CASELLA
CRE EMISSIONS

Test Report

Stack Emission Measurements

Jaguar Browns Lane

August 2004

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Test Report

Stack Emission Measurements

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Contents

1 Introduction

Premier Manufacturing Support Services (UK) Limited contracted Casella CRE Emissions Ltd to conduct an assessment of selected atmospheric emissions from the Browns Lane plant.

The process is regulated with respect to its emissions to atmosphere by the 1990 Environmental Protection Act (EPA) (Ref 5.1). Under this legislation potentially harmful emissions are to meet the emission concentration limits specified in the site authorisation, which are normally based on the limits suggested by the published Process Guidance Notes.

Mr P. Jones, Mr.. D. Maclaren, Mr. P. Waters, Mr. H. Saeed and Mr A. Ten-broake of Casella CRE Emissions carried out this work between July and October 2004. The project was given the Casella Stanger Project Number MMCX0041 and was carried out under the Premier Purchase Order number 604528.

2 Summary of Results

2.1 New Saw Mill

2.1.1 Particulates on 20/07/04

Sample Location	Run	Concentration (mg/Nm³)	Mass Emission (g/s)	Sampling Time
Cell 1	1	2	0.0028	14:00-14:32
	2	2	0.0031	14:38-15:10
Cell 2	1	1	0.0008	12:26-12:58
	2	<1	<0.0001	13:11-13:39
Cell 3	1	3	0.0064	10:08-10:40
	2	4	0.0085	11:23-11:55

Note: Emission concentrations expressed at reference conditions 273K, 101.3kPa, without correction for water vapour content.

2.1.2 Isocyanates on 20/07/04

Sample Location	Concentration (µg/Nm³)	Mass Emission (µg/s)	Sampling time
Cell 1	<13	<20.5618	14:05-14:20
Cell 2	<13	<22.3340	14:25-14:40
Cell 3	<13	<27.2650	14:45-15:00

Note: Emission concentrations expressed at reference conditions 273K, 101.3kPa, without correction for water vapour content.

2.2 Old Saw Mill

2.2.1 Particulates

Sample Location	Run	Concentration (mg/m^3)	Mass Emission (g/s)	Sampling time and date	Process Details
BL119 Spray Booth Acrylic	1	12	0.0137	08/09/04 11:50-15:04	Pump feeding laquer died during run whilst spraying laquer

Note: Emission concentrations expressed at reference conditions 273K, 101.3kPa, without correction for water vapour content.

2.3 Trim Shop

2.3.1 Particulates on 06/09/04

Sample Location	Run	Concentration (mg/Nm^3)	Mass Emission (g/s)	Sampling time	Process Details
BL 307 Buck Hood Extract	1	4	0.0103	11:45-12:17	Spraying was continuous during the run
	2	<1	<0.001	13:27-13:55	

Note: Emission concentrations expressed at reference conditions 273K, 101.3kPa, without correction for water vapour content.

2.4 COB Paint Shop

2.4.1 Particulates

Sample location	Run	Concentration (mg/Nm³)	Mass Emission(g/s)	Sampling Time and date	Process Details
BL252 Spray Bake	1	<1	<0.0001	9:20-9:50 09/09/04	
	2	<1	<0.0001	10:30-11:00 09/9/4	
BL259 Tac Rag Booth	1	<1	<0.0001	11:57-12:45 14/09/04	
	2	<1	<0.0001	13:02:13:50 14/09/4	
BL260A Colour Booth	1	<1	<0.0001	8:30-9:18 06/10/04	Three cars sprayed
	2	<1	<0.0001	9:20-10:08 06/10/04	
BL260B Colour Booth	1	<1	<0.0001	13:00-13:48 21/09/04	Two Cars sprayed
	2	<1	<0.0001	13:58-14:46 21/09/04	
BL260C Colour Booth	1	<1	<0.0001	14:10-14:58 14/09/04	
	2	<1	<0.0001	15:00-15:48 14/09/04	
BL261A Laquer Booth	1	<1	<0.0001	14:40-15:28 21/09/04	Two Cars sprayed
	2	<1	<0.0001	15:35-16:34 21/09/04	
BL261B Laquer Booth	1	6	0.0027	10:45-11:33 06/10/04	Three cars sprayed
	2	<1	<0.0001	11:35-12:23 06/10/04	

2.4.1 continued.

BL261C Laquer Booth	1	<1	<0.0001	13:55-14:31 06/10/04	Three cars sprayed
	2	<1	<0.0001	14:33-15:09 06/10/04	

Note: Emission concentrations expressed at reference conditions 273K, 101.3kPa, without correction for water vapour content.

2.4.2 Incinerator (BL001) on 08/09/04

Averaging time	Mean Concentration (mg/m³)			Max Concentration (mg/m³)			Min Concentration (mg/m³)		
	CO	NOx	VOC	CO	NOx	VOC	CO	NOx	VOC
14:15 to 14:30	1	58	<1	1	73	3	1	45	<1
14:30 to 14:45	1	64	<1	2	87	<1	<1	54	<1
14:45 to 15:00	1	66	<1	3	77	2	<1	46	<1
15:00 to 15:15	1	64	<1	3	78	2	<1	46	<1

Note: Emission concentrations expressed at reference conditions 273K, 101.3kPa, without correction for water vapour content.

2.4.3 VOC Emissions

Stack	Emmission Concentration (mg/Nm^3)	Mass Emission (g/s)	Sampling date and time	Process Details
BL 252 Spray Bake	2	0.0050	09/09/04 10:00-11:00	Covered a full cycle
Highest 2 minute mean	37	0.0925	10:30-10:32	During spraying of wing
BL 258 Blow Off	8	0.0133	08/09/04 10:35-11:35	
Highest 2 minute mean	42	0.0731	10:36-10:38	
BL 259 Tac Rag Booth	4	0.0125	14/09/04 13:15-14:15	
Highest 2 minute mean	29	0.0952	13:42-13:43	
BL 260A Colour Booth	6	0.0705	6/10/04 9:30-10:30	
Highest 2 minute mean	17	0.2071	10:09-10:11	
BL 260B Colour Booth	<1	0.0004	21/09/04 11:00-12:00	
Highest 2 minute mean	<1	0.0006	11:00-11:02	
BL 260C Colour Booth	<1	0.0001	21/09/04 13:34-14:34	
Highest 2 minute mean	<1	0.0001	14:17-14:19	
BL 261A Lacquer Booth Highest 2 minute mean	4	0.0134	21/09/04 14:41-14:43	
BL 261B Lacquer Booth	4	0.0120	6/10/04 10:20-11:20	
Highest 2 minute mean	23	0.0710	10:58-11:00	
BL 261C Lacquer Booth	2	0.0275	6/10/04 13:55-14:55	
Highest 2 minute mean	6	0.0944	14:47-14:49	

Note: Emission concentrations expressed at reference conditions 273K, 101.3kPa, without correction for water vapour content, as total carbon , propane equivalent.

2.4.4 Isocyanates

Sample Location	Emmission Concentration (µg/Nm³)	Mass Emission (µg/s)		Process Details
BL 252 Spray Bake	<0.233	<0.5825	9:40-10:50	Full cycle
BL 261A Lacquer Booth	<0.299	<1.1093	11:15:12:22	Spraying during tests
BL 261B Lacquer Booth	<0.242	<0.7381	11:16-12:25	
BL 261C Lacquer Booth	<0.253	<3.7140	11:18-12:30	

Note: Emission concentrations expressed at reference conditions 273K, 101.3kPa, without correction for water vapour content.

2.5 Spot Repair No. 1 Shop

2.5.1 Particulates on 07/09/04

Sample Location	Run	Emmission Concentration (mg/Nm³)	Mass Emission (g/s)	Sampling time	Process conditions
BL80A Spray Booth - Track 5	1	<1	0.0001	10:00-1:00	Irregular Spraying throughout
	2	<1	0.0005	11:00-12:00	
BL80B Spray Booth - Track 5	1	<1	<0.0001	13:20-14:20	
	2	<1	<0.0001	14:45-15:45	

Note: Emission concentrations expressed at reference conditions 273K, 101.3kPa, without correction for water vapour content.

2.5.2 VOC Emissions on 07/09/04

Stack	Emmission Concentration (mg/Nm³)	Mass Emission (g/s)	Sampling time	Process conditions
BL80A Spray Booth – Track 5	12	0.0540	10:06-11:06	Irregular Spraying throughout
Highest 2 minute mean	37	0.1607	10:57-10:59	
BL80B Spray Booth – Track 5	11	0.0496	14:47-15:47	
Highest 2 minute mean	44	0.1915	15:32-15:34	

Note: Emission concentrations expressed at reference conditions 273K, 101.3kPa, without correction for water vapour content.

2.6 VOC Speciation

Concentration values in micrograms per cubic metre

	BL 80A	BL 80B	BL 252	BL 258	BL 259	BL 260A	BL 260B	BL 260C	BL 261A	BL 261B	BL 261C
Toluene	2800	154	3102	-	7373	100	133	293	78	645	-
Esential Oil (himonene type compound	5938	-	-	62	-	-	-	-	-	-	-
Ethyl acetate	1415	-	163	-	-	-	-	-	-	-	-
Butyl acetate	1385	-	2122	-	-	-	747	53	156	230	226
Ethyl 2-methylbutrate	1169	-	-	-	-	-	-	-	-	-	-
m-xylene	1015	-	408	-	-	-	107	53	-	92	-
Cyclohexane	646	-	-	103	2510	-	-	-	-	-	-
Heptane	523	-	-	41	1255	-	-	-	-	-	-
Cyclic alkanes	-	-	-	-	1059	-	-	-	-	-	-
Unidentified hydrocarbons	1108	-	-	-	3137	-	293	-	-	-	189
C3 substituted Benzene	-	-	-	-	-	-	400	-	-	-	-

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3 Methodology

3.1 Particulate Matter

Sampling was carried out to the main procedural requirements of BS 6069:Section 4.3:1992, entitled "Method for the manual gravimetric determination of concentration and mass flow rate of particulate material in gas-carrying ducts". This method gives a more accurate result than BS 3405:1983. Standard USEPA Method 5 type sampling equipment was used. This basically consists of a heated, stainless steel probe and heated filter housing. Isokinetic sampling is maintained throughout each test by way of a control console, and due to the inclusion of an S-Type pitot in the sampling probe itself, the stack gas flow rate can be continuously monitored and the sampling rate can be modified to take account of any changes in flow rate in the stack thereby maintaining isokinetic sampling throughout the test. Dried preweighed filters were used, which were redried and weighed after sampling, and the mass of particulate collected determined from the weight difference. During sampling, the volume of air sampled was measured, and the particulates emission concentration were calculated from the mass of particulate collected, and the sample volume. This value was corrected to any gas reference conditions specified. This method accords to our documented in-house procedure, and is described in our Technical Procedure, TP16-IEM, which is UKAS accredited.

Uncertainty: $\pm 10\%$ Detection Limit: 1mg/Nm^3

3.2 Oxides of Nitrogen, Carbon Monoxide, and Oxygen.

The emission concentrations of these determinands were measured by of an Horiba PG250 multigas analyser, utilising the following detection principles:

NO_X – Chemiluminescence
CO - Non dispersive infrared
O – Zirconia Cell

The gas sample for analysis was extracted from the stack, and passed to the analyser via a heated sampling line, and gas conditioning unit to remove moisture from the sample prior to analysis. The analyser was calibrated on site for each determinand using a certified reference gas of known concentration, which is traceable to national standards. The instrument output was electronically logged. This measurement method is described in our in-house Technical Procedure TP24-HEM, which is UKAS accredited.

	Uncertainty	Detection Limit
NO_x	± 3.8%	1mg/Nm^3
CO	± 3.8%	1mg/Nm^3
O_2	± 6.7%	0.1%

3.3 Volatile Organic Compounds (VOCs)

The measurement of VOCs was carried out by using a heated portable flame ionisation detector (FID). The instrument used was a Signal 3030PM or a Bernath Model 3005 or Model 3006, and the sample gas was passed to the analyser via a heated sampling line. On-site calibration of the analyser was carried out before and after sampling using gases traceable from the national standard. During sampling the flue gases was drawn continuously via the heated sample line into the instrument. The displayed total VOC concentration was recorded during typical working conditions. The concentrations displayed by the FID are expressed as VOCs in ppm as total methane-equivalent or propane equivalent carbon as appropriate. A calculation was carried out to express these results in mg/m^3 methane or propane equivalent carbon at standard temperature and pressure. This method is based on USEPA Method 25A, and is described in our Technical Procedure, TP8-IEM, which is UKAS accredited.

Uncertainty: ± 5.8%

Detection Limit: 1mg/Nm^3

3.4 VOC Speciation

Sampling for volatile organic compounds was carried out by passing a measured volume of flue gas through a sampling system consisting of a prefilter, sample line and sorbent tube containing activated charcoal. Any volatile organic compounds were absorbed on the activated charcoal. After exposure, the tube was sealed and passed to a laboratory on our approved supplier's list. The sample was desorbed using carbon disulphide and analysed by GC/FID. This method is based on BS EN 13649:2002

Uncertainties: ± 25% for MIBK
± 17% Butyl acetate
± 7% Xylene

3.5 Isocyanates

A probe was inserted into the exhaust gas stream. A sample of the exhaust gas was removed non-isokinetically and the gas bubbled through impingers containing piperazine solution (the trapping reagent) using a portable sampling pump.

Upon completion of sampling, all samples were placed in clean containers sealed, labelled and forwarded to a laboratory for analysis.

This method is based in the HSE method MDHS 25/2 Organic Isocyanates.

3.6 Stack Gas Temperature

Stack gas temperature was measured by the use of a thermocouple and digital temperature indicator which were calibrated together. Temperature readings were taken at ten equally-spaced points, on one or two sampling lines across the duct, in order to obtain representative measurements. This method is described in our Technical Procedure TP2-IEM (ref 5.2), which is UKAS accredited .

3.7 Volumetric Flow Rates

The stack gas volumetric flow rates were calculated from in-duct pressure readings taken using a suitable pitot tube and calibrated manometer. Readings were taken at ten equally-spaced positions, on each of two sampling lines across the duct, in order to obtain a representative flow measurement. This procedure is in accordance with the relevant parts of BS 3405:1983, and is described in our Technical Procedure TP2-IEM (ref 5.2), which is UKAS accredited .

4 Results and Discussion

A full summary of results can be found in Section 2 of this report and also on the stack emission test certificate in the appendix.

BL 256 The Primer spotting was not being used and was therefore not monitored.

5 References

5.1 DEPARTMENT OF THE ENVIRONMENT (1990) *Environmental Protection Act 1990.* London: HMSO.

5.2 CASELLA STANGER (2004). *Technical Procedure Manual :* Manchester Casella CRE Emissions

6 Quality Statement

We confirm that in preparing this report we have exercised all reasonable skill and care.

Casella Stanger operates a Quality Assurance system, which is registered under BS EN ISO 9000. We confirm that this project has been carried out in accordance with the System Operating Procedures. In addition, Casella CRE Emissions holds a UKAS accreditation to BS 17025 for the measurement of the following parameters, which was carried out as part of this measurement exercise:

Particulate Matter
Nitrogen Oxides
Carbon Monoxide
Volatile Organic Compounds by FID
Stack Gas Velocity
Stack Gas Temperature
Stack Gas Oxygen Content