NATIONAL PHYSICAL LABORATORY
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Test Report

UKAS TESTING
0002

mCERTS

PPC COMPLIANCE TESTING FOR PAXFORD COMPOSITES LIMITED
14TH FEBRUARY 2012

Permit Number:	**B01/02**
Operator Name:	**Paxford Composites Ltd**
Installation Name:	**Paxford Composites**
Dates of Monitoring Visit:	**14th February 2012**
Contract Reference:	**B0102/PAXFORD/PAXFORD/FEB2012/SBs/PPC/Visit 1**
Client Contact:	**Neil Search**
Client Organisation:	**Paxford Composites Ltd**
Address:	**2 - 4 Redwongs Way** **Huntingdon** **PE29 7HB**
Monitoring Organisation:	**National Physical Laboratory (NPL)**
Address:	**Hampton Road** **Teddington** **Middlesex** **TW11 0LW**
Date of Report:	**23rd March 2012**
Report Author	**Matthew Ellison**

Report Approver:	Kevin Blakley	NPL Authorised Signatory
MCERTS Registration:	MM-03-317	Name: Mr R Robinson (for NPLML)
Level & TEs Held:	Level 2, TE1, TE2, TE3 & TE4	Signature:
Signature:		

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1.1 Monitoring Objectives

NPL were awarded a contract by Paxford Composites Limited to carry out emissions compliance testing at their factory in Huntingdon. The scope of work includes carrying out monitoring on three spray paint booths.

Each spray paint booth was monitored for Particulates, Isocyanates and VOCs. Each test lasted for half an hour and was conducted during normal operation of the spray booths.

Results have been reported at standard conditions (273K and 101.3 kPa) on a wet gas basis. Testing was carried out on the 14th February 2012.

1.2.1 Particulate Monitoring Results

Client: Paxford Composites Ltd
Site: Paxford Composites

Emission Point		Spray Booth One		Spray Booth Two		Spray Booth Three	
Test Designation		Run One	Blank	Run One	Blank	Run One	Blank
Emission Limit Value	mg/m^3, Reference Conditions	50	-	50	-	50	-
Periodic Monitoring Result	Reference Conditions	6.4	<0.2	4.8	<0.2	1.0	<0.2
Uncertainty (95% Confidence Level)	Reference Conditions	1.1	-	0.6	-	1.5	-
	Units	mg/m^3					
Reference Conditions		273K, 101.3 kPa on a wet gas basis					
Date	dd/mm/yyyy	14/02/2012					
Sample Period	From hh:mm	09:00	-	11:30	-	14:15	-
	To hh:mm	09:30	-	12:00	-	14:45	-
Monitoring Method		BS EN 13284:1					
Accreditation		UKAS & MCERTS					
Process Status		Spray paint batch run					

1.2.2 Isocyanates (HDI) Monitoring Results

Client: Paxford Composites Ltd
Site: Paxford Composites

Emission Point		Spray Booth One		Spray Booth Two		Spray Booth Three	
Test Designation		Run One	Blank	Run One	Blank	Run One	Blank
Emission Limit Value	mg/m^3, Reference Conditions	0.1	-	0.1	-	0.1	-
Periodic Monitoring Result	Reference Conditions	<0.0003	<0.0002	0.0003	<0.0001	0.004	<0.0001
Uncertainty (95% Confidence Level)	Reference Conditions	<0.00004	-	0.00003	-	0.001	-
	Units	mg/m^3					
Reference Conditions		273K, 101.3 kPa on a wet gas basis					
Date	dd/mm/yyyy	14/02/2012					
Sample Period	From hh:mm	09:45	-	12:20	-	15:00	-
	To hh:mm	10:15	-	12:50	-	15:30	-
Monitoring Method		US EPA CTM 36					
Accreditation		None					
Process Status		Spray paint batch run					

1.2.3 VOCs Monitoring Results

Client: Paxford Composites Ltd
Site: Paxford Composites

Emission Point		Spray Booth One	Spray Booth Two	Spray Booth Three
Test Designation		Run One	Run One	Run One
Emission Limit Value	mgC/m^3, Reference Conditions	50	50	50
Periodic Monitoring Result	Reference Conditions	221.5	49.0	53.6
Uncertainty (95% Confidence Level)	Reference Conditions	185.5	18.7	18.7
	Units	mgC/m^3		
Reference Conditions		273K, 101.3 kPa on a wet gas basis		
Date	dd/mm/yyyy	14/02/2012		
Sample Period	From hh:mm	09:00	11:45	14:55
	To hh:mm	09:30	12:15	15:25
Monitoring Method		BS EN 13526:2001		
Accreditation		UKAS & MCERTS		
Process Status		Spray paint batch run		

1.3 Operating Information

Paxford Composites is located in Huntingdon and specialises in design and manufacturing of a wide range of components. The site also has spray painting facilities and can use a variety of different paints such as Epoxy, Polyurethane and Polyester.

The site has three spray paint booths each approximately the size of a garage, this allows large items to be transported inside. Air is pumped in from outside and can be heated if necessary to aid in the curing of the products. The paint filled air is then passed through a filter before being emitted to the atmosphere via a vent stack. Each batch run lasts approximately 20 to 30 minutes, depending upon how many layers of paint are required, and the size of the components.

Continuous or Batch Process?	Batch Process
What part of the batch process was sampled? (If applicable)	The whole batch process was sampled
What fuel was used during monitoring? (If applicable)	None
What feedstock was used during monitoring? (If applicable)	None
What was the load during monitoring?	N/A
What abatement systems are present? Were they in operation?	A filter is installed in the vent system to reduce particulate emissions. This was in operation during the time of the monitoring
Periodic monitoring results and corresponding CEM values	There are no CEMS installed on the spray booths

1.4 Monitoring Deviations

Were all substances in the monitoring objectives monitored? If not why?	All substances set out in the objectives were monitored
Were all substances monitored in accordance to the relevant method? If not why?	Due to the duct area size of each spray booth, two sampling lines are required to monitor particulates to BS EN 13284:1. Whilst ports were provided, only one port on each spray booth could be accessed due to external obstructions and general accessibility
Were there any other issues relevant to the monitoring results?	No

1.5 Conclusions

NPL carried out the emissions monitoring for particulates, isocyanates and VOCs on all three paint spray booths on the 14th February 2012. No homogeneity tests have been carried out.

1.6 References

1. STA – Risk Assessment Guide: Industrial-emission monitoring – Version 10 - April 2008.

2. Environmental Agency - Manual Stack emission monitoring performance standard for Organisations – Version 7.2 - November 2011.

3. Environmental Agency – M1 Technical Guidance Note – Sampling requirements for stack emission monitoring – Version 6 –January 2010.

4. Environmental Agency – M2 Technical Guidance Note – Monitoring of stack emissions to air – Version 8 – July 2011.

5. Guidance on Assessing Measurement Uncertainty in Stack Emissions Monitoring, by Pullen J and Robinson R, Source Testing Association, Quality Guidance Note QGN1.

APPENDIX 1

2.1.1 Emissions Testing Personnel Details

Name	Role	MCERTS Number	Certification Level & Expiry Dates					
			Level 1	Level 2	TE1	TE2	TE3	TE4
Kevin Blakley	Team Leader	MM03 317	March-16	March-16	March-16	March-16	September-13	May-14
Matthew Ellison	Team Leader	MM05 682	September-13	September-13	September-13	September-13	December-13	September-13

2.1.2 Emissions Testing Procedures

Determinand	VOCs	Particulates	Isocyanates	H_2O	Stack Flow	Temperature
SRM Standard	BS EN 13526	BS EN 13284-1	US EPA CTM 36	BS EN 14790	BS EN 13284-1	BS EN 13284-1
Instrument	FID	Anderson Method 5	Anderson Method 5	Anderson Method 5	Pitot	Type K Thermocouple
Instrument Serial No.	AS0234	AS0003	AS0003	AS0003	AS0466	N/A
Principle	FID	Gravimetric	HPLC	Gravimetric	Flow	Temperature
Operational Range	0 - 1000 ppm	N/A	N/A	N/A	N/A	N/A
Certified Range	0 - 15 mg/m^3	N/A	N/A	N/A	N/A	N/A
Uncertainty	25%	10%	12%	15%	N/A	N/A
NPL Procedure	QPAS B 538	QPAS B 536	In House	QPAS B 536	QPAS B 536	QPAS B 536
UKAS Accreditation	YES	YES	NO	YES	YES	YES

Particulate and Isocyanate sampling was conducted using an Anderson Method 5 and sampling train. A sample was extracted through a filter and then down a heated probe and sample line. The stack gas was then passed through a series of impingers to remove the moisture before passing through the Method 5 console. The particulate filter had been weighed in a laboratory before and after testing in order to determine any weight gain. The isocyanate filter had been pre treated and sent to an analytical laboratory for analysis. The uncertainty quoted for the Isocyanate result is based upon the lab uncertainty.

VOC analysis was conducted using a SICK Bernath FID (Flame Ionisation Detector). A sample of stack gas was drawn through a heated filter and heated line before passing into the analyser.

The FID analyser zero and span settings were checked before and after each test run using zero grade nitrogen (ex BOC), a suitable gas mixture (BOC beta gas standard), traceable to national reference standards and a gas dilution system. The certified accuracies of the gas standards are listed below: -

SB1

Component	Sample Location	Cylinder ID	Certified Amount	Instrument Range	Certified Uncertainty
Propane	SB1	162576	51.6 ppm	0 - 1000 ppm	1%

SB2

Component	Sample Location	Cylinder ID	Certified Amount	Instrument Range	Certified Uncertainty
Propane	SB2	162576	51.6 ppm	0 - 100 ppm	1%

SB3

Component	Sample Location	Cylinder ID	Certified Amount	Instrument Range	Certified Uncertainty
Propane	SB3	162576	51.6 ppm	0 - 100 ppm	1%

These measurement uncertainties are expressed at a 95% level of confidence.

A leak test was conducted before testing to confirm hydraulic integrity of the gaseous sampling system. This was conducted by sending nitrogen down the entire sample line and ensuring a zero reading was obtained.

The electrical volt/millivolt outputs from the FID analyser was collected by a squirrel data logger and downloaded to digital media at the end of the day. Under the program used during the tests, the software records and stores individual readings every 2 seconds. From this data, the logger can perform a series of calculations to output 1 minute averaged measurement on a mass/volume basis. After each 1 minute average has been established the data buffer is reset and the process repeats.

2.1.3 Equipment Checklist Reference

See Work file PX04FEB12/CHECKLIST

2.1.4 Data Capture Location Reference

All data collected is transferred onto digital media at the end of the day, and then stored on the NPL internal servers upon arrival back at base. The location reference for this is below:

P:\Stack Emissions Team\Paxford Composites\PX04FEB12\7. Monitoring Record Sheets

APPENDIX 2

2.2.1 - Stack Diagram & Traverse Information

Spray Booth One Stack Diagram & Traverse Information

Test no	TRAVERSE	
Date	14-2-12	
Swirl Test Conducted	OK	
Stack Pres (with +/- above barometric if unknown enter zero)	0	mmH_20
Pitot Type and Tube ID	S-Type AS0446	

Conditions	Value	Units
Stack pressure	768.63	mmHg
Ref oxygen Value	21	%
Moisture Content	0.4	%
CO	0	ppm
CO_2	0	%
N_2	79.05	%
O_2	20.95	%
dry molecular wt	28.84	
stack molecular wt	28.79	
area of stack	0.47	m^2
Pbar	1024.5	mbar
Pbar	769	mmHg
pitot tube coeft	0.83	
Reference Temp	273	K
Reference Pressure	760	mmHg
PITOT LEAK CHECK (Yes/No)	YES	

Site: Paxford Composites **Stack Description:** SB1

Time of Survey: 08:45

SITE TEAM: KCB/MRE

COMMENTS: TRAVERSE

Diagram of Sample Location:

Flow Criteria Measurements		Fulfilled?
Is the gas flow angle <15° to the duct axis?	Yes	✔
Is there any local negative flow?	No	✔
Is the flow rate high enough to be measured?	Yes	✔
Ratio of flows less than 3:1 (or 9:1 for pressure readings)?	Yes	✔

SAMPLING LINE: A							
Traverse Point	Distance into duct (m)	Δ p mm H_2O	Δ p Pa	Stack Temp Ts °C	Velocity @ stack gas T&P on wet gas basis m/s	Angle of Swirl °	√Δp
1	A1	15.50	151.95	18	13.10	<15	3.94
2	A2	15.50	151.95	18	13.10	<15	3.94
3	A3	15.00	147.05	18	12.89	<15	3.87
4	A4	14.00	137.24	18	12.45	<15	3.74
5	A5	13.00	127.44	18	12.00	<15	3.61
6	A6	8.00	78.42	18	9.41	<15	2.83
7	A7	6.00	58.82	18	8.15	<15	2.45
8	A8	5.00	49.02	18	7.44	<15	2.24
9	A9	5.00	49.02	18	7.44	<15	2.24
10	A10	4.50	44.11	18	7.06	<15	2.12
	Average values	**10.2**	99.50	**18.0**	10.60	<15	3.19

Duct / Stack Flow Characteristics:	**SB1**	
Test No:	**TRAVERSE**	
	Average	**Units**
Stack Velocity at stack gas T & P and a wet gas basis	10.60	ms^{-1}
Stack flow @ STP, O_2 (ref) and on a dry gas basis	N/A	m^3s^{-1}
Stack flow @ stack gas T & P and on a wet gas basis	4.98	m^3s^{-1}
Stack flow @ stack gas T & P and on a dry gas basis	4.96	m^3s^{-1}
Stack flow @ STP and on a wet gas basis	4.73	m^3s^{-1}
Stack flow @ STP, O_2 (ref) and on a wet gas basis	N/A	m^3s^{-1}

Spray Booth Two Stack Diagram & Traverse Information

Test no	TRAVERSE	
Date	14-2-12	
Swirl Test Conducted	OK	
Stack Pres (with +/- above barometric if unknown enter zero)	0	mmH_20
Pitot Type and Tube ID	S-Type AS0446	

Conditions	Value	Units
Stack pressure	768.63	mmHg
Ref oxygen Value	21	%
Moisture Content	0.3	%
CO	0	ppm
CO_2	0	%
N_2	79.05	%
O_2	20.95	%
dry molecular wt	28.84	
stack molecular wt	28.81	
area of stack	0.64	m^2
Pbar	1024.5	mbar
Pbar	769	mmHg
pitot tube coeft	0.83	
Reference Temp	273	K
Reference Pressure	760	mmHg
PITOT LEAK CHECK (Yes/No)	YES	

Site: Paxford Composites **Stack Description:** SB2

Time of Survey: 11:15

SITE TEAM: KCB/MRE

COMMENTS: TRAVERSE

Diagram of Sample Location:

Flow Criteria Measurements		Fulfilled?
Is the gas flow angle <15° to the duct axis?	Yes	✔
Is there any local negative flow?	No	✔
Is the flow rate high enough to be measured?	Yes	✔
Ratio of flows less than 3:1 (or 9:1 for pressure readings)?	Yes	✔

SAMPLING LINE: A							
Traverse Point	Distance into duct (m)	Δ p mm H_2O	Δ p Pa	Stack Temp Ts °C	Velocity @ stack gas T&P on wet gas basis m/s	Angle of Swirl °	√Δp
1	A1	32.00	313.70	20	18.89	<15	5.66
2	A2	34.00	333.31	20	19.47	<15	5.83
3	A3	30.00	294.09	19	18.26	<15	5.48
4	A4	30.00	294.09	19	18.26	<15	5.48
5	A5	26.00	254.88	20	17.03	<15	5.10
6	A6	24.00	235.27	20	16.36	<15	4.90
7	A7	24.00	235.27	20	16.36	<15	4.90
8	A8	22.00	215.67	20	15.66	<15	4.69
9	A9	28.00	274.49	20	17.67	<15	5.29
10	A10	26.00	254.88	20	17.03	<15	5.10
	Average values	**27.6**	270.57	**19.8**	17.54	<15	5.25

Duct / Stack Flow Characteristics:	**SB2**	
Test No:	**TRAVERSE**	
	Average	**Units**
Stack Velocity at stack gas T & P and a wet gas basis	17.54	ms^{-1}
Stack flow @ STP, O_2 (ref) and on a dry gas basis	N/A	m^3s^{-1}
Stack flow @ stack gas T & P and on a wet gas basis	11.22	m^3s^{-1}
Stack flow @ stack gas T & P and on a dry gas basis	11.19	m^3s^{-1}
Stack flow @ STP and on a wet gas basis	10.58	m^3s^{-1}
Stack flow @ STP, O_2 (ref) and on a wet gas basis	N/A	m^3s^{-1}

Spray Booth Three Stack Diagram & Traverse Information

Test no	TRAVERSE	
Date	14-2-12	
Swirl Test Conducted	OK	
Stack Pres (with +/- above barometric if unknown enter zero)	0	mmH_20
Pitot Type and Tube ID	**S-Type AS0446**	
Conditions	**Value**	**Units**
Stack pressure	768.63	mmHg
Ref oxygen Value	21	%
Moisture Content	0.6	%
CO	0	ppm
CO_2	0	%
N_2	79.05	%
O_2	20.95	%
dry molecular wt	28.84	
stack molecular wt	28.77	
area of stack	0.59	m^2
Pbar	1024.5	mbar
Pbar	769	mmHg
pitot tube coeft	0.83	
Reference Temp	273	K
Reference Pressure	760	mmHg
PITOT LEAK CHECK (Yes/No)	YES	

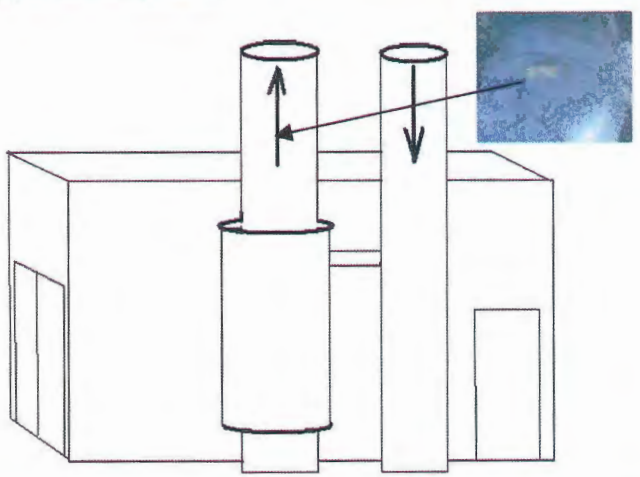
Site: Paxford Composites **Stack Description:** SB3

Time of Survey: 14:00

SITE TEAM: KCB/MRE

COMMENTS: TRAVERSE

Diagram of Sample Location:



Flow Criteria Measurements		**Fulfilled?**
Is the gas flow angle <15° to the duct axis?	Yes	✔
Is there any local negative flow?	No	✔
Is the flow rate high enough to be measured?	Yes	✔
Ratio of flows less than 3:1 (or 9:1 for pressure readings)?	Yes	✔

SAMPLING LINE: A							
Traverse Point	Distance into duct (m)	Δ p mm H_2O	Δ p Pa	Stack Temp Ts °C	Velocity @ stack gas T&P on wet gas basis m/s	Angle of Swirl °	√Δp
1	A1	4.50	44.11	20	7.09	<15	2.12
2	A2	4.50	44.11	20	7.09	<15	2.12
3	A3	4.00	39.21	21	6.69	<15	2.00
4	A4	4.50	44.11	21	7.10	<15	2.12
5	A5	4.00	39.21	21	6.69	<15	2.00
6	A6	3.50	34.31	21	6.26	<15	1.87
7	A7	3.50	34.31	21	6.26	<15	1.87
8	A8	3.50	34.31	21	6.26	<15	1.87
9	A9	4.00	39.21	21	6.69	<15	2.00
10	A10	3.50	34.31	21	6.26	<15	1.87
	Average values	**4.0**	38.72	**20.8**	6.65	<15	1.99

Duct / Stack Flow Characteristics:	**SB3**	
Test No:	**TRAVERSE**	
	Average	**Units**
Stack Velocity at stack gas T & P and a wet gas basis	6.65	ms^{-1}
Stack flow @ STP, O_2 (ref) and on a dry gas basis	N/A	m^3s^{-1}
Stack flow @ stack gas T & P and on a wet gas basis	3.92	m^3s^{-1}
Stack flow @ stack gas T & P and on a dry gas basis	3.90	m^3s^{-1}
Stack flow @ STP and on a wet gas basis	3.69	m^3s^{-1}
Stack flow @ STP, O_2 (ref) and on a wet gas basis	N/A	m^3s^{-1}

2.2.2 - One Minute Averaged Gaseous Emissions Data

Paxford Composites - Spray Booth One
273K, 101.3 kPa, on a Wet Gas Basis
14th February 2012

Time	VOCs (Cmg/m^3)
09:00	165.6
09:01	175.3
09:02	208.8
09:03	216.4
09:04	220.5
09:05	165.8
09:06	137.5
09:07	152.8
09:08	231.0
09:09	154.1
09:10	96.8
09:11	155.0
09:12	225.0
09:13	287.0
09:14	274.1
09:15	221.5
09:16	283.1
09:17	339.6
09:18	307.2
09:19	258.6
09:20	222.5
09:21	192.0
09:22	296.0
09:23	223.6
09:24	295.3
09:25	312.0
09:26	198.5
09:27	205.6
09:28	213.5
09:29	193.9
09:30	237.7
Maximum	**339.6**
Minimum	**96.8**
Average	**221.5**

Paxford Composites - Spray Booth Two
273K, 101.3 kPa, on a Wet Gas Basis
14th February 2012

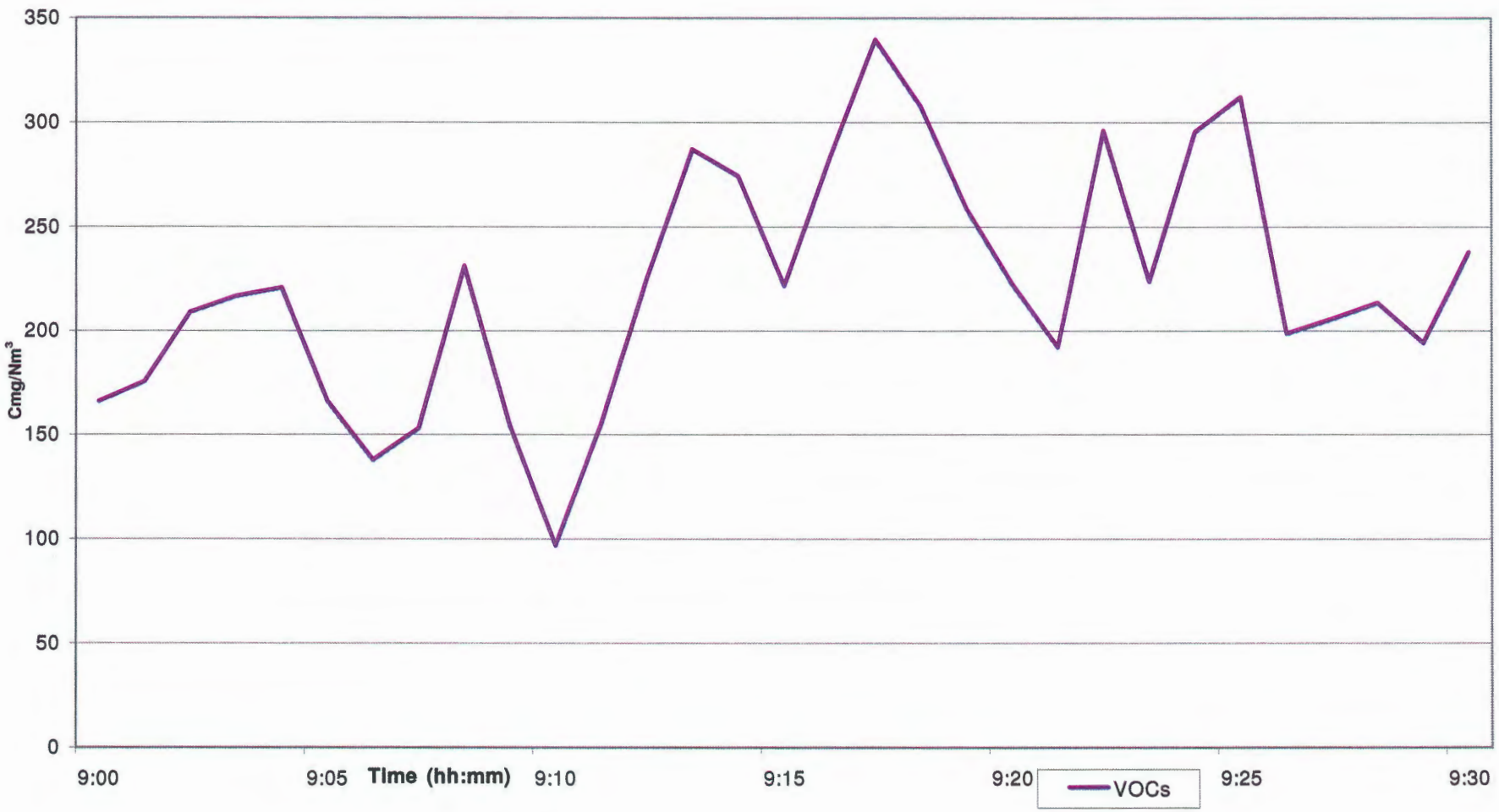
Time	VOCs (Cmg/m^3)
11:45	86.8
11:46	75.5
11:47	49.2
11:48	33.7
11:49	21.5
11:50	48.6
11:51	69.5
11:52	72.2
11:53	58.9
11:54	93.3
11:55	54.5
11:56	44.8
11:57	24.9
11:58	81.2
11:59	56.8
12:00	75.8
12:01	66.9
12:02	57.0
12:03	33.0
12:04	25.8
12:05	19.0
12:06	20.4
12:07	34.3
12:08	52.8
12:09	39.1
12:10	113.1
12:11	47.9
12:12	23.0
12:13	14.1
12:14	14.3
12:15	12.5
Maximum	**113.06**
Minimum	**12.45**
Average	**49.0**

Paxford Composites - Spray Booth Three
273K, 101.3 kPa on a Wet Gas Basis
14th February 2012

Time	VOCs (Cmg/m^3)
14:55	65.0
14:56	37.6
14:57	25.7
14:58	19.7
14:59	16.1
15:00	14.2
15:01	13.0
15:02	12.4
15:03	78.2
15:04	161.7
15:05	110.7
15:06	60.0
15:07	115.3
15:08	101.6
15:09	50.6
15:10	30.8
15:11	22.4
15:12	83.4
15:13	155.1
15:14	102.7
15:15	70.5
15:16	12.6
15:17	1.1
15:18	0.7
15:19	0.5
15:20	34.8
15:21	78.5
15:22	79.5
15:23	20.4
15:24	0.6
15:25	85.0
Maximum	**161.7**
Minimum	**0.5**
Average	**53.6**

2.2.3 - Gaseous Emissions Graphical Data

Spray Booth One Minute Averaged VOCs Emissions Data - 14th February 2012
(273.15K, 101.325kPa, on a Wet Gas basis) using the NPL Conventional Analysis Package



Spray Booth Two Minute Averaged VOCs Emissions Data - 14th February 2012
(273.15K, 101.325kPa, on a Wet Gas basis) using the NPL Conventional Analysis Package

Spray Booth Three Minute Averaged VOCs Emissions Data - 14th February 2012
(273.15K, 101.325kPa on a Wet Gas basis) using the NPL Conventional Analysis Package