

# STACK EMISSIONS MONITORING REPORT



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## Operator & Address:

Qioptiq Ltd  
Glascoed Road  
St Asaph  
Denbighshire  
LL17 0LL

## Permit:

EPR Permit: LAPPD DCC/PPC/6.4/036.0

## Release Point:

Holography Processing Plant

## Sampling Date(s):

19th November 2014

<b>ESG Job Number:</b>	LNO 12115
<b>Report Date:</b>	19th December 2014
<b>Version:</b>	1
<b>Report By:</b>	Dominic Houghton
<b>MCERTS Number:</b>	MM 04 529
<b>MCERTS Level:</b>	MCERTS Level 2 - Team Leader
<b>Technical Endorsements:</b>	1, 2, 3 & 4
<b>Report Approved By:</b>	Mark Woodruff
<b>MCERTS Number:</b>	MM 03 164
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<b>Technical Endorsements:</b>	1, 2, 3 & 4
<b>Signature:</b>	



## CONTENTS

### EXECUTIVE SUMMARY

#### Stack Emissions Monitoring Objectives

- Plant
- Operator
- Stack Emissions Monitoring Test House

#### Emissions Summary

#### Monitoring Times

#### Process Details

#### Monitoring Methods

#### Analytical Methods

- Sampling Methods with Subsequent Analysis
- On-Site Testing

#### Sampling Location

- Sampling Plane Validation Criteria
- Duct Characteristics
- Sampling Lines & Sample Points
- Sampling Platform
- Sampling Location / Platform Improvement Recommendations

#### Sampling and Analytical Method Deviations

### APPENDICES

APPENDIX 1 - Monitoring Schedule, Calibration Checklist & Monitoring Team

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 3 - Measurement Uncertainty Budget Calculations

## EXECUTIVE SUMMARY

### MONITORING OBJECTIVES

Qioptiq Ltd operates a holography coating process at St Asaph which is subject to EPR Permit LAPPC DCC/PPC/6.4/036.0, under the Environmental Permitting Regulations 2010.

Environmental Scientifics Group Limited were commissioned by Qioptiq Ltd to carry out stack emissions monitoring to determine the release of prescribed pollutants from the following Plant under normal operating conditions.

The results of these tests shall be used to demonstrate compliance with a set of emission limit values for prescribed pollutants as specified in the Plant's EPR Permit, LAPPC DCC/PPC/6.4/036.0.

#### **Plant**

Holography Processing Plant

#### **Operator**

Qioptiq Ltd  
Glascoed Road  
St Asaph  
Denbighshire  
LL17 0LL

EPR Permit: LAPPC DCC/PPC/6.4/036.0

#### **Stack Emissions Monitoring Test House**

Environmental Scientifics Group Limited - Stockport Laboratory  
Unit 5 Crown Industrial Estate  
Kenwood Road  
Stockport  
SK5 6PH  
UKAS and MCERTS Accreditation Number: 1015

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.  
MCERTS accredited results will only be claimed where both the sampling and analytical stages are UKAS accredited.  
This test report shall not be reproduced, except in full, without written approval of Environmental Scientifics Group Limited.

## EXECUTIVE SUMMARY

EMISSIONS SUMMARY					
Parameter	Units	Result	Calculated Uncertainty <i>+/-</i>	Limit	MCERTS accredited result
Isopropanol	mg/m <sup>3</sup>	93	19	-	✘
Isopropanol Emission Rate	g/hr	851	172	-	
Formaldehyde	mg/m <sup>3</sup>	0.35	0.08	-	✔
Formaldehyde Emission Rate	g/hr	3.2	0.70	-	
Stack Gas Temperature	°C	28.0	-	-	✔
Stack Gas Velocity	m/s	17.0	-	-	
Gas Volumetric Flow Rate (Actual)	m <sup>3</sup> /hr	10156	-	-	
Gas Volumetric Flow Rate (STP, Wet)	m <sup>3</sup> /hr	9113	-	-	
Gas Volumetric Flow Rate (STP, Dry)	m <sup>3</sup> /hr	9022	-	-	
Gas Volumetric Flow Rate at Reference Conditions	m <sup>3</sup> /hr	9113	-	-	

ND = None Detected,

Results at or below the limit of detection are highlighted by bold italic text.

The above volumetric flow rate is calculated using data from the preliminary survey. Mass emissions for non isokinetic tests are calculated using these values. For all isokinetic testing the mass emission is calculated using test specific flow data and not the above values.

Reference conditions are 273K, 101.3kPa without correction for water vapour

## EXECUTIVE SUMMARY

MONITORING TIMES			
Parameter	Sampling Date(s)	Sampling Times	Sampling Duration
Isopropanol Run 1	19 November 2014	10:13 - 10:43	30 minutes
Formaldehyde Run 1	19 November 2014	10:50 - 11:20	30 minutes
Stack Gas Flow Rate & Temperature Run 1	19 November 2014	10:05	-

## EXECUTIVE SUMMARY

PROCESS DETAILS	
Parameter	Process Details
Description of process	Holography Coating
Continuous or batch	Batch
Product Details	Water based paint containing Isopropanol and Formaldehyde
Part of batch to be monitored (if applicable)	Any
Normal load, throughput or continuous rating	Normal throughput
Fuel used during monitoring	N/A
Abatement	None
Plume Appearance	None visible

## EXECUTIVE SUMMARY

### Monitoring Methods

The selection of standard reference / alternative methods employed by Environmental Scientifics Group Limited is determined, wherever possible by the hierarchy of method selection outlined in Environment Agency Technical Guidance Note (Monitoring) M2. i.e. CEN, ISO, BS, US EPA etc.

MONITORING METHODS						
Species	Method Standard Reference Method / Alternative Method	ESG Technical Procedure	UKAS Lab Number	MCERTS Accredited Method	Limit of Detection (LOD)	Calculated MU +/- %
Isopropanol	SRM - BS EN 13649	AE 118	1015	Yes	0.84 mg/m <sup>3</sup>	20.2 %
Formaldehyde	SRM - BS EN 13649	AE 118	1015	Yes	0.008 mg/m <sup>3</sup>	22.3 %
Flow Rate / Temp.	SRM - BS EN 13284-1	AE 122	1015	Yes	5 Pa	-

## EXECUTIVE SUMMARY

### Analytical Methods

The following tables list the analytical methods employed together with the custody and archiving details:

SAMPLING METHODS WITH SUBSEQUENT ANALYSIS							
Species	Analytical Technique	Analytical Procedure	UKAS Lab Number	UKAS Accredited Lab Analysis	Analysis Lab (ESG or Subcontract)	Sample Archive Location	Archive Period
Isopropanol	GC-FID	ASC/SOP/213	1015	No	ESG - Bretby	ESG - Bretby	3 months
Formaldehyde	HPLC	ASC/SOP/201	1015	Yes	ESG -Bretby	ESG -Bretby	3 months

ON-SITE TESTING							
Species	Analytical Technique	Analytical Procedure	UKAS Lab Number	MCERTS Accredited Analysis	Laboratory	Data Archive Location	Archive Period
-	-	-	-	-	-	-	-

## EXECUTIVE SUMMARY

SAMPLING LOCATION					
Sampling Plane Validation Criteria	Value	Units	Requirement	Compliant	Method
Lowest Differential Pressure	177	Pa	$\geq 5$ Pa	Yes	BS EN 13284-1
Lowest Gas Velocity	15.73	m/s	-	-	-
Highest Gas Velocity	18.91	m/s	-	-	-
Ratio of Gas Velocities	1.20	: 1	< 3 : 1	Yes	BS EN 13284-1
Mean Velocity	16.97	m/s	-	-	-
Maximum angle of flow with regard to duct axis	<15	°	< 15°	Yes	BS EN 13284-1
No local negative flow	Yes	-	-	Yes	BS EN 13284-1

DUCT CHARACTERISTICS		
	Value	Units
Shape	Circular	-
Depth	0.46	m
Width	-	m
Area	0.17	m <sup>2</sup>
Port Depth	0	mm

SAMPLING LINES & POINTS			
	Isokinetic (CEN Methods)	Isokinetic (ISO Methods)	Non-Iso & Gases
Sample port size	-	-	1cm Hole
Number of lines used	-	-	1
Number of points / line	-	-	1
Duct orientation	-	-	Vertical
Filtration	-	-	Out Stack

SAMPLING PLATFORM	
General Platform Information	
Permanent / Temporary Platform / Ground level / Floor Level / Roof	Roof
Inside / Outside	Outside

M1 Platform requirements	
Is there a sufficient working area so work can be performed in a compliant manner	Yes
Platform has 2 levels of handrails (approximately 0.5 m & 1.0 m high)	Yes
Platform has vertical base boards (approximately 0.25 m high)	N/A
Platform has removable chains / self closing gates at the top of ladders	N/A
Handrail / obstructions do not hamper insertion of sampling equipment	N/A
Depth of Platform = >Stack depth / diameter + wall and port thickness + 1.5m	Yes

### Sampling Platform Improvement Recommendations (if applicable)

The sampling location meets all the requirements as specified in EA Guidance Note M1.

## EXECUTIVE SUMMARY

### **Sampling & Analytical Method Deviations**

In this instance there were no deviations from the sampling and analytical methods employed.

APPENDICES

**CONTENTS**

APPENDIX 1 - Monitoring Schedule, Calibration Checklist & Monitoring Team

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

APPENDIX 3 - Measurement Uncertainty Budget Calculations

APPENDIX 1 - Monitoring Schedule, Calibration Checklist & Monitoring Team

<b>MONITORING SCHEDULE</b>					
<b>Species</b>	<b>Method</b> Standard Reference Method / Alternative Method	<b>ESG</b> <b>Technical</b> <b>Procedure</b>	<b>UKAS Lab</b> <b>Number</b>	<b>MCERTS</b> <b>Accredited</b> <b>Method</b>	<b>Number of</b> <b>Samples</b>
Isopropanol	SRM - BS EN 13649	AE 118	1015	Yes	1
Formaldehyde	SRM - BS EN 13649	AE 118	1015	Yes	1
Flow Rate / Temp.	SRM - BS EN 13284-1	AE 122	1015	Yes	1

APPENDIX 1 - Monitoring Schedule, Calibration Checklist & Monitoring Team

CALIBRATEABLE EQUIPMENT CHECKLIST					
Extractive Sampling		Instrumental Analyser/s		Miscellaneous	
Equipment	Equipment I.D.	Equipment	Equipment I.D.	Equipment	Equipment I.D.
Control Box DGM	-	Horiba PG-250 Analyser	-	Laboratory Balance	LNO 00-12/00-13
Box Thermocouples	-	FT-IR	-	Tape Measure	LNO 24-DJH
Meter In Thermocouple	-	FT-IR Oven Box	-	Stopwatch	LNO 17-DJH
Meter Out Thermocouple	-	Bernath 3006 FID	-	Protractor	-
Control Box Timer	-	Signal 3030 FID	-	Barometer	LNO 08-DJH
Oven Box	-	Servomex	-	Digital Micromanometer	LNO 01-DJH
Probe	-	JCT Heated Head Filter	-	Digital Temperature Meter	LNO 03-DJH
Probe Thermocouple	-	Thermo FID	-	Stack Thermocouple	-
Probe	-	Stackmaster	-	Mass Flow Controller	LNO 29-67/29-65
Probe Thermocouple	-	FTIR Heater Box for Heated Line	-	MFC Display module	LNO 29-08
S-Pitot	-	Anemometer	-	1m Heated Line (1)	-
L-Pitot	LNO 10-104	Ecophysics NOx Analyser	-	1m Heated Line (2)	-
Site Balance	-	Chiller (JCT/MAK 10)	-	1m Heated Line (3)	-
Last Impinger Arm	-	Heated Line Controller (1)	-	5m Heated Line (1)	-
Dioxins Cond. Thermocouple	-	Heated Line Controller (2)	-	10m Heated Line (1)	-
Callipers	-	Site temperature Logger	-	10m Heated Line (2)	-
Small DGM	-		-	15m Heated Line (1)	-
Heater Controller	-		-	20m Heated Line (1)	-
Inclinometer (Swirl Device)	LNO 23-DJH		-	20m Heated Line (2)	-

NOTE: If the equipment I.D is represented by a dash (-), then this piece of equipment has not been used for this test.

CALIBRATION GASES					
Gas (traceable to ISO 17025)	Cylinder I.D Number	Supplier	ppm	%	Analytical Tolerance +/- %
-	-	-	-	-	-

APPENDIX 1 - Monitoring Schedule, Calibration Checklist & Monitoring Team

**STACK EMISSIONS MONITORING TEAM**

Team Leader

Dominic Houghton  
MCERTS Level 2, Technical Endorsements 1, 2, 3 & 4  
MM 04 529  
MCERTS Expiry Date - Dec 2016  
H&S Expiry Date - Sep 2019

Technician

Mark Derbyshire  
MCERTS Level 1, Technical Endorsement 1  
MM 07 824  
MCERTS Expiry Date - Dec 2017  
H&S Expiry Date - Apr 2017

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

<b>ISOPROPANOL SUMMARY</b>					
Test	Sampling Times	Concentration mg/m <sup>3</sup>	LOD mg/m <sup>3</sup>	Limit mg/m <sup>3</sup>	Emission Rate g/hr
Run 1	10:13 - 10:43 19 November 2014	93	0.84	-	851
Field Blank	-	0.83	-	-	-

Reference conditions are 273K, 101.3kPa without correction for water vapour

**ISOPROPANOL QUALITY ASSURANCE CHECKLIST**

Leak Test Results	Mean Sampling Rate l/min	Pre sampling leak rate l/min	Post sampling leak rate l/min	Acceptable leak rate l/min	Leak Tests Acceptable?
Run 1	0.2	0.003	0.003	0.004	Yes

	Type of tube	Max. Tube Temperature °C	Max. Storage / Transit Temp. °C
Run 1	Charcoal	20	18

Tube sampling temperature should be < 40°C

**ISOPROPANOL ADSORPTION EFFICIENCY**

Parameter	Total ug	Back ug	Adsorption Efficiency %	Acceptable Adsorption Efficiency %	Adsorption Efficiency Acceptable ?
Run 1	555	5	99	95	N/A - No ELV

N/A - As Isopropanol does not have an emission limit an absorption efficiency is not required.

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

FORMALDEHYDE SUMMARY					
Test	Sampling Times	Concentration mg/m <sup>3</sup>	LOD mg/m <sup>3</sup>	Limit mg/m <sup>3</sup>	Emission Rate g/hr
Run 1	10:50 - 11:20 19 November 2014	0.35	0.008	-	3.2
Field Blank	-	0.03	-	-	-

Reference conditions are 273K, 101.3kPa without correction for water vapour

**FORMALDEHYDE QUALITY ASSURANCE CHECKLIST**

Leak Test Results	Mean Sampling Rate l/min	Pre sampling leak rate l/min	Post sampling leak rate l/min	Acceptable leak rate l/min	Leak Tests Acceptable?
Run 1	0.2	0.002	0.003	0.004	Yes

	Type of tube	Max. Tube Temperature °C	Max. Storage / Transit Temp. °C
Run 1	Treated Silica	21	18

Tube sampling temperature should be < 40°C

**FORMALDEHYDE ADSORPTION EFFICIENCY**

Parameter	Total ug	Back ug	Adsorption Efficiency %	Acceptable Adsorption Efficiency %	Adsorption Efficiency Acceptable ?
Run 1	2.08	0.08	96	95	N/A - No ELV

N/A - As Formaldehyde does not have an emission limit an absorption efficiency is not required.

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

**PRELIMINARY STACK SURVEY**

Stack Characteristics		
Stack Diameter / Depth, D	0.46	m
Stack Width, W	-	m
Stack Area, A	0.17	m <sup>2</sup>
Average stack gas temperature	28	°C
Stack static pressure	0.22	kPa
Barometric Pressure	100	kPa
Pitot tube calibration coefficient, $K_{pt}$	0.90	-

Stack Gas Composition & Molecular Weights								
Component	Molar Mass M	Density kg/m <sup>3</sup> p	Conc Dry % Vol	Dry Volume Fraction r	Dry Conc kg/m <sup>3</sup> pi	Conc Wet % Vol	Wet Volume Fraction r	Wet Conc kg/m <sup>3</sup> pi
CO <sub>2</sub>	44	1.963059	0.030000	0.000300	0.000589	0.029700	0.000297	0.000583
O <sub>2</sub>	32	1.427679	20.950000	0.209500	0.299099	20.740500	0.207405	0.296108
N <sub>2</sub>	28	1.249219	79.020000	0.790200	0.987133	78.229800	0.782298	0.977262
H <sub>2</sub> O	18	0.803070	-	-	-	1.000000	0.010000	0.008031

Where:  $p = M / 22.41$      $pi = r \times p$

Calculation of Stack Gas Densities		
Determinand	Result	Units
Dry Density (STP), $P_{STD}$	1.2868	kg/m <sup>3</sup>
Wet Density (STP), $P_{STW}$	1.2820	kg/m <sup>3</sup>
Dry Density (Actual), $P_{Actual}$	1.1547	kg/m <sup>3</sup>
Average Wet Density (Actual), $P_{ActualW}$	1.150	kg/m <sup>3</sup>

Where:

$P_{STD}$  = sum of component concentrations, kg/m<sup>3</sup> (not including water vapour)

$P_{Actual} = P_{STD} \times (Ts / Ps) \times (Pa / Ta)$

$P_{STW} = (P_{STD} + pi \text{ of H}_2\text{O}) / (1 + (pi \text{ of H}_2\text{O} / 0.8036))$

$P_{ActualW} = P_{STW} \times (Ts / Ps) \times (Pa / Ta)$

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

**PRELIMINARY STACK SURVEY**

**TRAVERSE 1**

Date of Survey	19 November 2014
Time of Survey	10:05
Velocity Measurement Device:	L-Type Pitot

Sampling Line A							
Traverse Point	Distance into duct (m)	$\Delta P_{pt}$ mmH <sub>2</sub> O	$\Delta P_{pt}$ Pa	Temp °C	Velocity m/s	O <sub>2</sub> % Vol	Angle of Swirl °
1	0.02	20.0	196	28	16.59	-	<15
2	0.07	18.0	176	28	15.73	-	<15
3	0.12	19.0	186	28	16.17	-	<15
4	0.16	20.0	196	28	16.59	-	<15
5	0.21	21.0	206	28	16.99	-	<15
6	0.25	22.0	216	28	17.39	-	<15
7	0.30	24.0	235	28	18.17	-	<15
8	0.35	22.0	216	28	17.39	-	<15
9	0.39	23.0	225	28	17.79	-	<15
10	0.44	23.0	225	28	17.79	-	<15
Mean	-	21.2	208	28	17.06	-	

Sampling Line B							
Traverse Point	Distance into duct (m)	$\Delta P_{pt}$ mmH <sub>2</sub> O	$\Delta P_{pt}$ Pa	Temp °C	Velocity m/s	O <sub>2</sub> % Vol	Angle of Swirl °
1	0.02	18.0	176	28	15.73	-	<15
2	0.07	24.0	235	28	18.17	-	<15
3	0.12	26.0	255	28	18.91	-	<15
4	0.16	22.0	216	28	17.39	-	<15
5	0.21	20.0	196	28	16.59	-	<15
6	0.25	19.0	186	28	16.17	-	<15
7	0.30	18.0	176	28	15.73	-	<15
8	0.35	20.0	196	28	16.59	-	<15
9	0.39	20.0	196	28	16.59	-	<15
10	0.44	21.0	206	28	16.99	-	<15
Mean	-	20.8	204	28	16.89	-	

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

**PRELIMINARY STACK SURVEY (CONTINUED)**

Sampling Plane Validation Criteria				
EA Technical Guidance Note (Monitoring) M1	Result	Units	Requirement	Compliant
Lowest Differential Pressure	176.4	Pa	>= 5 Pa	Yes
Lowest Gas Velocity	15.73	m/s	-	-
Highest Gas Velocity	18.91	m/s	-	-
Ratio of Gas Velocities	1.20	-	< 3 : 1	Yes
Maximum angle of flow with regard to duct axis	0	°	< 15°	Yes
No local negative flow	Yes	-	-	Yes

Calculation of Stack Gas Velocity, V		
Velocity at Traverse Point, $V = K_{pt} \times (1-\epsilon) \times \sqrt{2 * \Delta P_{pt} / \rho_{ActualW}}$		
<b>Where:</b>		
$K_{pt}$ = Pitot tube calibration coefficient		
$(1-\epsilon)$ = Compressibility correction factor, assumed at a constant 0.998		
Average Stack Gas Velocity, Va	16.97	m/s

Calculation of Stack Gas Volumetric Flowrate, Q			
Duct gas flow conditions	Actual	Reference	Units
Temperature	28	0	°C
Total Pressure	100.22	101.3	kPa
Oxygen	21.0	21	%
Moisture	1.00	1.00	%

Gas Volumetric Flowrate	Result	Units
Average Stack Gas Velocity (Va)	16.97	m/s
Stack Area (A)	0.17	m <sup>2</sup>
Gas Volumetric Flowrate (Actual), Q <sub>Actual</sub>	10156	m <sup>3</sup> /hr
Gas Volumetric Flowrate (STP, Wet), Q <sub>STP</sub>	9113	m <sup>3</sup> /hr
Gas Volumetric Flowrate (STP, Dry), Q <sub>STP,Dry</sub>	9022	m <sup>3</sup> /hr
Gas Volumetric Flowrate (REF), Q <sub>Ref</sub>	9113	m <sup>3</sup> /hr

**Where:**  
 $Q_{Actual} = Va \times A \times 3600$   
 $Q_{STP} = Q (Actual) \times (Ts / Ta) \times (Pa / Ps) \times 3600$   
 $Q_{STP,Dry} = Q (STP) / (100 - (100 / Ma)) \times 3600$   
 $Q_{Ref} = Q (STP) \times ((100 - Ma) / (100 - Ms)) \times ((20.9 - O_{2a}) / (20.9 - O_{2s}))$

**Nomenclature:**  
Ts = Absolute Temperature, Standard Conditions, 273 K  
Ps = Absolute Pressure, Standard Conditions, 101.3 kPa  
Ta = Absolute Temperature, Actual Conditions, K  
Pa = Absolute Pressure, Actual Conditions, kPa  
Ma = Water vapour, Actual Conditions, % Vol  
Ms = Water vapour, Reference Conditions, % Vol  
O<sub>2a</sub> = Oxygen, Actual Conditions, % Vol  
O<sub>2s</sub> = Oxygen, Reference Conditions, % Vol



APPENDIX 3 - Measurement Uncertainty Budget Calculations

**MEASUREMENT UNCERTAINTY BUDGET - ISOPROPANOL**

Run	Sampled Volume m <sup>3</sup>	Sampled Gas Temp K	Sampled Gas Pressure kPa	Sampled Gas Humidity % by volume	Oxygen Content % by volume	Limit of Detection % by mass	Leak %	Uncollected Mass mg
<b>MU required</b>	<b>≤ 2%</b>	<b>≤ 2%</b>	<b>≤ 1%</b>	<b>≤ 1%</b>	<b>≤ 10%</b>	<b>≤ 5% of ELV</b>	<b>≤ 2%</b>	<b>≤ 10% of ELV</b>
Run 1	0.000004	2	0.5	1	N/A	0.005	-	-
as a %	0.0667	0.6826	0.4989	1.0000	N/A	N/A	1.5000	N/A
<b>compliant?</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>N/A</b>	<b>N/A</b>	<b>Yes</b>	<b>N/A</b>

Run	Volume (STP) m <sup>3</sup>	Mass of Isopropanol mg	O2 Correction -	Leak mg/m <sup>3</sup>	Uncollected Mass mg	Lab Uncertainty mg	Combined uncertainty
Run 1	0.006	0.555	1.000	0.809	0.003	-	-
MU as mg/m <sup>3</sup>	0.000	0.842	-	0.809	0.486	9.343	<b>9.429</b>
MU as %	0.000	0.901	-	0.866	0.520	10.000	-

<b>R1 - Uncertainty expressed at a 95% confidence level (where k = 2)</b>	<b>18.857</b>	<b>mg/m<sup>3</sup></b>	<b>20.18</b>	<b>%</b>
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Developed for the STA by R Robinson, NPL

APPENDIX 3 - Measurement Uncertainty Budget Calculations

**MEASUREMENT UNCERTAINTY BUDGET - FORMALDEHYDE**

Run	Sampled Volume m <sup>3</sup>	Sampled Gas Temp K	Sampled Gas Pressure kPa	Sampled Gas Humidity % by volume	Oxygen Content % by volume	Limit of Detection % by mass	Leak %	Uncollected Mass mg
<b>MU required</b>	<b>≤ 2%</b>	<b>≤ 2%</b>	<b>≤ 1%</b>	<b>≤ 1%</b>	<b>≤ 10%</b>	<b>≤ 5% of ELV</b>	<b>≤ 2%</b>	<b>≤ 10% of ELV</b>
Run 1	0.000004	2	0.5	1	N/A	0.00005	-	-
as a %	0.0667	0.6803	0.4989	1.0000	N/A	N/A	1.5000	N/A
<b>compliant?</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>N/A</b>	<b>N/A</b>	<b>Yes</b>	<b>N/A</b>

Run	Volume (STP) m <sup>3</sup>	Mass of Formaldehyde mg	O <sub>2</sub> Correction -	Leak mg/m <sup>3</sup>	Uncollected Mass mg	Lab Uncertainty mg	Combined uncertainty
Run 1	0.006	0.002	1.000	0.003	0.000	-	-
MU as mg/m <sup>3</sup>	0.000	0.008	-	0.003	0.014	0.035	<b>0.039</b>
MU as %	0.000	2.404	-	0.866	4.164	10.000	-

<b>R1 - Uncertainty expressed at a 95% confidence level (where k = 2)</b>	<b>0.077</b>	<b>mg/m<sup>3</sup></b>	<b>22.26</b>	<b>%</b>
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Developed for the STA by R Robinson, NPL

**END OF REPORT**