



REPORT ON STACK MONITORING

AT

ST PETERS ROAD WORKS  
HUNTINGDON

FOR

STEWART & LLOYDS PLASTICS

HUNTINGDON, CAMBRIDGESHIRE

BY

ASSOCIATED LABORATORY SERVICES LIMITED

BOCKING, BRAINTREE, ESSEX

DECEMBER 1995

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# 1. SCOPE OF WORK

An isokinetic sampling survey was carried out at the Huntingdon Works of Stewart & Lloyds Plastics. Processing involves removal of plastics from steel tooling using a fluidised bed furnace.

Emissions are vented to atmosphere via a cyclone system and a single vertical stack. Measurements were carried out through sampling ports installed in the side wall of the stack.

In order to provide the data required for calibration of the continuous monitor installed in the stack, Associated Laboratory Services Ltd were commissioned to carry out an isokinetic sampling survey for particulates.

Measurements were carried out on 1st December 1995.

## 2. TEST METHOD & CONDITIONS

### 2.1 Test Method

Sampling of particulates was undertaken at the 2 sampling ports installed in the stack.

Measurements were carried out as follows:-

#### Gas Temperature

The temperature of the gas in the ducts was measured using a digital thermometer, the thermocouple of which was inserted into the ductwork.

#### Gas Velocities

Gas velocities were calculated from velocity pressure readings obtained using a pitot tube and electronic micro manometer.

#### Total Particulates

The sampling of particulates was undertaken in accordance with the requirements of BS 3405. Collection of particulates was to pre-weighed glass fibre filters using a stainless steel probe with 4mm tip. Cumulative samples were collected using 2 sampling points per axis.

### 2.2 Sampling & Conditions

All sampling was carried out whilst plastic removal was being carried out. During the earlier part of the cycle, white fume was emitted from the stack (first sample).

Following profiling of temperature and pressure within the stack, 2 cumulative isokinetic particulate samples were collected.

Measured variations in temperature and velocity pressure were within the permitted range, and consequently the sampling complied with the requirements of BS 3405.

### 3. RESULTS & DISCUSSION

#### 3.1 Results

The results are detailed in Appendix IV and V.

Ambient temperature and pressure was measured for the purpose of calculating concentrations in accordance with standard reference conditions. Results are converted to standard conditions 273°K and 1013 mbar.

In summary the results are as follows:-

<u>Parameter</u>	<u>1st Sample</u>	<u>2nd Sample</u>
Particulates mg/m <sup>3</sup>	13.8	1.4

The average flow velocity at the sampling point in the stack was 16.9 metre per second (at gas temperature), giving a mean gas flowrate of 4.72m<sup>3</sup> per second (at 273°K).

#### 3.2 Discussion

The measurement of total particulates gave results which are higher for the first sample - this corresponds to a period when white fume was being emitted from the stack.

The particulate results are in excess of the ratio of 1.5 to 1, as prescribed in BS3405, however, all other measurements and variations in results do comply with the requirements.



#### 4. CONCLUSIONS

These conclusions are based on the measurements as carried out at the emission stack associated with the cyclone filters for the fluidised bed furnace at the Huntingdon Works of Stewart & Lloyds Plastics.

##### 4.1 Results

The results are summarised as follows

###### a) Particulates

1st sample 13.8 mg/Nm<sup>3</sup>

2nd sample 1.4 mg/Nm<sup>3</sup>

###### b) Flow rates at sampling port

Velocity 16.9 metre per second (at gas temperature)

Gas flowrate 4.72 m<sup>3</sup> per second (at 273°K).

##### 4.2 Validity of Results

The validity of results is based on

- a) Pressure and temperature measurements and variations in measurements are within the prescribed limits, and consequently comply with BS 3405.
- b) Whereas the ratio of particulate results is greater than 1.5 to 1, as prescribed in BS3405, this is likely to reflect a change in particulate loading through the batch cycle time (eg a white plume emitted from the stack during the early part of the batch cycle time corresponds to the higher particulate result).

For and on behalf of

ASSOCIATED LABORATORY SERVICES LIMITED

*KS/R*

K S Axon

# INSTRUMENT CALIBRATION REPORT



Company : Stewarts & Lloyds Plastics Ltd Date of Sampling : 1st December 1995  
 Site Address : St Peters Road PCME Job No. \_\_\_\_\_  
                   Huntingdon ALS Job No. 10150  
                   Cambridgeshire

Plant Identification : Fluidised Bed DISC/File Reference SL Plast  
                                   Furnace  
 Product/Process : Removal of plastics Test Carried Out by : PDH Willcock  
                           from steel tooling

Instrument Settings      Instrument : SL 600      Channel # : 1  
 During Sample

DT-770/SC-600

DT-200

Instrument Checks: Pass  
 Correct Time : Corrected  
 Sensitivity: Md  
 Old Cal factor: 0.06-2400  
 (in use during sampling)  
 Flow Compensation: OFF  
 O<sub>2</sub> Compensation: OFF

Coarse Gain Position : \_\_\_\_\_  
 Fine Gain Display: \_\_\_\_\_  
 Filter Position: \_\_\_\_\_  
 Coarse Gain: \_\_\_\_\_  
 Fine Gain: \_\_\_\_\_

## Instrument Results

<u>Run</u>	<u>Start Time</u>	<u>Finish Time</u>	<u>Duration (MINS)</u>	<u>Instrument Average (Y)</u>	<u>Instrument Max</u>	<u>Dust Conc mg/m3 (X)</u>
1.	-11.43	12.13	30	6.31	12.9	13.8
2.	12.35	13.05	30	5.61	6.64	1.4
3.						
4.						
Time Weighted Average	-----	-----	-----	5.96	-----	7.6

## Calibration Calculations

X (from Iso test) = 7.6  
 Y (Inst response) = 5.96

Scaling factor =  $\frac{X}{Y} = \frac{7.6}{5.96} = 1.275$

New ~~Gain~~ Cal Factor = scaling factor x old ~~Gain~~ Cal Factor  
 = 1.275 x 6.24 = 7.956

## Instrument Settings for Calibration

DT-770/SC-600

DT-200

Cal Factor : 7.956

CG Position : \_\_\_\_\_  
 FG Display : \_\_\_\_\_  
 Coarse Gain : \_\_\_\_\_  
 Fine Gain : \_\_\_\_\_

CAL FACTOR ENTERED  
 BY PCME 9-1-96

Product/Process : Removal of plastic residue from steel tooling

Table A

Process Conditions

Arrestment Type:	Cyclone Filter
Particulate Type:	Plastic
Gas Temperature:	79°C
Gas Flow Rate:	4.72 m <sup>3</sup> /sec
Appearance of Plume:	Initially highly visible white then invisible
Load of Plant:	Average

Table B

Results

	RUN 1	RUN 2
Date:	1.12.95	1.12.95
Test Period:	11.43-12.13	12.35-13.05
Duration:	30-minutes	30 minutes
Gas Temperature:	79°C	79°C
Mean Velocity at Sampling Points	16.9m/sec	16.9m/sec
Particulates at STP (1)	13.8mg/Nm <sup>3</sup>	1.4mg/Nm <sup>3</sup>

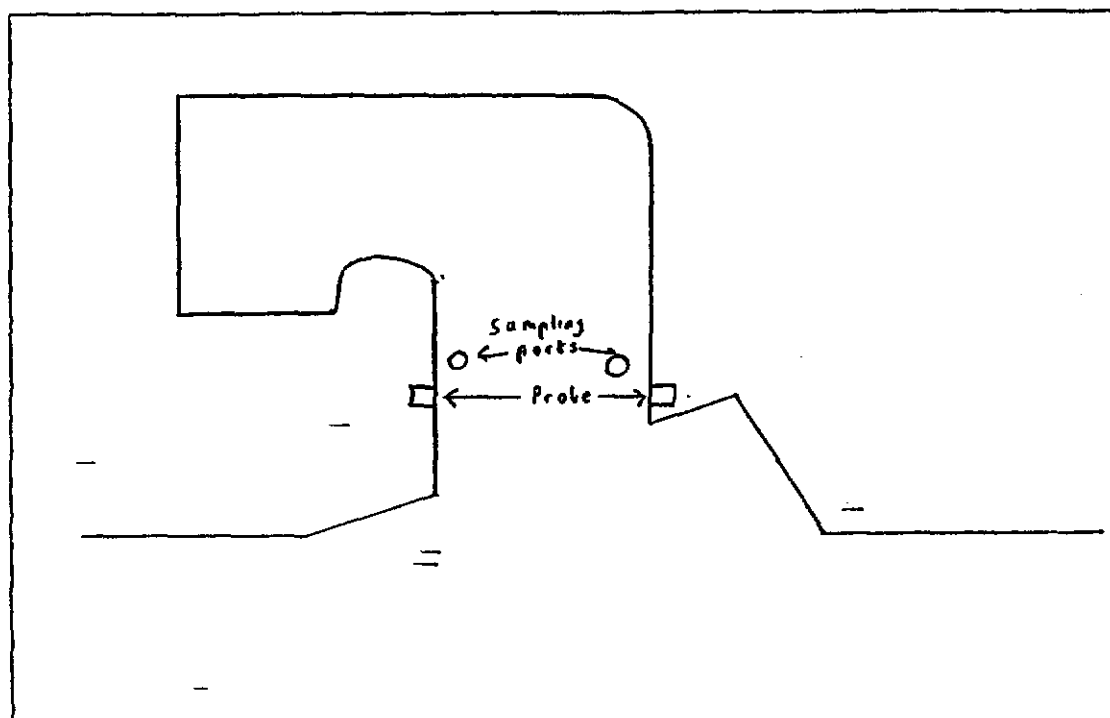
(1) Particulates stated at 273K, 101.3kPa.



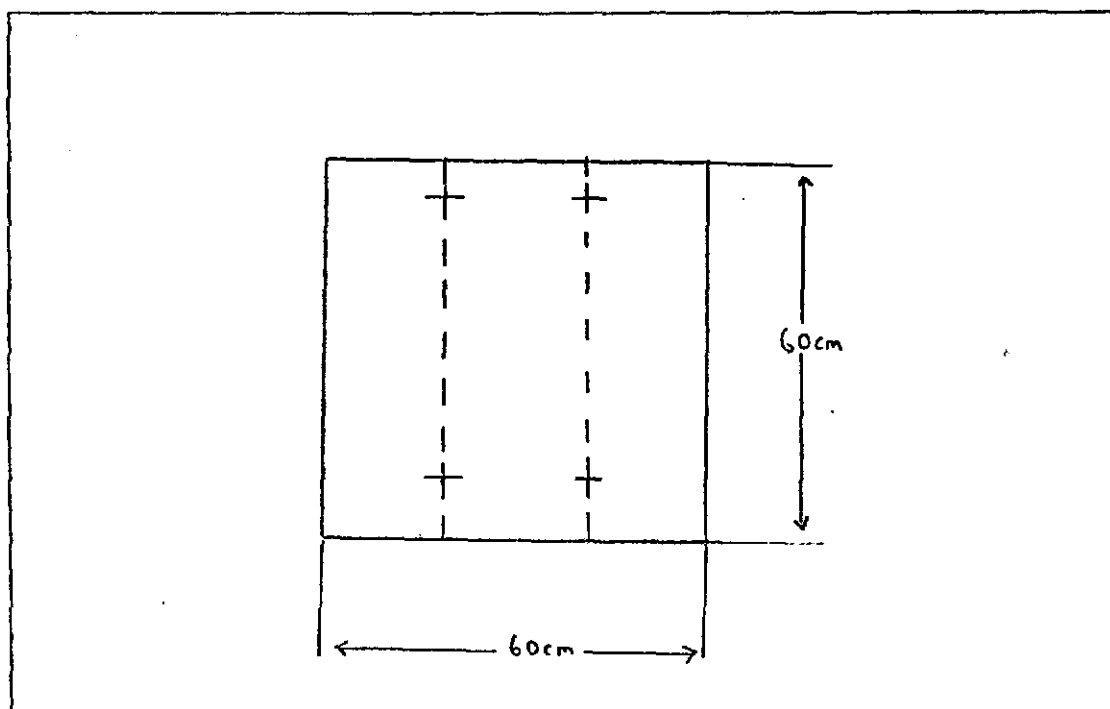
# PLANT LAYOUT

Site   Stewarts & Lloyds Plastics Ltd                      Plant   Cyclone Filter  
       St Peters Road  
       Huntingdon Cambridgeshire

## 1) Plant layout showing instrument location and sample place



## 2) Section of duct at sample place and dimensions





# STACK PARTICULATES MEASUREMENT

Client : Stewarts & Lloyds Plastics Ltd  
Site : St Peters Road, Huntingdon, Cambridgeshire

Date : 1st December 1995  
Time : 11.10 hrs  
Operator : PDH Willcock

Plant : Cyclone Filter  
Plant Load : Normal

Appearance of Plume : White then invisible  
Product/Process : Removal of plastic residues from steel tooling

Details of Duct		Atmospheric Conditions		
		Time	Pressure (Pa) in mb	Temperature °C
Shape	Square	Initial	1026	5.8
Dimension/Diameter	60cm	Final	1026	7.4
Area	0.36m <sup>2</sup>	Average	1026	6.6

## 1) Readings before sampling

Position	Axis 1			Axis 2		
	Distance into Duct (cms)	Velocity Pressure (Pascals)	Gas Temperature (°C)	Distance into Duct (cms)	Velocity Pressure (Pascals)	Gas Temperature (°C)
1	3	140	90.1	3	140	91.8
2	9	165	90.5	9	170	92.0
3	15	130	90.6	15	140	92.4
4	21	140	90.3	21	145	92.5
5	27	125	89.9	27	135	92.7
6	33	135	89.7	33	140	92.7
7	39	160	89.5	39	165	92.9
8	45	145	88.6	45	150	93.1
9	51	150	87.7	51	160	92.6
10	57	145	87.8	57	125	92.1
	Average	143.5	89.5	Average	147.0	92.5
	Mean Pv (in Pascals) :		145	Mean Tp (in °K = °C + 273) :		364
	Static Pressure, Ps (in Pascals) : -350					

Highest gas temperature = 93.1°C      Lowest gas temperature = 87.7°C

Permitted range of gas temperature readings (in °C) = (0.9Tp - 273) to (1.1Tp - 273) = 55°C to 127°C

Highest Pv = 170 pascals.      Lowest Pv = 125 pascals

Ratio  $\frac{Pv \text{ highest}}{Pv \text{ lowest}}$  = 1.4/1      (maximum permitted ratio = 9/1)

[illegible]



## STACK PARTICULATES MEASUREMENTS

### 4) Weighing Results

Sample No.	Filter No.	Weights (mg)		
		Before	After	Solids Collected
A	1	87.64	91.77	4.13
B	2	87.51	87.90	0.40

### 5) Calculations

#### 5.1 Mean Gas Velocity at Gas Temperature

$$V_{\text{mean}} = 0.075 \sqrt{P_v \text{ average} \left( \frac{273}{T \text{ average} + 273} \right)} \text{ m/sec}$$

where  $P_v \text{ average}$  = mean velocity pressure (pascals) } see 2  
 $T \text{ average}$  = mean gas temperature at the sampling points } above

$$V_{\text{mean}} = 0.075 \times 12.0 \sqrt{352} \\ = 16.9 \text{ m/sec}$$

#### 5.2 Mean Gas Flowrate at 273°K

$$Q = V_{\text{mean}} \times A \left( \frac{273}{273 + T \text{ average}} \right) \text{ m}^3/\text{sec}$$

where  $V_{\text{mean}}$  = mean gas velocity (see 5.1 above)

$A$  = internal area of duct in  $\text{m}^2$

$T \text{ average}$  = mean gas temperature at the sampling points

$$Q = 16.9 \times 0.36 \times \left( \frac{273}{273 + 79} \right) \\ = 4.72 \text{ m}^3/\text{sec}$$

STACK MONITORING - STEWARTS & LLOYDS PLASTICS LTD

ANALYSIS RESULTS - PARTICULATES

Date of Sampling - 1st December 1995  
Location - St Peters Road, Huntingdon  
Plant - Cyclone Filter from Furnace  
Ambient Conditions - 1026 mbar, 6.6°C

Sampling Location	Sampling Reference	Sampling Volume m <sup>3</sup>		Particulates	
		Recorded	Normalised	On Filter mg	Concentration mg/Nm <sup>3</sup>
A	1	0.327	0.300	4.13	13.8
		—			
	---	---	---	Average	
B	2	0.314	0.288	0.40	1.4
	---	---	---	Average	7.6

Normalised at 273°K and 1013 mbar.

Sampled in accordance with BS 3405 1983 Measurement of Particulate Emission including Grit and Dust (Simplified Method).

For and on behalf of  
ASSOCIATED LABORATORY SERVICES LIMITED

*KSA*

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