



# Envirocare

CONSULTANCY

## Report for the Periodic Monitoring of Emissions to Air

Part 1: Executive Summary  
Permit Number: Unknown  
Operator: Wyndeham Heron  
Installation: Printworks



Monitoring dates: 1<sup>st</sup> – 2<sup>nd</sup> September

Address: Wyndeham Heron  
The Bethnal Complex  
Colchester Road  
Maldon  
Essex

Monitoring Organisation: Envirocare Technical Consultancy Ltd  
St Blaise House  
Vaughan Street  
Bradford  
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Report Number: J-4029  
Version Number: 1  
Date of Report: 11<sup>th</sup> September 2009  
Report Approved By: Mr C G Mann  
MCERTS Registration Number: MM 06 695  
Function: Environmental Consultant

Signed:

Contents	Page Number
<b>Part 1 : Executive Summary</b>	
1.1 Monitoring Objectives	3
1.2 Monitoring Results	4
1.3 Operating Information	7
1.4 Monitoring Deviations	8
<b>Part 2 : Supporting Information</b>	
2.1 Appendix 1 : General Information	9
2.2 Appendix 2 : Results and Discussion	12

## Part 1: Executive Summary

### 1.1 Monitoring Objectives

Wyndeham Heron operate several printing process lines that have the potential to release controlled substances to atmosphere, and are subject to authorisation under the Environmental Protection Act 1990 (EPA). Under the act, Local Authorities regulate the printing processes with guidance from the Process Guidance Note PG6/16(04): Printworks.

In order for Wyndeham Heron to comply with its annual emission limits they have requested that Envirocare Technical Consultancy undertake a monitoring exercise on all of the thermal oxidiser abatement units and from the waste transport system compactor. The methodologies and results obtained form the basis of this report.

The 2 Rotoman presses have two print lines that run simultaneously and are located one above the other, each press has its own dryer, each with a duct exiting the dryer and emitting vertically alongside one another. The two Lithomans, each have a dedicated dryer.

### Emission Point Identification

Substances to Be Monitored	Rotoman 2		Rotoman 3		Lithoman 1	Lithoman 2	Compactor
	Lower	Upper	Lower	Upper			
CO	✓	✓	✓	✓	✓	✓	
NOx	✓	✓	✓	✓	✓	✓	
SO <sub>2</sub>	✓	✓	✓	✓	✓	✓	
VOCs	✓	✓	✓	✓	✓	✓	
Particulates							✓

## 1.2 Monitoring Results

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Uncertainty	Units	Reference Conditions	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method	Operating Status
Rotoman 2 Lower	CO	100	<b>47.6</b>	5.48	mg/Nm <sup>3</sup>	273 K, 101.3 kPa	01/09/09	15:21 – 16:41	BS EN 15058	MCERTS	Normal
	NOx	100	<b>45.5</b>	9.39	mg/Nm <sup>3</sup>	273 K, 101.3 kPa			BS EN 14792	MCERTS	Normal
	SO <sub>2</sub>	N/A	<b>8.4</b>	11.25	mg/Nm <sup>3</sup>	273 K, 101.3 kPa		EA TGN M 21	MCERTS	Normal	
	VOCs	20	<b>6.5</b>	0.80	mg/Nm <sup>3</sup>	273 K, 101.3 kPa		BS EN 12619	MCERTS	Normal	
Rotoman 2 Upper	CO	100	<b>54.4</b>	5.81	mg/Nm <sup>3</sup>	273 K, 101.3 kPa	01/09/09	17:29 – 18:51	BS EN 15058	MCERTS	Normal
	NOx	100	<b>58.1</b>	9.55	mg/Nm <sup>3</sup>	273 K, 101.3 kPa			BS EN 14792	MCERTS	Normal
	SO <sub>2</sub>	N/A	<b>8.1</b>	11.25	mg/Nm <sup>3</sup>	273 K, 101.3 kPa		EA TGN M 21	MCERTS	Normal	
	VOCs	20	<b>5.4</b>	0.79	mg/Nm <sup>3</sup>	273 K, 101.3 kPa		BS EN 12619	MCERTS	Normal	

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Uncertainty	Units	Reference Conditions	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method	Operating Status
Rotoman 3 Lower	CO	100	<b>77.8</b>	7.10	mg/Nm <sup>3</sup>	273 K, 101.3 kPa	02/09/09	10:04 – 11:01	BS EN 15058	MCERTS	Normal
	NOx	100	<b>56.9</b>	9.53	mg/Nm <sup>3</sup>	273 K, 101.3 kPa			BS EN 14792	MCERTS	Normal
	SO <sub>2</sub>	N/A	<b>7.7</b>	11.25	mg/Nm <sup>3</sup>	273 K, 101.3 kPa		EA TGN M 21	MCERTS	Normal	
	VOCs	20	<b>1.9</b>	0.77	mg/Nm <sup>3</sup>	273 K, 101.3 kPa		BS EN 12619	MCERTS	Normal	
Rotoman 3 Upper	CO	100	<b>39.2</b>	5.11	mg/Nm <sup>3</sup>	273 K, 101.3 kPa	11:43 – 16:02		BS EN 15058	MCERTS	Normal
	NOx	100	<b>65.2</b>	9.66	mg/Nm <sup>3</sup>	273 K, 101.3 kPa			BS EN 14792	MCERTS	Normal
	SO <sub>2</sub>	N/A	<b>5.4</b>	11.24	mg/Nm <sup>3</sup>	273 K, 101.3 kPa		EA TGN M 21	MCERTS	Normal	
	VOCs	20	<b>1.3</b>	.76	mg/Nm <sup>3</sup>	273 K, 101.3 kPa		BS EN 12619	MCERTS	Normal	

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Uncertainty	Units	Reference Conditions	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method	Operating Status
Lithoman 1	CO	100	<b>78.5</b>	6.80	mg/Nm <sup>3</sup>	273 K, 101.3 kPa	01/09/09	15:48 – 17:50	BS EN 15058	MCERTS	Normal
	NOx	100	<b>69.9</b>	5.06	mg/Nm <sup>3</sup>	273 K, 101.3 kPa			BS EN 14792	MCERTS	Normal
	SO <sub>2</sub>	N/A	<b>5.2</b>	19.8	mg/Nm <sup>3</sup>	273 K, 101.3 kPa	EA TGN M 21	MCERTS	Normal		
	VOCs	20	<b>1.3</b>	0.76	mg/Nm <sup>3</sup>	273 K, 101.3 kPa		BS EN 12619	MCERTS	Normal	
Lithoman 2	CO	100	<b>74.9</b>	6.58	mg/Nm <sup>3</sup>	273 K, 101.3 kPa	02/09/09	15:33 – 17:38	BS EN 15058	MCERTS	Normal
	NOx	100	<b>74.4</b>	5.21	mg/Nm <sup>3</sup>	273 K, 101.3 kPa			BS EN 14792	MCERTS	Normal
	SO <sub>2</sub>	N/A	<b>4.7</b>	19.8	mg/Nm <sup>3</sup>	273 K, 101.3 kPa	EA TGN M 21	MCERTS	Normal		
	VOCs	20	<b>4.6</b>	0.78	mg/Nm <sup>3</sup>	273 K, 101.3 kPa	BS EN 12619	MCERTS	Normal		
Compactor	Particulates	N/A	<b>2.05</b>	N/A	mg/Nm <sup>3</sup>	273 K, 101.3 kPa	02/09/09	12:29 – 15:38	MDHS 14/3	None	Normal

## 1.3 Operating Information

Emission Point Reference	Date	Process Type	Process Duration	Fuel	Feedstock	Abatement	Load
Rotoman 2 Lower	01/09/09	Drying Unit	Continuous with exceptions for paper and press changes	Natural Gas	N/A	MEGTEC Summit II	Trail Magazine 45,000 cph
Rotoman 2 Upper	01/09/09	Drying Unit	Continuous with exceptions for paper and press changes	Natural Gas	N/A	MEGTEC Summit II	Travel Magazine 43,000 cph
Rotoman 3 Lower	02/09/09	Drying Unit	Continuous with exceptions for paper and press changes	Natural Gas	N/A	MEGTEC Summit II	Champions League Magazine 40,000 cph
Rotoman 3 Upper	02/09/09	Drying Unit	Continuous with exceptions for paper and press changes	Natural Gas	N/A	MEGTEC Summit II	Champions League Magazine 40,000 cph
Lithoman 1	01/09/09	Drying Unit	Continuous with exceptions for paper and press changes	Natural Gas	N/A	MEGTEC DuelDry TNV	Yachting Magazine 60,000 cph
Lithoman 2	02/09/09	Drying Unit	Continuous with exceptions for paper and press changes	Natural Gas	N/A	MEGTEC DuelDry TNV	The Spectator Unknown speed
Compactor	02/09/09	Compactor	When required	N/A	Waste paper	Bag Filter	N/A

## 1.4 Monitoring Deviations

Emission Point Reference		Substance Deviations	Monitoring Deviations	Other Relevant Issues
Rotoman 2	Lower	N/A	N/A	N/A
	Upper	N/A	N/A	N/A
Rotoman 3	Lower	N/A	N/A	N/A
	Upper	N/A	N/A	N/A
Lithoman 1		N/A	N/A	N/A
Lithoman 2		N/A	N/A	N/A
Compactor		N/A	N/A	N/A

## Part 2: Supporting Information

### 2.1 Appendix 1: General Information

#### 2.1.1 Monitoring organisation staff details

Mr Chris Mann	MCERTS Level 2 (TE1, TE2, TE3, TE4)	MM06 695
Mr David Fisher	MCERTS Level 1	MM08 963

#### 2.1.2 Monitoring organisation method details

##### 2.1.2.1 Combustion Gases

Combustion gases were monitored using a Horiba Combustion Gas Analyser (Model PG250) that monitors the gaseous emissions by appropriate systems for the gas in question. Carbon Monoxide, CO and Sulphur Dioxide, SO<sub>2</sub> are assessed by NDIR (pneumatic) and NO<sub>x</sub> by chemiluminescence. It has an internal pump to draw a sample of the gas through the analyser at a rate of 0.4litres per minute.

Sample gases were drawn through a stainless steel tube, inserted into the stack, connected to a heated line (150°C) containing a heated PTFE filter. The heated line was, in turn, connected to a Testoterm Gas Preparation Unit, GPU, (Model 339) which contained a Peltier Cooler to condition the gas by removing moisture from the sampled gas down to around 1%, to enable a dried gas stream to be presented to the analyser. A PTFE tube connected the output from the GPU to the input connection to the Horiba analyser.

When the instrument had warmed up (60 mins), each pollutant was zeroed by passing 100% N<sub>2</sub> directly to the analyser. The analyser was then calibrated for each target pollutant with an appropriate calibration gas. Nitrogen was then passed directly to analyser again to ensure no zero drift. Nitrogen was then passed through the whole sampling system to ensure there were no leaks in the system (an Oxygen reading of greater than 0.1% would indicate the presence of a leak). Each calibration gas was then passed down the entire system to ensure there is no loss or absorption of the target pollutants. The measured value must be within  $\pm 2\%$  of the calibration gas value. At the end of the test nitrogen was passed down the entire system to check the zero values and then each calibration gas was passed down to the system to check for drift. If the post test calibration value is within 2% of the calibration gas value no action is required. If the obtained value is between 2-5% of the calibration gas value the drift must be compensated for. If the drift is greater than 5% the test is invalid.

The analyser was connected to a portable laptop computer running custom EDA 2000 data logging software, which enables the future processing of results. Readings were logged at 15-second intervals during calibration and 30-second intervals during monitoring periods. The conversion of the logged data in ppm to mg/m<sup>3</sup> and correction to standard conditions (273K & 101.3 kPa) was subsequently carried out for each Table. The average, maximum, and minimum values over the whole monitoring period are displayed for each parameter.

##### 2.1.2.2 Volatile Organic Compounds (VOCs)

All emissions were monitored for total VOCs utilising a portable organic vapour analyser fitted with a flame ionisation detector (Signal 3030PM). Gases were fed into the analysers along 5 and 15 metre heated lines.

#### a) Calibration

When the instrument had warmed up and stabilised, it was zeroed electronically by drawing sampled air over a catalyst to remove organic species, and (if required) adjusting the analyser to read 0.0 ppm. The "CAL" button on the analyser was then pressed to set the analyser to this value.

A certified span gas, traceable to National Standards, was then fed directly to the analyser through the SPAN port. If required the value displayed on the unit was adjusted to read the certified value. The "CAL" button was then pressed to set this value. The calibration gas was then sampled down the entire sampling system to ensure no leaks, absorption or loss of pollutant. It is required that the value obtained whilst sampling down the entire system is within  $\pm 2\%$  of the value obtained when sampling directly to the analyser.

At the end of the sampling period calibration gas was sampled down the entire system again to ensure the analyser hadn't drifted.

#### b) Sampling

The gaseous emissions were sampled directly from the stack, using the sampling hole in each duct, through a stainless steel probe and along the PTFE lined heated sample line to the instrument. An integral-heated PTFE filter in the input to the instrument removes any fine particulate matter material present in the sample gas.

#### c) Data collection

Data was collected by custom-designed Sigems data logging software (V1.8 or V1.0) at approximately 30-second intervals directly onto a laptop computer.

In all cases, the VOC level was measured as parts per million (ppm) of propane. The data obtained were then converted to express the concentration as  $\text{mg}/\text{Nm}^3$ , with respect to propane, and as carbon content.

#### 2.1.2.3 Particulate Monitoring

Ideally, particulate monitoring would follow the methodology described in BS EN 13284 or BS ISO 9096. However, due to the construction of the duct, specifically the absence of suitable place to locate a sampling plane, sampling of particulate matter from the waste paper compactor extract followed the requirements of MDHS 14.

Four 25mm glass fibre filters were attached to the wire mesh fastened across the duct face directly in the airstream. Each filter had been previously weighed. It was then inserted into a carrier head and attached to a sampling pump. The pump was calibrated at 2 litres per minute and then checked at the end of the test. On returning to base the filters were reweighed and the results inputted into the relevant spreadsheet in order to calculate the concentration of particulate and the mass emission rate.

#### 2.1.2.4 Standard Reference Conditions

There is a requirement under the Environmental Protection Act that all pollutants should be expressed at standard reference conditions of 273 K and 101.3 kPa. Hence the temperatures and local barometric pressure should be measured in order to correct the data and thus to express them at the reference conditions. These parameters were measured as follows:

#### 2.1.2.5 Temperature

The duct and ambient temperatures were monitored via a stainless steel sheathed Type K thermocouple (1.5 mm diameter) coupled to an electronic digital reader.

**2.1.2.6 Local Atmospheric Pressure**

An aneroid barometer (Luft Model) was used to measure the atmospheric pressure on each day of monitoring.

## 2.2 Appendix 2 : Results and Discussion

### 2.2.1 Rotoman 2, Lower

Monitoring on the Lower Drier was carried out on the 1<sup>st</sup> September at 15:21 – 16:41. The average concentration of CO emitted during this time was shown to be 47.6 mg/Nm<sup>3</sup>; well below the emission limit value of 100mg/Nm<sup>3</sup>. The average concentration of NOx emitted during this time was shown to be 45.5 mg/Nm<sup>3</sup>; also well below the emission limit value of 100mg/Nm<sup>3</sup>. The average concentration of SO<sub>2</sub> emitted during this time was shown to be 8.4 mg/Nm<sup>3</sup>; the permit does not include an emission limit value for SO<sub>2</sub>. The average concentration of VOCs emitted during this time was shown to be 6.5 mg/Nm<sup>3</sup>; well below the emission limit value of 20mg/Nm<sup>3</sup>.

The data collected is graphically represented in Figure 1, with further monitoring details found in Tables 1a – 1d.

### 2.2.2 Rotoman 2, Upper

Monitoring on the Upper Drier was carried out on the 1<sup>st</sup> September at 17:29 – 18:51. The average concentration of CO emitted during this time was shown to be 54.4 mg/Nm<sup>3</sup>; well below the emission limit value of 100mg/Nm<sup>3</sup>. The average concentration of NOx emitted during this time was shown to be 58.1 mg/Nm<sup>3</sup>; also well below the emission limit value of 100mg/Nm<sup>3</sup>. The average concentration of SO<sub>2</sub> emitted during this time was shown to be 8.1 mg/Nm<sup>3</sup>; as previously stated, the permit does not include an emission limit value for SO<sub>2</sub>. The average concentration of VOCs emitted during this time was shown to be 5.4 mg/Nm<sup>3</sup>; well below the emission limit value of 20mg/Nm<sup>3</sup>.

The data collected is graphically represented in Figure 2, with further monitoring details found in Tables 1a, 1b, 2a & 2b.

### 2.2.3 Rotman 3, Lower

Monitoring on the Lower Drier was carried out on the 2<sup>nd</sup> September at 10:04 – 11:01. The average concentration of CO emitted during this time was shown to be 77.8 mg/Nm<sup>3</sup>; below the emission limit value of 100mg/Nm<sup>3</sup>. The average concentration of NOx emitted during this time was shown to be 56.9 mg/Nm<sup>3</sup>; comfortably below the emission limit value of 100mg/Nm<sup>3</sup>. The average concentration of SO<sub>2</sub> emitted during this time was shown to be 7.7 mg/Nm<sup>3</sup>. The average concentration of VOCs emitted during this time was shown to be 1.9 mg/Nm<sup>3</sup>; well below the emission limit value of 20mg/Nm<sup>3</sup>.

The data collected is graphically represented in Figure 3, with further monitoring details found in Tables 3a – 3d.

### 2.2.4 Rotoman 3, Upper

Monitoring on the Upper Drier was carried out on the 2<sup>nd</sup> September at 11:43 – 16:02. The average concentration of CO emitted during this time was shown to be 39.2 mg/Nm<sup>3</sup>; well below the emission limit value of 100mg/Nm<sup>3</sup>. The average concentration of NOx emitted during this time was shown to be 65.2 mg/Nm<sup>3</sup>; also well below the emission limit value of 100mg/Nm<sup>3</sup>. The average concentration of SO<sub>2</sub> emitted during this time was shown to be 5.4 mg/Nm<sup>3</sup>. The average concentration of VOCs emitted during this time was shown to be 1.3 mg/Nm<sup>3</sup>; well below the emission limit value of 20mg/Nm<sup>3</sup>.

The data collected is graphically represented in Figure 4, with further monitoring details found in Tables 3a, 3b, 4a & 4b.

### 2.2.5 Lithoman 1

Monitoring on Lithoman 1 was carried out on the 1<sup>st</sup> September at 15:48 – 17:50. The average concentration of CO emitted during this time was shown to be 78.5 mg/Nm<sup>3</sup>; below the emission limit value of 100mg/Nm<sup>3</sup>. The average concentration of NOx emitted during

this time was shown to be 69.9 mg/Nm<sup>3</sup>; also below the emission limit value of 100mg/Nm<sup>3</sup>. The average concentration of SO<sub>2</sub> emitted during this time was shown to be 5.2 mg/Nm<sup>3</sup>. The average concentration of VOCs emitted during this time was shown to be 1.3 mg/Nm<sup>3</sup>; well below the emission limit value of 20mg/Nm<sup>3</sup>. The data collected is graphically represented in Figure 5, with further monitoring details found in Tables 5a – 5d.

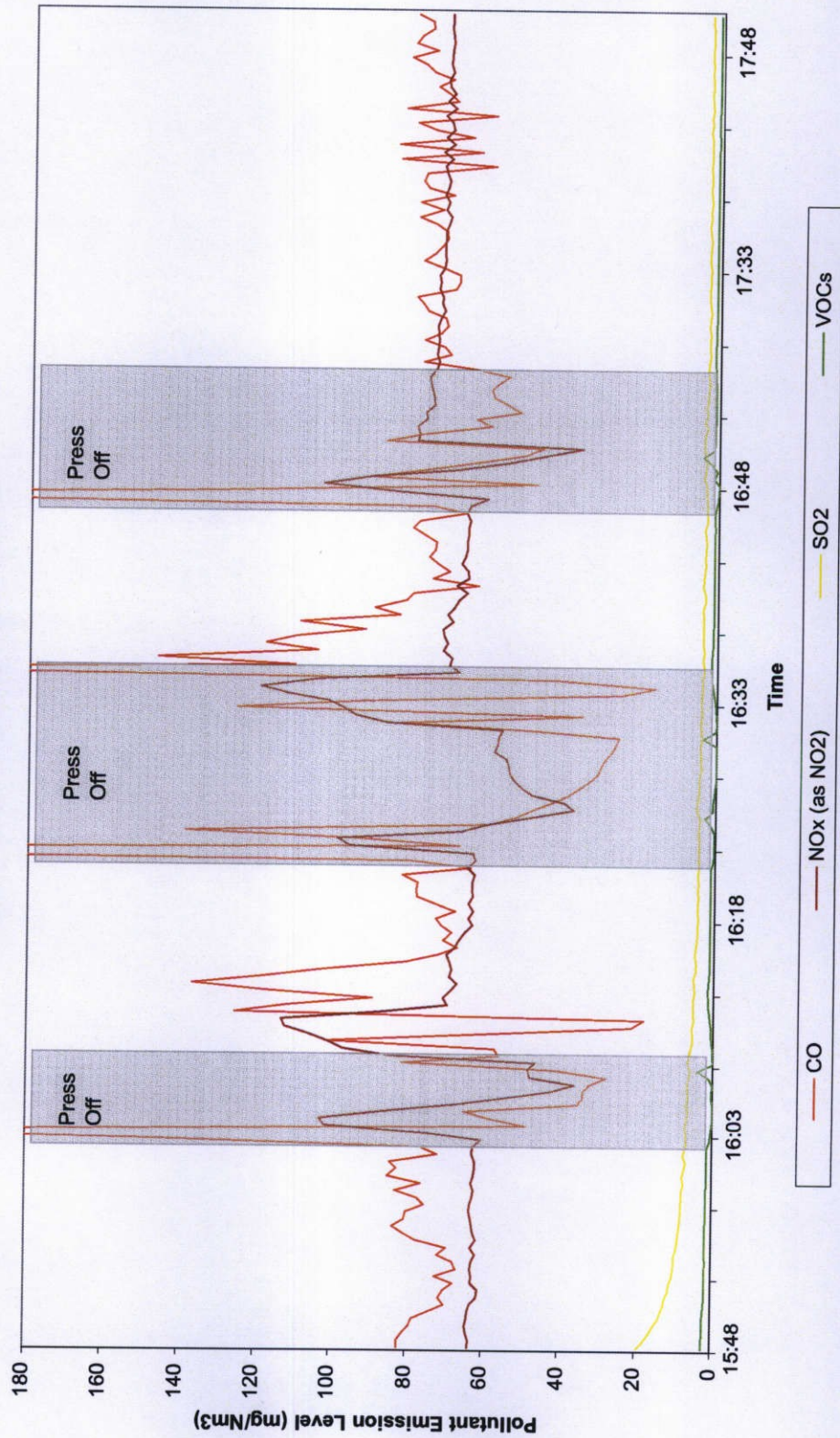
#### **2.2.6 Lithoman 2**

Monitoring on Lithoman 2 was carried out on the 2<sup>nd</sup> September at 15:33 – 17:38. The average concentration of CO emitted during this time was shown to be 74.9 mg/Nm<sup>3</sup>; below the emission limit value of 100mg/Nm<sup>3</sup>. The average concentration of NOx emitted during this time was shown to be 74.4 mg/Nm<sup>3</sup>; also below the emission limit value of 100mg/Nm<sup>3</sup>. The average concentration of SO<sub>2</sub> emitted during this time was shown to be 4.7 mg/Nm<sup>3</sup>. The average concentration of VOCs emitted during this time was shown to be 4.6 mg/Nm<sup>3</sup>; well below the emission limit value of 20mg/Nm<sup>3</sup>. The data collected is graphically represented in Figure 6, with further monitoring details found in Tables 6a – 6d.

#### **2.2.7 Compactor**

Monitoring on the Compactor was carried out for just over 3 hours on the 2<sup>nd</sup> September at 12:29 – 15:38. From the 4 tests carried out an average emission concentration of 2.05 mg/Nm<sup>3</sup> was obtained. This low level is in line with those found in previous years. Details of this monitoring can be seen in Table 7.

**Figure 5**  
**Combustion Gas and VOC Emissions from Lithoman 1**  
**Wyndeham Heron, Maldon (01/09/2009)**



**TABLE 5a**  
**Gaseous Analysis using Horiba (Model PG 250) Analyser**  
**Client Name: Wyndeham Heron, Maldon**  
**Combustion Gas and VOC Emissions from Lithoman 1 (01/09/09)**

Job no: 4029  
 Data entered by: DF

	Carbon Monoxide CO (ppm)	Oxide of Nitrogen NOx (ppm)	Sulphur Dioxide SO2 (ppm)	VOCs (ppm)	Conversion from ppm to mg/Nm <sup>3</sup>			
					CO (mg/Nm <sup>3</sup> )	NOx (as NO <sub>2</sub> ) (mg/Nm <sup>3</sup> )	SO2 (mg/Nm <sup>3</sup> )	VOCs (mg/Nm <sup>3</sup> )
<b>Average</b>	62.8	34.0	1.8	0.8	78.5	89.9	5.2	1.3
<b>Maximum</b>	117.3	55.2	6.8	1.5	146.8	113.3	19.4	2.4
<b>Minimum</b>	14.7	29.7	0.9	0.1	18.4	60.9	2.7	0.2

**TABLE 5b  
ANALYSER CALIBRATIONS**

Client Name: Wyndeham Heron, Maldon  
 Combustion Gas and VOC Emissions from Lithoman 1 (01/09/09)

Job no: 4029 Data entered by: DF

Analysers: 2

Type of Gas	CO	NO	SO2	VOCs
Certified Calibration Values	79.7	50.3	206.0	7.97
Period	ppm +/-2%	ppm +/-2%	ppm +/-2%	ppm +/-2%
Span PreCal direct to analyser	79.8	50.5	206.1	8.0
Zero PreCal through sample line	0.1	0.1	0.7	0.0
Span PreCal through sample line	79.2	50.3	196.0	8.0
Zero PostCal through sample line	0.7	0.3	-0.1	0.1
Span PostCal through sample line	79.0	50.1	195.9	7.7
Span Drift	0.2	0.4	0.1	
Zero Drift	-0.7	-0.4	0.4	
Is data valid without adjustment	YES	YES	YES	
Does data require adjustment	NO	NO	NO	
Is data invalid	NO	NO	NO	

Table 5c  
**Combustion Gas Emissions from Lithoman 1 (01/09/09)**

**UNCERTAINTY OF CARBON MONOXIDE BY HORIBA 1**

Reading = 

62.8
------

 ppm  
 Span Gas Certified Value = 

79.7
------

 ppm +/-2%

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.6280	0.3944
Zero Drift/Lower limit of detection	0.1ppm	0.1000	0.0100
Span Drift	2% of value	1.2560	1.5775
Linearity	1.2% of value	1.2000	1.4400
Setting Gas Divider	0.25% of value	0.1570	0.0246
Interference	2.9% of value	1.8212	3.3168
Span Gas	1% of span gas certified value	0.7970	0.6352

Sum U <sup>2</sup>	7.40
Total U	2.72 ppm
95% confidence	5.44 ppm
or	6.80 mg/Nm <sup>3</sup>

**UNCERTAINTY OF OXIDES OF NITROGEN BY HORIBA 1**

Reading = 

34
----

 ppm  
 Span Gas Certified Value = 

50.3
------

 ppm

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.3400	0.1156
Zero Drift/Lower limit of detection	0.4ppm	0.4000	0.1600
Span Drift	1.9% of value	0.6460	0.4173
Linearity	0.63% of value	0.6300	0.3969
Setting Gas Divider	0.25% of value	0.0850	0.0072
Interference	1.2% of value	0.4080	0.1665
Span Gas	1% of span gas certified value	0.5030	0.2530

Sum U <sup>2</sup>	1.52
Total U	1.23 ppm
95% confidence	2.46 ppm
or	5.96 mg/Nm <sup>3</sup>

**UNCERTAINTY OF SULPHUR DIOXIDE BY HORIBA 1**

Reading = 

1.8
-----

 ppm  
 Span Gas Certified Value = 

206
-----

 ppm

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.0180	0.0003
Zero Drift/Lower limit of detection	1.2ppm	1.6000	2.5600
Span Drift	1.9% of value	0.0342	0.0012
Linearity	1.44% of value	2.2800	5.1984
Setting Gas Divider	0.25% of value	0.0045	0.0000
Interference	1.2% of value	0.0216	0.0005
Span Gas	1% of span gas certified value	2.0600	4.2436

Sum U <sup>2</sup>	12.00
Total U	3.46 ppm
95% confidence	6.93 ppm
or	19.79 mg/Nm <sup>3</sup>

**TABLE 5d**

**UNCERTAINTY OF VOC BY SIGNAL3**

**Client Name:** Wyndeham Heron, Maldon

**Job No:** 4029

Reading = 0.8 ppm as C3H8  
 Span Gas= 7.97 ppm+/-2%

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.008	0.000
Detection threshold	0.2ppm	0.2	0.040
Noise	0.1 ppm	0.1	0.010
Linearity	0.06% of value	0.0048	0.000
Setting Gas Divider	0.25% of value	0.002	0.000
Temperature Drift	1% of value	0.008	0.000
Span Gas	1% of Value	0.0797	0.006

Sum U <sup>2</sup>	0.06
--------------------	------

Total U	0.24 ppm
---------	----------

95% confidence	0.48 ppm as C3H8
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or **0.76** mg/Nm<sup>3</sup> as carbon

**Figure 6**  
**Combustion Gas and VOC Emissions from Lithoman 2**  
**Wydeham Heron, Maldon (02/09/2009)**

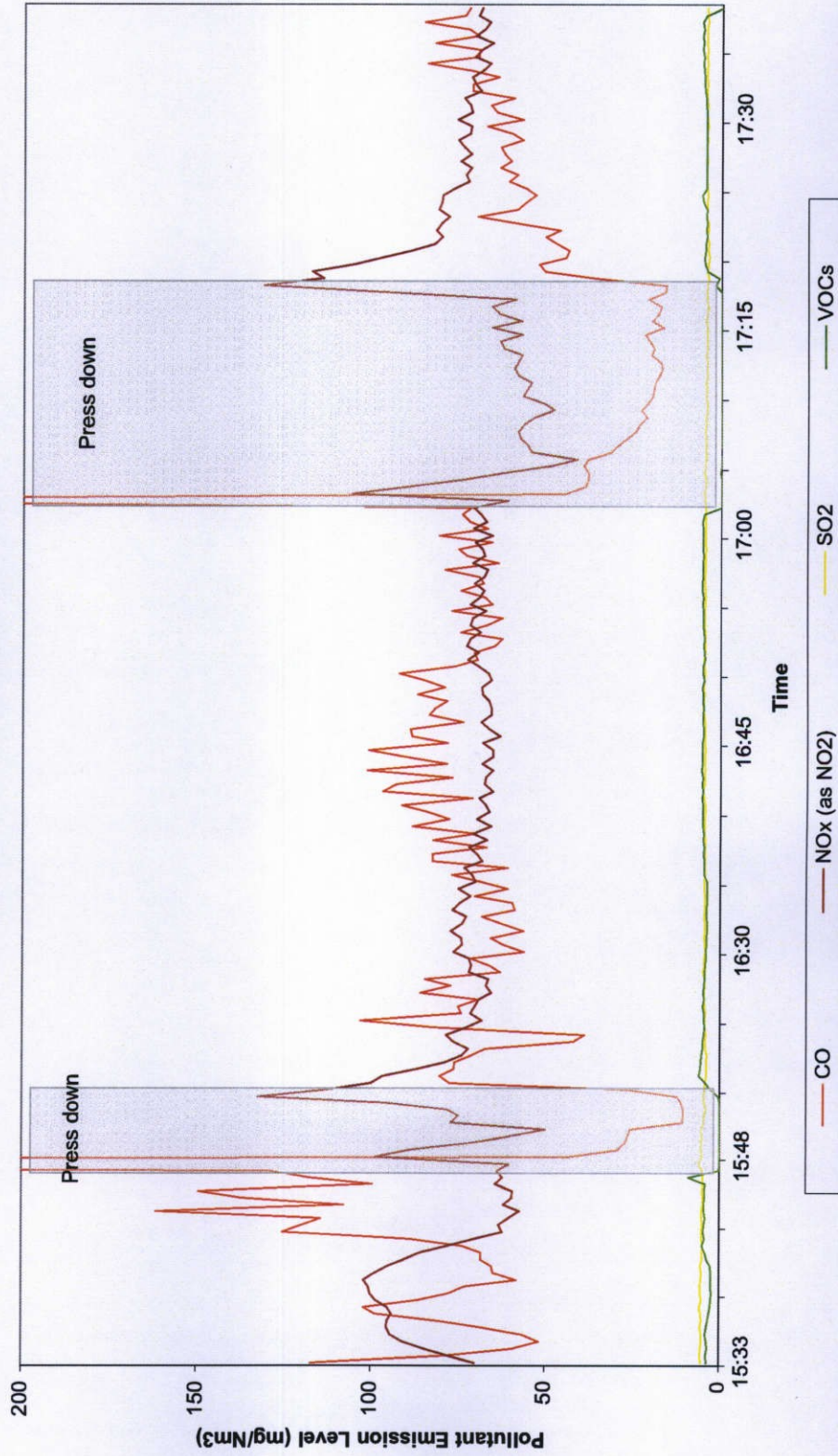


TABLE 4a  
 Gaseous Analysis using Horiba (Model PG 250) Analyser  
 Wyndeham Heron, Maldon  
 Combustion Gas and VOC Emissions from Lithoman 2 (02/09/09)

Mean Ambient Pressure =  
 Stack Temperature =

1008 mbar  
 322 °C

Job no: 4029  
 Data entered by: DF

	Carbon Monoxide CO (ppm)	Oxides of Nitrogen NOx (ppm)	Sulphur Dioxide SO2 (ppm)	VOCs (ppm)	Results Adjusted for Span and Zero Drift				Conversion from ppm to mg/Nm <sup>3</sup>			
					CO (ppm)	NOx (ppm)	SO2 (ppm)	VOCs (ppm)	CO (mg/Nm <sup>3</sup> )	NOx (as NO <sub>2</sub> ) (mg/Nm <sup>3</sup> )	SO2 (mg/Nm <sup>3</sup> )	VOCs (ppm)
Average	59.9	36.5	1.5	2.9	59.9	36.2	1.5	2.9	74.9	74.4	4.7	4.6
Maximum	129.3	97.7	1.9	5.5	129.3	97.3	2.0	5.5	161.6	117.7	5.6	8.8
Minimum	29.2	29.2	1.2	0.0	29.2	27.9	1.3	0.0	36.8	97.3	3.8	0.0

**TABLE 6b  
ANALYSER CALIBRATIONS**

Client Name: Wyndeham Heron, Maldon  
**Combustion Gas and VOC Emissions from Lithoman 2 (02/09/09)**

Job no: 4029 Data entered by: DF

Analysers: 2

Type of Gas	CO	NO	SO2	VOCs	F10	F11	H10	H11
Certified Calibration Values	79.7	50.3	206.0	7.97				
Period								
Span PreCal direct to analyser	80.3	50.4	206.3	0.1				
Zero PreCal through sample line	-0.2	0.1	1.1	7.9				
Span PreCal through sample line	80.1	51.2	202.7	8.0				
Zero PostCal through sample line	0.5	0.1	0.2	-0.4				
Span PostCal through sample line	80.5	50.1	198.1	7.4				
Span Drift	-0.5	2.3	2.2					
Zero Drift	-0.9	-0.1	0.4					
Is data valid without adjustment	YES	NO	NO					
Does data require adjustment	NO	YES	YES					
Is data invalid	NO	NO	NO					

Table 6c  
**Combustion Gas Emissions from Lithoman 2 (02/09/09)**

**UNCERTAINTY OF CARBON MONOXIDE BY HORIBA 1**

Reading =  ppm  
 Span Gas Certified Value =  ppm +/-2%

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.5990	0.3588
Zero Drift/Lower limit of detection	0.1ppm	0.1000	0.0100
Span Drift	2% of value	1.1980	1.4352
Linearity	1.2% of value	1.2000	1.4400
Setting Gas Divider	0.25% of value	0.1498	0.0224
Interference	2.9% of value	1.7371	3.0175
Span Gas	1% of span gas certified value	0.7970	0.6352

Sum U <sup>2</sup>	6.92
Total U	2.63 ppm
95% confidence	5.26 ppm
or	6.58 mg/Nm <sup>3</sup>

**UNCERTAINTY OF OXIDES OF NITROGEN BY HORIBA 1**

Reading =  ppm  
 Span Gas Certified Value =  ppm

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.3620	0.1310
Zero Drift/Lower limit of detection	0.4ppm	0.4000	0.1600
Span Drift	1.9% of value	0.6878	0.4731
Linearity	0.63% of value	0.6300	0.3969
Setting Gas Divider	0.25% of value	0.0905	0.0082
Interference	1.2% of value	0.4344	0.1887
Span Gas	1% of span gas certified value	0.5030	0.2530

Sum U <sup>2</sup>	1.61
Total U	1.27 ppm
95% confidence	2.54 ppm
or	5.21 mg/Nm <sup>3</sup>

**UNCERTAINTY OF SULPHUR DIOXIDE BY HORIBA 1**

Reading =  ppm  
 Span Gas Certified Value =  ppm

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.0160	0.0003
Zero Drift/Lower limit of detection	1.2ppm	1.6000	2.5600
Span Drift	1.9% of value	0.0304	0.0009
Linearity	1.44% of value	2.2800	5.1984
Setting Gas Divider	0.25% of value	0.0040	0.0000
Interference	1.2% of value	0.0192	0.0004
Span Gas	1% of span gas certified value	2.0600	4.2436

Sum U <sup>2</sup>	12.00
Total U	3.46 ppm
95% confidence	6.93 ppm
or	19.79 mg/Nm <sup>3</sup>

**TABLE 6d**

**UNCERTAINTY OF VOC BY SIGNAL3**

**Client Name:** Wyndeham Heron, Maldon

**Job No:** 4029

Reading = 2.9 ppm as C3H8  
 Span Gas= 7.97 ppm+/-2%

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.029	0.001
Detection threshold	0.2ppm	0.2	0.040
Noise	0.1 ppm	0.1	0.010
Linearity	0.06% of value	0.0174	0.000
Setting Gas Divider	0.25% of value	0.00725	0.000
Temperature Drift	1% of value	0.029	0.001
Span Gas	1% of Value	0.0797	0.006

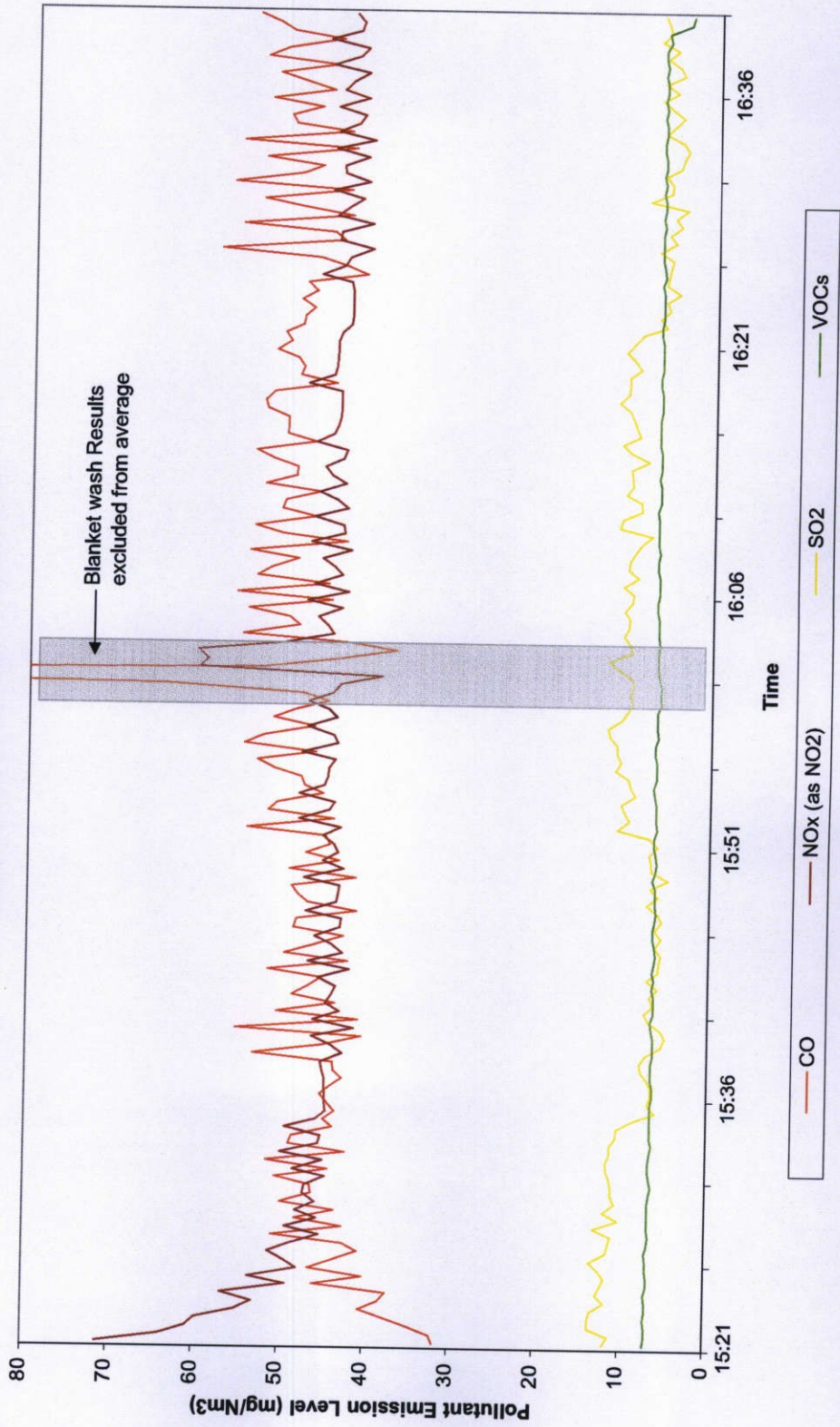
Sum U <sup>2</sup>	0.06
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Total U	0.24 ppm
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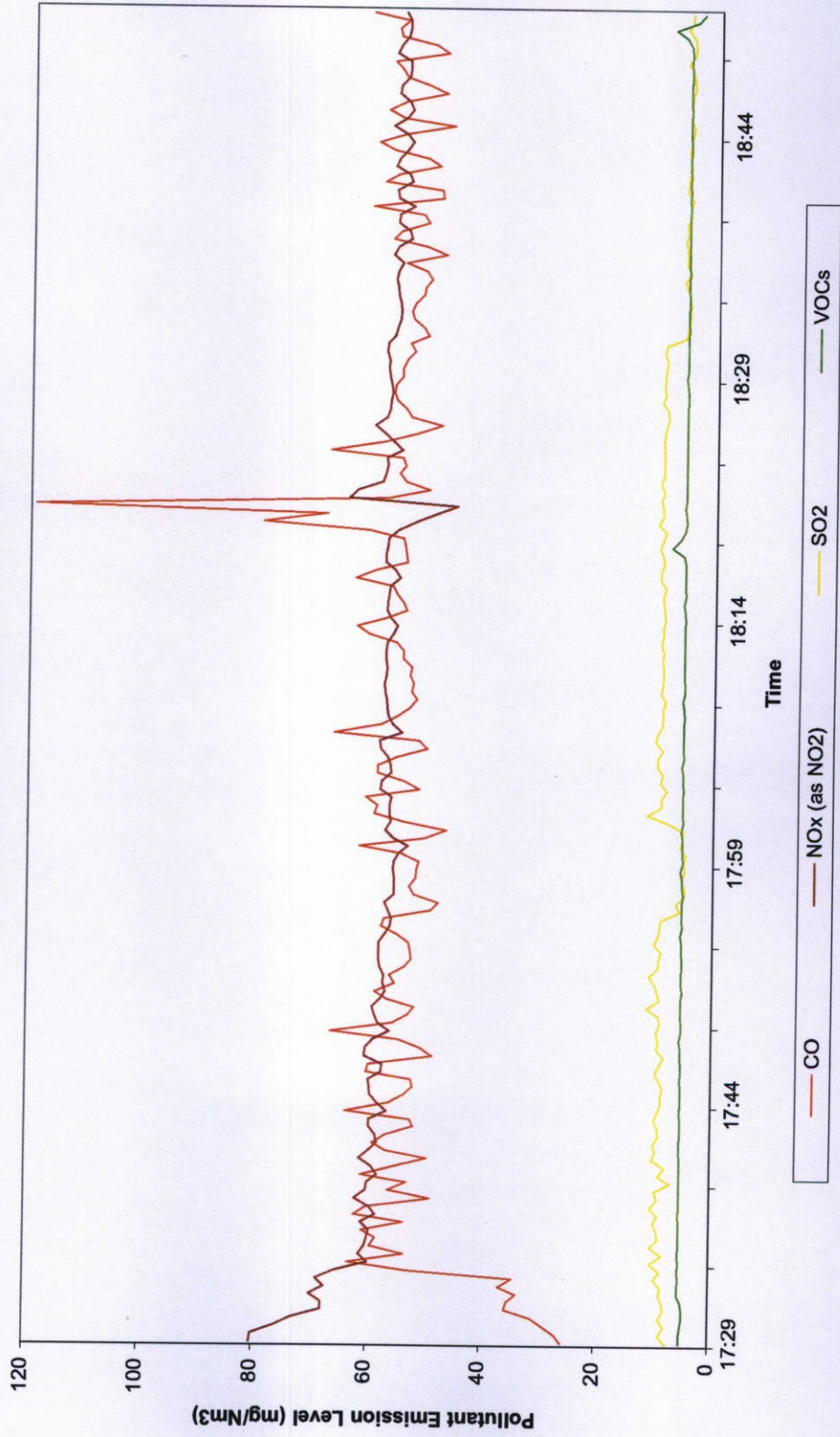
95% confidence	0.48 ppm as C3H8
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or **0.78** mg/Nm<sup>3</sup> as carbon

**Figure 1**  
**Combustion Gas and VOC Emissions from Rotoman 2, Lower**  
**Wyndeham Heron, Maldon (01/09/2009)**



**Figure 2**  
**Combustion Gas and VOC Emissions from Rotoman 2, Upper**  
**Wyndeham Heron, Maldon (01/09/2009)**



**TABLE 1a**  
**Gaseous Analysis using Horiba (Model PG 250) Analyser**  
**Wyndeham Heron, Maldon**  
**Combustion Gas and VOC Emissions from Rotoman 2, Lower and Upper (01/09/09)**

Job no: 4029  
 Data entered by: DF

**Rotoman 2 LOWER**

	Carbon Monoxide CO (ppm)	Oxides of Nitrogen NOx (ppm)	Sulphur Dioxide SO2 (ppm)	VOCs (ppm)	Conversion from ppm to mg/Nm <sup>3</sup>			
					CO (mg/Nm <sup>3</sup> )	NOx (as NO <sub>2</sub> ) (mg/Nm <sup>3</sup> )	SO2 (mg/Nm <sup>3</sup> )	VOCs (mg/Nm <sup>3</sup> )
Average	38.1	22.2	2.9	4.0	47.6	45.5	8.4	6.5
Maximum	46.7	34.7	4.7	4.4	58.3	71.2	13.5	7.1
Minimum	25.3	19.8	1.3	2.1	31.7	40.6	3.9	3.4

**Rotoman 2 UPPER**

	Carbon Monoxide CO (ppm)	Oxides of Nitrogen NOx (ppm)	Sulphur Dioxide SO2 (ppm)	VOCs (ppm)	Conversion from ppm to mg/Nm <sup>3</sup>			
					CO (mg/Nm <sup>3</sup> )	NOx (as NO <sub>2</sub> ) (mg/Nm <sup>3</sup> )	SO2 (mg/Nm <sup>3</sup> )	VOCs (mg/Nm <sup>3</sup> )
Average	43.5	28.3	2.8	3.4	54.4	56.1	6.1	5.4
Maximum	85.3	39.1	4.1	5.1	119.1	80.3	11.6	8.2
Minimum	20.6	22.2	1.7	2.0	25.9	45.5	4.8	3.2

**TABLE 1b  
ANALYSER CALIBRATIONS**

**Client Name:** Wyndeham Heron, Maldon  
**Combustion Gas and VOC Emissions from Rotoman 2, Lower and Upper (01/09/09)**

**Job no:** 4029 **Data entered by:** DF

**Analysers:**

Type of Gas	CO	NO	SO2	VOCs	F10
<b>Certified Calibration Values</b>	118.6	209.0	156.0	7.97	F11
<b>Period</b>					H10
Span PreCal direct to analyser	118.9	209.3	155.4	7.8	H11
Zero PreCal through sample line	0.7	0.1	1.9	0.0	
Span PreCal through sample line	118.7	208.9	150.0	8.3	
Zero PostCal through sample line	1.2	0.4	0.6	2.2	
Span PostCal through sample line	117.2	205.2	149.2	7.9	
Span Drift	1.3	1.7	0.5		
Zero Drift	-0.4	-0.2	0.8		
Is data valid without adjustment	YES	YES	YES		D12
Does data require adjustment	NO	NO	NO		D13
Is data invalid	NO	NO	NO		D14
					D15

**Table 1c**  
**Combustion Gas Emissions from Rotoman 2 Lower (01/09/09)**

**UNCERTAINTY OF CARBON MONOXIDE BY HORIBA 1**

Reading =  ppm  
Span Gas Certified Value =  ppm +/-2%

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.3810	0.1452
Zero Drift/Lower limit of detection	0.1ppm	0.1000	0.0100
Span Drift	2% of value	0.7620	0.5806
Linearity	1.2% of value	1.2000	1.4400
Setting Gas Divider	0.25% of value	0.0953	0.0091
Interference	2.9% of value	1.1049	1.2208
Span Gas	1% of span gas certified value	1.1860	1.4066

Sum U <sup>2</sup>	4.81
Total U	2.19 ppm
95% confidence	4.39 ppm
or	5.48 mg/Nm <sup>3</sup>

**UNCERTAINTY OF OXIDES OF NITROGEN BY HORIBA 1**

Reading =  ppm  
Span Gas Certified Value =  ppm

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.2220	0.0493
Zero Drift/Lower limit of detection	0.4ppm	0.4000	0.1600
Span Drift	1.9% of value	0.4218	0.1779
Linearity	0.63% of value	0.6300	0.3969
Setting Gas Divider	0.25% of value	0.0555	0.0031
Interference	1.2% of value	0.2664	0.0710
Span Gas	1% of span gas certified value	2.0900	4.3681

Sum U <sup>2</sup>	5.23
Total U	2.29 ppm
95% confidence	4.57 ppm
or	9.39 mg/Nm <sup>3</sup>

**UNCERTAINTY OF SULPHUR DIOXIDE BY HORIBA 1**

Reading =  ppm  
Span Gas Certified Value =  ppm

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.0290	0.0008
Zero Drift/Lower limit of detection	1.2ppm	1.2000	1.4400
Span Drift	1.9% of value	0.0551	0.0030
Linearity	1.44% of value	0.0418	0.0017
Setting Gas Divider	0.25% of value	0.0073	0.0001
Interference	1.2% of value	0.0348	0.0012
Span Gas	1% of span gas certified value	1.5800	2.4336

Sum U <sup>2</sup>	3.88
Total U	1.97 ppm
95% confidence	3.94 ppm
or	11.25 mg/Nm <sup>3</sup>

**Table 2a**  
**Combustion Gas Emissions from Rotoman 2, Upper (01/09/09)**

**UNCERTAINTY OF CARBON MONOXIDE BY HORIBA 1**

Reading =  ppm  
Span Gas Certified Value =  ppm +/-2%

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.4350	0.1892
Zero Drift/Lower limit of detection	0.1ppm	0.1000	0.0100
Span Drift	2% of value	0.8700	0.7569
Linearity	1.2% of value	1.2000	1.4400
Setting Gas Divider	0.25% of value	0.1088	0.0118
Interference	2.9% of value	1.2615	1.5914
Span Gas	1% of span gas certified value	1.1860	1.4066

Sum U <sup>2</sup>	5.41
Total U	2.33 ppm
95% confidence	4.65 ppm
or	5.81 mg/Nm <sup>3</sup>

**UNCERTAINTY OF OXIDES OF NITROGEN BY HORIBA 1**

Reading =  ppm  
Span Gas Certified Value =  ppm

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.2830	0.0801
Zero Drift/Lower limit of detection	0.4ppm	0.4000	0.1600
Span Drift	1.9% of value	0.5377	0.2891
Linearity	0.63% of value	0.6300	0.3969
Setting Gas Divider	0.25% of value	0.0708	0.0050
Interference	1.2% of value	0.3396	0.1153
Span Gas	1% of span gas certified value	2.0900	4.3681

Sum U <sup>2</sup>	5.41
Total U	2.33 ppm
95% confidence	4.65 ppm
or	9.55 mg/Nm <sup>3</sup>

**UNCERTAINTY OF SULPHUR DIOXIDE BY HORIBA 1**

Reading =  ppm  
Span Gas Certified Value =  ppm

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.0280	0.0008
Zero Drift/Lower limit of detection	1.2ppm	1.2000	1.4400
Span Drift	1.9% of value	0.0532	0.0028
Linearity	1.44% of value	0.0403	0.0016
Setting Gas Divider	0.25% of value	0.0070	0.0000
Interference	1.2% of value	0.0336	0.0011
Span Gas	1% of span gas certified value	1.5600	2.4336

Sum U <sup>2</sup>	3.88
Total U	1.97 ppm
95% confidence	3.94 ppm
or	11.25 mg/Nm <sup>3</sup>

**TABLE 1d**

**UNCERTAINTY OF VOC BY SIGNAL2**

**Client Name:** Wyndeham Heron

**Job No:** 4029

Reading = 4.0 ppm as C3H8  
 Span Gas= 7.97 ppm+/-2%

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.04	0.002
Zero Drift/ Detection	0.2ppm	0.2	0.040
Noise	0.1 ppm	0.1	0.010
Linearity	1.0% of value	0.04	0.002
Setting Gas Divider	0.25% of value	0.01	0.000
Temperature Drift	1% of value	0.04	0.002
Span Gas	1% of Value	0.0797	0.006

Sum U <sup>2</sup>	0.06
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Total U	0.25 ppm
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95% confidence	0.49 ppm as C3H8
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or **0.80** mg/Nm<sup>3</sup> as carbon

**TABLE 2b**

**UNCERTAINTY OF VOC BY SIGNAL2**

**Client Name:** Wyndeham Heron

**Job No:** 4029

Reading = 3.4 ppm as C3H8  
 Span Gas= 7.97 ppm+/-2%

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.034	0.001
Zero Drift/ Detection	0.2ppm	0.2	0.040
Noise	0.1 ppm	0.1	0.010
Linearity	1.0% of value	0.034	0.001
Setting Gas Divider	0.25% of value	0.0085	0.000
Temperature Drift	1% of value	0.034	0.001
Span Gas	1% of Value	0.0797	0.006

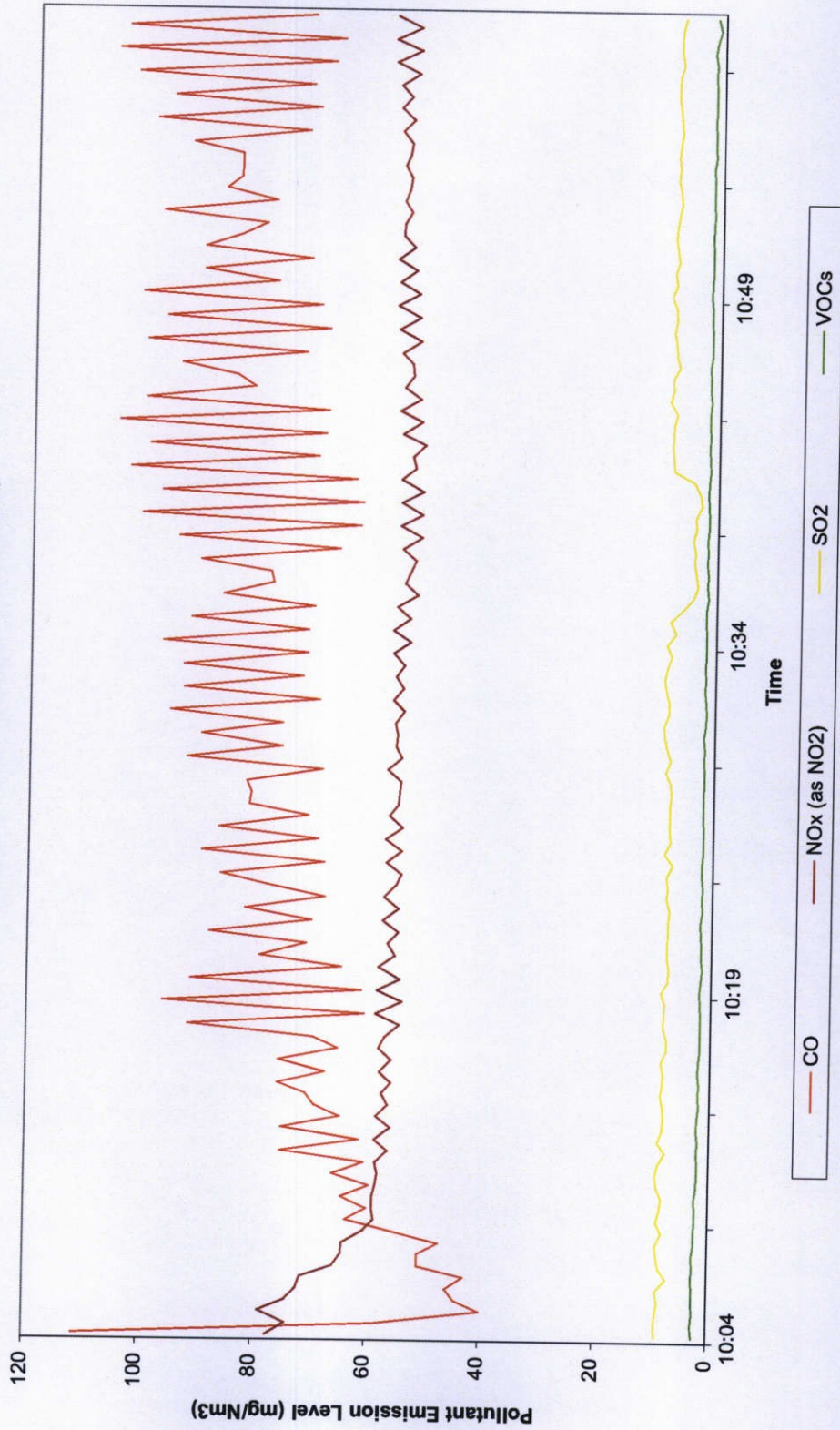
Sum U <sup>2</sup>	0.06
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Total U	0.24 ppm
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95% confidence	0.49 ppm as C3H8
----------------	------------------

or **0.79** mg/Nm<sup>3</sup> as carbon

**Figure 3**  
**Combustion Gas and VOC Emissions from Rotoman 3, Lower**  
**Wyndeham Heron, Maldon (02/09/2009)**



**Figure 4**  
**Combustion Gas and VOC Emissions from Rotoman 3, Upper**  
**Wyndeham Heron, Maldon (02/09/2009)**

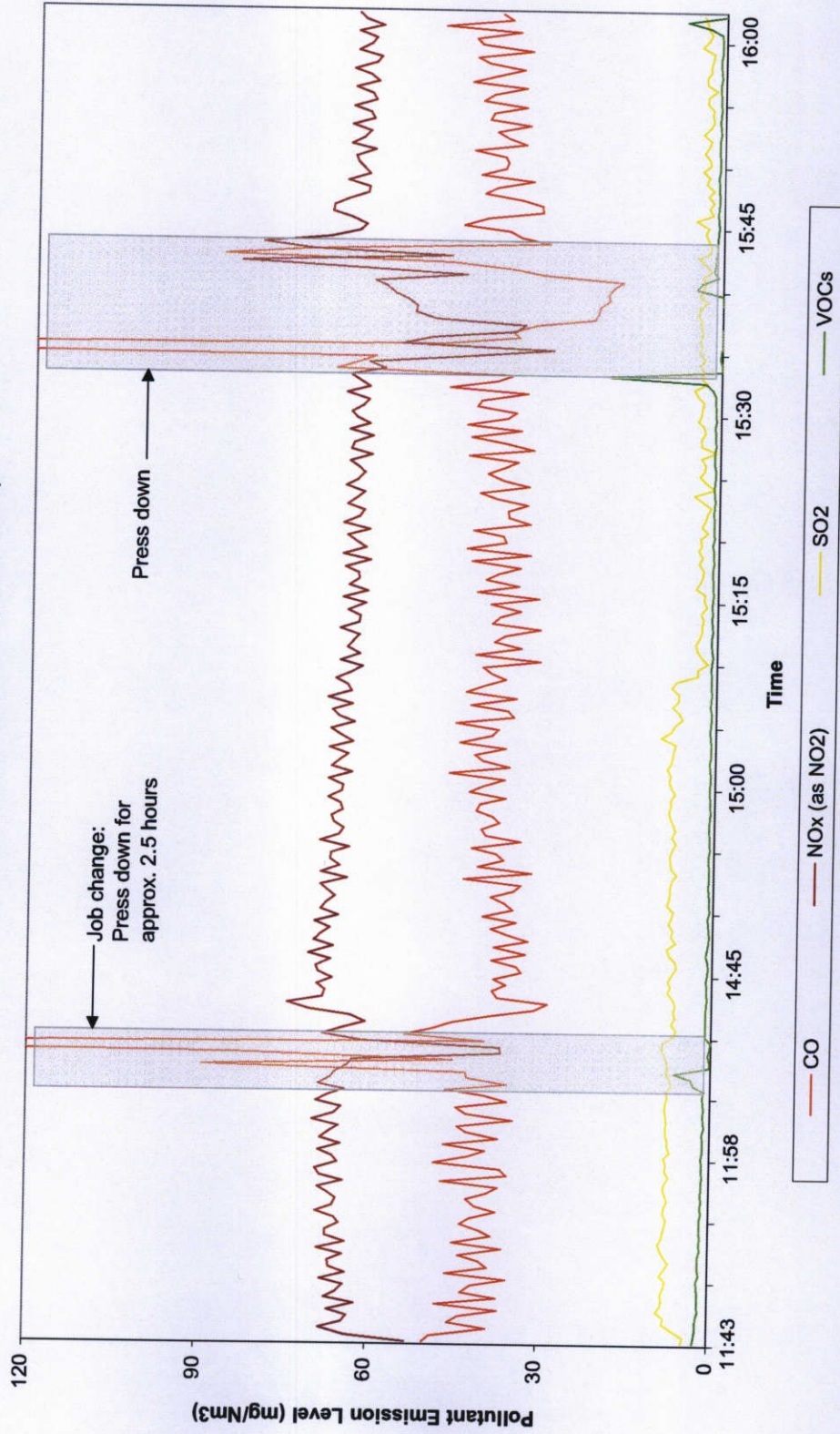


TABLE 3a  
Gaseous Analysis using Horiba (Model PG 250) Analyser  
Wyndeham Heron, Maldon  
Combustion Gas and VOC Emissions from Rotoman 3, Lower and Upper (02/09/09)

Job no: 4029  
Data entered by: DF

Rotoman 3 LOWER												
	Carbon Monoxide CO (ppm)	Oxides of Nitrogen NOx (ppm)	Sulphur Dioxide SO2 (ppm)	VOCs (ppm)	Results Adjusted for Span and Zero Drift				Conversion from ppm to mg/Nm <sup>3</sup>			
					CO (ppm)	NOx (ppm)	SO2 (ppm)	VOCs (ppm)	CO (mg/Nm <sup>3</sup> )	NOx (as NO <sub>2</sub> ) (mg/Nm <sup>3</sup> )	SO2 (mg/Nm <sup>3</sup> )	VOCs (mg/Nm <sup>3</sup> )
Average	81.6	27.7	2.8	1.2	82.2	27.7	2.7	1.2	77.5	58.5	7.7	1.5
Maximum	88.2	38.4	3.5	1.7	89.0	38.4	3.3	1.7	111.2	78.8	8.4	2.8
Minimum	31.8	28.1	1.1	0.5	31.8	28.1	1.1	0.8	38.9	31.8	3.0	1.0

Rotoman 3 UPPER												
	Carbon Monoxide CO (ppm)	Oxides of Nitrogen NOx (ppm)	Sulphur Dioxide SO2 (ppm)	VOCs (ppm)	Results Adjusted for Span and Zero Drift				Conversion from ppm to mg/Nm <sup>3</sup>			
					CO (ppm)	NOx (ppm)	SO2 (ppm)	VOCs (ppm)	CO (mg/Nm <sup>3</sup> )	NOx (as NO <sub>2</sub> ) (mg/Nm <sup>3</sup> )	SO2 (mg/Nm <sup>3</sup> )	VOCs (mg/Nm <sup>3</sup> )
Average	30.3	31.7	2.0	0.8	31.3	31.7	1.9	0.8	39.2	65.2	5.4	1.3
Maximum	39.3	36.3	3.5	12.8	38.8	36.3	3.4	12.8	48.9	74.4	8.7	28.5
Minimum	22.2	25.9	0.9	0.0	23.1	23.8	0.3	0.0	28.8	25.1	0.8	0.0

**TABLE 3b  
ANALYSER CALIBRATIONS**

Client Name: Wydeham Heron, Maldon

**Combustion Gas and VOC Emissions from Rotoman 3, Lower and Upper (02/09/09)**

Job no: 4029

Data entered by: DF

Analysers:

1

Type of Gas	CO	ppm +/-2%	NO	ppm +/-2%	SO2	ppm +/-2%	VOCs	ppm +/-2%
<b>Certified Calibration Values</b>	118.6		209.0		156.0		7.97	
<b>Period</b>								
Span PreCal direct to analyser	119.1	ppm	209.1	ppm	155.9	ppm	8.0	ppm
Zero PreCal through sample line	-0.4	ppm	0.1	ppm	1.9	ppm	1.1	ppm
Span PreCal through sample line	117.2	ppm	207.4	ppm	149.2	ppm	8.1	ppm
Zero PostCal through sample line	0.4	ppm	0.4	ppm	0.1	ppm	0.4	ppm
Span PostCal through sample line	114.2	ppm	205.4	ppm	146.1	ppm	7.7	ppm
Span Drift	2.5	%	1.0	%	2.0	%		
Zero Drift	-0.7	%	-0.1	%	1.2	%		
Is data valid without adjustment	NO		YES		NO			
Does data require adjustment	YES		NO		YES			
Is data invalid	NO		NO		NO			

F10  
F11  
H10  
H11  
g cells sho  
D12  
D13  
D14  
D15

**Table 3c**  
**Combustion Gas Emissions from Rotoman 3 Lower (02/09/09)**

**UNCERTAINTY OF CARBON MONOXIDE BY HORIBA 1**

Reading =  ppm  
Span Gas Certified Value =  ppm +/-2%

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.6220	0.3869
Zero Drift/Lower limit of detection	0.1ppm	0.1000	0.0100
Span Drift	2% of value	1.2440	1.5475
Linearity	1.2% of value	1.2000	1.4400
Setting Gas Divider	0.25% of value	0.1555	0.0242
Interference	2.9% of value	1.8038	3.2537
Span Gas	1% of span gas certified value	1.1880	1.4066

Sum U <sup>2</sup>	8.07
Total U	2.84 ppm
95% confidence	5.68 ppm
or	7.10 mg/Nm <sup>3</sup>

**UNCERTAINTY OF OXIDES OF NITROGEN BY HORIBA 1**

Reading =  ppm  
Span Gas Certified Value =  ppm

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.2770	0.0767
Zero Drift/Lower limit of detection	0.4ppm	0.4000	0.1600
Span Drift	1.9% of value	0.5263	0.2770
Linearity	0.63% of value	0.6300	0.3969
Setting Gas Divider	0.25% of value	0.0693	0.0048
Interference	1.2% of value	0.3324	0.1105
Span Gas	1% of span gas certified value	2.0900	4.3681

Sum U <sup>2</sup>	5.39
Total U	2.32 ppm
95% confidence	4.64 ppm
or	9.53 mg/Nm <sup>3</sup>

**UNCERTAINTY OF SULPHUR DIOXIDE BY HORIBA 1**

Reading =  ppm  
Span Gas Certified Value =  ppm

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.0270	0.0007
Zero Drift/Lower limit of detection	1.2ppm	1.2000	1.4400
Span Drift	1.9% of value	0.0513	0.0026
Linearity	1.44% of value	0.0389	0.0015
Setting Gas Divider	0.25% of value	0.0068	0.0000
Interference	1.2% of value	0.0324	0.0010
Span Gas	1% of span gas certified value	1.5600	2.4336

Sum U <sup>2</sup>	3.88
Total U	1.97 ppm
95% confidence	3.94 ppm
or	11.25 mg/Nm <sup>3</sup>

**Table 4a**  
**Combustion Gas Emissions from Rotoman 3 Upper (02/09/09)**

**UNCERTAINTY OF CARBON MONOXIDE BY HORIBA 1**

Reading =  ppm  
Span Gas Certified Value =  ppm +/-2%

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.3130	0.0980
Zero Drift/Lower limit of detection	0.1ppm	0.1000	0.0100
Span Drift	2% of value	0.6260	0.3919
Linearity	1.2% of value	1.2000	1.4400
Setting Gas Divider	0.25% of value	0.0783	0.0061
Interference	2.9% of value	0.9077	0.8239
Span Gas	1% of span gas certified value	1.1860	1.4066

Sum U <sup>2</sup>	4.18
Total U	2.04 ppm
95% confidence	4.09 ppm
or	5.11 mg/Nm <sup>3</sup>

**UNCERTAINTY OF OXIDES OF NITROGEN BY HORIBA 1**

Reading =  ppm  
Span Gas Certified Value =  ppm

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.3170	0.1005
Zero Drift/Lower limit of detection	0.4ppm	0.4000	0.1600
Span Drift	1.9% of value	0.6023	0.3628
Linearity	0.83% of value	0.6300	0.3969
Setting Gas Divider	0.25% of value	0.0793	0.0063
Interference	1.2% of value	0.3804	0.1447
Span Gas	1% of span gas certified value	2.0900	4.3681

Sum U <sup>2</sup>	5.54
Total U	2.35 ppm
95% confidence	4.71 ppm
or	9.66 mg/Nm <sup>3</sup>

**UNCERTAINTY OF SULPHUR DIOXIDE BY HORIBA 1**

Reading =  ppm  
Span Gas Certified Value =  ppm

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.0190	0.0004
Zero Drift/Lower limit of detection	1.2ppm	1.2000	1.4400
Span Drift	1.0% of value	0.0361	0.0013
Linearity	1.44% of value	0.0274	0.0007
Setting Gas Divider	0.25% of value	0.0048	0.0000
Interference	1.2% of value	0.0228	0.0005
Span Gas	1% of span gas certified value	1.5600	2.4336

Sum U <sup>2</sup>	3.88
Total U	1.97 ppm
95% confidence	3.94 ppm
or	11.24 mg/Nm <sup>3</sup>

**TABLE 3d**

**UNCERTAINTY OF VOC BY SIGNAL2**

**Client Name:** Wyndeham Heron

**Job No:** 4029

Reading = 1.2 ppm as C3H8  
 Span Gas= 7.97 ppm+/-2%

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.012	0.000
Zero Drift/ Detection	0.2ppm	0.2	0.040
Noise	0.1 ppm	0.1	0.010
Linearity	1.0% of value	0.012	0.000
Setting Gas Divider	0.25% of value	0.003	0.000
Temperature Drift	1% of value	0.012	0.000
Span Gas	1% of Value	0.0797	0.006

Sum U <sup>2</sup>	0.06
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Total U	0.24 ppm
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95% confidence	0.48 ppm as C3H8
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or **0.77** mg/Nm<sup>3</sup> as carbon

**TABLE 4b**

**UNCERTAINTY OF VOC BY SIGNAL2**

**Client Name:** Wyndeham Heron

**Job No:** 4029

Reading = 0.8 ppm as C3H8  
 Span Gas= 7.97 ppm+/-2%

Parameter	Uncertainty criteria	U	U <sup>2</sup>
Repeatability	1% of value	0.008	0.000
Zero Drift/ Detection	0.2ppm	0.2	0.040
Noise	0.1 ppm	0.1	0.010
Linearity	1.0% of value	0.008	0.000
Setting Gas Divider	0.25% of value	0.002	0.000
Temperature Drift	1% of value	0.008	0.000
Span Gas	1% of Value	0.0797	0.006

Sum U <sup>2</sup>	0.06
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Total U	0.24 ppm
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95% confidence	0.48 ppm as C3H8
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or **0.76** mg/Nm<sup>3</sup> as carbon

Table 7  
Wyndeham Heron  
PARTICULATE MATTER EMISSIONS TO ATMOSPHERE DATA (MDHS 14 METHOD)

Site: Wyndeham Heron Duct: Compactor Date: 02/09/2009  
Atmospheric Press: 1009 mbar

Duct Reference	Pump/Filter No.	Flow Checks (l/min)		Average Flow (l/min)	Time ON (hr:m:s)	Time OFF (hr:m:s)	Elapsed Time (hr:m:s)	Air Volume Sampled (m³)	Filter Masses (mg)		Concn. Partic. Matter (mg/m³)	Corr. Part. Matt. Concn. (mg/Nm³)	AIR FLOW DATA			Corrected Volume Flow (Nm³/hr)	Mass Flow Rate (kg/hr)	
		Start	Finish						Initial	Final			Duct Diammeter (cm)	Air Temp. (°C)	Mean Slot Velocity (m/s) <sup>(1)</sup>			Volume Flow (m³/hr)
1	23	2.00	1.75	1.88	12:29:00	15:38:00	03:09:00	0.35438	25.29	25.41	0.12	0.34	60.00	24	20.20	7401.99	6777.0	0.002
2	9	1.50	1.90	1.70	12:29:00	15:38:00	03:09:00	0.32130	24.90	25.58	0.68	2.12	60.00	24	22.40	8208.15	7515.1	0.015
3	15	2.00	2.00	2.00	12:28:00	15:38:00	03:09:00	0.37800	24.73	25.51	0.78	2.06	60.00	24	21.20	7768.43	7112.5	0.013
4	13	2.00	0.00	1.00	12:29:00	15:38:00	03:09:00	0.18900	24.77	25.61	0.84	4.44	60.00	24	19.40	7108.85	6508.6	0.026

Max	4.07
Min	0.31
Average =	2.05

Max 0.026  
Min 0.002  
Average = 0.014