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ADVANCE
ENVIRONMENTAL

PARTICULATE EMISSION MONITORING
AGGREGATE INDUSTRIES UK LIMITED
EXPRESS ASPHALT
COVENTRY
WARWICKSHIRE

Report on Particulate Emission Monitoring

to

Determine the Levels of Particulate Emission

from the

Parker Roadstone Coating Plant

at

Aggregate Industries UK Limited

Express Asphalt

Coventry

Warwickshire

Report Submitted to:

Plant Manager

Aggregates Industries UK Limited

Express Asphalt

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Company Principal

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Technical Officer

Date:

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1. INTRODUCTION

On 05 August 2002, particulate emission testing was undertaken by Advance Environmental at Aggregate Industries UK Limited, Express Asphalt, Coventry. During the test, the weather was noted as overcast with light drizzle and an ambient air temperature of 18 °C.

The purpose of the emission testing was to ensure compliance with the requirements of the Authorisation issued by Coventry City Council under Part I of the Environmental Protection Act 1990.

2. BACKGROUND

Part 1 of the Environmental Protection Act, 1990 came into force on the 1st. April, 1991 and introduced enhanced Industrial Pollution Control for HMIP (now the Environment Agency) and Local Authorities. Schedule 1 of the Environmental Protection (Prescribed Processes and Substances) Regulations 1991 (as amended), prescribed Part B processes for Local Authority Air Pollution Control.

Part 3 of the schedule covers mineral industries and the associated processes, which are operated by Aggregate Industries UK Limited at Express Asphalt, Coventry. The authorisation of these processes by local authorities has introduced emission monitoring requirements in accordance with the following process guidance note:-

- PG3/15(96) Secretary of State's Guidance - Mineral Drying and Roadstone Coating Processes.

3. MONITORING CONTRACTOR

The emissions test was co-ordinated by Mr K Gough, Company Principal, Advance Environmental. Mr Gough has 18 years experience of undertaking particulate emission testing on plant used in the quarrying and allied industries and is a certified Level 2 Isokinetic Sampling Engineer.

4. MONITORING PROTOCOL

4.1 Test method and references

Isokinetic sampling of the contained emission sources was undertaken using the B.C.U.R.A. (British Coal Utilisation Research Association) test equipment and the monitoring protocols utilised followed the procedures given within the following British Standards and Technical Guidance Notes:-

- **BS 3405: 1983** Measurement of Particulate Emissions including grit and dust;
- **Environmental Protection Act Technical Guidance Note (Monitoring) M1** Sampling facility requirements for the monitoring of particulates in gaseous releases to atmosphere; and
- **Environmental Protection Act Technical Guidance Note (Monitoring) M2** Monitoring emissions of pollutants at source.

4.1.1 Accuracy of reference standards

According to BS 3405: 1983 the accuracy of the monitoring methods utilised will be about +/- 25% of the particulate concentration under defined conditions. However, in practice the level of accuracy will be much improved than that described by the standard given the experience and competence of the sampling personnel.

4.2 Sampling Procedure

4.2.1 Sampling equipment

The equipment used during the sampling procedure was the Airflow Developments Limited BCURA isokinetic particulate sampling equipment, which meets the requirement of the BS3405: 1983 standard method for the measurement of particulate emissions. The equipment was comprised of:-

- Probe;
- cyclone separator;
- sampling nozzle;
- grit hopper;
- filter holder;
- filter medium;
- pump;
- flexible hose; and
- flow rate control equipment.

Ancillary equipment used included a temperature probe, pitot-static tube, micro-manometer and balance, all of which meet the requirements specified in the standard method.

All equipment was inspected in the laboratory before being taken on to site to ensure it was in good condition. Tests were also undertaken to verify that there would be no leaks from the sampling train. The filter medium, which was comprised of two grade of glass wool was prepared, conditioned and pre-weighed before use, as were the grit hoppers.

4.2.2 Preparation for sampling

No site visit was undertaken prior to undertaking the sampling procedure, as monitoring had previously been undertaken at the site, during which time the sampling position, working platform, sampling ports, access and safety precautions were found to be satisfactory and in accordance with the requirements of Technical Guidance Note M1.

Before sampling commenced, a preliminary velocity and temperature survey was undertaken using a pitot-static tube, Airflow Developments PVM100 micro manometer and Comark Limited KM450S temperature probe, the latter two instruments have current certificates of calibration. The micro manometer was zeroed before, during and after the sampling.

The internal dimensions of the flue were known from the previous monitoring undertaken. However, a further measurement was taken to check that the internal diameter had not been reduced by build-up of particulate matter.

4.2.3 Sample collection

During the sample collection procedure, samples were taken from four sampling points at the centre of four equal areas along two sampling planes at 90^0 to each other.

Four sampling points were chosen because the flue area was less than 2.5 m^2. Cumulative sampling was undertaken along each sampling plane and the sampling duration at each sampling point was four minutes.

After the first set of samples were taken, the velocity and temperature measurements were repeated to ensure that the conditions were still within the required range. A duplicate set of samples were then taken, as outlined above. Velocity and temperature measurements were also undertaken at the end of the sampling procedure.

At all times during the sampling procedure the sampling technicians were in contact with the process operator to ensure that the plant was in full production and there were no changes in the process that might affect the representative nature of the samples collected.

Prior to commencement of sampling, the Alpha continuous particulate emission monitor was switched to manual mode and the average emission in mg/m^3 and gain settings were recorded whilst the first and second sets of samples were being collected. These were later reported to the manufacturer who advised on any necessary adjustments to the gain settings in order to calibrate the monitor.

Note: Due to limited production, it was necessary for material to be dried for the purpose of completing the second test.

4.2.4 Analysis of samples

On returning to the laboratory, the cyclone separator was washed and the residue was dried. The filters and grit hoppers were also dried, conditioned in a desiccator and weighed. The weighing equipment used was a Sartorious Research R180D analytical balance, capable of weighing to five decimal places. The balance is calibrated annually and a current certificate of calibration is held.

4.2.5 Calculation of results

The calculations were made using the formula specified for cumulative sampling in section 10 of BS 3405: 1983.

The recorded filter weights, velocity, temperature, sampling duration and internal flue dimensions were used to calculate:-

- The mass rate of solids emission in kg/hr; and

- The solids concentration in mgm^{-1}

4.3 Sampling Results

The Authorisation for the Parker Plant specifies an emission limit of 100 mg/m^3 expressed at standard conditions of 273 K and 101.3 kPa without correction for water vapour content.

At the time of sampling, a mean particulate matter concentration of 16.8 mg/m^3 was recorded. It can be concluded, therefore, that the emission from the Parker Plant complies with the emission limit currently imposed.

4.4 Comments

During each sampling period, the average results from the Alpha continuous emission monitor were logged. Readings of between 8.20 mg/m^3 (Test 1) and 7.08 mg/m^3 (Test 2) were recorded during the measurement periods. The present gain setting was noted as 10.1900. It can be concluded that the monitor was outside the required tolerance and an adjustment of the gain setting using the measured mean particulate matter concentration as the calibration factor has been carried out.

The full procedural requirements of BS 3405: 1983 could not be achieved due to:-

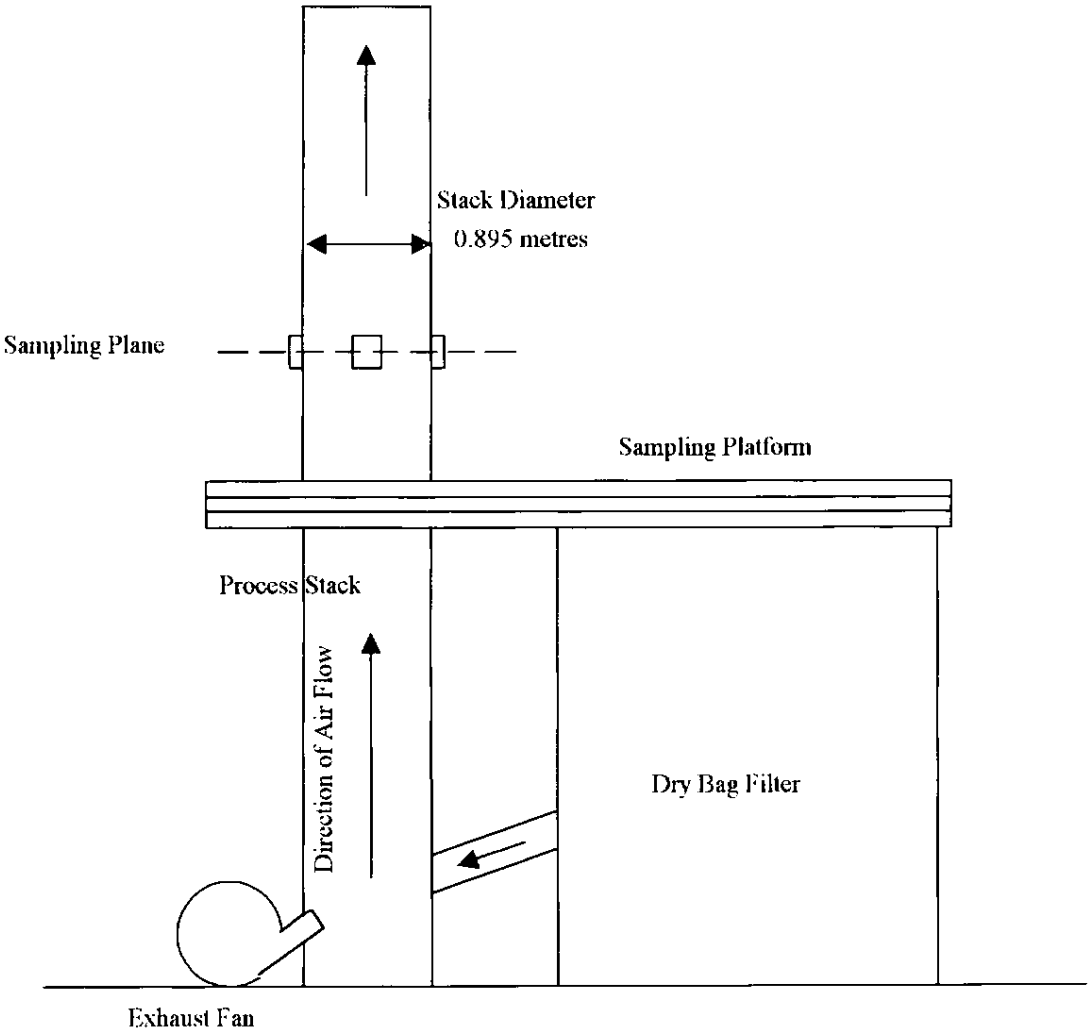
- clause 8.3, low particulate loading;

The quoted efflux velocity is measured at the sampling position, not at discharge.

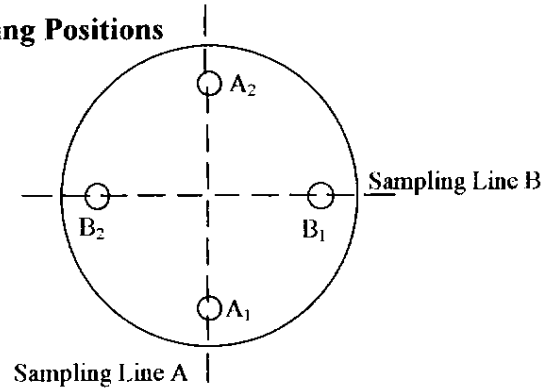
Full details of the sampling location, conditions and measurements taken are provided in the following sections.

5. SAMPLING LOCATION

5.1 Process Plant Layout



5.2 Sampling Positions



6. SUMMARY REPORT

ADVANCE ENVIRONMENTAL
PARTICULATE EMISSION TEST
SUMMARY REPORT

SITE :	Coventry Roadstone	PLANT :	Parker	EQUIPMENT :	Dry bag filter system	DATE OF TEST :	05.08.02

METEOROLOGICAL CONDITIONS

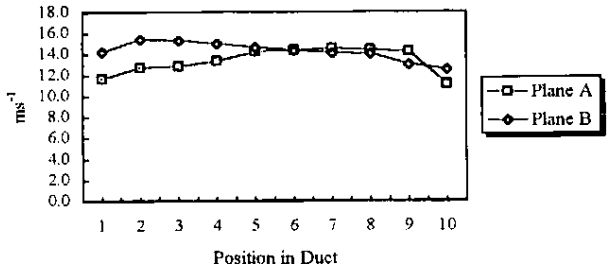
Weather:	Overcast with light drizzle	Ambient Air Temperature (°C):	18

PLANT DETAILS

Operating Conditions:	Continuous production of coated roadstone during the period of test.	Cross Sectional Area of Duct (m²):	0.629
		Authorisation Emission Limit (mg/m³):	100

VARIATION OF PITOSTATIC AIR VELOCITY

Position	Plane A	Plane B
1	11.6	14.2
2	12.7	15.4
3	12.8	15.3
4	13.3	15.0
5	14.2	14.6
6	14.3	14.3
7	14.5	14.1
8	14.4	14.0
9	14.2	13.0
10	11.1	12.5



TEST RESULTS TO BS 3405:1983 (AT 273K AND 101.3 KPa)

	Test 1	Test 2	Mean
Gas Temperature (°C)	70	67.5	
Nozzle Size (m²)	0.0002	0.0002	
Total Sampling Time (mins)	16	16	
Gas Flow Rate (m³/min)	415	400	
Solids Emission Rate (Kg/hr)	0.48	0.34	0.41
Solids Concentration (mg/m³)	19.3	14.3	16.8
Efflux Velocity (m/s)			13.8
Gas Flow Rate At Operating Temperature (m³/min)			521

LABORATORY ANALYSIS

Cyclone No.	B			
Lab. Ref. No.				
Final Wt. (g)				
Initial Wt. (g)				
Total Wt. (g)	0.0221			
Filter No.	21	22		
Lab. Ref. No.	AE/F/17102	AE/F/17202		
Final Wt. (g)	127.1256	133.0850		
Initial WT. (g)	127.1247	133.0849		
Total Wt. (g)	0.0009	0.0001	0.0000	0.0000
% Wt. Cyclone (g)	0.0004	0.0000		
Total Wt. (g) A	0.0013	0.0001	0.0000	0.0000
Hopper No.	21	22		
Lab. Ref. No.	AE/H/17102	AE/H/17202		
Final Wt. (g)	46.3117	45.5904		
Initial Wt. (g)	46.2848	45.5706		
Total Wt. (g)	0.0269	0.0198	0.0000	0.0000
% Wt. Cyclone (g)	0.0125	0.0092		
Total Wt. (g) B	0.0394	0.0290	0.0000	0.0000
Total A + B	0.0407	0.0291	0.0000	0.0000

COMMENTS:

The current maximum permitted concentration of solids in the flue gas for this plant is given in the EPA Authorisation Document. which states a limit of 100 mg/m^3. The measured emission of 16.8 mg/m^3 was therefore below this limit at the time of the test. The requirements of BS 3405: 1983 could not be achieved due to low particulate loading.

Note: The efflux velocity quoted is measured at the sampling position not at the point of discharge.

K Gough - ADVANCE Environmental

7. SAMPLING RECORDS

Preliminary Velocity and Temperature Survey

Sample Point No.	Sample Line A			Sample Line B		
	Distance Along Line (m)	Gas Velocity (ms^{-1})	Gas Temperature (°C)	Distance Along Line (m)	Gas Velocity (ms^{-1})	Gas Temperature (°C)
1	0.05	11.6	72	0.05	14.2	73
2	0.15	12.7	72	0.15	15.4	73
3	0.25	12.8	72	0.25	15.3	73
4	0.35	13.3	73	0.35	15.0	72
5	0.45	14.2	73	0.45	14.6	72
6	0.55	14.3	73	0.55	14.3	72
7	0.65	14.5	73	0.65	14.1	72
8	0.75	14.4	73	0.75	14.0	72
9	0.85	14.2	73	0.85	13.0	72
10	0.95	11.1	73	0.95	12.5	72
Mean			73 (1)			72 (2)

Mean gas temperature 1 = 73 °C

Mean gas temperature 2 = 72 °C

Mean gas temperature (in K) $T_p = \frac{(\text{mean (1)} + \text{mean (2)})}{2} + 273 = 345.5$

Permitted range of gas temperature readings (in °C)= $(0.9T_p - 273)$ to $(1.1T_p - 273)$

= 38 to 107

Highest gas velocity reading (either sampling line) (in ms^{-1}) = 15.4

Lowest gas velocity reading (either sampling line) (in ms^{-1}) = 11.1

Ratio highest/lowest = 1.4:1 (maximum permitted ratio = 3:1)

With a circular duct of 0.895 m, the flue area = 0.629 m^2

Sampling can be undertaken at the selected location and samples to be taken at 4 sampling points located on two sampling lines.

Test 1

SAMPLING POINT		GAS VELOCITY		GAS TEMPERATURE	
Sample Position	Distance Along Line (m)	Initial v_1 (ms^{-1})	Final v_2 (ms^{-1})	Initial t_1 (°C)	Final t_2 (°C)
A_1	0.15	12.7	12.9	72	67
A_2	0.85	14.2	13.4	73	67
B_1	0.15	15.4	13.8	73	67
B_2	0.85	13.0	12.8	72	67
		Total		Mean	
		55.3	52.9	72.5	67
				$t_m = 70$	

Permitted range of total v_2 = 0.95 (total v_1) to 1.05 (total v_1) = 52.5 to 58.0

Sample Position	Nozzle Area (m^2)	Duration of Sampling (s^{-1})	Cyclone DP (kPa)
A_1	0.0002	240	1.80
A_2	0.0002	240	1.80
B_1	0.0002	240	2.00
B_2	0.0002	240	1.70

Cumulative Sampling Undertaken

Sample Container	Ref. Number	Initial Weight (g)	Final Weight (g)	Collected Solids (g)	Mass of Collected Solids (g)
Filter 21	AEF17102	127.1247	127.1256	0.0009	0.0407
Grit Pot 21	AEH17102	46.2848	46.3117	0.0269	
Cyclone B				0.0129	

Test 2

SAMPLING POINT		GAS VELOCITY		GAS TEMPERATURE	
Sample Position	Distance Along Line (m)	Initial v_1 (ms^{-1})	Final v_2 (ms^{-1})	Initial t_1 (°C)	Final t_2 (°C)
A_1	0.15	12.9	12.4	67	68
A_2	0.85	13.4	13.0	67	68
B_1	0.15	13.8	12.9	67	68
B_2	0.85	12.8	12.2	67	68
		Total		Mean	
		52.9	50.5	67	68
				$t_m = 67.5$	

Permitted range of total v_2 = 0.95 (total v_1) to 1.05 (total v_1) = 50.0 to 55.5

Sample Position	Nozzle Area (m^2)	Duration of Sampling (s^{-1})	Cyclone DP (kPa)
A_1	0.0002	240	1.50
A_2	0.0002	240	1.65
B_1	0.0002	240	1.50
B_2	0.0002	240	1.35

Cumulative Sampling Undertaken

Sample Container	Ref. Number	Initial Weight (g)	Final Weight (g)	Collected Solids (g)	Mass of Collected Solids (g)
Filter 22	AEF17202	133.0849	133.0850	0.0001	0.0291
Grit Pot 22	AEH17202	45.5706	45.5904	0.0198	
Cyclone B				0.0092	

Test Results

	Result of Test 1	Result of Test 2	Ratio of higher result to lower result	Mean result if ratio is not more than 1.5:1
Mass rate of Solids Emission, M (Kg/hr)	0.48	0.34	1.4:1	0.41
Solids Concentration, C (mg/m^{-3})	19.3	14.3	1.3:1	16.8