

**Our Ref: P-RED09-041/EB/R1/Rev0**  
**Client Ref:**

**2<sup>nd</sup> November 2009**

**Peter Dipple**  
**Jaguar Cars Ltd**  
**Castle Bromwich Plant**  
**C/1/011**  
**Chester Road**  
**Castle Vale**  
**Birmingham B35 7RA**

**Dear Peter**

**Re: Emissions Monitoring – Browns Lane**

Please find enclosed two copies of your report for the monitoring carried out on the 14<sup>th</sup>, 15<sup>th</sup> and 16<sup>th</sup> September 2009.

If you have any questions with respect to the report please contact me on the numbers below or directly on 07971 628431; alternatively you can email me at [elena@redwing.org.uk](mailto:elena@redwing.org.uk).

Yours sincerely

**Elena Berek BSc (Hons), MSc, CSci, CChem MRSC**  
**Director**



**PROJECT TEAM**

Project work carried out by:

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MCerts Level 1 – MM 06 702

**Vicki Gavin – Senior Consultant**

MCerts Level 1 – MM 02 018

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**Elena Berek – Director**

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Date:

2<sup>nd</sup> November 2009

Report reviewed by:

**Philip Butler - Director**

Signature:

  
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Date:

2<sup>nd</sup> November 2009

Report authorised by:

Philip Butler

Signature:

  
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Date:

2<sup>nd</sup> November 2009

**SEPTEMBER 2009**

**EMISSIONS MONITORING**

**BROWNS LANE**

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Castle Bromwich Plant  
C/1/011  
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**Report Number P-RED09-041/EB/R1/Rev0**

**2<sup>nd</sup> November 2009**

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**EXECUTIVE SUMMARY**

The following document details the emissions to air monitoring survey undertaken by Tony Berek and Vicki Gavin of Redwing Environmental Ltd at Jaguar Cars Ltd, Browns Lane during September 2009.

All results pertain to the dates monitored only; these dates include 14<sup>th</sup>, 15<sup>th</sup> and 16<sup>th</sup> September 2009.

A summary of results is shown below:-

Emission point reference Stack N <sup>o</sup>	Total Particulate Matter range at reference conditions (mg/m <sup>3</sup> )	Highest 30 minute VOC Concentrations at reference conditions (mg/m <sup>3</sup> )	Isocyanate Concentrations at reference conditions (mg/m <sup>3</sup> )	Velocity corrected to reference conditions (m/s)	Volume flow corrected to reference conditions (m <sup>3</sup> /hr)
VMC 3 Polyester Auto Cell 1	Run 1 – 0.9 Run 2 – 4.1	26.9 <b>(24.3)</b>	<0.0001	8.5	8662
VMC 3 Polyester Auto Cell 2	Run 1 – 0.1 Run 2 – 1.0	14.6 <b>(14.0)</b>	<0.0001	8.1	8205
VMC 3 Polyester Auto Cell 3	Run 1 – 4.1 Run 2 – 9.5	41.2 <b>(35.5)</b>	<0.0001	7.9	7996
VMC 3 Manual PU Spray 1	Run 1 – 1.8 Run 2 – 13.9	70.9 <b>(39.5)</b>	<0.0001	12.1	15817
VMC 2 – Manual Gear Nob	Run 1 - <0.6 Run 2 - <0.6	35.3 <b>(31.4)</b>	<0.0001	7.1	29636
VMC 3 PU Auto	Run 1 – 0.4 Run 2 – 0.5	52.0 <b>(28.9)</b>	<0.0001	7.3	16800

**The figures in blue are the average concentrations obtained for the duration of the run**

**NOTE 1: Reference conditions are standard temperature (273K) and standard pressure (101.3kPa)**

**1.0 INTRODUCTION**

The monitoring of the seven exhausts were monitored with respect to quotation **Q-RED09-041/EB/v0** for the compliance check monitoring of emissions to air. The substances requested for monitoring at each emission point are listed below:

**Monitoring Programme**

Substances to be monitored	Emission Point Identification					
	VMC 3 Auto Cell 1	VMC 3 Auto Cell 2	VMC 3 Auto Cell 3	VMC 3 Manual 1	VMC Manual 2 gear nob	VMC 3 PU Auto
Total Particulate Matter	✓	✓	✓	✓	✓	✓
Volatile Organic Compounds	✓	✓	✓	✓	✓	✓
Isocyanates	✓	✓	✓	✓	✓	✓

**Special requirements** *Monitoring is only carried out during normal operations, no monitoring was carried out during scheduled or unscheduled breaks.*

- 1.1 The emission results will be compared to the results listed in the local authority permit.
- 1.2 The velocity and temperature profiles were within the required parameters or 3:1 metres/second and ± 10% for temperature profile. This information indicates that the sample ports are in ideal positions to collect the samples under representative conditions.

## 1.3 Monitoring Results

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Reference Conditions 273 K, 101.3 kPa	Date of Sampling	Start and End Times	Monitoring Method Reference	Operating Status
VMC 3 Polyester Auto Cell 1	Total Particulate Matter	50	Run 1 – 0.9 Run 2 – 4.1	mg/m <sup>3</sup>	273, 101.3kPa	15/09/09	0922 – 0954 1000 - 1032	BS EN 13284-1	Normal
	Volatile Organic Compounds	50	24.3	mg/m <sup>3</sup>			0922 - 1022	BS EN 13526	
	Isocyanates	0.1	<0.0001	mg/m <sup>3</sup>			0920 - 1020	USEPA Method 36	
VMC 3 Polyester Auto Cell 2	Total Particulate Matter	50	Run 1 – 0.9 Run 2 – 4.1	mg/m <sup>3</sup>	273, 101.3kPa	14/09/09	1408 – 1440 1445 - 1517	BS EN 13284-1	Normal
	Volatile Organic Compounds	50	14.6	mg/m <sup>3</sup>			1407 - 1507	BS EN 13526	
	Isocyanates	0.1	<0.0001	mg/m <sup>3</sup>			1410 - 1510	USEPA Method 36	
VMC 3 Polyester Auto Cell 3	Total Particulate Matter	50	Run 1 – 0.9 Run 2 – 4.1	mg/m <sup>3</sup>	273, 101.3kPa	14/09/09	1247 – 1319 1327 - 1359	BS EN 13284-1	Normal
	Volatile Organic Compounds	50	35.5	mg/m <sup>3</sup>			1250 - 1350	BS EN 13526	
	Isocyanates	0.1	<0.0001	mg/m <sup>3</sup>			1247 - 1347	USEPA Method 36	

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Reference Conditions 273 K, 101.3 kPa	Date of Sampling	Start and End Times	Monitoring Method Reference	Operating Status
VMC 3 PU Manual Spray 1	Total Particulate Matter	50	Run 1 – 1.8 Run 2 – 13.9	mg/m <sup>3</sup>	273, 101.3kPa	16/09/09	1042 – 1114 1117 - 1149	BS EN 13284-1	Normal
	Volatile Organic Compounds	50	39.5	mg/m <sup>3</sup>			1042 - 1142	BS EN 13526	
	Isocyanates	0.1	<0.0001	mg/m <sup>3</sup>			1050 - 1150	USEPA Method 36	
VMC 2 Manual Gear Nob	Total Particulate Matter	50	Run 1 – <0.6 Run 2 – <0.6	mg/m <sup>3</sup>	273, 101.3kPa	16/09/09	1225 – 1257 1300 - 1332	BS EN 13284-1	Normal
	Volatile Organic Compounds	50	31.4	mg/m <sup>3</sup>			1230 - 1330	BS EN 13526	
	Isocyanates	0.1	<0.0001	mg/m <sup>3</sup>			1225 - 1325	USEPA Method 36	
VMC 3 PU Auto	Total Particulate Matter	50	Run 1 – 0.4 Run 2 – 0.5	mg/m <sup>3</sup>	273, 101.3kPa	15/09/09	0930 – 1002 1005 - 1037	BS EN 13284-1	Normal
	Volatile Organic Compounds	50	28.9	mg/m <sup>3</sup>			0932 - 1032	BS EN 13526	
	Isocyanates	0.1	<0.0001	mg/m <sup>3</sup>			0930 - 1030	USEPA Method 36	



## 2 Supporting Information (Held by Redwing Environmental Ltd)

### 2.1 General Information

#### 2.1.1 Redwing Environmental Ltd staff details

Tony Berek – MCerts Level 1  
Registration number MM 06 702

Vicki Gavin – MCerts Level 1  
Registration number MM 02 018

### 2.2 Redwing Environmental Ltd method details

#### 2.2.1 Test Methods

##### 2.2.2 Particulate matter BS EN 13284-1: 2002

2.2.3 Total particulate matter was sampled using a Zambelli isokinetic sampling system in accordance with BS EN 13284-1: 2002 – Determination of Low Range Mass Concentration of dust (< 50mg/m<sup>3</sup>).

2.2.4 The Zambelli sampling system monitors temperature, static pressure and velocities within the duct using an S-type pitot tube and K-type thermocouple. The sampling rate is continuously monitored and adjusted relative to the duct velocity to ensure isokinetic-sampling conditions are maintained throughout the monitoring period.

2.2.5 Exhaust gases were drawn under isokinetic conditions from the exhaust points using the Zambelli sampling probe, particulate matter was then collected on a pre-weighed quartz filter (or most suitable filter for process) contained within the filter cassette holder, and the total particulate matter determined gravimetrically.

2.2.6 It is also necessary to wash the probe and nozzle out with water and then acetone between sampling and the weight of the probe washing added to that collected on the sample filter. Analysis of an acetone/water blank will be carried out and the result corrected accordingly.

2.2.7 The sample positions were calculated with respect to BS EN 13284-1: 2002 – Stationary source emissions – Determination of Low Range Mass Concentration of dust.

2.2.8 Sampling may be carried out internally or externally, the method used will be reported and provided there are no deviations from the method the uncertainty for the monitoring procedure is reported to be within the requirements specified by the Hazardous Waste Directive (HWD) as stated in the Environment Agency Technical Document M2

Uncertainty: ± 30%

## **2.3 Stack Velocity, Pressure and Temperature Measurements**

2.3.1 The stack velocity, pressure and temperature were measured by full pitot traverses of the duct using the points provided. Measurements were taken at ten equally spaced points along each proposed sampling line, excluding the 5% of the effective flue diameter from the wall.

## **2.4 Volatile organic compounds (BS EN 13526: 2001)**

2.4.1 Monitoring to determine VOC emission concentrations was in accordance with BS EN 13526: 2001.

2.4.2 Volatile organic compound concentrations were measured using a Signal 3030PM portable heated VOC analyser. The analyser works by burning the gas sample in a hydrogen flame. This ionises any organic compounds present and the current produced across an electric field is proportional to the number of carbon atoms.

2.4.3 The analyser and heated line were zeroed and calibrated with a test gas (80 ppm and 800ppm propane) prior to each sampling run. VOC sampling was undertaken over a period of at least 60 minutes to cover any process variation.

2.4.4 All data was logged onto a Grant Squirrel data logger set at 5 second logging intervals.

2.4.5 A list of response factors are available so that specific concentrations can be calculated for known solvents within the sample exhaust.

2.4.6 A heated line from the sample point to analyser was used to ensure that condensation did not occur leading to the loss of sample concentration.

## **2.5 Leak tests for extractive techniques**

2.5.1 All extractive-sampling techniques were tested for leaks before sampling proceeded. Any leaks present were eliminated prior to sampling and will be reported.

2.5.2 Leak checks are carried out during the calibration procedure, as the concentration of the calibration gas is known it is easily noticed if air is entering the sample line and diluting the gas.

## **2.6 Isocyanates (USEPA Method 36)**

2.6.1 There are several Isocyanates; these include TDI, MDI, HDI and IPDI. The isocyanate monitored was TDI (Toluene diisocyanate). All Isocyanates follow the same procedure for sampling and analysis.

2.6.2 Isocyanates can be sampled non-isokinetically following MDHS 25 or isokinetically following USEPA Method 36. The same equipment used for Particulate sampling was used for the monitoring of Isocyanates.

### **3.0 Quality Assurance**

- 3.1 Redwing Environmental Ltd will always endeavour to follow the methods specified in the Environment Agency Technical Guidance M2. The methods followed are listed as our Technical Procedures and will be put forward for UKAS accreditation.
- 3.2 Redwing Environmental Ltd is accredited to ISO 9001: 2000 and ISO 17025:2005

### **4.0 Disclaimer**

- 4.1 Redwing Environmental Ltd confirms that in preparing this report all reasonable skill and care has been exercised.
  - 4.1.1 Unless specifically assigned or transferred within the terms of the agreement, Redwing Environmental Ltd asserts and retains all copyright, and other Intellectual Property Rights, in and over the report and its contents.

# **APPENDIX 1**

## **Particulate and Velocity Certificates**

Stack Reference ID		VMC 3 Auto cell 1					
	Jaguar Motor Cars Ltd						
	RUN 1			RUN 2			
Filter Reference No	Q47/070909/06			Q47/070909/07			
Date	15th September 2009			15th September 2009			
Sample Period	9:22	to	9:54	10:00	to	10:32	
Velocity (Nm/s)	8.51						
Volume (Nm <sup>3</sup> /hr)	8662						
Average Stack Temp (°C)	21.80						
Permitted Temp Range (°C)	7.06	to			to	36.54	
Lowest Velocity Reading (m/s)	7.66						
Highest Velocity Reading (m/s)	9.15						
Ratio (less than 3:1)	1.20	:			:	1	
Oxygen %	20.8						
Carbon Dioxide %	0.10						
Moisture (%)	1.35						
Litres sampled	772			721			
Corrected volume sampled (m <sup>3</sup> )	0.729			0.681			
Blank Filter Run (mg/m <sup>3</sup> )	0.028						
Blank Wash Run (mg/m <sup>3</sup> )	0.014						
Particulate weight collected on filter (mg)	0.630			1.430			
Particulate Concentration on Filter (mg/m <sup>3</sup> )	0.86			2.10			
Particulate weight collected in Wash (mg)	0.02			1.35			
Particulate Concentration in Wash (mg/m <sup>3</sup> )	0.03			1.98			
Total Particulate Concentration (mg/m <sup>3</sup> )	0.89			4.08			
Total Particulate Concentration corrected for Oxygen, dry gas (mg/m <sup>3</sup> )	N/A			N/A			
Total Particulate Mass Emission (kg/hour)	0.026			0.132			

Stack Reference ID		VMC 3 Auto cell 2					
		Jaguar Motor Cars Ltd					
		RUN 1			RUN 2		
Filter Reference No	Q47/070909/03			Q47/070909/04			
Date	14th September 2009			14th September 2009			
Sample Period	14:08	to	14:40	14:45	to	15:17	
Velocity (Nm/s)	8.06						
Volume (Nm <sup>3</sup> /hr)	8205						
Average Stack Temp (°C)	21.68						
Permitted Temp Range (°C)	6.94	to			to	36.41	
Lowest Velocity Reading (m/s)	6.85						
Highest Velocity Reading (m/s)	9.44						
Ratio (less than 3:1)	1.38	:			:	1	
Oxygen %	20.8						
Carbon Dioxide %	0.10						
Moisture (%)	1.41						
Litres sampled	772			756			
Corrected volume sampled (m <sup>3</sup> )	0.718			0.703			
Blank Filter Run (mg/m <sup>3</sup> )	0.028						
Blank Wash Run (mg/m <sup>3</sup> )	0.014						
Particulate weight collected on filter (mg)	0.020			0.680			
Particulate Concentration on Filter (mg/m <sup>3</sup> )	0.03			0.97			
Particulate weight collected in Wash (mg)	0.06			0.01			
Particulate Concentration in Wash (mg/m <sup>3</sup> )	0.08			0.01			
Total Particulate Concentration (mg/m <sup>3</sup> )	0.11			0.98			
Total Particulate Concentration corrected for Oxygen, dry gas (mg/m <sup>3</sup> )	N/A			N/A			
Total Particulate Mass Emission (kg/hour)	0.003			0.031			

Stack Reference ID		VMC 3 Auto cell 3					
	Jaguar Motor Cars Ltd						
	RUN 1			RUN 2			
Filter Reference No	Q47/070909/01			Q47/070909/02			
Date	14th September 2009			14th September 2009			
Sample Period	12:47	to	13:19	13:27	to	13:59	
Velocity (Nm/s)	7.86						
Volume (Nm <sup>3</sup> /hr)	7996						
Average Stack Temp (°C)	21.68						
Permitted Temp Range (°C)	6.94	to			to	36.41	
Lowest Velocity Reading (m/s)	6.97						
Highest Velocity Reading (m/s)	8.55						
Ratio (less than 3:1)	1.23		:			1	
Oxygen %	20.8						
Carbon Dioxide %	0.10						
Moisture (%)	1.48						
Litres sampled	734			736			
Corrected volume sampled (m <sup>3</sup> )	0.690			0.685			
Blank Filter Run (mg/m <sup>3</sup> )	0.029						
Blank Wash Run (mg/m <sup>3</sup> )	0.015						
Particulate weight collected on filter (mg)	1.290			0.730			
Particulate Concentration on Filter (mg/m <sup>3</sup> )	1.87			1.06			
Particulate weight collected in Wash (mg)	1.54			5.81			
Particulate Concentration in Wash (mg/m <sup>3</sup> )	2.23			8.48			
Total Particulate Concentration (mg/m <sup>3</sup> )	4.10			9.54			
Total Particulate Concentration corrected for Oxygen, dry gas (mg/m <sup>3</sup> )	N/A			N/A			
Total Particulate Mass Emission (kg/hour)	0.110			0.284			

Stack Reference ID	VMC 3 Manual PU Spray booth					
	Jaguar Motor Cars Ltd					
	RUN 1			RUN 2		
Filter Reference No	Q47/070909/08			Q47/070909/09		
Date	16th September 2009			16th September 2009		
Sample Period	10:42	to	11:14	11:17	to	11:49
Velocity (Nm/s)	7.34					
Volume (Nm <sup>3</sup> /hr)	16800					
Average Stack Temp (°C)	22.80					
Permitted Temp Range (°C)	8.01	to			to	37.59
Lowest Velocity Reading (m/s)	5.35					
Highest Velocity Reading (m/s)	10.27					
Ratio (less than 3:1)	1.92	:			:	1
Oxygen %	20.8					
Carbon Dioxide %	0.10					
Moisture (%)	1.60					
Litres sampled	707			631		
Corrected volume sampled (m <sup>3</sup> )	0.668			0.596		
Blank Filter Run (mg/m <sup>3</sup> )	0.032					
Blank Wash Run (mg/m <sup>3</sup> )	0.016					
Particulate weight collected on filter (mg)	0.410			6.070		
Particulate Concentration on Filter (mg/m <sup>3</sup> )	0.61			10.19		
Particulate weight collected in Wash (mg)	0.80			2.23		
Particulate Concentration in Wash (mg/m <sup>3</sup> )	1.20			3.74		
Total Particulate Concentration (mg/m <sup>3</sup> )	1.81			13.93		
Total Particulate Concentration corrected for Oxygen, dry gas (mg/m <sup>3</sup> )	N/A			N/A		
Total Particulate Mass Emission (kg/hour)	0.058			0.288		



Stack Reference ID		VMC 3 Automatic PU Spray booth					
	Jaguar Motor Cars Ltd						
	RUN 1			RUN 2			
Filter Reference No	Q47/070909/10			Q47/070909/11			
Date	15th September 2009			15th September 2009			
Sample Period	9:30	to	10:02	10:05	to	10:37	
Velocity (Nm/s)	12.10						
Volume (Nm <sup>3</sup> /hr)	15817						
Average Stack Temp (°C)	21.60						
Permitted Temp Range (°C)	6.87	to			to	36.33	
Lowest Velocity Reading (m/s)	11.20						
Highest Velocity Reading (m/s)	12.59						
Ratio (less than 3:1)	1.12		:			1	
Oxygen %	20.8						
Carbon Dioxide %	0.10						
Moisture (%)	1.00						
Litres sampled	1079			1047			
Corrected volume sampled (m <sup>3</sup> )	1.019			0.989			
Blank Filter Run (mg/m <sup>3</sup> )	0.020						
Blank Wash Run (mg/m <sup>3</sup> )	0.010						
Particulate weight collected on filter (mg)	0.060			0.030			
Particulate Concentration on Filter (mg/m <sup>3</sup> )	0.06			0.03			
Particulate weight collected in Wash (mg)	0.33			0.44			
Particulate Concentration in Wash (mg/m <sup>3</sup> )	0.32			0.45			
Total Particulate Concentration (mg/m <sup>3</sup> )	0.38			0.48			
Total Particulate Concentration corrected for Oxygen, dry gas (mg/m <sup>3</sup> )	N/A			N/A			
Total Particulate Mass Emission (kg/hour)	0.016			0.021			

Stack Reference ID		VMC2 Manual Gear Nob Spray Booth					
	Jaguar Motor Cars Ltd						
	RUN 1			RUN 2			
Filter Reference No	Q47070909/13			Q47070909/14			
Date	16-Sep-09			16-Sep-09			
Sample Period	12:25	to	12:57	13:00	to	13:32	
Average Velocity (Nm/s)	7.06						
Average Volume (Nm <sup>3</sup> /hr)	29636						
Average Stack Temp (°C)	20.00						
Permitted Temp Range (°C)	5.49		to			34.80	
Lowest Velocity Reading (m/s)	6.20						
Highest Velocity Reading (m/s)	8.68						
Ratio (less than 3:1)	1.40		:			1	
Oxygen %	20.9						
Carbon Dioxide %	0.00						
Moisture (%)	0.07						
Litres sampled	469			475			
Corrected volume sampled (m <sup>3</sup> )	4.488			4.545			
Blank Filter Run (mg/m <sup>3</sup> )	<0.22						
Particulate Concentration on Filter (mg/m <sup>3</sup> )	<0.6			<0.6			
Particulate Concentration in Wash (mg/m <sup>3</sup> )	<0.6			<0.6			
Total Particulate Concentration (mg/m <sup>3</sup> )	<0.6			<0.6			
Total Particulate Concentration corrected for Oxygen, dry gas (mg/m <sup>3</sup> )	N/A			N/A			
Total Particulate Mass Emission (kg/hour)	<0.001			<0.001			

# **APPENDIX 2**

## **Volatile Organic Compound Results**

VMC 3 Polyester Automatic Cell 1 - VOC Monitoring					
Date	Time	VOC mg/m <sup>3</sup>	Date	Time	VOC mg/m <sup>3</sup>
15-Sep-09	09:22:47	27.59	15-Sep-09	10:11:47	26.74
15-Sep-09	09:23:47	25.01	15-Sep-09	10:12:47	26.10
15-Sep-09	09:24:47	24.25	15-Sep-09	10:13:47	29.60
15-Sep-09	09:25:47	24.75	15-Sep-09	10:14:47	28.22
15-Sep-09	09:26:47	26.37	15-Sep-09	10:15:47	25.38
15-Sep-09	09:27:47	25.73	15-Sep-09	10:16:47	25.02
15-Sep-09	09:28:47	29.23	15-Sep-09	10:17:47	27.85
15-Sep-09	09:29:47	27.95	15-Sep-09	10:18:47	26.18
15-Sep-09	09:30:47	25.09	15-Sep-09	10:19:47	28.70
15-Sep-09	09:31:47	25.02	15-Sep-09	10:20:47	30.21
15-Sep-09	09:32:47	27.47	15-Sep-09	10:21:47	26.63
15-Sep-09	09:33:47	26.24			
15-Sep-09	09:34:47	29.38			
15-Sep-09	09:35:47	29.12			
15-Sep-09	09:36:47	26.89			
15-Sep-09	09:37:47	25.22			
15-Sep-09	09:38:47	28.24			
15-Sep-09	09:39:47	26.86			
15-Sep-09	09:40:47	28.49			
15-Sep-09	09:41:47	14.11			
15-Sep-09	09:42:47	9.21			
15-Sep-09	09:43:47	8.39			
15-Sep-09	09:44:47	7.43			
15-Sep-09	09:45:47	6.98			
15-Sep-09	09:46:47	6.72			
15-Sep-09	09:47:47	6.56			
15-Sep-09	09:48:47	6.46			
15-Sep-09	09:49:47	23.22			
15-Sep-09	09:50:47	24.03			
15-Sep-09	09:51:47	25.28			
15-Sep-09	09:52:47	26.36			
15-Sep-09	09:53:47	25.73			
15-Sep-09	09:54:47	28.70			
15-Sep-09	09:55:47	27.77			
15-Sep-09	09:56:47	25.26			
15-Sep-09	09:57:47	24.06			
15-Sep-09	09:58:47	26.60			
15-Sep-09	09:59:47	25.79			
15-Sep-09	10:00:47	27.59			
15-Sep-09	10:01:47	29.38			
15-Sep-09	10:02:47	26.04			
15-Sep-09	10:03:47	23.58			
15-Sep-09	10:04:47	26.47			
15-Sep-09	10:05:47	26.63			
15-Sep-09	10:06:47	27.29			
15-Sep-09	10:07:47	31.40			
15-Sep-09	10:08:47	27.87			
15-Sep-09	10:09:47	24.54			
15-Sep-09	10:10:47	26.65			
			<b>Average</b>		<b>24.31</b>

VMC 3 Polyester Automatic Cell 2 - VOC Monitoring					
Date	Time	VOC mg/m <sup>3</sup>	Date	Time	VOC mg/m <sup>3</sup>
14-Sep-09	14:07:22	21.38	14-Sep-09	14:56:22	12.78
14-Sep-09	14:08:22	20.01	14-Sep-09	14:57:22	13.26
14-Sep-09	14:09:22	18.08	14-Sep-09	14:58:22	13.10
14-Sep-09	14:10:22	16.31	14-Sep-09	14:59:22	13.26
14-Sep-09	14:11:22	15.35	14-Sep-09	15:00:22	13.26
14-Sep-09	14:12:22	14.87	14-Sep-09	15:01:22	13.26
14-Sep-09	14:13:22	14.95	14-Sep-09	15:02:22	13.42
14-Sep-09	14:14:22	14.71	14-Sep-09	15:03:22	13.26
14-Sep-09	14:15:22	14.38	14-Sep-09	15:04:22	13.26
14-Sep-09	14:16:22	14.06	14-Sep-09	15:05:22	13.66
14-Sep-09	14:17:22	13.90	14-Sep-09	15:06:22	13.42
14-Sep-09	14:18:22	14.06	14-Sep-09	15:07:22	13.10
14-Sep-09	14:19:22	14.06			
14-Sep-09	14:20:22	14.06			
14-Sep-09	14:21:22	14.06			
14-Sep-09	14:22:22	14.38			
14-Sep-09	14:23:22	14.38			
14-Sep-09	14:24:22	14.22			
14-Sep-09	14:25:22	14.38			
14-Sep-09	14:26:22	13.90			
14-Sep-09	14:27:22	14.06			
14-Sep-09	14:28:22	14.06			
14-Sep-09	14:29:22	13.74			
14-Sep-09	14:30:22	13.74			
14-Sep-09	14:31:22	13.42			
14-Sep-09	14:32:22	13.26			
14-Sep-09	14:33:22	13.26			
14-Sep-09	14:34:22	13.10			
14-Sep-09	14:35:22	13.42			
14-Sep-09	14:36:22	13.26			
14-Sep-09	14:37:22	13.10			
14-Sep-09	14:38:22	13.42			
14-Sep-09	14:39:22	13.74			
14-Sep-09	14:40:22	13.74			
14-Sep-09	14:41:22	13.90			
14-Sep-09	14:42:22	13.74			
14-Sep-09	14:43:22	14.06			
14-Sep-09	14:44:22	13.90			
14-Sep-09	14:45:22	13.90			
14-Sep-09	14:46:22	14.22			
14-Sep-09	14:47:22	13.26			
14-Sep-09	14:48:22	13.42			
14-Sep-09	14:49:22	13.26			
14-Sep-09	14:50:22	13.10			
14-Sep-09	14:51:22	13.10			
14-Sep-09	14:52:22	12.78			
14-Sep-09	14:53:22	12.78			
14-Sep-09	14:54:22	12.78			
14-Sep-09	14:55:22	12.94			
			<b>Average</b>		<b>13.97</b>

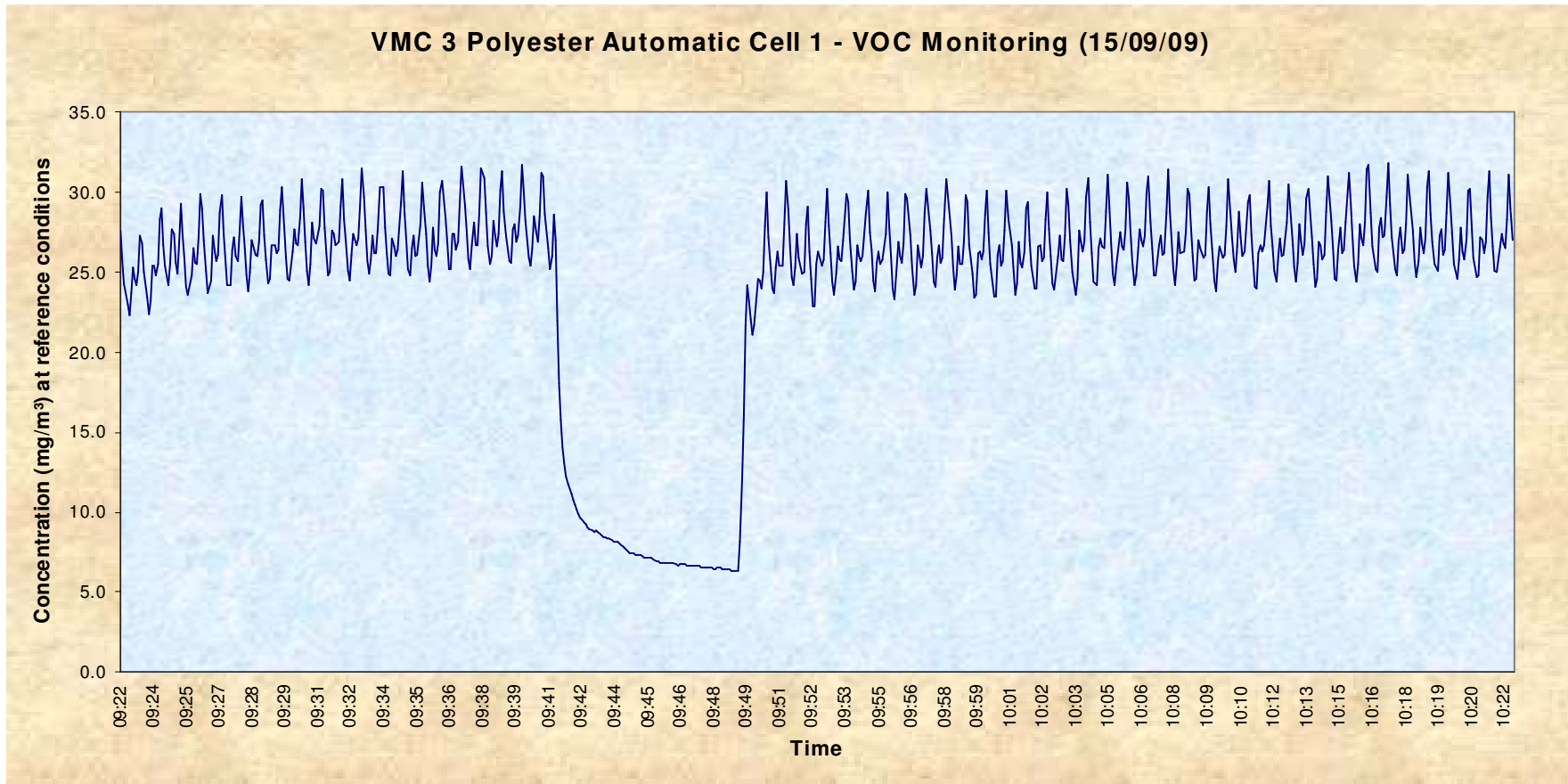
VMC 3 Polyester Automatic Cell 3 - VOC Monitoring					
Date	Time	VOC mg/m <sup>3</sup>	Date	Time	VOC mg/m <sup>3</sup>
14-Sep-09	12:50:46	33.94	14-Sep-09	13:39:46	46.96
14-Sep-09	12:51:46	37.86	14-Sep-09	13:40:46	45.13
14-Sep-09	12:52:46	45.29	14-Sep-09	13:41:46	41.95
14-Sep-09	12:53:46	43.65	14-Sep-09	13:42:46	42.91
14-Sep-09	12:54:46	41.59	14-Sep-09	13:43:46	43.10
14-Sep-09	12:55:46	44.45	14-Sep-09	13:44:46	41.75
14-Sep-09	12:56:46	37.83	14-Sep-09	13:45:46	43.62
14-Sep-09	12:57:46	33.62	14-Sep-09	13:46:46	48.57
14-Sep-09	12:58:46	36.96	14-Sep-09	13:47:46	49.79
14-Sep-09	12:59:46	43.33	14-Sep-09	13:48:46	43.55
14-Sep-09	13:00:46	46.13	14-Sep-09	13:49:46	45.03
14-Sep-09	13:01:46	41.14	14-Sep-09	13:50:46	38.67
14-Sep-09	13:02:46	44.90			
14-Sep-09	13:03:46	42.65	Average		35.51
14-Sep-09	13:04:46	33.69			
14-Sep-09	13:05:46	24.46			
14-Sep-09	13:06:46	15.24			
14-Sep-09	13:07:46	12.66			
14-Sep-09	13:08:46	11.51			
14-Sep-09	13:09:46	10.80			
14-Sep-09	13:10:46	11.06			
14-Sep-09	13:11:46	11.38			
14-Sep-09	13:12:46	10.48			
14-Sep-09	13:13:46	10.54			
14-Sep-09	13:14:46	9.64			
14-Sep-09	13:15:46	8.94			
14-Sep-09	13:16:46	26.90			
14-Sep-09	13:17:46	42.98			
14-Sep-09	13:18:46	41.30			
14-Sep-09	13:19:46	38.76			
14-Sep-09	13:20:46	40.89			
14-Sep-09	13:21:46	41.85			
14-Sep-09	13:22:46	39.54			
14-Sep-09	13:23:46	41.56			
14-Sep-09	13:24:46	47.03			
14-Sep-09	13:25:46	45.96			
14-Sep-09	13:26:46	41.50			
14-Sep-09	13:27:46	42.46			
14-Sep-09	13:28:46	15.30			
14-Sep-09	13:29:46	30.02			
14-Sep-09	13:30:46	34.39			
14-Sep-09	13:31:46	41.72			
14-Sep-09	13:32:46	44.65			
14-Sep-09	13:33:46	41.50			
14-Sep-09	13:34:46	44.45			
14-Sep-09	13:35:46	39.47			
14-Sep-09	13:36:46	32.01			
14-Sep-09	13:37:46	34.20			
14-Sep-09	13:38:46	44.07			

VMC 2 Manual Gear Nob - VOC Monitoring					
Date	Time	VOC mg/m <sup>3</sup>	Date	Time	VOC mg/m <sup>3</sup>
16-Sep-09	12:30:02	4.02	16-Sep-09	13:19:02	16.07
16-Sep-09	12:31:02	3.21	16-Sep-09	13:20:02	12.86
16-Sep-09	12:32:02	3.21	16-Sep-09	13:21:02	11.25
16-Sep-09	12:33:02	3.21	16-Sep-09	13:22:02	10.45
16-Sep-09	12:34:02	3.21	16-Sep-09	13:23:02	9.64
16-Sep-09	12:35:02	3.21			
16-Sep-09	12:36:02	3.21			
16-Sep-09	12:37:02	3.21			
16-Sep-09	12:38:02	3.21			
16-Sep-09	12:39:02	4.82			
16-Sep-09	12:40:02	3.21			
16-Sep-09	12:41:02	16.07			
16-Sep-09	12:42:02	19.29			
16-Sep-09	12:43:02	523.13	Average		31.42
16-Sep-09	12:44:02	306.96			
16-Sep-09	12:45:02	69.91			
16-Sep-09	12:46:02	36.16			
16-Sep-09	12:47:02	23.30			
16-Sep-09	12:48:02	16.07			
16-Sep-09	12:49:02	14.46			
16-Sep-09	12:50:02	11.25			
16-Sep-09	12:51:02	9.64			
16-Sep-09	12:52:02	8.84			
16-Sep-09	12:53:02	8.04			
16-Sep-09	12:54:02	8.04			
16-Sep-09	12:55:02	8.04			
16-Sep-09	12:56:02	6.43			
16-Sep-09	12:57:02	8.04			
16-Sep-09	12:58:02	6.43			
16-Sep-09	12:59:02	7.23			
16-Sep-09	13:00:02	7.23			
16-Sep-09	13:01:02	6.43			
16-Sep-09	13:02:02	7.23			
16-Sep-09	13:03:02	5.63			
16-Sep-09	13:04:02	6.43			
16-Sep-09	13:05:02	7.23			
16-Sep-09	13:06:02	4.82			
16-Sep-09	13:07:02	6.43			
16-Sep-09	13:08:02	7.23			
16-Sep-09	13:09:02	6.43			
16-Sep-09	13:10:02	8.04			
16-Sep-09	13:11:02	11.25			
16-Sep-09	13:12:02	11.25			
16-Sep-09	13:13:02	11.25			
16-Sep-09	13:14:02	8.84			
16-Sep-09	13:15:02	355.18			
16-Sep-09	13:16:02	60.27			
16-Sep-09	13:17:02	28.13			
16-Sep-09	13:18:02	20.89			

VMC 3 PU Manual Spray - VOC Monitoring					
Date	Time	VOC mg/m <sup>3</sup>	Date	Time	VOC mg/m <sup>3</sup>
16-Sep-09	10:42:05	8.84	16-Sep-09	11:31:05	7.23
16-Sep-09	10:43:05	13.66	16-Sep-09	11:32:05	7.23
16-Sep-09	10:44:05	12.05	16-Sep-09	11:33:05	5.63
16-Sep-09	10:45:05	13.66	16-Sep-09	11:34:05	5.63
16-Sep-09	10:46:05	24.91	16-Sep-09	11:35:05	7.23
16-Sep-09	10:47:05	74.73	16-Sep-09	11:36:05	5.63
16-Sep-09	10:48:05	181.61	16-Sep-09	11:37:05	5.63
16-Sep-09	10:49:05	173.57	16-Sep-09	11:38:05	5.63
16-Sep-09	10:50:05	212.14	16-Sep-09	11:39:05	7.23
16-Sep-09	10:51:05	191.25	16-Sep-09	11:40:05	7.23
16-Sep-09	10:52:05	165.54	16-Sep-09	11:41:05	7.23
16-Sep-09	10:53:05	176.79	16-Sep-09	11:42:05	7.23
16-Sep-09	10:54:05	234.64			
16-Sep-09	10:55:05	107.68		Average	39.47
16-Sep-09	10:56:05	71.52			
16-Sep-09	10:57:05	60.27			
16-Sep-09	10:58:05	50.63			
16-Sep-09	10:59:05	44.20			
16-Sep-09	11:00:05	37.77			
16-Sep-09	11:01:05	34.55			
16-Sep-09	11:02:05	31.34			
16-Sep-09	11:03:05	28.13			
16-Sep-09	11:04:05	26.52			
16-Sep-09	11:05:05	23.30			
16-Sep-09	11:06:05	21.70			
16-Sep-09	11:07:05	20.09			
16-Sep-09	11:08:05	18.48			
16-Sep-09	11:09:05	16.88			
16-Sep-09	11:10:05	15.27			
16-Sep-09	11:11:05	15.27			
16-Sep-09	11:12:05	13.66			
16-Sep-09	11:13:05	13.66			
16-Sep-09	11:14:05	12.05			
16-Sep-09	11:15:05	12.05			
16-Sep-09	11:16:05	12.05			
16-Sep-09	11:17:05	10.45			
16-Sep-09	11:18:05	10.45			
16-Sep-09	11:19:05	10.45			
16-Sep-09	11:20:05	8.84			
16-Sep-09	11:21:05	8.84			
16-Sep-09	11:22:05	8.84			
16-Sep-09	11:23:05	8.84			
16-Sep-09	11:24:05	8.84			
16-Sep-09	11:25:05	7.23			
16-Sep-09	11:26:05	7.23			
16-Sep-09	11:27:05	7.23			
16-Sep-09	11:28:05	7.23			
16-Sep-09	11:29:05	7.23			
16-Sep-09	11:30:05	7.23			

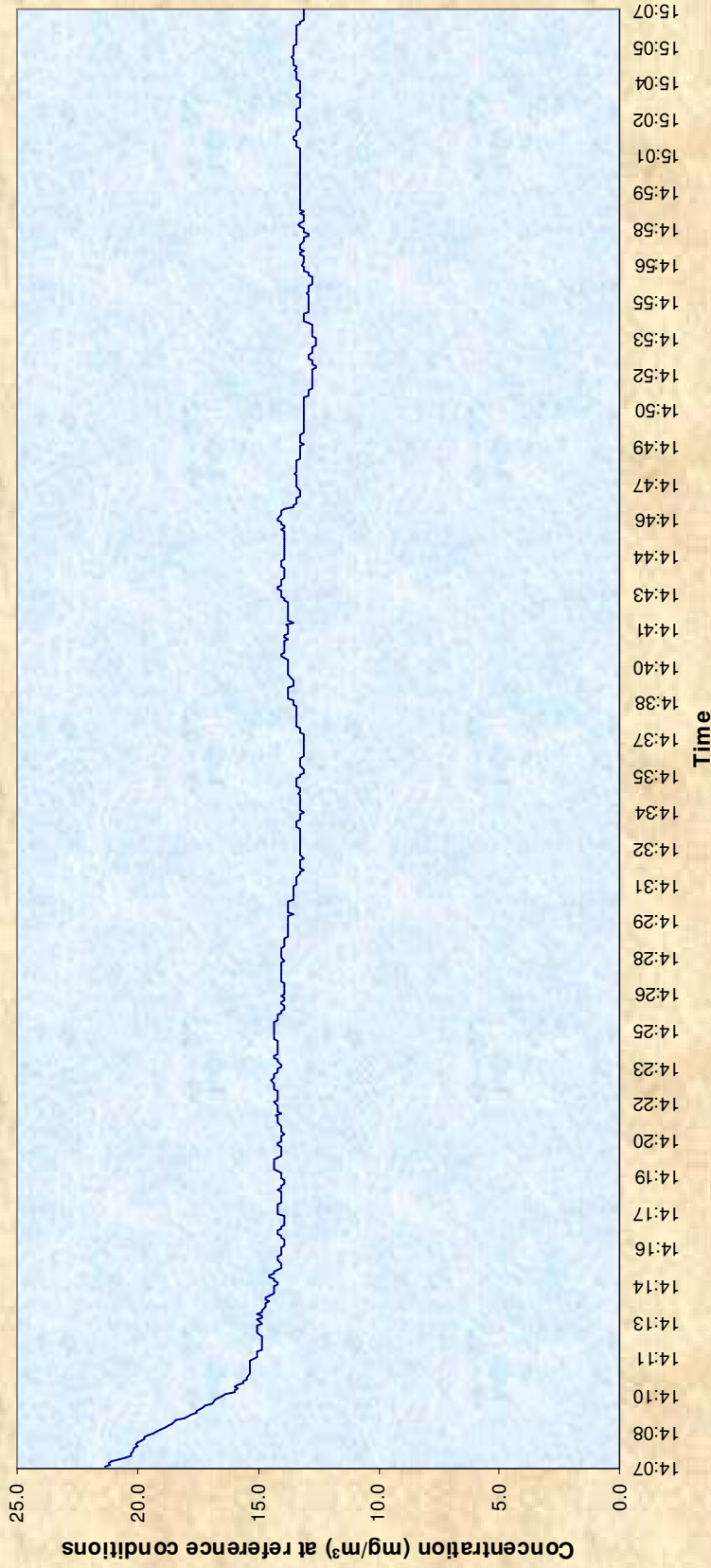


VMC 3 PU Automatic Spray - VOC					
Date	Time	VOC mg/m <sup>3</sup>	Date	Time	VOC mg/m <sup>3</sup>
15-Sep-09	09:30:00	7.23	15-Sep-09	10:19:00	4.02
15-Sep-09	09:31:00	7.23	15-Sep-09	10:20:00	4.02
15-Sep-09	09:32:00	7.23	15-Sep-09	10:21:00	4.02
15-Sep-09	09:33:00	7.23	15-Sep-09	10:22:00	4.02
15-Sep-09	09:34:00	53.84	15-Sep-09	10:23:00	4.02
15-Sep-09	09:35:00	60.27	15-Sep-09	10:24:00	4.02
15-Sep-09	09:36:00	130.18	15-Sep-09	10:25:00	4.02
15-Sep-09	09:37:00	141.43	15-Sep-09	10:26:00	4.02
15-Sep-09	09:38:00	110.89	15-Sep-09	10:27:00	4.02
15-Sep-09	09:39:00	226.61	15-Sep-09	10:28:00	4.02
15-Sep-09	09:40:00	124.55	15-Sep-09	10:29:00	4.02
15-Sep-09	09:41:00	84.38			
15-Sep-09	09:42:00	85.18			
15-Sep-09	09:43:00	57.05			
15-Sep-09	09:44:00	52.23			
15-Sep-09	09:45:00	26.52			
15-Sep-09	09:46:00	34.55			
15-Sep-09	09:47:00	68.30			
15-Sep-09	09:48:00	42.59			
15-Sep-09	09:49:00	65.09			
15-Sep-09	09:50:00	53.84			
15-Sep-09	09:51:00	36.16			
15-Sep-09	09:52:00	23.30			
15-Sep-09	09:53:00	18.48			
15-Sep-09	09:54:00	16.88			
15-Sep-09	09:55:00	13.66			
15-Sep-09	09:56:00	13.66			
15-Sep-09	09:57:00	12.05			
15-Sep-09	09:58:00	10.45			
15-Sep-09	09:59:00	10.45			
15-Sep-09	10:00:00	10.45			
15-Sep-09	10:01:00	8.84			
15-Sep-09	10:02:00	8.84			
15-Sep-09	10:03:00	8.84			
15-Sep-09	10:04:00	8.84			
15-Sep-09	10:05:00	8.84			
15-Sep-09	10:06:00	7.23			
15-Sep-09	10:07:00	7.23			
15-Sep-09	10:08:00	7.23			
15-Sep-09	10:09:00	7.23			
15-Sep-09	10:10:00	7.23			
15-Sep-09	10:11:00	7.23			
15-Sep-09	10:12:00	5.63			
15-Sep-09	10:13:00	5.63			
15-Sep-09	10:14:00	5.63			
15-Sep-09	10:15:00	5.63			
15-Sep-09	10:16:00	5.63			
15-Sep-09	10:17:00	3.21			
15-Sep-09	10:18:00	4.02			
			<b>Average</b>		<b>28.89</b>

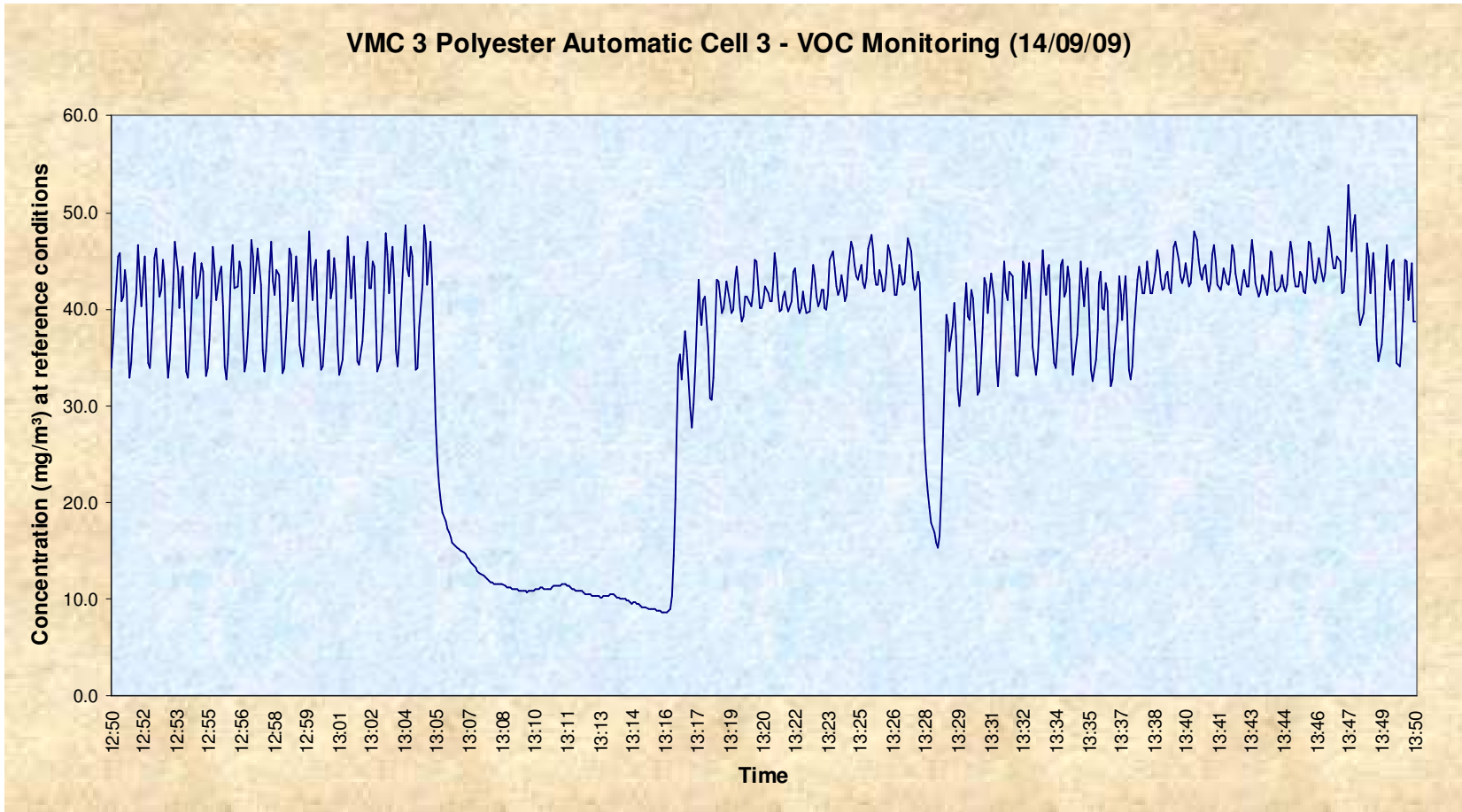


Average Run Time			Volatile Organic Compound (ppm)			Volatile Organic Compound (mg/m <sup>3</sup> )		
			Mean	Max	Min	Mean	Max	Min
9:22	to	9:52	13.53	19.73	3.94	21.75	31.71	6.33
9:52	to	10:22	16.73	19.80	14.47	26.89	31.82	23.26

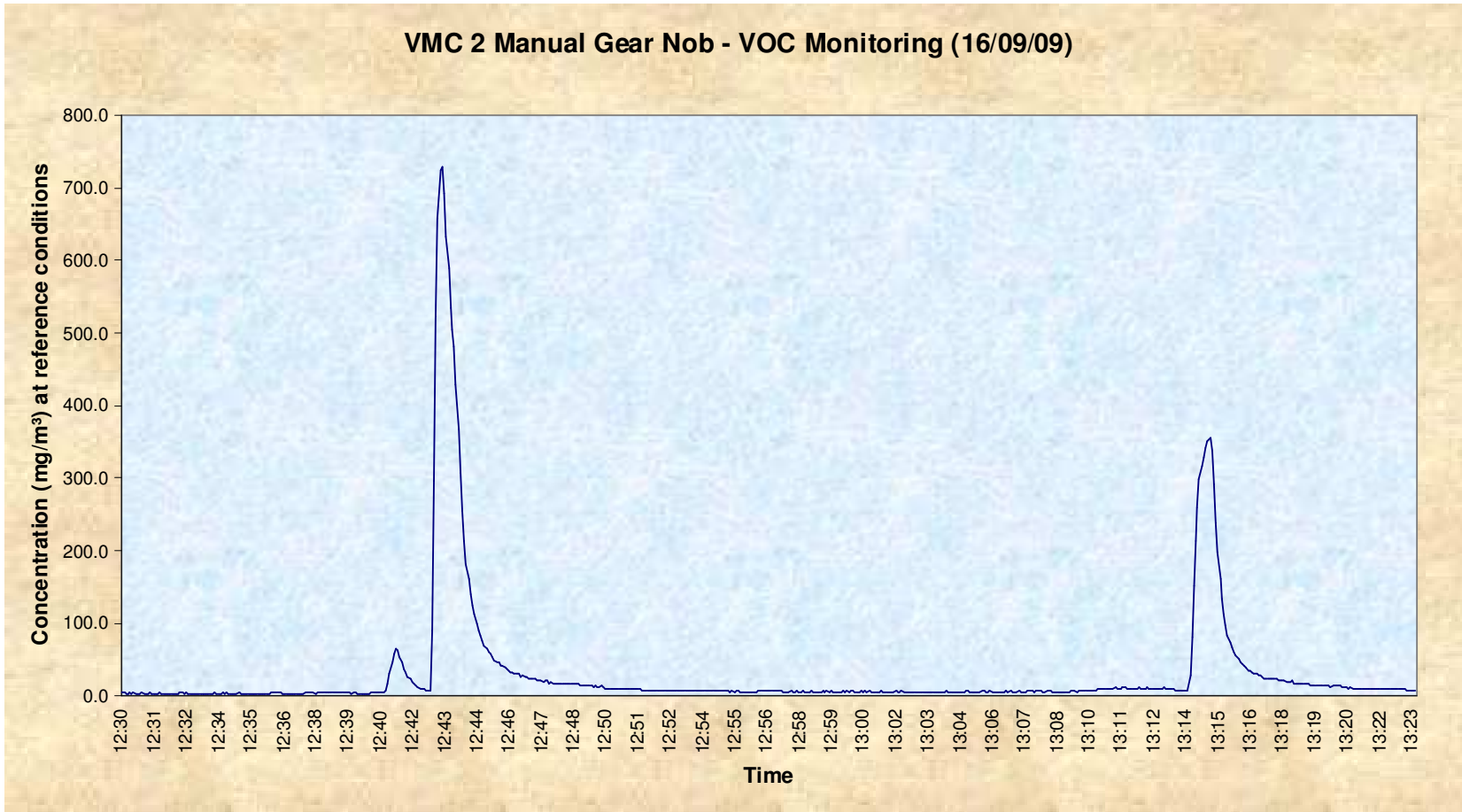
VMC 3 Polyester Automatic Cell 2 - VOC Monitoring (14/09/09)



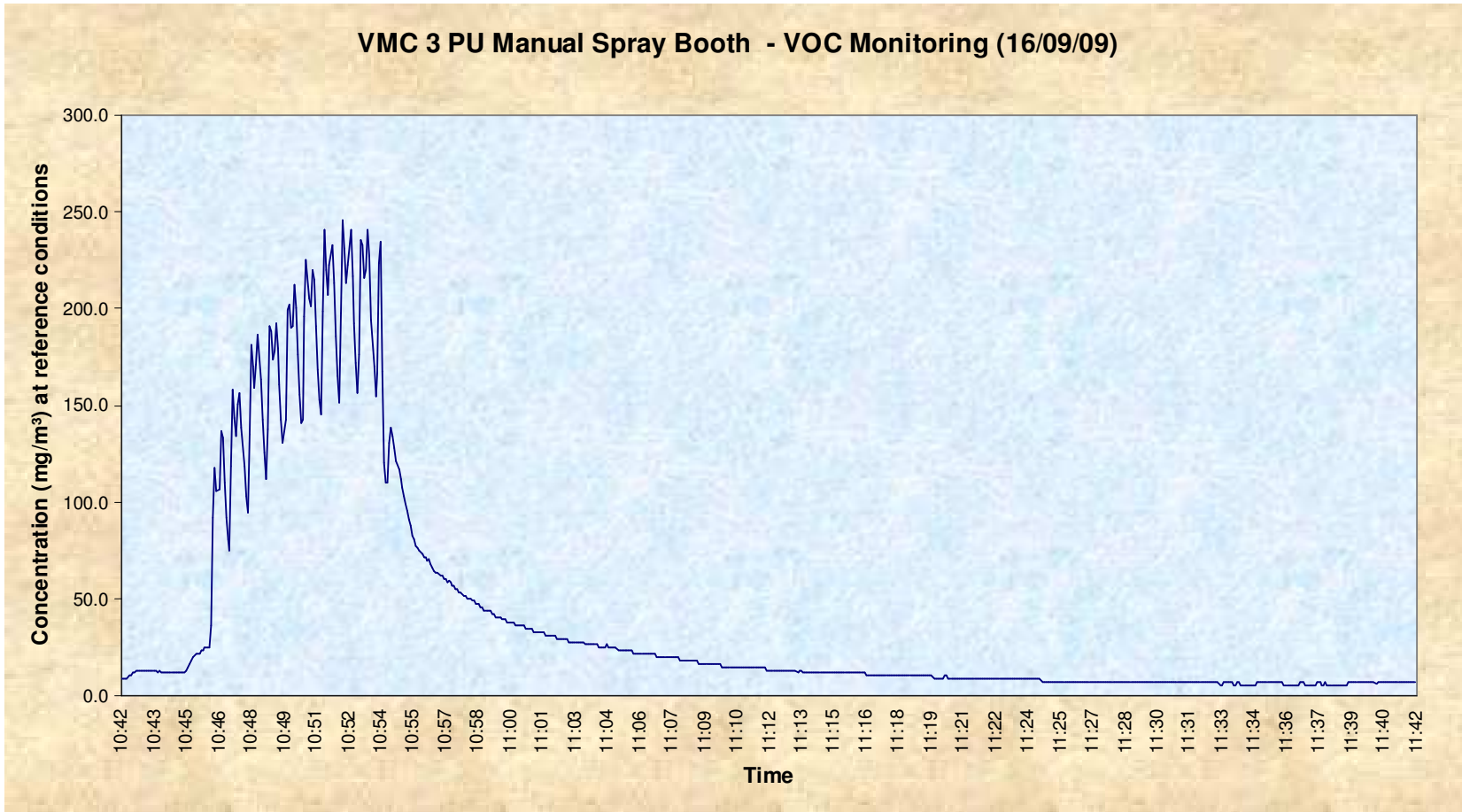
Average Run Time		Volatile Organic Compound (ppm)		Volatile Organic Compound (mg/m <sup>3</sup> )	
		Mean	Max	Mean	Min
14:07	to 14:37	9.06	13.30	14.56	13.10
14:37	to 15:07	8.32	8.85	13.37	12.62



Average Run Time			Volatile Organic Compound (ppm)			Volatile Organic Compound (mg/m³)		
			Mean	Max	Min	Mean	Max	Min
12:50	to	13:20	18.56	30.34	5.38	29.82	48.76	8.65
13:20	to	13:50	25.65	32.86	9.52	41.22	52.81	15.30

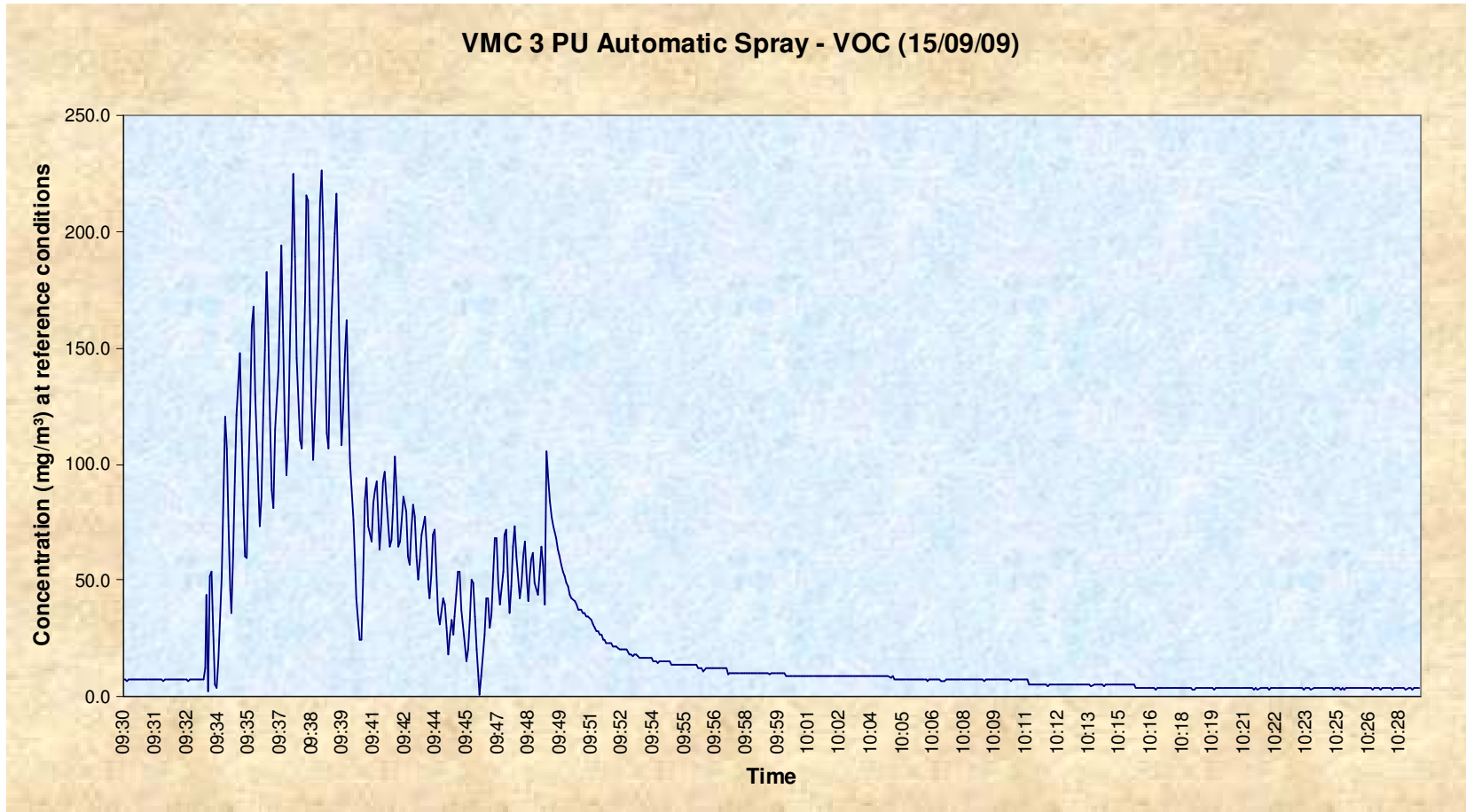


Average Run Time			Volatile Organic Compound (ppm)			Volatile Organic Compound (mg/m³)		
			Mean	Max	Min	Mean	Max	Min
12:30	to	13:00	21.97	453.50	2.00	35.30	728.84	3.21
13:00	to	13:30	16.41	221.00	3.00	26.37	355.18	4.82



Average Run Time			Volatile Organic Compound (ppm)			Volatile Organic Compound (mg/m³)		
			Mean	Max	Min	Mean	Max	Min
10:42	to	11:12	43.81	153.00	5.50	70.40	245.89	8.84
11:12	to	11:42	5.26	8.50	3.50	8.46	13.66	5.63





Average Run Time			Volatile Organic Compound (ppm)			Volatile Organic Compound (mg/m³)		
			Mean	Max	Min	Mean	Max	Min
9:30	to	10:00	32.38	141.00	0.50	52.04	226.61	0.80
10:00	to	10:30	3.58	6.50	2.00	5.76	10.45	3.21



# **APPENDIX 3**

## **Velocity raw information**

Velocity & Temperature Profile following BS EN 13284-1									
<b>Client</b>		Jaguar Motor Cars Ltd							
<b>Site Address</b>		Browns Lane, Coventry							
<b>Job Number</b>		P-RED09-041/EB/R1/Rev0							
<b>Date</b>		15th September 2009							
<b>Operator(s)</b>		Vicki Gavin & Tony Berek							
<b>Stack Reference</b>		VMC 3 Auto cell 1			<b>Isokinetic Sample Positions (%)</b> multiply by diameter to obtain sample points		<b>Sampling Plane Diagram</b>		
<b>Number of Stacks</b>		1			1 14.60				
<b>Stack Configuration</b>		Round			2 85.40				
<b>Dimensions (mtrs)</b>		0.60			3 N/A				
<b>Outlet Diameter (if applicable) (metres)</b>					4 N/A				
<b>Number of Sample Ports</b>		2			5 N/A				
<b>Number of Samples per Axis / Port</b>		2			6 N/A				
<b>Nozzle Diameter (mm)</b>		8.0			7 N/A				
<b>Nozzle Area (m<sup>2</sup>)</b>		0.00005024			8 N/A				
<b>Stack Area (m<sup>2</sup>)</b>		0.283			<b>Average Isokinetic Flow Rate (ltrs/min)</b>		<b>Axis 1</b>		<b>Axis 2</b>
<b>Pitot Coefficient</b>		1.00	<b>Pitot Calibration Due Date</b>			April 2009		<b>Atmos. Pressure (kPa)</b>	
<b>Position</b>		<b>Distance</b>	<b>Axis 1</b>	<b>Temperature</b>	<b>Swirl Test</b>	<b>Axis 2</b>	<b>Temperature</b>	<b>Swirl Test</b>	101.0
<b>No.</b>		<b>(cms)</b>	<b>(pa)</b>	<b>(C)</b>	<b>Pass (Y/N)</b>	<b>(pa)</b>	<b>(C)</b>	<b>Pass (Y/N)</b>	<b>Static Pressure (pa)</b>
1		8.76	38	21.8	Y	43	21.8	Y	46.00
2		51.24	35	21.8	Y	47	21.8	Y	
3		N/A							<b>1 Axis</b>
4		N/A							<b>2 Axis</b>
5		N/A							<b>Velocity of flow (Nm/s)</b>
6		N/A							8.06
7		N/A							8.95
8		N/A							<b>Volume Flow Rate (Nm<sup>3</sup>/s)</b>
<b>Averages</b>			37	21.8		45	21.8		2.28
<b>Mean Flue Gas Temp (in K) Tp = ((Mean T1 + Mean T2)/2)+273) =</b>									2.53
<b>Permitted Range of gas temperature readings (C) = (0.95Tp-273) to (1.05Tp-273) =</b>									<b>Reduced Exit Velocity (m/s)</b>
<b>Highest Velocity Reading (m/s) =</b>									7.7
<b>Lowest Velocity Reading (m/s) =</b>									1.20 : 1
<b>Ratio Highest:Lowest (Max permitted = 3:1)</b>									N/A
<b>On site Checklist</b>									
<b>Range of Gas Temps</b>		OK			<b>Manometer Leak Check</b>		OK		
<b>Leak Check recorded (l/min)</b>		<0.1			<b>Pitot Leak Check</b>		OK		
<b>Leak Check &lt; 2% Vol (l/min)</b>		0.51			<b>Overall Isokinetic Ratio (%) (-5 to +15%)</b>		94.1		
<b>Passed minimum Velocity requirements (&gt;5pa)</b>		YES			<b>Passed Highest to lowest Velocity (3:1)</b>		YES		
<b>Negative Local Flow Present, YES or NO (Yes = Fail)</b>		NO			<b>Are there sufficient rails and kick board? (YES, NO or N/A)</b>		YES		
<b>Is the Platform area greater than 5m<sup>2</sup>? (YES, NO or N/A)</b>		YES			<b>Is the area in front of the sample line the length of the probe + 1 metre? (YES or NO)</b>		YES		
<b>Site Equipment Used</b>									
<b>Pitot Reference</b>		RED 0136			<b>Manometer Reference</b>		RED 0096		
<b>Thermometer Reference</b>		RED 0095			<b>Thermocouple Reference</b>		RED 0273		
<b>Balance Reference</b>		RED 0204			<b>Sampling Pump Reference</b>		RED 0258		
<b>Tape Measure Reference</b>		RED 0122			<b>Barometer Reference</b>		RED 0094		

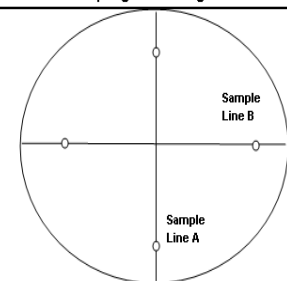
Client	Jaguar Motor Cars Ltd								
Site Address	Browns Lane, Coventry								
Job Number	P-RED09-041/EB/R1/Rev0								
Date	14th September 2009								
Operator(s)	Vicki Gavin & Tony Berek								
Stack Reference	VMC 3 Auto cell 2				Isokinetic Sample Positions (%) multiply by diameter to obtain sample points				
					1	14.60			
Number of Stacks	1				2	85.40			
Stack Configuration	Round				3	N/A			
Dimensions (mtrs)	0.60				4	N/A			
Outlet Diameter (if applicable) (metres)					5	N/A			
Number of Sample Ports	2				6	N/A			
Number of Samples per Axis / Port	2				7	N/A			
Nozzle Diameter (mm)	8.0				8	N/A			
Nozzle Area (m <sup>2</sup> )	0.00005024				Average Isokinetic Flow Rate (ltrs/min)			Axis 1	Axis 2
Stack Area (m <sup>2</sup> )	0.283							22.22	26.38
Pitot Coefficient	1.00	Pitot Calibration Due Date			April 2009			Atmos. Pressure (kPa)	
Position	Distance	Axis 1	Temperature	Swirl Test	Axis 2	Temperature	Swirl Test	101.0	
No.	(cms)	(pa)	(C)	Pass (Y/N)	(pa)	(C)	Pass (Y/N)	Static Pressure (pa)	
1	8.76	33	21.7	Y	50	21.7	Y	23.00	
2	51.24	28	21.7	Y	36	21.6	Y	1 Axis	2 Axis
3	N/A							Velocity of flow (Nm/s)	
4	N/A							7.37	8.75
5	N/A							Volume Flow Rate (Nm <sup>3</sup> /s)	
6	N/A							2.08	2.47
7	N/A							Reduced Exit Velocity (m/s)	
8	N/A								
Averages		31	21.7		43	21.7		N/A	
Mean Flue Gas Temp (in K) $T_p = ((\text{Mean } T_1 + \text{Mean } T_2)/2) + 273$					294.68				
Permitted Range of gas temperature readings (C) = $(0.95T_p - 273)$ to $(1.05T_p - 273)$					6.94		to		36.41
Highest Velocity Reading (m/s) =					9.4				
Lowest Velocity Reading (m/s) =					6.8				
Ratio Highest/Lowest (Max permitted = 3:1)					1.38 : 1				
<b>On site Checklist</b>									
Range of Gas Temps	OK				Manometer Leak Check			OK	
Leak Check recorded (l/min)	<0.1				Pitot Leak Check			OK	
Leak Check < 2% Vol (l/min)	0.49				Overall Isokinetic Ratio (%) (-5 to +15%)			99.3	
Passed minimum Velocity requirements (>5pa)	YES				Passed Highest to lowest Velocity (3:1)			YES	
Negative Local Flow Present, YES or NO (Yes = Fail)	NO				Are there sufficient rails and kick board? (YES, NO or N/A)			YES	
Is the Platform area greater than 5m <sup>2</sup> ? (YES, NO or N/A)	YES				Is the area in front of the sample line the length of the probe + 1 metre? (YES or NO)			YES	
<b>Site Equipment Used</b>									
Pitot Reference	RED 0136				Manometer Reference			RED 0096	
Thermometer Reference	RED 0095				Thermocouple Reference			RED 0273	
Balance Reference	RED 0204				Sampling Pump Reference			RED 0258	
Tape Measure Reference	RED 0122				Barometer Reference			RED 0094	

Client	Jaguar Motor Cars Ltd								
Site Address	Browns Lane, Coventry								
Job Number	P-RED09-041/EB/R1/Rev0								
Date	14th September 2009								
Operator(s)	Vicki Gavin & Tony Berek								
Stack Reference	VMC 3 Auto cell 3				Isokinetic Sample Positions (%) multiply by diameter to obtain sample points				
					1	14.60			
Number of Stacks	1				2	85.40			
Stack Configuration	Round				3	N/A			
Dimensions (mtrs)	0.60				4	N/A			
Outlet Diameter (if applicable) (metres)					5	N/A			
Number of Sample Ports	2				6	N/A			
Number of Samples per Axis / Port	2				7	N/A			
Nozzle Diameter (mm)	8.0				8	N/A			
Nozzle Area (m <sup>2</sup> )	0.00005024				Average Isokinetic Flow Rate (ltrs/min)			Axis 1	Axis 2
Stack Area (m <sup>2</sup> )	0.283							22.40	24.96
Pitot Coefficient	1.00	Pitot Calibration Due Date			April 2009			Atmos. Pressure (kPa)	
Position	Distance	Axis 1	Temperature	Swirl Test	Axis 2	Temperature	Swirl Test	101.0	
No.	(cms)	(pa)	(C)	Pass (Y/N)	(pa)	(C)	Pass (Y/N)	Static Pressure (pa)	
1	8.76	33	21.8	Y	41	21.6	Y	23.00	
2	51.24	29	21.6	Y	36	21.7	Y	1 Axis	2 Axis
3	N/A							Velocity of flow (Nm/s)	
4	N/A							7.43	8.28
5	N/A							Volume Flow Rate (Nm <sup>3</sup> /s)	
6	N/A							2.10	2.34
7	N/A							Reduced Exit Velocity (m/s)	
8	N/A								
Averages		31	21.7		39	21.7		N/A	
Mean Flue Gas Temp (in K) $T_p = ((\text{Mean } T_1 + \text{Mean } T_2)/2) + 273$ =					294.68				
Permitted Range of gas temperature readings (C) = $(0.95T_p - 273)$ to $(1.05T_p - 273)$ =					6.94 to 36.41				
Highest Velocity Reading (m/s) =					8.5				
Lowest Velocity Reading (m/s) =					7.0				
Ratio Highest/Lowest (Max permitted = 3:1)					1.23 : 1				
<b>On site Checklist</b>									
Range of Gas Temps	OK				Manometer Leak Check	OK			
Leak Check recorded (l/min)	<0.1				Pitot Leak Check	OK			
Leak Check < 2% Vol (l/min)	0.47				Overall Isokinetic Ratio (%) (-5 to +15%)	96.9			
Passed minimum Velocity requirements (>5pa)	YES				Passed Highest to lowest Velocity (3:1)	YES			
Negative Local Flow Present, YES or NO (Yes = Fail)	NO				Are there sufficient rails and kick board? (YES, NO or N/A)	YES			
Is the Platform area greater than 5m <sup>2</sup> ? (YES, NO or N/A)	YES				Is the area in front of the sample line the length of the probe + 1 metre? (YES or NO)	YES			
<b>Site Equipment Used</b>									
Pitot Reference	RED 0136				Manometer Reference	RED 0096			
Thermometer Reference	RED 0095				Thermocouple Reference	RED 0273			
Balance Reference	RED 0204				Sampling Pump Reference	RED 0258			
Tape Measure Reference	RED 0122				Barometer Reference	RED 0094			

<b>Client</b>		Jaguar Motor Cars Ltd							
<b>Site Address</b>		Browns Lane, Coventry							
<b>Job Number</b>		P-RED09-041/EB/R1/Rev0							
<b>Date</b>		16th September 2009							
<b>Operator(s)</b>		Vicki Gavin & Tony Berek							
<b>Stack Reference</b>		VMC 3 Manual PU Spray booth			<b>Isokinetic Sample Positions (%)</b> multiply by diameter to obtain sample points		<b>Sampling Plane Diagram</b>		
					1 14.60				
<b>Number of Stacks</b>		1			2 85.40				
<b>Stack Configuration</b>		Round			3 N/A				
<b>Dimensions (mtrs)</b>		0.90			4 N/A				
<b>Outlet Diameter (if applicable) (metres)</b>					5 N/A				
<b>Number of Sample Ports</b>		2			6 N/A				
<b>Number of Samples per Axis / Port</b>		2			7 N/A				
<b>Nozzle Diameter (mm)</b>		8.0			8 N/A				
<b>Nozzle Area (m<sup>2</sup>)</b>		0.00005024			<b>Average Isokinetic Flow Rate (ltrs/min)</b>		<b>Axis 1</b>	<b>Axis 2</b>	
<b>Stack Area (m<sup>2</sup>)</b>		0.636					26.89	17.34	
<b>Pitot Coefficient</b>		1.00		<b>Pitot Calibration Due Date</b>			April 2009		
<b>Position</b>		<b>Distance</b>		<b>Axis 1</b>		<b>Temperature</b>		<b>Swirl Test</b>	
<b>No.</b>		<b>(cms)</b>		<b>(pa)</b>		<b>(C)</b>		<b>Pass (Y/N)</b>	
1		13.14		59		22.8		Y	
2		76.86		30		22.8		Y	
3		N/A							
4		N/A							
5		N/A							
6		N/A							
7		N/A							
8		N/A							
<b>Averages</b>				45		22.8		19	
								22.8	
<b>Mean Flue Gas Temp (in K) <math>T_p = ((\text{Mean } T_1 + \text{Mean } T_2)/2) + 273</math></b>								295.80	
<b>Permitted Range of gas temperature readings (C) = <math>(0.95T_p - 273)</math> to <math>(1.05T_p - 273)</math></b>								8.01 to 37.59	
<b>Highest Velocity Reading (m/s)</b>		=						10.3	
<b>Lowest Velocity Reading (m/s)</b>		=						5.3	
<b>Ratio Highest/Lowest (Max permitted = 3:1)</b>								1.92 : 1	
<b>On site Checklist</b>									
<b>Range of Gas Temps</b>		OK		<b>Manometer Leak Check</b>		OK			
<b>Leak Check recorded (l/min)</b>		<0.1		<b>Pitot Leak Check</b>		OK			
<b>Leak Check &lt; 2% Vol (l/min)</b>		0.44		<b>Overall Isokinetic Ratio (%) (-5 to +15%)</b>		99.9			
<b>Passed minimum Velocity requirements (&gt;5pa)</b>		YES		<b>Passed Highest to lowest Velocity (3:1)</b>		YES			
<b>Negative Local Flow Present, YES or NO (Yes = Fail)</b>		NO		<b>Are there sufficient rails and kick board? (YES, NO or N/A)</b>		YES			
<b>Is the Platform area greater than 5m<sup>2</sup>? (YES, NO or N/A)</b>		YES		<b>Is the area in front of the sample line the length of the probe + 1 metre? (YES or NO)</b>		YES			
<b>Site Equipment Used</b>									
<b>Pitot Reference</b>		RED 0136		<b>Manometer Reference</b>		RED 0096			
<b>Thermometer Reference</b>		RED 0095		<b>Thermocouple Reference</b>		RED 0273			
<b>Balance Reference</b>		RED 0204		<b>Sampling Pump Reference</b>		RED 0258			
<b>Tape Measure Reference</b>		RED 0122		<b>Barometer Reference</b>		RED 0094			

<b>Client</b>	Jaguar Motor Cars Ltd						
<b>Site Address</b>	Browns Lane, Coventry						
<b>Job Number</b>	P-RED09-41/EB/R1/Rev0						
<b>Date</b>	16/9/2009			<b>Port Depth (cm)</b>			
<b>Site Team</b>	Vicki Gavin & Tony Berek						
<b>Isokinetic Sampling Method ISO 9096</b>	<input type="checkbox"/> BS EN 13284-1 <input checked="" type="checkbox"/>		<b>Isokinetic Sample Points (cms)</b>			<b>Isokinetic Flow (l/min)</b>	
<b>Stack Reference</b>	VMC2 Manual Gear Nob Spray Booth		<b>1</b>	0.16	<b>Axis 1</b>	<b>Axis 2</b>	
			<b>2</b>	0.49	25.98	21.91	
			<b>3</b>	0.85	22.25	20.50	
			<b>4</b>	N/A	19.37	19.75	
<b>Number of Stacks</b>			<b>1</b>		<b>Axis 3</b>	<b>Axis 4</b>	
<b>Configuration (Round / Rectangular)</b>			<b>2</b>	N/A	N/A	N/A	
<b>Dimensions - Sample port side (mtrs)</b>	0.98		<b>3</b>				
<b>Dimensions - other (mtrs)</b>	1.19		<b>4</b>	N/A	N/A	N/A	
<b>Number of Sample Ports</b>	2		<b>1</b>	0.16	21.91	N/A	
<b>Number of Samples per Axis / Port</b>	3		<b>2</b>	0.49	20.13	N/A	
<b>Nozzle Diameter (mm)</b>	8.0		<b>3</b>	0.85	18.58	N/A	
<b>Nozzle Area (m<sup>2</sup>)</b>	0.00005024		<b>4</b>	N/A	N/A	N/A	
<b>Stack Area (m<sup>2</sup>)</b>	1.166		<b>Average Isokinetic Flow Rate (ltrs/min)</b>				
			<b>Axis 1</b>	<b>Axis 2</b>	<b>Axis 3</b>	<b>Axis 4</b>	
			22.53	20.72	20.21	N/A	
<b>FLOW DATA</b>							
<b>Pitot Coefficient</b>	1		<b>Pitot Calibration Date</b>		April 2009		<b>Atmos. Pressure (kPa)</b>
<b>Position</b>	<b>Distance</b>	<b>Axis 1</b>	<b>Axis 2</b>	<b>Axis 3</b>	<b>Axis 4</b>	100.7	
<b>No.</b>	<b>(cms)</b>	<b>(pa)</b>	<b>(pa)</b>	<b>(pa)</b>	<b>(pa)</b>	<b>Static Pressure (pa)</b>	
1	16.33	45	32	32		333	
2	49.00	33	28	27		<b>Velocity of Flow (Nm/s)</b>	
3	84.93	25	26	23		<b>Axis 1</b>	<b>Axis 2</b>
4	N/A					7.58	6.88
<b>Averages</b>		34.3	28.7	27.3	N/A	<b>Axis 3</b>	<b>Axis 4</b>
<b>Swirl Test &lt; 15 degrees</b>		Y	Y	Y	N/A	6.72	N/A
<b>TEMPERATURE DATA (°C)</b>							
<b>Position</b>	<b>Distance</b>	<b>Axis 1</b>	<b>Axis 2</b>	<b>Axis 3</b>	<b>Axis 4</b>	<b>Volume Flow Rate (Nm<sup>3</sup>/s)</b>	
1	16.33	20.1	20.1	20.1		<b>Axis 1</b>	<b>Axis 2</b>
2	49.00	20.1	20.2	20.2		8.84	8.02
3	84.93	20.2	20.1	20.2		<b>Axis 3</b>	<b>Axis 4</b>
4	N/A					7.84	N/A
<b>Averages</b>		20.1	20.1	20.2			
<b>Mean Flue Gas Temp (in K) <math>T_p = ((\text{Mean } T_1 + \text{Mean } T_2)/2) + 273</math>) =</b>				293.1	<b>On-site Check list</b>		
<b>Permitted Range of gas temperature readings (C) = <math>(0.95T_p - 273)</math> to <math>(1.05T_p - 273)</math> =</b>				5.49			
				34.80	<b>Manometer Leak Check</b>	<b>Tick or Cross to Indicate</b>	
<b>Highest Pressure Reading (pa) =</b>				45	<b>Range of Gas Temps</b>	OK	
<b>Lowest Pressure Reading (pa) =</b>				23	<b>Leak Check (l/min)</b>	<0.1	
<b>Ratio Highest/Lowest (Max permitted = 3:1)</b>				1.96	<b>Leak Check 2% Vol (l/min)</b>	0.42	
				1	<b>Swirl Test (&lt;15°)</b>	OK	

Client	Jaguar Motor Cars Ltd								
Site Address	Browns Lane, Coventry								
Job Number	P-RED09-041/EB/R1/Rev0								
Date	15th September 2009								
Operator(s)	Vicki Gavin & Tony Berek								
Stack Reference	VMC 3 Automatic PU Spray booth				Isokinetic Sample Positions (%) multiply by diameter to obtain sample points				
					1	14.60			
Number of Stacks	1				2	85.40			
Stack Configuration	Round				3	N/A			
Dimensions (mtrs)	0.68				4	N/A			
Outlet Diameter (if applicable) (metres)					5	N/A			
Number of Sample Ports	2				6	N/A			
Number of Samples per Axis / Port	2				7	N/A			
Nozzle Diameter (mm)	7.7				8	N/A			
Nozzle Area (m <sup>2</sup> )	0.0004654				Average Isokinetic Flow Rate (ltrs/min)			Axis 1	Axis 2
Stack Area (m <sup>2</sup> )	0.363							32.91	34.66
Pitot Coefficient	1.00	Pitot Calibration Due Date			April 2009			Atmos. Pressure (kPa)	
Position	Distance	Axis 1	Temperature	Swirl Test	Axis 2	Temperature	Swirl Test	101.0	
No.	(cms)	(pa)	(C)	Pass (Y/N)	(pa)	(C)	Pass (Y/N)	Static Pressure (pa)	
1	9.93	75	21.6	Y	84	21.7	Y	51.00	
2	58.07	81	21.5	Y	89	21.6	Y	1 Axis	2 Axis
3	N/A							Velocity of flow (Nm/s)	
4	N/A							11.79	12.41
5	N/A							Volume Flow Rate (Nm <sup>3</sup> /s)	
6	N/A							4.28	4.51
7	N/A							Reduced Exit Velocity (m/s)	
8	N/A								
Averages		78	21.6		87	21.7		N/A	
Mean Flue Gas Temp (in K) $T_p = ((\text{Mean } T1 + \text{Mean } T2)/2) + 273.15 =$					294.60				
Permitted Range of gas temperature readings (C) = $(0.95T_p - 273.15)$ to $(1.05T_p - 273.15) =$					6.87 to 36.33				
Highest Velocity Reading (m/s) =					12.6				
Lowest Velocity Reading (m/s) =					11.2				
Ratio Highest/Lowest (Max permitted = 3:1)					1.12 : 1				
<b>On site Checklist</b>									
Range of Gas Temps		OK			Manometer Leak Check			OK	
Leak Check recorded (l/min)		<0.1			Pitot Leak Check			OK	
Leak Check < 2% Vol (l/min)		0.68			Overall Isokinetic Ratio (%) (-5 to +15%)			99.8	
Passed minimum Velocity requirements (>5pa)		YES			Passed Highest to lowest Velocity (3:1)			YES	
Negative Local Flow Present, YES or NO (YES = Fail)		NO			Are there sufficient rails and kick board? (YES, NO or N/A)			YES	
Is the Platform area greater than 5m <sup>2</sup> ? (YES, NO or N/A)		YES			Is the area in front of the sample line the length of the probe + 1 metre? (YES or NO)			YES	
<b>Site Equipment Used</b>									
Pitot Reference	RED 0136			Manometer Reference			RED 0096		
Thermometer Reference	RED 0095			Thermocouple Reference			RED 0273		
Balance Reference	RED 0204			Sampling Pump Reference			RED 0258		
Tape Measure Reference	RED 0122			Barometer Reference			RED 0094		



# **APPENDIX 4**

## **Isocyanate Results**



<b>Client</b>	Jaguar Cars Ltd								
<b>Site Address</b>	Browns Lane, Coventry								
<b>Job Number</b>	P-RED09-041/EB/R1/Rev0								
<b>Date</b>	14th, 15th and 16th September 2009								
<b>Operator(s)</b>	Tony Berek & Vicki Gavin								
<b>Pump Reference</b>	<b>Sample ID</b>	<b>Location / Process / Operator</b>	<b>Pump Flow (mls/min)</b>		<b>Sample Duration (mins)</b>		<b>Total Volume (l)</b>	<b>Mass of Analyte (ug)</b>	<b>Concentration (mg/m<sup>3</sup>)</b>
RED 0258	09/041/101	VMC 3 POLYESTER AUTOMATIC SPRAY CELL 3 14th September 2009	<b>Initial</b>	411826.00	<b>Start</b>	12:47	1470	<0.2	<0.0001
			<b>Final</b>	413296.00	<b>Finish</b>	13:47			
			<b>Average</b>	1470.00	<b>Total</b>	60			
RED 0258	09/041/102	VMC 3 POLYESTER AUTOMATIC SPRAY CELL 2 14th September 2009	<b>Initial</b>	413296.00	<b>Start</b>	14:10	1528	<0.2	<0.0001
			<b>Final</b>	414824.00	<b>Finish</b>	15:10			
			<b>Average</b>	1528.00	<b>Total</b>	60			
RED 0258	09/041/103	VMC 3 POLYESTER AUTOMATIC SPRAY CELL 1 15th September 2009	<b>Initial</b>	414824.00	<b>Start</b>	9:20	1516	<0.2	<0.0001
			<b>Final</b>	416340.00	<b>Finish</b>	10:20			
			<b>Average</b>	1516.00	<b>Total</b>	60			
RED 0258	09/041/104	P U AUTOMATIC SPRAY CELL 15th September 2009	<b>Initial</b>	417678.00	<b>Start</b>	9:30	2126	<0.2	<0.0001
			<b>Final</b>	419804.00	<b>Finish</b>	10:30			
			<b>Average</b>	2126.00	<b>Total</b>	60			
RED 0258	09/041/105	VMC 3 PU MANUAL SPRAY 1 16th September 2009	<b>Initial</b>	416340.00	<b>Start</b>	10:42	1338	<0.2	<0.0001
			<b>Final</b>	417678.00	<b>Finish</b>	11:42			
			<b>Average</b>	1338.00	<b>Total</b>	60			
RED 0258	09/041/106	VMC 2 Manual Gear Nob 16th September 2009	<b>Initial</b>	0.00	<b>Start</b>	12:25	873.00	<0.2	<0.0001
			<b>Final</b>	873.00	<b>Finish</b>	13:25			
			<b>Average</b>	873.00	<b>Total</b>	60			
N/A	09/041/107	Blank	<b>Initial</b>	n/a	<b>Start</b>	n/a	n/a	<0.2	<0.0001
			<b>Final</b>	n/a	<b>Finish</b>	n/a			
			<b>Average</b>	n/a	<b>Total</b>	n/a			

