

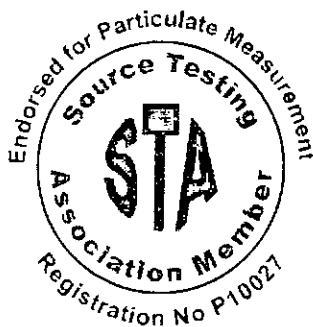
Clive Berry
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PARTICULATE EMISSIONS SURVEY

JUNE 2003

DURR LIMITED

Broxell Close
Warwick
CV34 5QF
Tel: 01234 217091 Fax: 01234 210573



CASELLA STANGER LTD

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Project 191960103/EB/R1/Rev0

EXECUTIVE SUMMARY

Below is a summary table of the results obtained

Summary of results and emission concentration limits (Page 1 of 1)

Stack Reference	^(a) Particulate Concentration Run-1 (mg/m ³)	^(a) Particulate Concentration Run-2 (mg/m ³)	^(a) Average Particulate (mg/m ³)
Top Coat Booth 1	0.03	0.4	0.22
Top Coat Booth 2	0.56	2.94	1.75
Primer Flash Off	0.18	0.19	0.18
Top Coat Oven	0.19	1.8	1.0
Top Coat Flash Off	1.49	1.01	1.25
Primer Booth 1	3.54	0.91	2.22
Primer Booth 2	2.74	4.21	3.48

Note 1: All results at reference conditions 273K, 101.3kPa.

Note 2: Tests marked ^(a) are entirely covered by our UKAS accreditation.

Note 3: Tests marked ^(b) are covered by our UKAS accreditation for sampling; and the sample analysis was carried out by a sub-contracted UKAS accredited laboratory.

Note 4: Tests marked ^(c) are covered by our UKAS accreditation for sampling and the analysis was carried out by a non-UKAS accredited laboratory.

Note 5: Tests marked ^(d) are not covered by our UKAS accreditation for sampling, but the sub-contract laboratory holds UKAS accreditation for the sampling analysis.

Note 6: Tests marked ^(e) are not covered by a UKAS accreditation held by ourselves, or any third party.

Approved By: Clive Berry



Date: 27th June 2003

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Executive Summary

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1.0 Introduction

- 1.1 Durr Ltd has installed spray booths and exhausts at the Terex site in Coventry. The company have a requirement to undertake emission monitoring of the stacks which will come under Local Authority control as a Part B process and require annual monitoring.

2.0 Methodology

2.1 Total Particulate Matter

2.1.1 Total Particulate Sampling – Unheated.

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. Manual USEPA Method 5 type sampling equipment were used. This basically consists of a stainless steel probe and in stack filter.

- 2.1.2 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.

- 2.1.3 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: $\pm 25\%$

Detection Limit: $1\text{mg}/\text{Nm}^3$

2.2 Exhaust gas velocity measurements

2.2.1 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, which is UKAS accredited.

2.3 Stack Gas Temperature

2.3.1 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, which is UKAS accredited.

3.0 Results

3.1 Data standardisation

3.1.1 Pollutant concentrations are expressed at reference conditions 273 K (0°C) and 101.3 kPa (1 atmosphere) with no correction for water vapour or oxygen content.

3.2 Sampling conditions

3.2.1 Details of release point sampling conditions are shown in Table 1 of Appendix 1.

3.3 Sampling details and results

3.3.1 All raw data is represented in Appendix 2

4.0 Results Summary

Stack Reference	Particulate Concentration Run 1 (mg/m ³)	Particulate Concentration Run 2 (mg/m ³)	Average Particulate (mg/m ³)
Top Coat Booth 1	0.03	0.4	0.22
Top Coat Booth 2	0.56	2.94	1.75
Primer Flash Off	0.18	0.19	0.18
Top Coat Oven	0.19	1.8	1.0
Top Coat Flash Off	1.49	1.01	1.25
Primer Booth 1	3.54	0.91	2.22
Primer Booth 2	2.74	4.21	3.48

5.0 Quality Statement

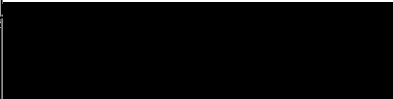

We confirm that in preparing this report we have exercised all reasonable skill and care.

Casella Stanger are registered by BSI to ISO9001 (BS5750 Part 1), and all work in connection with this project was carried out in accordance with our Quality Management System. In addition, Casella Stanger holds a UKAS accreditation for measurement of the following determinants, which were measured as part of this project:

Stack Gas Temperature
Volumetric Flow Rates
Total Particulate Matter

5.1 The site personnel also have the MCerts Accreditation.

6.0 Authentication

Client	Durr Limited
Title	Particulate Emissions Monitoring – June 2003
Project number	191960103/EB/R1/Rev0
Version 1	Status - Final issue
Site Work carried out by	Elena Berek – Team Leader (MCerts Level 2) Vicki Gavin – Consultant (MCerts Level 1)
Report prepared by Elena Berek	
Date	26 th June 2003
Report checked and approved by Clive Berry	
Date	27 th June 2003

APPENDIX 1

Result tables

Summary Certificate: PARTICULATE EMISSIONS & VELOCITY PROFILE

Report Written By: [Redacted]

Date: - 26th June 2003

Report Approved By: [Redacted]

Date: - 27th June 2003

Client	Durr - Treex		
Site Address	Coventry		
Job Number	191960103		
Date	10-Jun-03	UKAS Sample Method(s)	N/A
Operator(s)	Elena Berek & Vicki Gavin	UKAS Equipment Reference(s)	N/A
Boiler / Process Information		Isokinetic Sampling Information	
Boiler / Machine Number	Top coat 1	Isokinetic Sampling Method	BS6069
Number of Stacks	1	Samples per Axis	6
Configuration (Round / Rectangular)	Round	Stack Area (m2)	2.011
Dimensions (mtrs)	1.60	Isokinetic Sample Points (cms)	
Outlet Diameter (if applicable) (mtrs)	N/A	1	7.04
Number of Sample Ports	2	2	23.36
Number of Samples per Axis / Port	6	3	47.36
Nozzle Diameter (mm)	6	4	112.64
		5	136.64
		6	152.96
		7	N/A
		8	N/A
		Isokinetic Flow Rate (ltrs/min)	25

Duct Survey

Pitot Type	s	Pitot Calibration Data				26/3/02		Atmos. Pressure (mbars)	
		Axis 1 (Pa)	Temperature (C)	Axis 2 (Pa)	Temperature (C)	Static Pressure (Pa)	Volume Flow (Nm ³ /hr)		
Position No.	Distance (cms)								
1	10.4	122.0	22.0	128.0	22.0	-35.0			
2	24.0	126.0	22.0	118.0	22.0	94358.57			
3	40.0	115.0	22.0	87.0	22.0	Volume Flow (Nm ³ /s)			
4	56.0	100.0	22.0	76.0	22.0	26.21			
5	72.0	90.0	22.0	64.0	22.0	Normalised Flow (Nm/s)			
6	88.0	81.0	22.0	75.0	22.0	13.04			
7	104.0	57.0	22.0	51.0	22.0	Velocity of flow (m/s)			
8	120.0	47.0	22.0	66.0	22.0	14.86			
9	136.0	53.0	22.0	86.0	22.0	Reduced Exit Velocity (m/sec)			
10	152.0	64.0	22.0	116.0	22.0	N/A			
Averages		85.5	22.0	90.1	22.0				

Particulate Survey - Isokinetic Sampling

Pump Type	Zambelli	Samples		Comments
Pump Calibration Data	19/9/03	Axis 1	Axis 2	
Sample Number(s)		M1318	M1323	
Test Start Time		1005	1045	
Test Finish Time		1035	1115	
Start Dry Litres		669802	670176	
Finish Dry Litres		670176	670710	
Atmospheric Pressure (mbars)		986	986	
Average Gas Temperature (C)		23.0	23.0	
Oxygen (%)		N/A	N/A	
CO2 (%)		N/A	N/A	
Filter weight (mg)		0.010	0.200	
Concentration (mg/Nm ³)		0.030	0.417	

(litres pulled through filter)

105g than.

Summary Certificate: PARTICULATE EMISSIONS & VELOCITY PROFILE

Report Written By: - [REDACTED]

Date: - 26th June 2003

Report Approved By: - [REDACTED]

Date: - 27th June 2003

Client	Durr - Treex		
Site Address	Coventry		
Job Number	191960103		
Date	10-Jun-03	UKAS Sample Method(s)	N/A
Operator(s)	Elena Berec & Vicki Gavin	UKAS Equipment Reference(s)	N/A
Boiler / Process Information		Isokinetic Sampling Information	
Boiler / Machine Number	Top coat 2	Isokinetic Sampling Method	BS6069
		Samples per Axis	6
Number of Stacks		Stack Area (m ²)	2.011
Configuration (Round / Rectangular)	Round	Isokinetic Sample Points (cms)	
Dimensions (mtrs)	1.60	1	7.04
		5	136.64
Outlet Diameter (if applicable) (mtrs)	N/A	2	23.36
		6	152.96
Number of Sample Ports	2	3	47.36
		7	N/A
Number of Samples per Axis / Port	6	4	112.64
		8	N/A
Nozzle Diameter (mm)	5	Isokinetic Flow Rate (ltrs/min)	17

Duct Survey

Pitot Type		Pitot Calibration Data				26/3/02	
Position No.	Distance (cms)	Axis 1 (Pa)	Temperature (C)	Axis 2 (Pa)	Temperature (C)	Atmos. Pressure (mbars)	Static Pressure (Pa)
1	10.4	143.0	22.0	177.0	22.0	986	-16.0
2	24.0	95.0	22.0	98.0	22.0		Volume Flow (Nm ³ /hr)
3	40.0	72.0	22.0	92.0	22.0		92306.28
4	56.0	46.0	22.0	67.0	22.0		Volume Flow (Nm ³ /s)
5	72.0	46.0	22.0	59.0	22.0		25.64
6	88.0	40.0	22.0	34.0	22.0		Normalised Flow (Nm/s)
7	104.0	49.0	22.0	52.0	22.0		12.75
8	120.0	41.0	22.0	70.0	22.0		Velocity of flow (m/s)
9	136.0	48.0	22.0	93.0	22.0		14.53
10	152.0	106.0	22.0	133.0	22.0		Reduced Exit Velocity (m/sec)
Averages		68.6	22.0	96.2	22.0		N/A

Particulate Survey - Isokinetic Sampling

Pump Type	Zambelli	Samples		Comments
Pump Calibration Data	19/9/03	Axis 1	Axis 2	
Sample Number(s)		M1311	M1316	
Test Start Time		1128	1200	
Test Finish Time		1158	1230	
Start Dry Litres		670710	671112	
Finish Dry Litres		671112	671568	
Atmospheric Pressure (mbars)		986	986	
Average Gas Temperature (C)		24.0	24.0	
Oxygen (%)		N/A	N/A	
CO2 (%)		N/A	N/A	
Filter weight (mg)		0.200	1.200	
Concentration (mg/Nm ³)		0.556	2.941	

Summary Certificate: PARTICULATE EMISSIONS & VELOCITY PROFILE

Report Written By: - [REDACTED]

Date: - 26th June 2003

Report Approved By: - [REDACTED]

Date: - 27th June 2003

Client	Durr - Treex				
Site Address	Coventry				
Job Number	191960103				
Date	10-Jun-03	UKAS Sample Method(s)	N/A		
Operator(s)	Elena Berek & Vicki Gavin	UKAS Equipment Reference(s)	N/A		
Boiler / Process Information		Isokinetic Sampling Information			
Boiler / Machine Number	Primer Flash off	Isokinetic Sampling Method	BS6069		
Number of Stacks	1	Samples per Axis	4		
Configuration (Round / Rectangular)	Round	Stack Area (m2)	0.528		
Dimensions (mtrs)	0.82	Isokinetic Sample Points (cms)			
Outlet Diameter (if applicable) (mtrs)	N/A	1	5.494	5	N/A
Number of Sample Ports	2	2	20.5	6	N/A
Number of Samples per Axis / Port	4	3	61.50	7	N/A
Nozzle Diameter (mm)	6	4	76.51	8	N/A
		Isokinetic Flow Rate (ltrs/min)	28		

Duct Survey

Pitot Type	s	Pitot Calibration Data				26/3/02		Atmos. Pressure (mbars)
Position No.	Distance (cms)	Axis 1 (Pa)	Temperature (C)	Axis 2 (Pa)	Temperature (C)	Static Pressure (Pa)	986	
1	5.3	110.0	33.0	99.0	33.0	38.0		
2	12.3	102.0	33.0	89.0	33.0	Volume Flow (Nm ³ /hr)		
3	20.5	98.0	33.0	86.0	33.0	26827.33		
4	28.7	86.0	33.0	101.0	33.0	Volume Flow (Nm ³ /s)		
5	36.9	85.0	33.0	104.0	33.0	7.45		
6	45.1	77.0	33.0	117.0	33.0	Normalised Flow (Nm/s)		
7	53.3	98.0	33.0	126.0	33.0	14.11		
8	61.5	123.0	33.0	138.0	33.0	Velocity of flow (m/s)		
9	69.7	131.0	33.0	126.0	33.0	16.38		
10	77.9	141.0	33.0	121.0	33.0	Reduced Exit Velocity (m/sec)		
Averages		105.1	33.0	111.9	33.0	N/A		

Particulate Survey - Isokinetic Sampling

Pump Type	Zambelli	Samples		Comments
Pump Calibration Data	19/9/03	Axis 1	Axis 2	
Sample Number(s)		M1310	M1327	
Test Start Time		1300	1340	
Test Finish Time		1330	1420	
Start Dry Litres		671568	672180	
Finish Dry Litres		672180	672761	
Atmospheric Pressure (mbars)		986	986	
Average Gas Temperature (C)		24.0	24.0	
Oxygen (%)		N/A	N/A	
CO2 (%)		N/A	N/A	
Filter weight (mg)		0.100	0.100	
Concentration (mg/Nm ³)		0.183	0.192	

Summary Certificate: PARTICULATE EMISSIONS & VELOCITY PROFILE

Report Written By: - [REDACTED]

Date: - 26th June 2003

Report Approved By: - [REDACTED]

Date: - 27th June 2003

Client	Durr-Treox				
Site Address	Coventry				
Job Number	191960103				
Date	10-Jun-03	UKAS Sample Method(s)	N/A		
Operator(s)	Elena Berek & Vicki Gavin	UKAS Equipment Reference(s)	N/A		
Boiler / Process Information			Isokinetic Sampling Information		
Boiler / Machine Number	Topcoat Oven	Isokinetic Sampling Method	BS6069		
Number of Stacks	1	Samples per Axis	2		
Configuration (Round / Rectangular)	Round	Stack Area (m2)	0.196		
Dimensions (mtrs)	0.50	Isokinetic Sample Points (cms)			
Outlet Diameter (if applicable) (mtrs)	N/A	1	7.3	5	N/A
Number of Sample Ports	2	2	42.7	6	N/A
Number of Samples per Axis / Port	2	3	N/A	7	N/A
Nozzle Diameter (mm)	6	4	N/A	8	N/A
		Isokinetic Flow Rate (ltrs/min)	31		

Duct Survey

Pitot Type	Pitot Calibration Data					26/3/02	
Position No.	Distance (cms)	Axis 1 (Pa)	Temperature (C)	Axis 2 (Pa)	Temperature (C)	Atmos. Pressure (mbars)	
1	3.3	102.0	73.0	115.0	73.0	986	Static Pressure (Pa)
2	7.5	130.0	73.0	131.0	73.0		-109.0
3	12.5	138.0	73.0	139.0	73.0		Volume Flow (Nm ³ /hr)
4	17.5	151.0	73.0	149.0	73.0		10596.79
5	22.5	149.0	73.0	145.0	73.0		Volume Flow (Nm ³ /s)
6	27.5	137.0	73.0	160.0	73.0		2.94
7	32.5	144.0	73.0	160.0	73.0		Normalised Flow (Nm/s)
8	37.5	153.0	73.0	146.0	73.0		14.99
9	42.5	144.0	73.0	143.0	73.0		Velocity of flow (m/s)
10	47.5	122.0	73.0	118.0	73.0		18.50
	Averages	137.0	73.0	141.4	73.0		Reduced Exit Velocity (m/sec)
							N/A

Particulate Survey - Isokinetic Sampling

Pump Type	Zambelli	Samples		Comments
Pump Calibration Data	19/9/03	Axis 1	Axis 2	
Sample Number(s)		M1317	M1328	
Test Start Time		0820	0857	
Test Finish Time		0850	0927	
Start Dry Litres		668663	669244	
Finish Dry Litres		669244	669802	
Atmospheric Pressure (mbars)		986	986	
Average Gas Temperature (C)		19.0	20.0	
Oxygen (%)		N/A	N/A	
CO2 (%)		N/A	N/A	
Filter weight (mg)		0.100	0.900	
Concentration (mg/Nm ³)		0.189	1.778	

Summary Certificate: PARTICULATE EMISSIONS & VELOCITY PROFILE

Report Written By: - [REDACTED]

Date: - 26th June 2003

Report Approved By: - [REDACTED]

Date: - 27th June 2003

Client	Durr - Treex				
Site Address	Coventry				
Job Number	191960103				
Date	09-Jun-03	UKAS Sample Method(s)	N/A		
Operator(s)	Elena Berek & Vicki Gavin	UKAS Equipment Reference(s)	N/A		
Boiler / Process Information		Isokinetic Sampling Information			
Boiler / Machine Number	Flash off	Isokinetic Sampling Method	BS6069		
		Samples per Axis	4		
Number of Stacks	1	Stack Area (m2)	0.739		
Configuration (Round / Rectangular)	Round	Isokinetic Sample Points (cms)			
Dimensions (mtrs)	0.97	1	6.499	5	N/A
Outlet Diameter (if applicable) (mtrs)	N/A	2	24.25	6	N/A
Number of Sample Ports	2	3	72.75	7	N/A
Number of Samples per Axis / Port	4	4	90.50	8	N/A
Nozzle Diameter (mm)	5	Isokinetic Flow Rate (ltrs/min)	24		

Duct Survey

Pitot Type	s	Pitot Calibration Data				26/3/02		Atmos. Pressure (mbars)
Position No.	Distance (cms)	Axis 1 (Pa)	Temperature (C)	Axis 2 (Pa)	Temperature (C)	994		
1	6.3	173.0	54.0	154.0	54.0	Static Pressure (Pa)		
2	14.6	192.0	54.0	176.0	54.0	98.0		
3	24.3	193.0	54.0	174.0	54.0	Volume Flow (Nm ³ /hr)		
4	34.0	177.0	54.0	183.0	54.0	44768.53		
5	43.7	171.0	54.0	167.0	54.0	Volume Flow (Nm ³ /s)		
6	53.4	164.0	54.0	154.0	54.0	12.44		
7	63.1	166.0	54.0	149.0	54.0	Normalised Flow (Nm/s)		
8	72.8	149.0	54.0	153.0	54.0	15.83		
9	82.5	171.0	54.0	163.0	54.0	Velocity of flow (m/s)		
10	92.2	161.0	54.0	160.0	54.0	20.29		
Averages		171.7	54.0	163.7	54.0	Reduced Exit Velocity (m/sec)		
						N/A		

Particulate Survey - Isokinetic Sampling

Pump Type	Zambelli	Samples		Comments
Pump Calibration Data	19/9/03	Axis 1	Axis 2	
Sample Number(s)		M1322	M1321	
Test Start Time		1354	1433	
Test Finish Time		1424	1503	
Start Dry Litres		667775	668221	
Finish Dry Litres		668221	668658	
Atmospheric Pressure (mbars)		994	994	
Average Gas Temperature (C)		24.0	23.0	
Oxygen (%)		N/A	N/A	
CO2 (%)		N/A	N/A	
Filter weight (mg)		0.600	0.400	
Concentration (mg/Nm ³)		1.492	1.011	

Summary Certificate: PARTICULATE EMISSIONS & VELOCITY PROFILE

Report Written By: - [REDACTED]

Date: - 26th June 2003

Report Approved By: - [REDACTED]

Date: - 27th June 2003

Client	Durr - Treex				
Site Address	Coventry				
Job Number	191960103				
Date	09-Jun-03	UKAS Sample Method(s)	N/A		
Operator(s)	Elena Berek & Vicki Gavin	UKAS Equipment Reference(s)	N/A		
Boiler / Process Information		Isokinetic Sampling Information			
Boiler / Machine Number	Primer 1	Isokinetic Sampling Method	BS6069		
		Samples per Axis	6		
Number of Stacks	1	Stack Area (m2)	2.011		
Configuration (Round / Rectangular)	Round	Isokinetic Sample Points (cms)			
Dimensions (mtrs)	1.60	1	7.04	5	136.64
Outlet Diameter (if applicable) (mtrs)	N/A	2	23.36	6	152.96
Number of Sample Ports	2	3	47.36	7	N/A
Number of Samples per Axis / Port	6	4	112.64	8	N/A
Nozzle Diameter (mm)	6	Isokinetic Flow Rate (ltrs/min)	25		

Duct Survey

Pitot Type	s	Pitot Calibration Data		26/3/02		Atmos. Pressure (mbars)
Position No.	Distance (cms)	Axis 1 (Pa)	Temperature (C)	Axis 2 (Pa)	Temperature (C)	994
1	10.4	85.0	17.0	183.0	17.0	Static Pressure (Pa) 99.0
2	24.0	52.0	17.0	95.0	17.0	Volume Flow (Nm ³ /hr)
3	40.0	53.0	17.0	58.0	17.0	95157.43
4	56.0	44.0	17.0	52.0	17.0	Volume Flow (Nm ³ /s)
5	72.0	40.0	17.0	45.0	17.0	26.43
6	88.0	47.0	17.0	49.0	17.0	Normalised Flow (Nm/s)
7	104.0	62.0	17.0	36.0	17.0	13.15
8	120.0	77.0	17.0	47.0	17.0	Velocity of flow (m/s)
9	136.0	150.0	17.0	47.0	17.0	14.93
10	152.0	223.0	17.0	88.0	17.0	Reduced Exit Velocity (m/sec)
	Averages	83.3	17.0	81.5	17.0	N/A

Particulate Survey - Isokinetic Sampling

Pump Type	Zambelli	Samples		Comments
Pump Calibration Data	19/9/03	Axis 1	Axis 2	
Sample Number(s)		M1313	M1309	
Test Start Time		1006	1046	
Test Finish Time		1036	1118	
Start Dry Litres		666075	666322	
Finish Dry Litres		666322	666807	
Atmospheric Pressure (mbars)		994	994	
Average Gas Temperature (C)		20.0	24.0	
Oxygen (%)		N/A	N/A	
CO2 (%)		N/A	N/A	
Filter weight (mg)		0.800	0.400	
Concentration (mg/Nm ³)		3.543	0.914	

Summary Certificate: PARTICULATE EMISSIONS & VELOCITY PROFILE

Report Written By: - [REDACTED]

Date: - 26th June 2003

Report Approved By: - [REDACTED]

Date: - 27th June 2003

Client	Durr Treex		
Site Address	Coventry		
Job Number	191960103		
Date	09-Jun-03	UKAS Sample Method(s)	N/A
Operator(s)	Elena Berek & Vicki Gavin	UKAS Equipment Reference(s)	N/A
Boiler / Process Information		Isokinetic Sampling Information	
Boiler / Machine Number	Primer 2	Isokinetic Sampling Method	BS6069
Number of Stacks	1	Samples per Axis	6
Configuration (Round / Rectangular)	Round	Stack Area (m ²)	2.011
Dimensions (mtrs)	1.60	Isokinetic Sample Points (cms)	5
Outlet Diameter (If applicable) (mtrs)	N/A		136.64
Number of Sample Ports	2		152.96
Number of Samples per Axis / Port	6		N/A
Nozzle Diameter (mm)	6		N/A
		Isokinetic Flow Rate (ltrs/min)	25

Duct Survey

Pitot Type	s	Pitot Calibration Data				26/3/02		Atmos. Pressure (mbars)
Position No.	Distance (cms)	Axis 1 (Pa)	Temperature (C)	Axis 2 (Pa)	Temperature (C)	Static Pressure (Pa)	Volume Flow (Nm ³ /hr)	
1	10.4	178.0	18.0	164.0	18.0	994		
2	24.0	132.0	18.0	123.0	18.0	78.0		
3	40.0	105.0	18.0	103.0	18.0	98977.54		
4	56.0	87.0	18.0	89.0	18.0	Volume Flow (Nm ³ /s)		
5	72.0	67.0	18.0	76.0	18.0	27.49		
6	88.0	54.0	18.0	56.0	18.0	Normalised Flow (Nm/s)		
7	104.0	69.0	18.0	45.0	18.0	13.67		
8	120.0	78.0	18.0	56.0	18.0	Velocity of flow (m/s)		
9	136.0	94.0	18.0	78.0	18.0	15.55		
10	152.0	103.0	18.0	94.0	18.0	Reduced Exit Velocity (m/sec)		
	Averages	96.7	18.0	94.6	18.0	N/A		

Particulate Survey - Isokinetic Sampling

Pump Type	Zambelli	Samples		Comments
Pump Calibration Data	19/9/03	Axis 1	Axis 2	
Sample Number(s)		M1324	M1305	
Test Start Time		1128	1215	
Test Finish Time		1158	1315	
Start Dry Litres		666818	667222	
Finish Dry Litres		667222	667775	
Atmospheric Pressure (mbars)		994	994	
Average Gas Temperature (C)		24.0	24.0	
Oxygen (%)		N/A	N/A	
CO2 (%)		N/A	N/A	
Filter weight (mg)		1.000	2.100	
Concentration (mg/Nm ³)		2.744	4.210	

Top Coat 1 Axis 1

Calculation concentration

$$C = \frac{M}{Q}$$

C = concentration (g/m³ @ 0°C)

M = total rate of particulate emission (g/s)

Q = total gas flow rate (m³/sec @ 0°C)

$$Q = \left(\frac{273}{273+t} \right) VA$$

t = mean gas temp (°C) for sample

A = internal area of flue at sample plane (m²)

$$V = 0.075(\sqrt{h})\sqrt{(273+t)}$$

V = mean gas velocity (m/s)

\sqrt{h} = mean of \sqrt{h} of each pitot reading for sample

$$\sqrt{h} = \frac{\text{sum of } \sqrt{\text{pitot readings}}}{\text{no. sampling points}}$$

$$= \frac{91.17}{6}$$

$$V = 0.075 \times 15.20 \times \sqrt{(273 + 23)}$$

$$= 19.61$$

$$Q = \left(\frac{273}{273+23} \right) \times 19.61 \times 2.011$$

$$= 36.37 \text{ m}^3/\text{s @ } 0^\circ\text{C}$$

$$M = \frac{Am}{n\theta} \times 10^6$$

m = mass collected (g)

n = no. sampling points

a = nozzle size (mm²) → 6mm pit not² so

θ = duration of sampling at each point (secs)

$$\pi r^2 r = 3$$

$$= \frac{2.011}{6} \times \frac{0.00001}{252 \times 300} \times 10^6$$

$$\frac{0.00002011}{50886}$$

$$= 0.000395$$

$$C = \frac{M}{Q}$$

$$= 0.0000109 \text{ g/m}^3 \text{ (x 1000 for mg/m}^3\text{)}$$

$$= 0.0109 \text{ mg/m}^3$$

Report says 0.030

Top Coat 1 Axis 2.

Calculation concentration

$$C = \frac{M}{Q}$$

C = concentration (g/m³ @ 0°C)

M = total rate of particulate emission (g/s)

Q = total gas flow rate (m³/sec @ 0°C)

$$Q = \left(\frac{273}{273+t} \right) VA$$

t = mean gas temp (°C) for sample

A = internal area of flue at sample plane (m²)

$$V = 0.075(\sqrt{h})\sqrt{(273+t)}$$

V = mean gas velocity (m/s)

\sqrt{h} = mean of $\sqrt{}$ of each pitot reading for sample

$$\sqrt{h} = \frac{\text{sum of } \sqrt{\text{pitot readings}}}{\text{no. sampling points}} = \frac{92.19}{6}$$

$$V = 0.075 \times \underline{15.365} \times \sqrt{(273 + \underline{23})}$$
$$= \underline{19.826}$$

$$Q = \left(\frac{273}{273 + \underline{23}} \right) \times \underline{19.826} \times \underline{2.011}$$
$$= \underline{36.772} \text{ m}^3/\text{s @ } 0^\circ\text{C}$$

$$M = \frac{Am}{na\theta} \times 10^6$$

m = mass collected (g)

n = no. sampling points

a = nozzle size (mm²)

θ = duration of sampling at each point (secs)

$$= \frac{2.011 \times 0.0002}{6 \times 28.27 \times 300} \times 10^6$$
$$= \underline{0.0079} \quad \frac{6.0004022}{50886}$$

$$C = \frac{M}{Q}$$

$$= \underline{0.00214} \text{ g/m}^3 \text{ (x 1000 for mg/m}^3\text{)}$$

$$= \underline{0.215} \text{ mg/m}^3$$

Report says 0.417

Top Coat 2 Axis 1

Calculation concentration

$$C = \frac{M}{Q}$$

C = concentration (g/m³ @ 0°C)
 M = total rate of particulate emission(g/s)
 Q = total gas flow rate (m³/sec @ 0°C)

$$Q = \left(\frac{273}{273+t} \right) VA$$

t = mean gas temp (°C) for sample
 A = internal area of flue at sample plane (m²)

$$V = 0.075(\sqrt{h})\sqrt{(273 + t)}$$

V = mean gas velocity (m/s)
 \sqrt{h} = mean of $\sqrt{\quad}$ of each pitot reading for sample

$$\sqrt{h} = \frac{\text{sum of } \sqrt{\text{pitot readings}}}{\text{no. sampling points}}$$

$$= \frac{80.707}{6}$$

$$V = 0.075 \times 13.451 \times \sqrt{(273 + 24)}$$

$$= 17.386$$

$$Q = \left(\frac{273}{273+24} \right) \times 17.386 \times 2.011$$

$$= 32.14 \text{ m}^3/\text{s @ } 0^\circ\text{C}$$

$$M = \frac{Am}{n\theta} \times 10^6$$

m = mass collected (g)
 n = no. sampling points
 a = nozzle size (mm²) 5mm
 θ = duration of sampling at each point(secs)

5mm

$$= \frac{2.011}{6} \times \frac{0.0002}{19.63 \times 300} \times 10^6$$

$$= 0.0114$$

$$\frac{\pi r^2}{\pi 2.5^2} \quad r = 2.5$$

$$0.0004022$$

$$\underline{\underline{35334}}$$

$$C = \frac{M}{Q}$$

$$= \frac{0.00035}{0.00035} \text{ g/m}^3 \text{ (x 1000 for mg/m}^3\text{)}$$

$$= 0.35 \text{ mg/m}^3$$

Report says 0.556

Top Coat 2 Axis 2

Calculation concentration

$$C = \frac{M}{Q}$$

C = concentration (g/m³ @ 0°C)

M = total rate of particulate emission (g/s)

Q = total gas flow rate (m³/sec @ 0°C)

$$Q = \left(\frac{273}{273+t} \right) VA$$

t = mean gas temp (°C) for sample

A = internal area of flue at sample plane (m²)

$$V = 0.075(\sqrt{h})\sqrt{(273+t)}$$

V = mean gas velocity (m/s)

\sqrt{h} = mean of $\sqrt{}$ of each pitot reading for sample

$$\sqrt{h} = \frac{\text{sum of } \sqrt{\text{pitot readings}}}{\text{no. sampling points}}$$

$$= \frac{91.25}{6}$$

$$V = 0.075 \times 15.21 \times \sqrt{(273 + 24)}$$
$$= 17.23$$

$$Q = \left(\frac{273}{273+24} \right) \times 17.23 \times 2.011$$
$$= 31.85 \text{ m}^3/\text{s @ } 0^\circ\text{C}$$

$$M = \frac{Am}{na\theta} \times 10^6$$

m = mass collected (g)

n = no. sampling points

a = nozzle size (mm²)

θ = duration of sampling at each point (secs)

$$= \frac{2.011 \times 0.0012}{6 \times 19.6 \times 300} \times 10^6$$
$$= 0.068$$
$$\frac{0.0024132}{35280}$$

$$C = \frac{M}{Q}$$

$$= \frac{0.0024}{31.85} \text{ g/m}^3 \text{ (x 1000 for mg/m}^3\text{)}$$

$$= 2.15 \text{ mg/m}^3$$

Report says 2.94

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CASELLA
STANGER

Facsimile

To Wendy Smith
 Company County City Council
 Fax Number 02476 231840
 cc
 From Elena Bersek

Date 5th December 2003
 Our ref: 191960103 (Over/Telex)
 Your ref:
 Total no. of pages 2 (incl)

Dear Wendy,

Please find calculations below:-

Top Gat 1 Axis 1

- 1) LITRES SAMPLED = $670176 - 669802 = 374$ LITRES - GROSS LITRES
 To TEMPERATURE OF GAS METER (23°) = $374 \times \frac{273}{273 + 24} = 344.9$ L
- 2) WEIGHT OF FILTER = < 10 μ g
- 3) CONCENTRATION = $\frac{\text{WT OF FILTER } (< 10 \mu\text{g})}{\text{NO LITRES SAMPLED (CORRECTED)}} = \frac{< 10 \mu\text{g}}{344.9 \text{ L}} = < 0.029 \mu\text{g/L}$
- 4) $\mu\text{g/L} \equiv \text{mg/m}^3$ ($\mu\text{g} \times 1000 = \text{mg}$ & $\text{L} \times 1000 = \text{m}^3$) $\equiv < 0.029 \text{ mg/m}^3$
- 5) CORRECT FOR PRESSURE $\frac{1013 \text{ (STD)}}{986 \text{ (ACTUAL)}} = 1.027$
- 6) $< 0.029 \text{ mg/m}^3 \times 1.027 = < 0.0298 \text{ mg/m}^3$

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BRIEFLY

TOPCOAT 1 AXIS 2

NO OF LITRES 534, COLLECTED 492.5 LITRES

$$\text{Conc}^{\Delta} = \frac{200 \mu\text{g}}{492.5 \text{ L}} = 0.406 \mu\text{g/L} = 0.406 \text{ mg/m}^3$$

$$\text{CORRECTED FOR PRESSURE} = 0.406 \text{ mg/m}^3 \times \frac{1013}{986} = \cancel{0.417} 0.417 \text{ mg/m}^3$$

TOPCOAT 2 AXIS 1

NO OF LITRES 402, COLLECTED FOR 24°C = 369.5 LITRES

$$\text{Conc}^{\Delta} = \frac{200 \mu\text{g}}{369.5} = 0.541 \mu\text{g/L} = 0.541 \text{ mg/m}^3$$

$$\text{CORRECTED FOR PRESSURE} = 0.541 \text{ mg/m}^3 \times \frac{1013}{986} = 0.556 \text{ mg/m}^3$$

TOPCOAT 2 AXIS 2

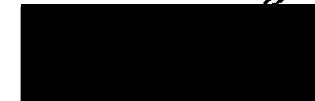
NO OF LITRES 456 (L) COLLECTED (24°C) 419.2 LITRES

$$\text{Conc}^{\Delta} = \frac{1200 \mu\text{g}}{419.2 \text{ L}} = 2.86 \mu\text{g/L} = 2.86 \text{ mg/m}^3$$

$$\text{CORRECTED FOR PRESSURE} = 2.86 \text{ mg/m}^3 \times \frac{1013}{986} = 2.94 \text{ mg/m}^3$$

I HOPE THE ABOVE IS OK IF YOU DO HAVE ANY OTHER
 QUERIES PLEASE DON'T HESITATE IN CONTACTING ME.

Kindest regards



E BEREK