QUALITY CONTROL SHEET

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EXECUTIVE SUMMARY

Table 1: Summary results for the Spraybake 1 booth

Substances Reported	Date of Sampling	Duration of Sampling	Mean Emission Concentration (mg/m^3)
Particulate matter	6 April 2004	24 minutes	1.8

Average efflux velocity: 9.3 m/s

The results indicate that the particulate emission concentration from the stack is probably within the emission limit of 10 mg/m^3, and is therefore compliant with PG 6/34 (97) (See note in Chapter 3.1 on pitot ratios).

Table 2: Summary results for the Spraybake 2 booth

Substances Reported	Date of Sampling	Duration of Sampling	Mean Emission Concentration (mg/m^3)
Particulate matter	6 April 2004	24 minutes	4.0

Average efflux velocity: 8.5 m/s

The stack emissions comply with the particulate emission concentration limit of 10mg/m^3 specified in PG6/34(97).

Table 3: Summary results for the Spraybake 3 booth

Substances Reported	Date of Sampling	Duration of Sampling	Mean Emission Concentration (mg/m^3)
Particulate matter	6 April 2004	24 minutes	2.3

Average efflux velocity: 7.5 m/s

The results indicate that the particulate emission concentration from the stack is probably within the emission limit of 10 mg/m^3, and is therefore compliant with PG 6/34 (97) (See note in Chapter 3.3 on pitot ratios).

1. NATURE OF WORK

Enviros Consulting Ltd & Robin Hanny Associates were requested by Nationwide Crash Repair Centres Limited, to monitor the particulate emissions from three spray booths at their site in Coventry.

All results obtained have been interpreted in accordance with the Secretary of States Process Guidance Note:

PG6/34 (97) Re-Spraying of Road Vehicles

Monitoring was carried out in accordance with BS3405: 1983 *Measurements of Particulate Emissions Including Grit and Dust simplified method (revised 1989).*

2. METHODS OF MEASUREMENT, SAMPLING AND ANALYSIS

2.1 Characterisation of Air Flow in Flues

Air velocity pressure and temperature measurements were taken to characterise the air flow in the discharge flues. All measurements were taken in accordance with BS 3405: 1983 (revised 1989) "Measurement of particulate emission including grit and dust (simplified method)".

A pitot tube coupled to a DP Measurement TT570 micromanometer was used to measure the air velocity (dynamic) pressure and static pressure. The instrument is calibrated annually by Associated Instruments.

2.2 Total Particulate Matter Emissions

Samples are taken using an isokinetic sampling method. In other words sampling at a rate such that the average velocity of the gas entering the sampling nozzle is the same as the velocity of the gas in the flue at the sampling point.

To confirm the suitability of the sampling position a preliminary survey was carried out, by measuring the pitot pressures (static and dynamic pressures), and the temperature at ten equally spaced points along two lines (Lines A and B).

For compliance with BS 3405, the ratio of the highest to the lowest pitot dynamic pressure reading must not exceed 9:1 and temperature readings at any point must not differ by more than 10% from the mean.

The pitot static and dynamic pressures were recorded and by using the formula below, the average velocity in the stack was calculated:

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

V = velocity m/s

$\sqrt{h}$ = is the mean of $\sqrt{h_1}$ where $\sqrt{h_1}$ is the square root of the dynamic pressure recorded at each sampling point

t = is the mean of the gas temperatures (in ^{0}C) at the sampling points

From the average air velocity in the stack, the sampling flow rate is calculated, so ensuring isokinetic sampling during particulate sampling.

Filters used to collect the samples were supplied by an external laboratory. The filters were transported to the site in separate closed containers. On completion of the monitoring programme all filters were re-sealed in the containers and returned to the laboratory and re-weighed following the appropriate laboratory procedures. The laboratory services were provided by Scientific Analysis Laboratories Ltd.

The total particulate matter emitted was calculated using the calculation detailed in BS3405: 1983 Section 3:10.

The concentration, C, of particulate matter emission in milligrams per cubic metre (mg/m^3) at 0°C is given by the formula;

$$C = \frac{M}{Q} x 10^3$$

Where Q is the calculated total gas flow rate in cubic metres per second at 0°C. It is given by the formula;

$$Q = \left[\frac{273}{273 + t}\right] V.A$$

A = Internal area, in m^2, of the flue

V = Mean gas velocity, in m/s

t = Gas temperature, in ^0C

and M is the total rate of particulate emission in grams per second. It is given by the formula;

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

m = Total mass of solids, in g, collected from all the sampling points

n = The number of sampling points

A = Internal area, in m^2, of the flue at the sampling plane

A = Cross-sectional area, in mm^2, of sampling nozzle

θ = The duration, in seconds, of sampling at each individual sampling point

3. RESULTS

3.1 Spraybake 1 booth

3.1.1 Air Velocity Measurements

Internal diameter of the flue stack = 766 mm

Average internal temperature: Line A = 26.9°C

Line B = 26.9°C

Pitot Reading Ref Point	Distance Across Sampling Line (m)	Line A Pressure Measurements (Pa)			Line B Pressure Measurements (Pa)		
		Total[1]	Static[2]	Dynamic[3]	Total[1]	Static[2]	Dynamic[3]
1	0.070	125	71	54	117	62	55
2	0.139	121	26	95	108	38	70
3	0.209	77	42	35	78	23	55
4	0.279	36	26	10	30	12	18
5	0.348	38	4	34	58	17	41
6	0.418	71	40	31	84	15	69
7	0.487	112	62	50	96	35	61
8	0.557	144	76	68	111	61	50
9	0.627	162	94	68	147	74	73
10	0.696	160	101	59	155	101	54

Highest pitot - dynamic reading (a): 95 Pa

Lowest pitot - dynamic reading (b): 10 Pa

Ratio highest to lowest a/b: 9.50: 1

[1] Total Pressure – measured from the Pitot nozzle using the DP Measurement TT570 manometer
[2] Static Pressure – measured from holes along the edge of the Pitot tube using the DP Measurement TT570 manometer
[3] Dynamic Pressure – calculated as Total Pressure minus Static Pressure

As the ratio of the highest to the lowest pitot readings exceeded 9:1, sampling was not undertaken in accordance with BS 3405. Full results are presented in Appendix 1 and summarised below:

Sample	Concentration of Particulate emissions (mg/m^3)	Average Velocity at Sampling Points (m/s)
Test 1	1.2	9.3
Test 2	2.5	9.3
Average	1.8	

The results are interpreted in accordance with the Secretary of States Process Guidance Note:

PG 6/34 (97) Re-Spraying of Road Vehicles

Where the following emissions should not be exceeded:

- Particulate Matter 10 mg/m^3

The results indicate that the particulate emission concentration from the stack is probably within the emission limit of 10 mg/m^3, and is therefore compliant with PG 6/34 (97).

3.2 Spraybake 2 booth

3.2.1 Air Velocity Measurements

Internal diameter of the flue stack = 766 mm

Average internal temperature: Line A = 33.0°C

Line B = 33.0°C

Pitot Reading Ref Point	Distance Across Sampling Line (m)	Line A Pressure Measurements (Pa)			Line B Pressure Measurements (Pa)		
		Total[1]	Static[2]	Dynamic[3]	Total[1]	Static[2]	Dynamic[3]
1	0.070	195	128	67	196	143	53
2	0.139	190	145	45	187	146	41
3	0.209	202	151	51	205	158	47
4	0.279	188	149	39	196	154	42
5	0.348	196	155	41	204	149	55
6	0.418	205	157	48	187	152	35
7	0.487	206	156	50	196	153	43
8	0.557	210	163	47	185	158	27
9	0.627	186	155	31	209	161	48
10	0.696	175	161	14	203	154	49

Highest pitot - dynamic reading (a): 67 Pa

Lowest pitot - dynamic reading (b): 14 Pa

Ratio highest to lowest a/b: 4.79: 1

[1] Total Pressure – measured from the Pitot nozzle using the DP Measurement TT570 manometer
[2] Static Pressure – measured from holes along the edge of the Pitot tube using the DP Measurement TT570 manometer
[3] Dynamic Pressure –calculated as Total Pressure minus Static Pressure

As the ratio of the highest to the lowest pitot readings did not exceed 9:1, sampling was undertaken in accordance with BS 3405. Full results are presented in Appendix 1 and summarised below:

Sample	Concentration of Particulate emissions (mg/m^3)	Average Velocity at Sampling Points (m/s)
Test 1	7.8	8.5
Test 2	0.1	8.5
Average	4.0	

The results are interpreted in accordance with the Secretary of States Process Guidance Note:

PG 6/34 (97) Re-Spraying of Road Vehicles

Where the following emissions should not be exceeded:

- Particulate Matter 10 mg/m^3

The particulate emission concentration from the stack is within the emission limit of 10 mg/m^3, and is therefore compliant with PG 6/34 (97).

3.3 Spraybake 3 booth

3.2.2 Air Velocity Measurements

Internal diameter of the flue stack = 766 mm

Average internal temperature: Line A = 30.4°C

Line B = 30.1°C

Pitot Reading Ref Point	Distance Across Sampling Line (m)	Line A Pressure Measurements (Pa)			Line B Pressure Measurements (Pa)		
		Total[1]	Static[2]	Dynamic[3]	Total[1]	Static[2]	Dynamic[3]
1	0.070	126	88	38	104	70	34
2	0.139	117	84	33	106	72	34
3	0.209	106	91	15	100	75	25
4	0.279	102	86	16	99	86	13
5	0.348	112	78	34	86	80	6
6	0.418	118	74	44	105	81	24
7	0.487	123	78	45	118	69	49
8	0.557	137	82	55	121	78	43
9	0.627	140	95	45	127	86	41
10	0.696	138	104	34	132	85	47

Highest pitot - dynamic reading (a): 55 Pa

Lowest pitot - dynamic reading (b): 6 Pa

Ratio highest to lowest a/b: 9.17: 1

[1] Total Pressure – measured from the Pitot nozzle using the DP Measurement TT570 manometer
[2] Static Pressure – measured from holes along the edge of the Pitot tube using the DP Measurement TT570 manometer
[3] Dynamic Pressure –calculated as Total Pressure minus Static Pressure

As the ratio of the highest to the lowest pitot readings exceeded 9:1, sampling was not undertaken in accordance with BS 3405. Full results are presented in Appendix 1 and summarised below:

Sample	Concentration of Particulate emissions (mg/m^3)	Average Velocity at Sampling Points (m/s)
Test 1	4.4	7.5
Test 2	0.2	7.5
Average	2.3	

The results are interpreted in accordance with the Secretary of States Process Guidance Note:

PG 6/34 (97) Re-Spraying of Road Vehicles

Where the following emissions should not be exceeded:

- Particulate Matter 10 mg/m^3

The results indicate that the particulate emission concentration from the stack is probably within the emission limit of 10 mg/m^3, and is therefore compliant with PG 6/34 (97).

APPENDICES TO REPORT

SAMPLING RESULTS AND CALCULATIONS

Spraybake 1 booth

Client: Nationwide, Coventry

Stack Ref: Spraybake 1

Date: 06/04/2004
Time 10:20

	Filter No.
Sample 1	6672
Sample 2	6673

Internal x distance of stack (mm) =
Internal y distance of stack (mm) =
Internal diameter,d, of stack (mm) = 766
Internal area, A, of stack at Sampling Location (m^2) = 0.46

Comments:

Preliminary Air Velocity and Temperature Measurement

Pitot reading reference point	First Sampling Line (A)					Second Sampling Line (B)				
	Distance along line (m)	Velocity Pitot-static reading (Pa)			Gas Temperature (t) (°C)	Distance along line (m)	Velocity Pitot-static reading (Pa)			Gas Temperature (t) (°C)
		Total (P_t)	Static (P_s)	Dynamic (P_d)			Total (P_t)	Static (P_s)	Dynamic (P_d)	
1	0.070	125	71	54	27.0	0.070	117	62	55	27.0
2	0.139	121	26	95	27.1	0.139	108	38	70	26.9
3	0.209	77	42	35	27.1	0.209	78	23	55	26.9
4	0.279	36	26	10	26.8	0.279	30	12	18	26.9
5	0.348	38	4	34	26.9	0.348	58	17	41	26.9
6	0.418	71	40	31	26.9	0.418	84	15	69	26.8
7	0.487	112	62	50	26.8	0.487	96	35	61	26.7
8	0.557	144	76	68	27.0	0.557	111	61	50	26.8
9	0.627	162	94	68	27.0	0.627	147	74	73	26.9
10	0.696	160	101	59	26.8	0.696	155	101	54	26.9
					Mean t = 26.94					Mean t = 26.87

Mean flue gas temperature (in °C) (Tp) =	26.91		
Permitted range of gas temperature readings (in °C) =	24.21	to	29.60
Highest pitot (P_d) reading (either sampling line) (in Pa) =	95.00		
Lowest pitot (P_d) reading (either sampling line) (in Pa) =	10.00		
Ratio of highest to lowest Pitot reading =	9.50 : 1		

Client: Nationwide, Coventry Stack Ref: Spraybake 1

Date: 06/04/2004

Internal x distance of stack (mm) =
Internal y distance of stack (mm) =
Internal diameter,d, of stack (mm) = 766
Internal area, A, of stack (m^2) = 0.46

Gas Velocity and Temperature Measurements at sampling points

Sampling Point Number[1]	Flue gas temperature (°C)		Pitot static readings		
	Initial t_1 (°C)	Final t_2 (°C)	Initial h_1 (Pa) P_d	Final h_2 (Pa) (P_d)	$\sqrt{h_1}$
A1	27.1		35	35	5.92
A2	27		68	68	8.25
B1	26.9		55	55	7.42
B2	26.8		50	50	7.07
	Mean t_1	Mean t_2	Total h_1	Total h_2	Mean $\sqrt{h_1}$
	26.95		208.00	208.00	7.16

Mean temperature (in °C) = 27.0
Mean $\sqrt{h}$ = 7.16
Permitted range of Total h (in Pa) = 187.20 to 228.80

Average Gas Velocity at Sampling Points 9.30 m/s

[1] Sampling Point Number – locations at which particulate samples were taken along Sampling Lines A and B. Samples 1 and 2 were taken at 25% and 75% of the distance along each line, respectively.

Client: Nationwide, Coventry Stack Ref: Spraybake 1

Date: 06/04/2004

Internal x distance of stack (mm) =
Internal y distance of stack (mm) =
Internal diameter,d, of stack (mm) = 766
Internal area, A, of stack (m^2) = 0.46

Sampling Results

Sampling Point Number	Sample Reference	Nozzle diameter (mm)	Nozzle Area, a (mm^2)	Duration of Sampling, θ (s)	a x θ	Flowmeter Setting (actual)	Mass of Solids Collected (g)
A1	Filter 1	4.0	12.57	180	2261.95	7.01	0.00009
A2	Filter 1	4.0	12.57	180	2261.95	7.01	
B1	Filter 1	4.0	12.57	180	2261.95	7.01	
B2	Filter 1	4.0	12.57	180	2261.95	7.01	
A1	Filter 2	4.0	12.57	180	2261.95	7.01	0.00019
A2	Filter 2	4.0	12.57	180	2261.95	7.01	
B1	Filter 2	4.0	12.57	180	2261.95	7.01	
B2	Filter 2	4.0	12.57	180	2261.95	7.01	

Summary of Results

Parameter \ Sample	Filter 1	Filter 2	Mean
Temperature (t) (°C)	26.95	26.95	26.95
Velocity (V) (m/s)	9.30	9.30	9.30
Mass of Solids collected (g)	0.00009	0.00019	0.00014
Gas flow rate, Q, (m^3/s)	3.902	3.902	3.902

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

Parameter \ Sample	Filter 1	Filter 2	Ratio of higher to lower result		Mean result
Mass Rate of emission (M) (g/s)	0.0046	0.0097	2.1	: 1	0.01
Concentration at 0°C (C) (mg/m^3)	**1.17**	**2.48**	2.1	: 1	**1.83**

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

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

Spraybake 2 booth

Client: Nationwide, Coventry

Stack Ref: Spraybake 2

Date: 06/04/2004
Time 11:05:00

	Filter No.
Sample 1	6693
Sample 2	6689

Internal x distance of stack (mm) =
Internal y distance of stack (mm) =
Internal diameter,d, of stack (mm) = 766
Internal area, A, of stack at Sampling Location (m^2) = 0.46

Comments:

Preliminary Air Velocity and Temperature Measurement

Pitot reading reference point	First Sampling Line (A)					Second Sampling Line (B)				
	Distance along line (m)	Velocity Pitot-static reading (Pa)			Gas Temperature (t) (°C)	Distance along line (m)	Velocity Pitot-static reading (Pa)			Gas Temperature (t) (°C)
		Total (P_t)	Static (P_s)	Dynamic (P_d)			Total (P_t)	Static (P_s)	Dynamic (P_d)	
1	0.070	195	128	67	33.0	0.070	196	143	53	32.8
2	0.139	190	145	45	32.8	0.139	187	146	41	32.9
3	0.209	202	151	51	32.8	0.209	205	158	47	32.9
4	0.279	188	149	39	33.1	0.279	196	154	42	33.0
5	0.348	196	155	41	33.2	0.348	204	149	55	33.0
6	0.418	205	157	48	33.1	0.418	187	152	35	33.2
7	0.487	206	156	50	33.1	0.487	196	153	43	33.2
8	0.557	210	163	47	33.0	0.557	185	158	27	33.1
9	0.627	186	155	31	32.7	0.627	209	161	48	33.0
10	0.696	175	161	14	32.7	0.696	203	154	49	32.9
					Mean t = 32.95					Mean t = 33.00

Mean flue gas temperature (in °C) (Tp) =	32.98		
Permitted range of gas temperature readings (in °C) =	29.68	to	36.27
Highest pitot (P_d) reading (either sampling line) (in Pa) =	67.00		
Lowest pitot (P_d) reading (either sampling line) (in Pa) =	14.00		
Ratio of highest to lowest Pitot reading =	4.79 : 1		

Client: Nationwide, Coventry Stack Ref: Spraybake 2

Date: 06/04/2004

Internal x distance of stack (mm) =
Internal y distance of stack (mm) =
Internal diameter,d, of stack (mm) = 766
Internal area, A, of stack (m^2) = 0.46

Gas Velocity and Temperature Measurements at sampling points

Sampling Point Number[1]	Flue gas temperature (°C)		Pitot static readings		
	Initial t_1 (°C)	Final t_2 (°C)	Initial h_1 (Pa) P_d	Final h_2 (Pa) (P_d)	$\sqrt{h_1}$
A1	32.8		51	51	7.14
A2	33		47	47	6.86
B1	32.9		47	47	6.86
B2	33.1		27	27	5.20
	Mean t_1	Mean t_2	Total h_1	Total h_2	Mean $\sqrt{h_1}$
	32.95		172.00	172.00	6.51

Mean temperature (in °C) = 33.0
Mean $\sqrt{h}$ = 6.51
Permitted range of Total h (in Pa) = 154.80 to 189.20

Average Gas Velocity at Sampling Points 8.54 m/s

[1] Sampling Point Number – locations at which particulate samples were taken along Sampling Lines A and B. Samples 1 and 2 were taken at 25% and 75% of the distance along each line, respectively.

Client: Nationwide, Coventry Stack Ref: Spraybake 2

Date: 06/04/2004

Internal x distance of stack (mm) =
Internal y distance of stack (mm) =
Internal diameter,d, of stack (mm) = 766
Internal area, A, of stack (m^2) = 0.46

Sampling Results

Sampling Point Number	Sample Reference	Nozzle diameter (mm)	Nozzle Area, a (mm^2)	Duration of Sampling, θ (s)	a x θ	Flowmeter Setting (actual)	Mass of Solids Collected (g)
A1	Filter 1	4.0	12.57	180	2261.95	6.44	0.00054
A2	Filter 1	4.0	12.57	180	2261.95	6.44	
B1	Filter 1	4.0	12.57	180	2261.95	6.44	
B2	Filter 1	4.0	12.57	180	2261.95	6.44	
A1	Filter 2	4.0	12.57	180	2261.95	6.44	0.00001
A2	Filter 2	4.0	12.57	180	2261.95	6.44	
B1	Filter 2	4.0	12.57	180	2261.95	6.44	
B2	Filter 2	4.0	12.57	180	2261.95	6.44	

Summary of Results

Parameter \ Sample	Filter 1	Filter 2	Mean
Temperature (t) (°C)	32.95	32.95	32.95
Velocity (V) (m/s)	8.54	8.54	8.54
Mass of Solids collected (g)	0.00054	0.00001	0.000275
Gas flow rate, Q, (m^3/s)	3.513	3.513	3.513

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

Parameter \ Sample	Filter 1	Filter 2	Ratio of higher to lower result		Mean result
Mass Rate of emission (M) (g/s)	0.0275	0.0005	54.0	: 1	0.01
Concentration at 0°C (C) (mg/m^3)	**7.83**	**0.14**	54.0	: 1	**3.99**

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

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

Spraybake 3 booth

Client: Nationwide, Coventry

Stack Ref: Spraybake 3

Date: 06/04/2004
Time 14:10:00

	Filter No.
Sample 1	6686
Sample 2	6687

Internal x distance of stack (mm) =
Internal y distance of stack (mm) =
Internal diameter,d, of stack (mm) = 766
Internal area, A, of stack at Sampling Location (m^2) = 0.46

Comments:

Preliminary Air Velocity and Temperature Measurement

Pitot reading reference point	First Sampling Line (A)					Second Sampling Line (B)				
	Distance along line (m)	Velocity Pitot-static reading (Pa)			Gas Temperature (t) (°C)	Distance along line (m)	Velocity Pitot-static reading (Pa)			Gas Temperature (t) (°C)
		Total (P_t)	Static (P_s)	Dynamic (P_d)			Total (P_t)	Static (P_s)	Dynamic (P_d)	
1	0.070	126	88	38	30.6	0.070	104	70	34	30.1
2	0.139	117	84	33	30.6	0.139	106	72	34	30.0
3	0.209	106	91	15	30.6	0.209	100	75	25	30.1
4	0.279	102	86	16	30.4	0.279	99	86	13	30.1
5	0.348	112	78	34	30.3	0.348	86	80	6	30.2
6	0.418	118	74	44	30.3	0.418	105	81	24	30.1
7	0.487	123	78	45	30.2	0.487	118	69	49	30.1
8	0.557	137	82	55	30.3	0.557	121	78	43	30.1
9	0.627	140	95	45	30.3	0.627	127	86	41	30.2
10	0.696	138	104	34	30.1	0.696	132	85	47	30.0
					Mean t = 30.37					Mean t = 30.10

Mean flue gas temperature (in °C) (Tp) =	30.24		
Permitted range of gas temperature readings (in °C) =	27.21	to	33.26
Highest pitot (P_d) reading (either sampling line) (in Pa) =	55.00		
Lowest pitot (P_d) reading (either sampling line) (in Pa) =	6.00		
Ratio of highest to lowest Pitot reading =	9.17 : 1		

Client: Nationwide, Coventry Stack Ref: Spraybake 3

Date: 06/04/2004

Internal x distance of stack (mm) =
Internal y distance of stack (mm) =
Internal diameter,d, of stack (mm) = 766
Internal area, A, of stack (m^2) = 0.46

Gas Velocity and Temperature Measurements at sampling points

Sampling Point Number[1]	Flue gas temperature (°C)		Pitot static readings		
	Initial t_1 (°C)	Final t_2 (°C)	Initial h_1 (Pa) P_d	Final h_2 (Pa) (P_d)	$\sqrt{h_1}$
A1	30.6		15	15	3.87
A2	30.3		55	55	7.42
B1	30.1		25	25	5.00
B2	30.1		43	43	6.56
	Mean t_1	Mean t_2	Total h_1	Total h_2	Mean $\sqrt{h_1}$
	30.28		138.00	138.00	5.71

Mean temperature (in °C) = 30.3
Mean $\sqrt{h}$ = 5.71
Permitted range of Total h (in Pa) = 124.20 to 151.80

Average Gas Velocity at Sampling Points 7.46 m/s

[1] Sampling Point Number – locations at which particulate samples were taken along Sampling Lines A and B. Samples 1 and 2 were taken at 25% and 75% of the distance along each line, respectively.

Client: Nationwide, Coventry Stack Ref: Spraybake 3

Date: 06/04/2004

Internal x distance of stack (mm) =
Internal y distance of stack (mm) =
Internal diameter,d, of stack (mm) = 766
Internal area, A, of stack (m^2) = 0.46

Sampling Results

Sampling Point Number	Sample Reference	Nozzle diameter (mm)	Nozzle Area, a (mm^2)	Duration of Sampling, θ (s)	a x θ	Flowmeter Setting (actual)	Mass of Solids Collected (g)
A1	Filter 1	4.0	12.57	180	2261.95	5.62	0.00027
A2	Filter 1	4.0	12.57	180	2261.95	5.62	
B1	Filter 1	4.0	12.57	180	2261.95	5.62	
B2	Filter 1	4.0	12.57	180	2261.95	5.62	
A1	Filter 2	4.0	12.57	180	2261.95	5.62	0.00001
A2	Filter 2	4.0	12.57	180	2261.95	5.62	
B1	Filter 2	4.0	12.57	180	2261.95	5.62	
B2	Filter 2	4.0	12.57	180	2261.95	5.62	

Summary of Results

Parameter \ Sample	Filter 1	Filter 2	Mean
Temperature (t) (°C)	30.28	30.28	30.28
Velocity (V) (m/s)	7.46	7.46	7.46
Mass of Solids collected (g)	0.00027	0.00001	0.00014
Gas flow rate, Q, (m^3/s)	3.095	3.095	3.095

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

Parameter \ Sample	Filter 1	Filter 2	Ratio of higher to lower result		Mean result
Mass Rate of emission (M) (g/s)	0.0138	0.0005	27.0	: 1	0.01
Concentration at 0°C (C) (mg/m^3)	**4.44**	**0.16**	27.0	: 1	**2.30**

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

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