		0	mg/m3				CO2 range	0			5	
CO2 (15%)		0	% by vol				120 range	0	0			
H2O (30%)		0.0	% by vol		4.000		nstrumentVoltageR			110		
dependenceonvoltage		1.05	%fullscale/10V		2%fs/10V	V	/oltage	104.5	115.5	110)	
losses in the line (leak)		0	% of value		2% of value							
Uncertainty of calibration gas		2	% of value					1				
Performancecharacteristic		weasurementperform	nancerelatedtostationa	aryconditions	Value afur		in malifier	-				
Standard deviation of repeatability a	t 70r0		Uncertainty uno		for mean	ncertaintyqu	use repat span					
Standard deviation of repeatability at zero Standard deviation of repeatability at span level			u _{ro}		for mean		0.02		l lse largest neg	ative or positive in	nterferenteffect	
Lack of fit			u _{fs}		ior mean		-5.25	-	0000 10190001109			
Drift			U _{0dr}				0.00	1	0	0.00)	
volumeorpressure flow dependence			Uspres				0.00	1	0	0.00)	
atmopshericpressuredependence			Uapres				0.00		0	0.00)	
ambienttemperaturedependence			Utemp				0.00	1	Interferenceund	ertainty	0	
NH3 (20 mg/m3)			Uinterf				0.00	1			<u> </u>	
CO2 (15%)							0.00	1				
H2O (30%)							0.00					
Dependenceonvoltage			U _{vot}				0.33]				
losses in the line (leak)			Uleak				0.00]				
Uncertainty of calibration gas			Ucalib				0.83					
Measurementuncertainty		Result	72.30	mg/m ³	1							
Combineduncertainty			5.33	mg/m ³								
		2	10.66	mg/m ³	-							

Expandeduncertainty	10.66 mg.m ⁻³			
Expandeduncertainty	7.10 % ELV			
Uncertainty corrected to std conds			10.66	mg.m-3(corrected)
Expandeduncertainty	k =	2	10.66	mg/m ³
Combineduncertainty			5.33	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

Reference: 105435/QE8400/PX01FEB09 Permit No: B01/02 Checked by: Temperature, K

273.00 273.00 1.00

Uncertainty calculation for Gaseous Measurement BS EN 13526 VOCs

Limitvalue	150	mg.m ⁻³ (corrected)Carbon	Gas	Propane Correctionforreferenceconditions								
		-	FullScale		ppm				02, %	Moisture,%	Pressure,KPa	Temperature, K
Measuredconcentration	17.76	5 ppm	Cal gas conc	51.4	ppm			ref	21.00	0.00) 101.3	0 273.0
Measuredconcentration	28.50	mg.m ⁻³ (273K,101.3kPa) Carbon	Conversion	0.62305296				measured	21.00	0.00	0 101.3	0 273.0
			FullScale	62.30529595	mg.m ⁻³ (Carbon)	F	actors		1.00	1.00	1.0	0 1.0
			Cal gas conc	32.02492212	mg.m ⁻³ (Carbon)	C	CorrectionFactor		1.00			
Performancecharacteristics		Value			specification		Effect of drift		1			
Responsetime		10	seconds		180.000		0.00) mg/m3				
Numberofreadingsinmeasurement		30					0.00) % value				
Repeatability at zero		0.005	% full scale		0.200							
Repeatabilityatspanlevel		0.083	% full scale		2.000				-			
Deviation from linearity		-1.46	% of value		2.000			ranges				
Zero drift		0	%fullscale		2.000			min	max	valueatcalib		
Span drift		0	%fullscale		2.000	fl	low	1.9		2	2	
volumeorpressureflow dependence		0.02	% of full scale/kPa		0.033	p	oressure	101.30) 101.3	101.3	3	
atmosphericpressuredependence		0	% of value/kPa		0.750		emp	289				
ambienttemperaturedependence		0.025	%fullscale/10K		0.300		NH3 range	0		(
NH3 (20 mg/m3)		0	mg/m3				CO2 range	0				
CO2 (15%) H2O (30%)		0.0	% by vol % by vol		4.000		H2Orange nstrumentVoltageR	() 0	(
dependence on voltage		1.05	% full scale/10V		4.000 2%fs/10V		/oltage	aung 104.5	115.5			
losses in the line (leak)		0	% of value		2% of value	V	ronage	104.3	110.0	III	J	
Uncertainty of calibration gas		2	% of value		2% OF VALUE							
oncontainty of calloration gao		—	nancerelatedtostation	arvconditions				7				
Performancecharacteristic			Uncertainty		Valueofur	ncertaintyqu	uantity					
Standard deviation of repeatability at	t zero		U _{r0}		for mean		use rep at span					
Standard deviation of repeatability at	span level		U _{rs}		for mean		0.02		Use largest neg	ative or positive i	nterferent effect	
Lack of fit			U _{fit}				-0.53		0	0.00)	
Drift			u _{0dr}				0.00		0	0.00)	
volume or pressure flow dependence			U _{spres}				0.00	-	0	0.00		
atmopshericpressuredependence			U _{apres}				0.00		0			
ambienttemperaturedependence			U _{temp}				0.00		Interferenceund		0.0	0
NH3 (20 mg/m3)			u _{interf}				0.00			,		
CO2 (15%)							0.00	-				
H2O (30%)							0.00					
Dependenceonvoltage			U _{volt}				0.33					
losses in the line (leak)			Uleak				0.00					
Uncertainty of calibration gas			Ucalib				0.33					
Measurementuncertainty		Result	28.50	mg/m ³	n in the second s							
Combineduncertainty			0.70	mg/m ³								
Expandeduncertainty	k=	2	1.41	mg/m ³								
Expandeduncentainty	K -		1.41	ing/in								
Uncertainty corrected to std conds			1.41	mg.m-3(corrected)	1							

0.94 % ELV 1.41 mg.m

Note:

Enter values into green boxes

expressed with a level of confidence of 95%

expressed with a level of confidence of 95%

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Expandeduncertainty

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