REPORT ON STACK MONITORING

AT

GLYNWED PIPE SYSTEMS LTD

FOR

GLYNWED PIPE SYSTEMS LTD

HUNTINGDON, CAMBRIDGESHIRE, PE18 7DJ

BY

ASSOCIATED LABORATORY SERVICES LIMITED
BOCKING, BRAINTREE, ESSEX
TELEPHONE NO. - 01376 328646

MARCH 2001

REPORT NO. 16019

INDEX

Appendices

1. SCOPE OF WORK

A stack sampling survey was carried out at the Huntingdon Works of Glynwed Pipe Systems Ltd. Processing involves removal of plastic 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. In addition, volatile organic compounds were monitored.

In accordance with the 1996 Revision of PG2/9 (96) Metal Decontamination Processes, moisture was also measured in order to correct the results to reference conditions (the oxygen correction not being required for fluidised bed systems). The emission from the stack was observed.

Measurements were carried out on 15 March 2001.

2. TEST METHOD & CONDITIONS

2.1 Test Method

Sampling 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 BS3405. 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.

Moisture

Moisture was determined by absorption on silica gel in accordance with the general requirements of US EPA Method 4.

Volatile Organic Compounds

Real time measurements of total VOC's were carried out with a portable Auto FIM gas chromatograph, with flame ionisation detection.

Readings were recorded at 1 minute intervals.

2.2 Sampling & Conditions

All sampling was carried out whilst plastic removal was being carried out. Sampling was commenced at the beginning of the batch cycle, and continued for the larger part of the cycle. It was noted that the burners had been adjusted since the previous monitoring visit, and that the temperature control range for the burner operation had been increased.

Following profiling of temperature and pressure within the stack, 2 cumulative isokinetic particulate samples were collected. During the same period, real time measurements of VOC's were carried out, and moisture samples collected.

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

The plume from the stack was observed during the process cycle. The plume was invisible, with no evidence of any droplets.

3. RESULTS & DISCUSSION

3.1 Results

The results are detailed in Appendix IV to VI.

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, also corrected for moisture.

In summary the results are as follows:-

Parameter	1st Run	2nd Run	Mean Value
Particulates mg/m^3			
- at 273°K and 1013 mbar	6.17	2.24	4.21
- at 273°K, 1013 mbar, & dry gas	6.22	2.26	4.24

The average flow velocity at the sampling point in the stack was 18.3 metre per second (at gas temperature), giving a mean gas flowrate of 5.20m^3 per second (at 273°K).

VOC levels during the process cycle were as follows

	Total VOC's as C @ 273°C, 1013mbar mg/m^3	
Period	Maximum	Average
Gasification & cooling down	1471	49
Final Phase	29	21

A print out from the Auto FIM analysis showing instrument readings against time is attached (note this is shown on 2 graphs, up to and after 8000 seconds, with VOC results on different scales).

3.2 Discussion

Particulates

The measurement of particulates gave results, corrected for temperature and pressure which are outside the prescribed ratio of 1.5 to 1, and consequently are not in compliance with BS 3405.

However, overall particulate levels are similar to previous results, and well below the emission standard.

The sampling flow rates are within the permitted range for isokinetic conditions, and all other measurements and variations in results comply with the requirements of BS3405.

VOC's

Following burner adjustment and a change in burner operation, VOC levels are generally well below previous results. Both instantaneous maxima and average results, corrected for temperature and pressure, are about 75% of previous levels for "gasification & cooling down", and nearly 5% of previous levels for the "final phase".

4. CONCLUSIONS

These conclusions are based on the measurements as carried out at the emission stack associated with cyclone filters for the fluidised bed furnace at the Huntingdon Works of Glynwed Pipe Systems Ltd on 15 March 2001.

4.1 Results

Sampling was carried out during the cycle for the furnace.

The results are summarised as follows

a) Particulates — At 273°K, 1013 mbar, dry gas

1st Sample	6.22 mg/m^3
2nd Sample	2.26 mg/m^3

b) VOC's

	At 273°K, 1013 mbar, dry gas	
	Maximum	Average
Gasification & cooling down	1471	49
Final phase	29	21

c) Flow rates at sampling port

Velocity	18.3	metre per second (at gas temperature)
Gas flowrate	5.20	m^3 per second (at 273°K).

d) Emission Plume

The plume was invisible during the process cycle with no evidence of any droplets.

4.2 Conclusions

The ratio of particulate results is outside the prescribed ratio of 1.5 to 1, but all pressure and temperature measurements and variations in measurements are within the limits prescribed by BS 3405. As with previous measurements, overall particulate levels are well below the emission standard of 50 mg/m^3.

Following burner adjustment and a change in burner operation, VOC levels are significantly lower than before, with average values much closer to the emission standard of 20 mg/m^3 as carbon.

Stack emission velocity exceeds the minimum as recommended in the process guidance note.

The emission plume was invisible, with no evidence of any droplets.

For and on behalf of
ASSOCIATED LABORATORY SERVICES LIMITED

K S Axon

INSTRUMENT CALIBRATION REPORT

Company : Glynwed Pipe Systems Ltd
Site Address: St Peters Road, Huntingdon, Cambridgeshire
Plant Identification: Fluidised Bed Furnace
Product/Process: Removal of plastics from steel tooling

Date of Sampling : 15 March 2001
PCME Job No. N/A
ALS Job No. 16019
DISC/File Reference
Test Carried Out by PDH Willcock

Instrument Settings During Sample Instrument : SC600 Channel # : 1

DT-770/SC-600

Instrument Checks : Pass
Correct Time : Corrected
Sensitivity : Md
Old Cal Factor : 002.9500
(in use during sampling)
Flow Compensation : OFF
O2 Compensation : OFF

DT-200

Course Gain Position : _____
Fine Gain Display : _____
Filter Position : _____
Course Gain : _____
Fine Gain : _____

Instrument Results

Run	Start Time	Finish Time	Duration (Mins)	Instrument Average (Y)	Instrument Max	Dust Conc mg/m^3 (X)
1.	11.27	11.57	30	7.13	9.71	6.17
2.	12.25	12.55	30	5.11	10.30	2.24
3.						
4.						
Time Weighted Average	- - - -	- - - -	- - - -	6.12	- - - -	4.21

Calibration Calculations

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

Scaling factor = X = _____ =

New Gain Cal Factor = scaling fctor = Gain x old Cal Factor =

Instrument Settings for Calibration

DT-770/SC-600

Cal Factor : _____

DT-200

CG Position : _____
FG Display : _____
Course Gain : _____
Fine Gain : _____

Product/Process : Removal of plastic residue from steel tooling

Table A

Process Conditions

Arrestment Type :	Cyclone Filter
Particulate Type :	Plastic
Gas Temperature :	73°C
Gas Flow Rate :	5.20 m^3/sec
Appearance of Plume :	Invisible
Load of Plant :	Average

Table B

Results

	Run 1	Run 2
Date :	15.03.01	15.03.01
Test Period	11.27-11.57	12.25-12.55
Duration	30 mins	30 mins
Gas Temperature :	73°C	73°C
Mean Velocity at Sampling Points	18.3 m/sec	18.3 m/sec
Particulates at STP (1)	6.17 mg/m^3	2.24 mg/m^3
Particulates at normalised conditions (2)	6.22 mg/Nm^3	2.26 mg/Nm^3

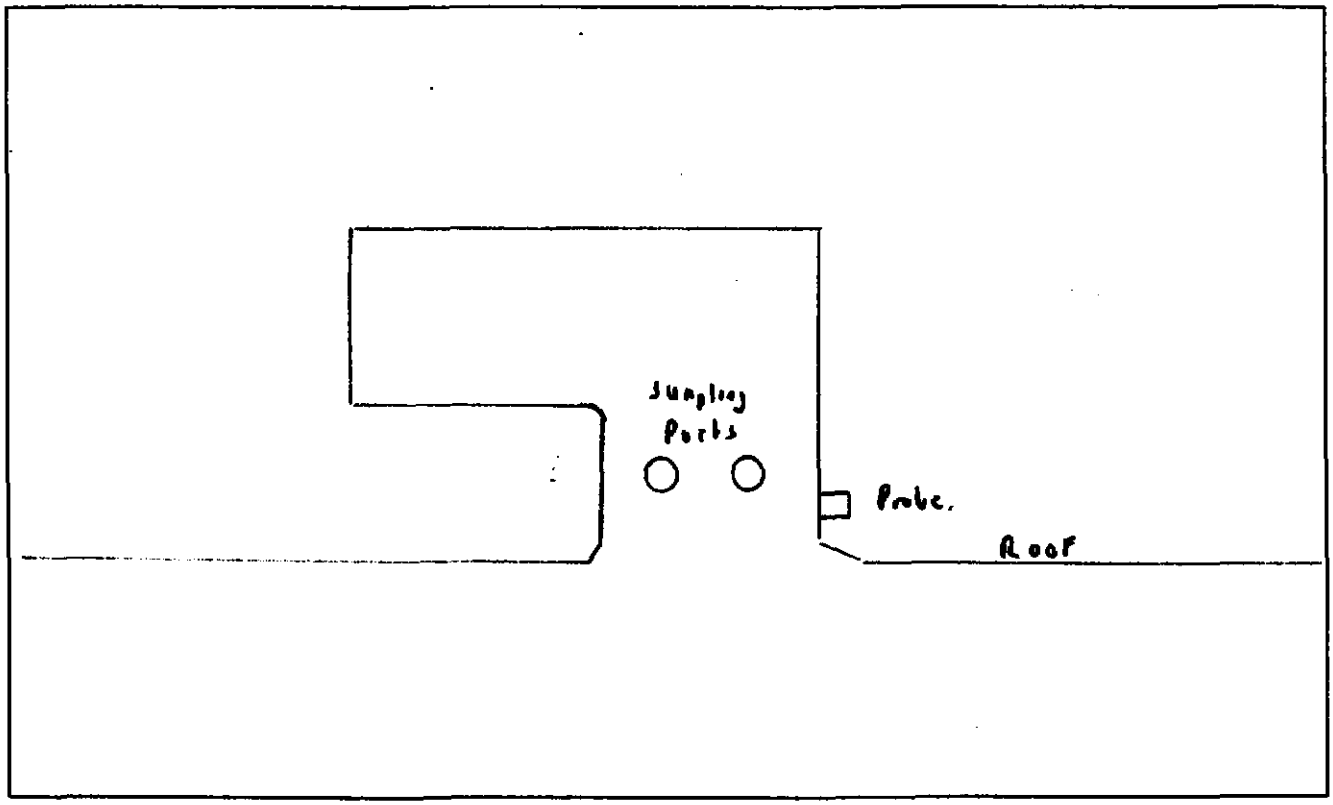
(1) Particulates stated at 273K, 101.3kPa.

(2) Normalised conditions are 273K, 101.3kPa, dry gas.

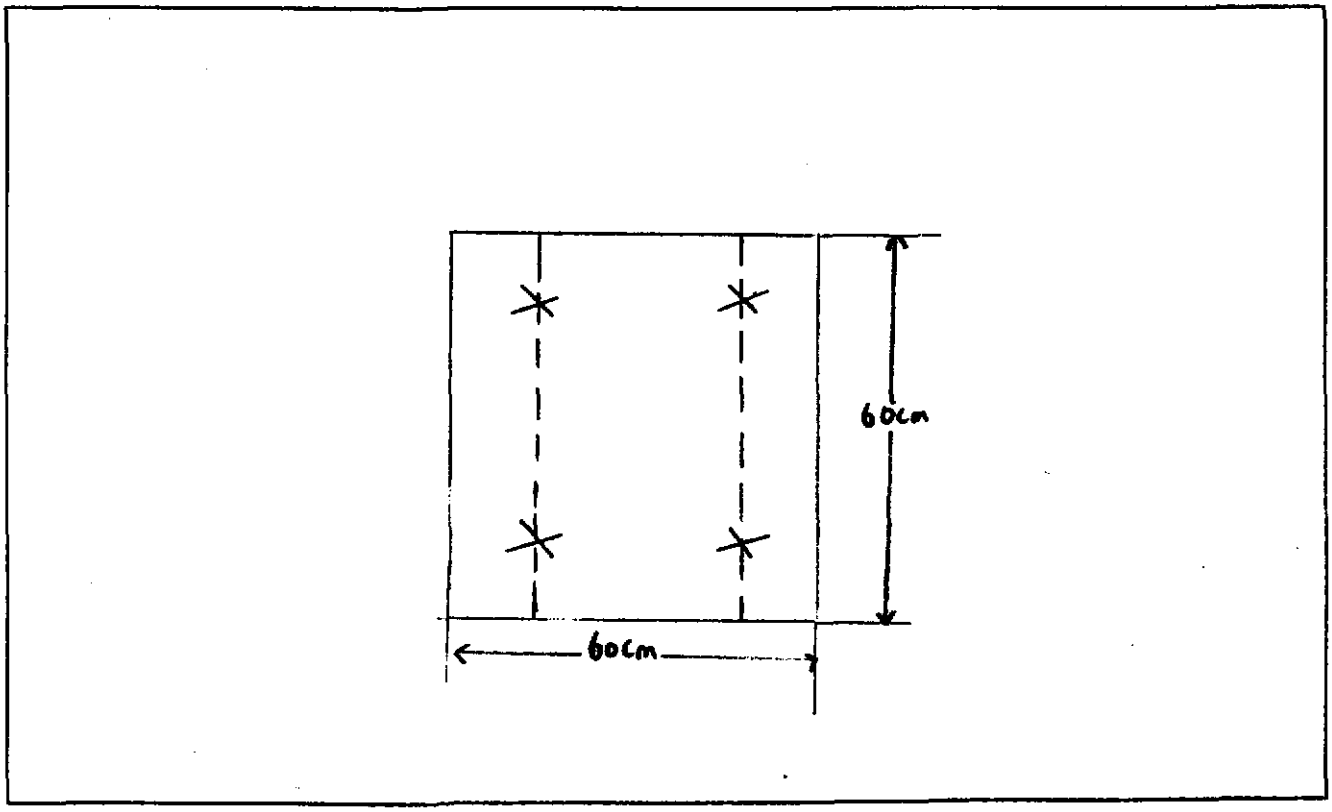
PLANT LAYOUT

Site	Glynwed Pipe Systems Ltd Huntingdon, Cambridgeshire	Plant	Fluidised Bed Furnace

1) Plant layout showing instrument location and sample place



2) Section of duct at sample place and dimensions



STACK PARTICULATES MEASUREMENT

Client : Glynwed Pipe Systems Ltd
Site : St Peters Road, Huntingdon Cambridgeshire

Date : 15 March 2001
Time : 11.15 hrs
Operator : PDH Willcock

Plant : Cyclone Filter
Plant Load: Normal

Appearance of Plume Invisible
Product/Process Removal of plastic residue from steel tooling

Details of Duct		Atmospheric Conditions		
		Time	Pressure (Pa) in mb	Temperature °C
Shape	Square	Initial	1004	10.8
Dimension/Diameter	60cm	Final	1001	14.2
Area	0.36^2	Average	1003	12.5

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	230	73.2	3	230	72.9
2.	9	230	73.2	9	230	72.9
3.	15	220	73.2	15	210	73.0
4.	21	220	73.3	21	155	73.0
5.	27	215	73.3	27	140	73.0
6.	33	210	73.3	33	135	73.1
7.	39	210	73.3	39	135	73.1
8.	45	210	73.4	45	145	73.2
9.	51	180	73.4	51	140	73.2
10.	57	160	73.4	57	140	73.2
	Average	208.5	73.3	Average	166.0	73.1
	Mean Pv (in Pascals) : 187			Mean Tp (in °K = °C + 273): 346		
	Static Pressure, Ps (in Pascals): 360					

High gas temperature = 73.4 Lowest gas temperature = 72.9

Permitted range of gas temperature readings (in °C) = (0.9Tp - 273) to (1.1Tp - 273) = 38°C to 108°C

Highest Pv = 230 pascals Lowest Pv = 135 pascals

Ratio $\frac{\text{Pv highest}}{\text{Pv lowest}}$ = 1.7/1 (maximum permitted ratio = 9/1)

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Stack Particulates Measurements

2) Readings at Sampling

Axis	Distance into Duct (cm)	Gas Temperature °C		Velocity Pressure (Pascals)			
		Initial	Final	Initial	Final	Average	√Average
1	15	73.2	61.7	220	185	202.5	14.2
	45	73.4	61.9	210	170	165	12.8
2	15	73.0	61.3	210	175	192.5	13.9
	45	73.2	616	145	125	135	11.6
	Totals	292.8	246.5	785	655	-------	52.5
	Average	73.2	61.6	-------	-------	-------	13.1

Permitted range of total Pv final = 0.9 x total Pv initial to 1.1 x total Pv initial
= 567 pascals to 693 pascals

3) Sampling Conditions

Sample Reference	Axis	Time			Nozzle Diameter mm	Sample Rate l/min	Gas Meter Volme (litres)		
		Initial	Final	Elapsed			Initial	Final	Total
1	A	11.27	11.57	30 mins	4	13	352041	352478	437
2	B	12.25	12.55	30 mins	4	13	352478	352936	458

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STACK PARTICULATES MEASUREMENTS

4) Weighing Results

Sample No.	Filter No.	Weights (mg)		
		Before	After	Solids Collected
A	1	92.61	95.16	2.55
B	2	92.84	93.81	0.97

5) Calculations

5.1 Mean Gas Velocity at Gas Temperature

V mean = 0.075 √Pv average √(T average + 273) m/sec

where Pv average = mean velocity pressure (pascals) } see 2
T average = mean gas temperature at the sampling points} above

V mean = 0.075 x 13.1√346

= 18.3 m/sec

5.2 Mean Gas Flowrate at 273°K

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

where V mean = mean gas velocity (see 5.1 above)
A = internal area of duct in m^2
T average = mean gas temperature at the sampling points

$$Q = 18.3 \times 0.36 \times \frac{(273)}{(273 + 73)}$$

= 5.20 m^3/sec

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - PARTICULATES

Date of Sampling 15 March 2001
Sample Location St Peters Road, Huntingdon, Cambridgeshire
Plant Fluidised Bed Furnace
Ambient Conditions 1003 mbar 12.5°C

Sampling Location	Sampling Reference	Sampling Volume m^3		Moisture Level % vol/vol	Particulates		
		Recorded	Normalised		On Filter mg	Concentration at 273°K, 1013 mbar mg/m^3	Concentration at 273°K, 1013 mbar, dry gas mg/m^3
1	A	0.437	0.413	0.8	2.55	6.17	6.22
2	B	0.458	0.433	0.8	0.97	2.24	2.26

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

19 March 2001

K S Axon
Director

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - MOISTURE

Date of Sampling 15 March 2001
Sample Location St Peters Road, Huntingdon, Cambridgeshire
Plant Fluidised Bed Furnace
Ambient Conditions *1003 mbar 12.5°C*

Sample Reference	Time			Sampling Rate l/min	Sampling Volume litres		Wt of water gm	Moisture Level	
	Initial	Final	Elapsed		Recorded	Normalised		gm/litre	% vol/vol*
M1	11.27	11.57	00.30	13	437	413	3.00	0.0073	0.91
M2	12.25	12.55	00.30	13	458	433	2.47	0.0057	0.71

Normalised at 273°K and 1013 mbar.
* 1 mole of water occupies 22.4 litre at normalised conditions.
Determined by absorption onto silica gel in accordance with general requirements of US EPA Method 4.

For and on behalf of
ASSOCIATED LABORATORY SERVICES LIMITED

19 March 2001

K S Axon
Director

Sheet 1 of 1

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	15 March 2001
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	1003 mbar 12.5°C

1. Gasification & Cooling Down Phase

Run	Time	Instrument Reading	Total VOC's as C at 273°K & 1013mbar mg/m^3	Total VOC's as C at 273°K, 1013 mbar, dry gas mg/m^3
1	11.01	80	57	
	11.02	70	50	
	11.03	70	50	
	11.04	70	50	
	11.05	60	43	
	11.06	50	36	
	11.07	50	36	
	11.08	50	36	
	11.09	40	29	
	11.10	40	29	
	11.11	30	21	
	11.12	35	25	
	11.13	40	29	
	11.14	40	29	
	11.15	35	25	
	11.16	50	36	
	11.17	35	25	
	11.18	40	29	
	11.19	45	32	
	11.20	30	21	
	11.21	30	21	
	11.22	25	18	
	11.23	40	29	
	11.24	35	25	
	11.25	50	36	
	11.26	30	21	
	11.27	25	18	
	11.28	25	18	
	11.29	25	18	
	11.30	25	18	
	11.31	30	21	
	11.32	30	21	
	11.33	30	21	
	11.34	30	21	
	11.35	25	18	
	11.36	25	18	
	11.37	25	18	
	11.38	25	18	
	11.39	40	29	
	11.40	30	21	

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	15 March 2001
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	1003 mbar 12.5°C

1. Gasification & Cooling Down Phase (continued)

Run	Time	Instrument Reading	Total VOC's as C at 273°K & 1013mbar mg/m^3	Total VOC's as C at 273°K, 1013 mbar, dry gas mg/m^3
1	11.41	35	25	
	11.42	35	25	
	11.43	30	21	
	11.44	30	21	
	11.45	25	18	
	11.46	30	21	
	11.47	25	18	
	11.48	25	18	
	11.49	30	21	
	11.50	30	21	
	11.51	40	29	
	11.52	30	21	
	11.53	35	25	
	11.54	35	25	
	11.55	30	21	
	11.56	35	25	
	11.57	30	21	
	11.58	35	25	
	11.59	40	29	
	12.00	35	25	
	12.01	35	25	
	12.02	30	21	
	12.03	40	29	
	12.04	35	25	
	12.05	40	29	
	12.06	40	29	
	12.07	40	29	
	12.08	35	25	
	12.09	35	25	
	12.10	30	21	
	12.11	40	29	
	12.12	35	25	
	12.13	30	21	
	12.14	35	25	
	12.15	30	21	
	12.16	30	21	
	12.17	30	21	
	12.18	35	25	
	12.19	40	29	

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	15 March 2001
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	1003 mbar 12.5°C

1. Gasification & Cooling Down Phase (continued)

Run	Time	Instrument Reading	Total VOC's as C at 273°K & 1013mbar mg/m^3	Total VOC's as C at 273°K, 1013 mbar, dry gas mg/m^3
1	12.20	40	29	
	12.21	40	29	
	12.22	40	29	
	12.23	725	518	
	12.24	110	79	
	12.25	30	21	
	12.26	20	14	
	12.27	30	21	
	12.28	25	18	
	12.29	20	14	
	12.30	30	21	
	12.31	35	25	
	12.32	25	18	
	12.33	30	21	
	12.34	30	21	
	12.35	30	21	
	12.36	25	18	
	12.37	30	21	
	12.38	25	18	
	12.39	25	18	
	12.40	2060	1471	
	12.41	135	96	
	12.42	75	54	
	12.43	60	43	
	12.44	60	43	
	12.45	70	50	
	12.46	60	43	
	12.47	55	39	
	12.48	40	29	
	12.49	50	36	
	12.50	50	36	
	12.51	45	32	
	12.52	45	32	
	12.53	40	29	
	12.54	45	32	
	12.55	700	500	
	12.56	170	121	

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	15 March 2001
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	1003 mbar 12.5°C

1. Gasification & Cooling Down Phase (continued)

Run	Time	Instrument Reading	Total VOC's as C at 273°K & 1013mbar mg/m^3	Total VOC's as C at 273°K, 1013 mbar, dry gas mg/m^3
	12.57	30	21	
	12.58	25	18	
	12.59	25	18	
Run 1 Average			49	49*

Direct stack readings using Auto Fim 11 with flame ionisation detection.
Calibration factor = 1.0 (Methane standard).
Nomalised at 273°K & 1013mbar.
* Corrected for 0.8% moisture.

For and on behalf of
ASSOCIATED LABORATORY SERVICES LIMITED

19 March 2001

K S Axon
Director

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	15 March 2001
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	1003 mbar 12.5°C

2. Final Phase

Run	Time	Instrument Reading	Total VOC's as C at 273°K & 1013mbar mg/m^3	Total VOC's as C at 273°K, 1013 mbar, dry gas mg/m^3
2	13.00	25	18	
	13.01	25	18	
	13.02	25	18	
	13.03	25	18	
	13.04	30	21	
	13.05	25	18	
	13.06	25	18	
	13.07	30	21	
	13.08	25	18	
	13.09	30	21	
	13.10	35	25	
	13.11	30	21	
	13.12	25	18	
	13.13	30	21	
	13.14	30	21	
	13.15	30	21	
	13.16	25	18	
	13.17	25	18	
	13.18	20	14	
	13.19	30	21	
	13.20	25	18	
	13.21	25	18	
	13.22	25	18	
	13.23	20	14	
	13.24	25	18	
	13.25	30	21	
	13.26	20	14	
	13.27	25	18	
	13.28	30	21	
	13.29	30	21	
	13.30	25	18	
	13.31	20	14	
	13.32	20	14	
	13.33	25	18	
	13.34	30	21	
	13.35	30	21	
	13.36	25	18	
	13.37	20	14	
	13.38	30	21	
	13.39	25	18	

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	15 March 2001
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	1003 mbar 12.5°C

2. Final Phase (continued)

Run	Time	Instrument Reading	Total VOC's as C at 273°K & 1013mbar mg/m^3	Total VOC's as C at 273°K, 1013 mbar, dry gas mg/m^3
2	13.40	20	14	
	13.41	25	18	
	13.42	30	21	
	13.43	30	21	
	13.44	30	21	
	13.45	25	18	
	13.46	40	29	
	13.47	25	18	
	13.48	35	25	
	13.49	35	25	
	13.50	40	29	
	13.51	35	25	
	13.52	35	25	
	13.53	35	25	
	13.54	35	25	
	13.55	30	21	
	13.56	45	32	
	13.57	40	29	
	13.58	30	21	
	13.59	30	21	
	14.00	35	25	
	14.01	35	25	
	14.02	40	29	
	14.03	35	25	
	14.04	30	21	
	14.05	30	21	
	14.06	35	25	
	14.07	40	29	
	14.08	30	21	
	14.09	35	25	
	14.10	30	21	
	14.11	35	25	
	14.12	25	18	
	14.13	30	21	
	14.14	30	21	
	14.15	20	14	
	14.16	30	21	
	14.17	30	21	
	14.18	25	18	
	14.19	30	21	

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	15 March 2001
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	1003 mbar 12.5°C

2. Final Phase (continued)

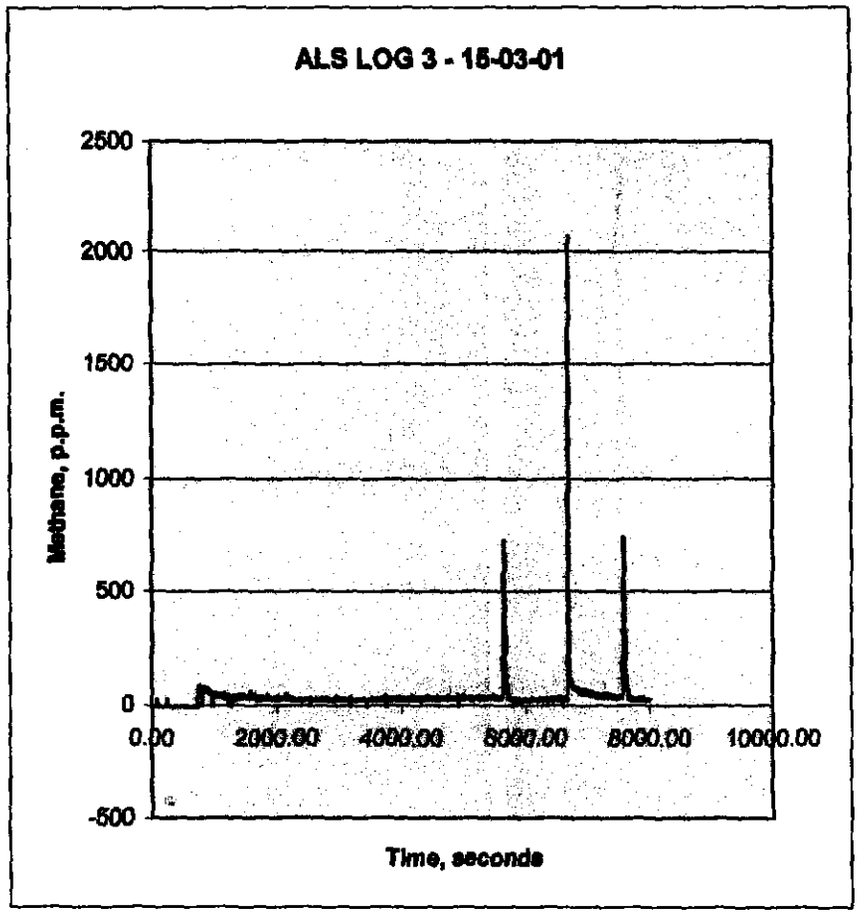
Run	Time	Instrument Reading	Total VOC's as C at 273°K & 1013mbar mg/m^3	Total VOC's as C at 273°K, 1013 mbar, dry gas mg/m^3
2	14.20	30	21	
	14.21	25	18	
	14.22	25	18	
	14.23	25	18	
	14.24	25	18	
	14.25	25	18	
	14.26	30	21	
	14.27	20	14	
	14.28	30	21	
	14.29	25	18	
	14.30	25	18	
	14.31	30	21	
	14.32	15	11	
	14.33	10	7	
Run 2 Average			21	21*

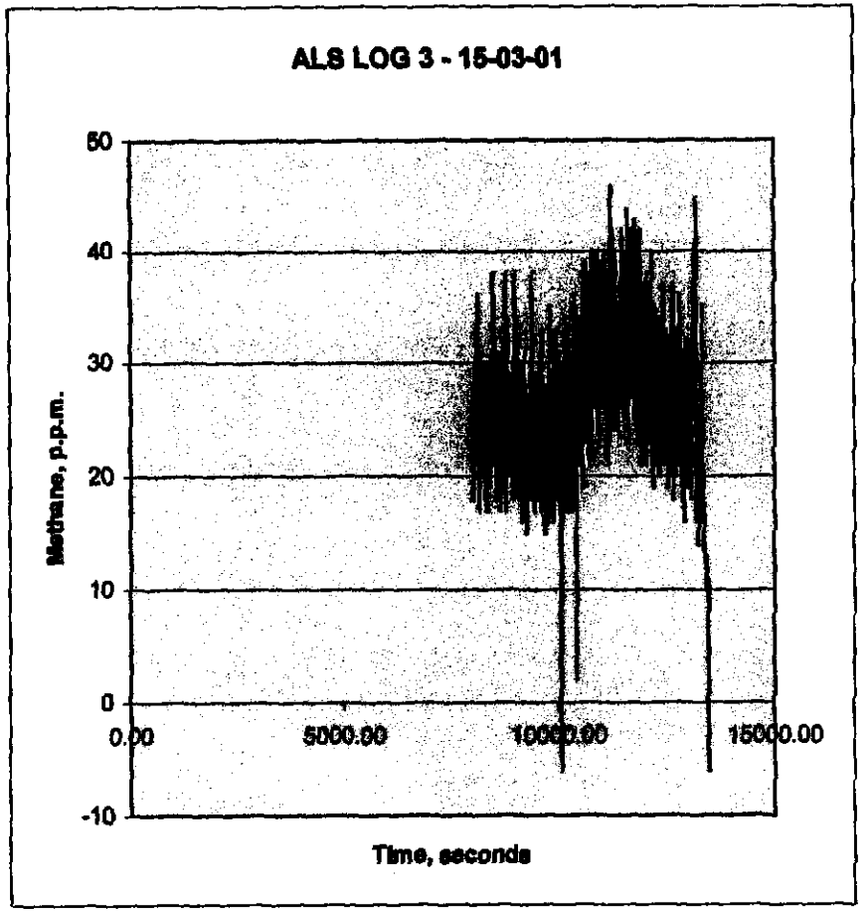
Direct stack readings using Auto Fim 11 with flame ionisation detection.
Calibration factor = 1.0 (Methane standard).
Nomalised at 273°K & 1013mbar.
* Corrected for 0.8% moisture.

For and on behalf of
ASSOCIATED LABORATORY SERVICES LIMITED 19 March 2001

K S Axon
Director

ALS - LOG 3
15/03/01





26/03/01

ASSOCIATED LABORATORY
SERVICES LIMITED
CHRISTY HOUSE, CHURCH LANE
BOCKING, BRAINTREE, ESSEX, CM7 5RX
Telephone: Braintree (01376) 328646
Fax : Braintree (01376) 552923

CHEMICAL AND ANALYTICAL SERVICES
FOR COMMERCE AND INDUSTRY

Our Ref 15696/L1

Mr E Cross
Glynwed Pipe Systems Ltd
St Peters Road
Huntingdon
Cambridgeshire PE18 7DJ

21 December 2000

Dear Mr Cross

VOC Monitoring - Fluidised Bed Furnace

Please find attached the results of the VOC monitoring in the emission stack to the fluidised bed furnace.

1. Background & Sampling

The requirement was for monitoring of volatile organic compounds (VOC's) in the emission stack with correction for moisture.

Servicing of the furnace had just been completed by the engineers, and the stack emission monitoring overlapped and continued from the start up.

The outline programme was as follows

Before 09.00 hrs - Burner on, furnace heating to temperature.

11.00 - Emission monitoring of "gasification & cooling phase" commenced.

11.15 - Cradle containing 1 large part loaded to furnace.

12.46 - Gas to burner switched off.

12.56 - First stage of emission monitoring stopped.

13.51 - Burner on again for "final phase".
Second stage of emission monitoring started.

14.51 - Completion of second stage emission monitoring.
Burner off.
Cradle removed.

VOC monitoring was carried out using an Auto FIM gas chromatograph with flame ionisation detector. Readings were recorded at 1 minute intervals.

Moisture was determined by absorption on silica gel in accordance with the general requirements for US EPA Method 4.

Cont ....

2. Monitoring Results

The detailed results for VOC monitoring are attached and include

- VOC readings at 1 minute intervals during both the "gasification and cooling down" phase, and the "final" phase.
- a print out from the Auto FIM analyser showing instrument readings against time.

VOC levels follow a distinct pattern as follows

a) Furnace heating up
   - VOC's ranging up to 2000 mg/m^3.

b) Loading of cradle, gasification & cooling down
   - VOC's reduce to below 50 mg/m^3, with an occasional short term increase (particularly when the burner was turned off), decaying to nil during cooling down.

c) Final phase
   - VOC's oscillating in the range of about 10 to 1900 mg/m^3.

The results for moisture in the emission stack are also attached, and showed relatively low levels in the range 0.9 to 1.0% vol/vol.

3. Summary

VOC monitoring has been carried out in the emission stack of the fluidised bed furnace immediately following servicing of the furnace.

A distinctive pattern of VOC levels has been identified as follows

a) Furnace set up
   - elevated VOC's up to 2000 mg/m^3.

b) Loading, gasification & cooling down
   - immediate reduction in VOC's to relatively low levels (below 50 mg/m^3), decaying to nil during cooling down.

c) Final phase
   - VOC's oscillating in the range of about 10 to 1900 mg/m^3.

Moisture levels are relatively low at about 1.0% vol/vol.

Yours sincerely
For and on behalf of
ASSOCIATED LABORATORY SERVICES LIMITED

KSAx

K S Axon
Director

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	30 November 2000
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	999 mbar 9.6°C

1. Gasification & Cooling Down Phase

Run	Time	Instrument Reading	Total VOC's as C at 273°K & 1013mbar mg/m^3	Total VOC's as C at 273°K, 1013 mbar, dry gas mg/m^3
1	11.01	580	414	
	11.02	460	329	
	11.03	105	75	
	11.04	810	579	
	11.05	2800	2000	
	11.06	860	614	
	11.07	240	171	
	11.08	60	43	
	11.09	840	600	
	11.10	100	71	
	11.11	90	64	
	11.12	880	629	
	11.13	200	143	
	11.14	80	57	
	11.15	95	68	
	11.16	60	43	
	11.17	65	46	
	11.18	45	32	
	11.19	45	32	
	11.20	35	25	
	11.21	32	23	
	11.22	35	25	
	11.23	30	21	
	11.24	28	20	
	11.25	28	20	
	11.26	25	18	
	11.27	27	19	
	11.28	25	18	
	11.29	25	18	
	11.30	23	16	
	11.31	18	13	
	11.32	20	14	
	11.33	22	16	
	11.34	18	13	
	11.35	16	11	
	11.36	20	14	
	11.37	14	10	
	11.38	14	10	
	11.39	14	10	
	11.40	18	13	

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	30 November 2000
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	999 mbar 9.6°C

1. Gasification & Cooling Down Phase (continued)

Run	Time	Instrument Reading	Total VOC's as C at 273°K & 1013mbar mg/m^3	Total VOC's as C at 273°K, 1013 mbar, dry gas mg/m^3
1	11.41	50	36	
	11.42	60	43	
	11.43	18	13	
	11.44	18	13	
	11.45	150	107	
	11.46	60	43	
	11.47	33	24	
	11.48	12	9	
	11.49	100	71	
	11.50	30	21	
	11.51	25	18	
	11.52	20	14	
	11.53	18	13	
	11.54	12	9	
	11.55	12	9	
	11.56	50	36	
	11.57	130	93	
	11.58	40	29	
	11.59	60	43	
	12.00	14	10	
	12.01	20	14	
	12.02	22	16	
	12.03	30	21	
	12.04	25	18	
	12.05	30	21	
	12.06	50	36	
	12.07	40	29	
	12.08	40	29	
	12.09	45	32	
	12.10	40	29	
	12.11	20	14	
	12.12	12	9	
	12.13	18	13	
	12.14	15	11	
	12.15	10	7	
	12.16	5	4	
	12.17	5	4	
	12.18	5	4	
	12.19	250	179	

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	30 November 2000
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	999 mbar 9.6°C

1. Gasification & Cooling Down Phase (continued)

Run	Time	Instrument Reading	Total VOC's as C at 273°K & 1013mbar mg/m^3	Total VOC's as C at 273°K, 1013 mbar, dry gas mg/m^3
1	12.20	30	21	
	12.21	30	21	
	12.22	20	14	
	12.23	20	14	
	12.24	22	16	
	12.25	25	18	
	12.26	16	11	
	12.27	12	9	
	12.28	400	286	
	12.29	20	14	
	12.30	15	11	
	12.31	15	11	
	12.32	12	9	
	12.33	12	9	
	12.34	18	13	
	12.35	14	10	
	12.36	10	7	
	12.37	10	7	
	12.38	12	9	
	12.39	12	9	
	12.40	10	7	
	12.41	10	7	
	12.42	14	10	
	12.43	12	9	
	12.44	10	7	
	12.45	10	7	
	12.46	620	443	
	12.47	25	18	
	12.48	1	1	
	12.49	0	0	
	12.50	0	0	
	12.51	0	0	
	12.52	0	0	
	12.53	0	0	
	12.54	0	0	
	12.55	0	0	
	12.56	0	0	
Run 1 Average			74	75*

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	30 November 2000
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	999 mbar 9.6°C

1. Gasification & Cooling Down Phase (continued)

Direct stack readings using Auto Fim 11 with flame ionisation detection.
Calibration factor = 1.0 (Methane standard).
Nomalised at 273°K & 1013mbar.
* Corrected for 1.0% moisture.

For and on behalf of
ASSOCIATED LABORATORY SERVICES LIMITED 20 December 2000

K S Axon
Director

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	30 November 2000
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	999 mbar 9.6°C

2. Final Phase

Run	Time	Instrument Reading	Total VOC's as C at 273°K & 1013mbar mg/m^3	Total VOC's as C at 273°K, 1013 mbar, dry gas mg/m^3
2	13.51	780	557	
	13.52	890	636	
	13.53	1000	714	
	13.54	100	71	
	13.55	85	61	
	13.56	650	464	
	13.57	15	11	
	13.58	100	71	
	13.59	700	500	
	14.00	90	64	
	14.01	2000	1429	
	14.02	700	500	
	14.03	1450	1036	
	14.04	80	57	
	14.05	700	500	
	14.06	30	21	
	14.07	100	71	
	14.08	700	500	
	14.09	80	57	
	14.10	700	500	
	14.11	40	29	
	14.12	1300	929	
	14.13	450	321	
	14.14	700	500	
	14.15	550	393	
	14.16	720	514	
	14.17	70	50	
	14.18	680	486	
	14.19	2600	1857	
	14.20	50	36	
	14.21	700	500	
	14.22	30	21	
	14.23	700	500	
	14.24	60	43	
	14.25	50	36	
	14.26	90	64	
	14.27	80	57	
	14.28	650	464	
	14.29	1600	1143	
	14.30	50	36	

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	30 November 2000
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	999 mbar 9.6°C

2. Final Phase (continued)

Run	Time	Instrument Reading	Total VOC's as C at 273°K & 1013mbar mg/m³	Total VOC's as C at 273°K, 1013 mbar, dry gas mg/m³
2	14.31	150	107	
	14.32	75	54	
	14.33	130	93	
	14.34	2000	1429	
	14.35	60	43	
	14.36	300	214	
	14.37	160	114	
	14.38	50	36	
	14.39	300	214	
	14.40	25	18	
	14.41	75	54	
	14.42	700	500	
	14.43	1100	786	
	14.44	70	50	
	14.45	200	143	
	14.46	60	43	
	14.47	45	32	
	14.48	50	36	
	14.49	1100	786	
	14.50	80	57	
	14.51	750	536	
Run 2 Average			347	351*

Direct stack readings using Auto Fim 11 with flame ionisation detection.
Calibration factor = 1.0 (Methane standard).
Nomalised at 273°K & 1013mbar.
* Corrected for 1.0% moisture.

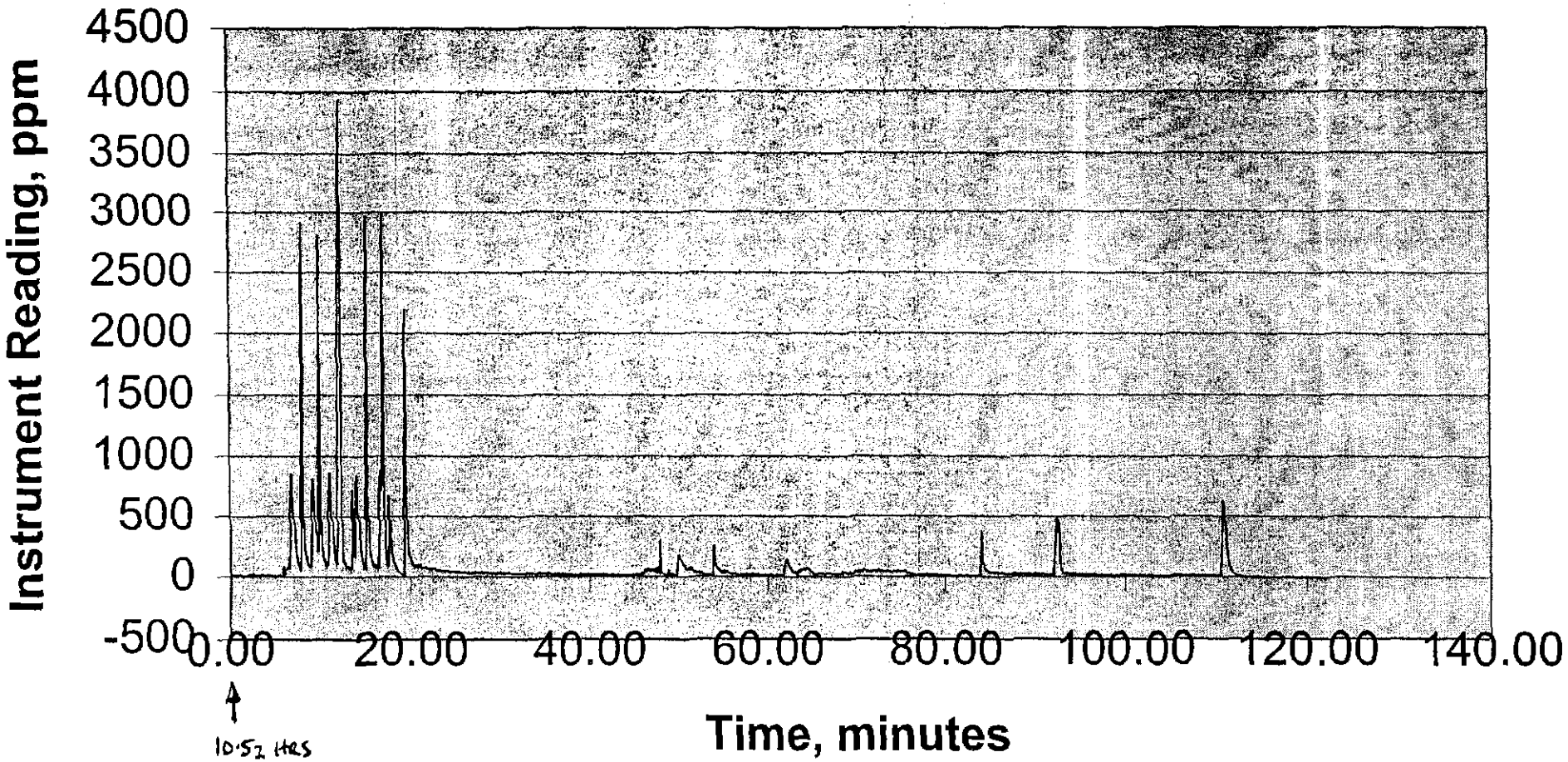
For and on behalf of
ASSOCIATED LABORATORY SERVICES LIMITED

20 December 2000

K S Axon
Director

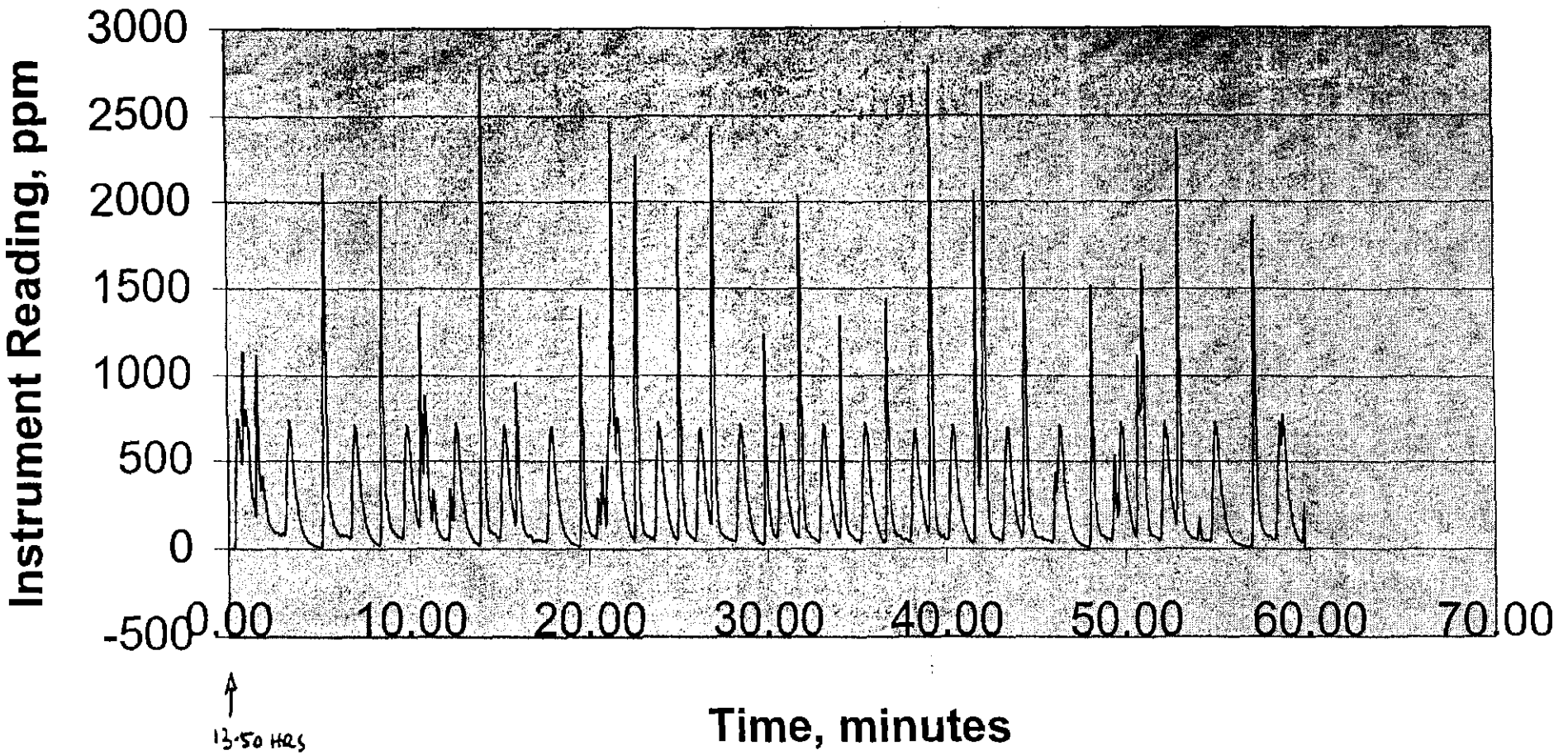
ALS LOG 1

GASIFICATION & COOLING DOWN PHASE



ALS LOG 2

FINAL PHASE



STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - MOISTURE

Date of Sampling 30 November 2000
Sample Location St Peters Road, Huntingdon, Cambridgeshire
Plant Fluidised Bed Furnace
Ambient Conditions 999 mbar 9.6°C

Sample Reference	Time			Sampling Rate l/min	Sampling Volume litres		Wt of water gm	Moisture Level	
	Initial	Final	Elapsed		Recorded	Normalised		gm/litre	% vol/vol*
M1	11.31	12.01	00.30	10	328	312	2.57	0.008	1.0
M2	12.45	13.15	00.30	10	341	324	2.53	0.007	0.9

Normalised at 273°K and 1013 mbar.
* 1 mole of water occupies 22.4 litre at normalised conditions.
Determined by absorption onto silica gel in accordance with general requirements of US EPA Method 4.

For and on behalf of
ASSOCIATED LABORATORY SERVICES LIMITED

20 December 2000

K S Axon
Director

REPORT ON STACK MONITORING

AT

GLYNWED PIPE SYSTEMS LTD

FOR

GLYNWED PIPE SYSTEMS LTD

HUNTINGDON, CAMBRIDGESHIRE, PE18 7DJ

BY

ASSOCIATED LABORATORY SERVICES LIMITED
BOCKING, BRAINTREE, ESSEX
TELEPHONE NO. - 01376 328646

AUGUST 2000

REPORT NO. 15437

INDEX

Appendices

1. SCOPE OF WORK

A stack sampling survey was carried out at the Huntingdon Works of Glynwed Pipe Systems Ltd. Processing involves removal of plastic 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. In addition, volatile organic compounds were monitored.

In accordance with the 1996 Revision of PG2/9 (96) Metal Decontamination Processes, moisture was also measured in order to correct the results to reference conditions (the oxygen correction not being required for fluidised bed systems). The emission from the stack was observed.

Measurements were carried out on 17 August 2000

2. TEST METHOD & CONDITIONS

2.1 Test Method

Sampling 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 BS3405. 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.

Moisture

Moisture was determined by absorption on silica gel in accordance with the general requirements of US EPA Method 4.

Volatile Organic Compounds

Real time measurements of total VOC's were carried out with a portable GasTec Analyser, with flame ionisation detection.

2.2 Sampling & Conditions

All sampling was carried out whilst plastic removal was being carried out. Sampling was commenced at the beginning of the batch cycle, and continued for the larger part of the cycle. It was noted that some larger items were in the furnace.

Following profiling of temperature and pressure within the stack, 2 cumulative isokinetic particulate samples were collected. During the same period, real time measurements of VOC's were carried out, and moisture samples collected.

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

The plume from the stack was observed during the process cycle. The plume was invisible, with no evidence of any droplets.

3. RESULTS & DISCUSSION

3.1 Results

The results are detailed in Appendix IV to VI.

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, also corrected for moisture.

In summary the results are as follows:-

Parameter	1st Run	2nd Run	Mean Value
Particulates mg/m^3			
- at 273°K and 1013 mbar	5.45	7.04	6.25
- at 273°K, 1013 mbar, & dry gas	5.49	7.09	6.29

The average flow velocity at the sampling point in the stack was 17.5 metre per second (at gas temperature), giving a mean gas flowrate of 4.84m^3 per second (at 273°K).

VOC levels during the process cycle were as follows

Time	Total VOC's as C @ 273°C, 1013mbar mg/m^3	Total VOC's as C @ 273°C, 1013mbar dry gas mg/m^3
12.04-12.34	368	370
13.00-13.30	781	786
13.58-14.28	998	1005
14.30-15.00	1219	1227

3.2 Discussion

Particulates

The measurement of particulates gave results, corrected for temperature and pressure which are within the prescribed ratio of 1.5 to 1.

Overall particulate levels are well below the emission standard.

The sampling flow rates are within the permitted range for isokinetic conditions, and all other measurements and variations in results comply with the requirements of BS3405.

VOC's

The VOC levels corrected for temperature and pressure range up to 1300 mg/m^3 (real time reading) and consequently are within the range as previously measured (up to 2800 mg/m^3).

Results increased during the cycle - this may be related to the presence of larger items in the furnace taking longer to "burn off".

4. CONCLUSIONS

These conclusions are based on the measurements as carried out at the emission stack associated with cyclone filters for the fluidised bed furnace at the Huntingdon Works of Glynwed Pipe Systems Ltd on 17 August 2000.

4.1 Results

Sampling was carried out during the complete cycle for the furnace.
The results are summarised as follows

a) Particulates

	At 273°K, 1013 mbar, dry gas
1st Sample	5.49 mg/m^3
2nd Sample	7.09 mg/m^3

b) VOC's

	At 273°K, 1013 mbar, dry gas
1st Sample	370 mg/m^3 as C
2nd Sample	786 mg/m^3 as C
3rd Sample	1005 mg/m^3 as C
4th Sample	1227 mg/m^3 as C

c) Flow rates at sampling port

Velocity	17.5	metre per second (at gas temperature)
Gas flowrate	4.84	m^3 per second (at 273°K).

d) Emission Plume
The plume was invisible during the process cycle with no evidence of any droplets.

4.2 Conclusions

The ratio of particulate results is within the prescribed ratio of 1.5 to 1, and all pressure and temperature measurements and variations in measurements are within the limits prescribed by BS 3405. As with previous measurements, overall particulate levels are well below the emission standard.

VOC levels are in the same range as previously, but with a lower maximum real time reading.

Stack emission velocity exceeds the minimum as recommended in the process guidance note.

The emission plume was invisible, with no evidence of any droplets.

For and on behalf of
ASSOCIATED LABORATORY SERVICES LIMITED

K S Axon

INSTRUMENT CALIBRATION REPORT

Company : Glynwed Pipe Systems Ltd
Site Address: St Peters Road, Huntingdon, Cambridgeshire
Plant Identification: Fluidised Bed Furnace
Product/Process: Removal of plastics from steel tooling

Date of Sampling : 17 August 2000
PCME Job No. N/A
ALS Job No. 15437
DISC/File Reference
Test Carried Out by PDH Willcock

Instrument Settings During Sample Instrument : SC600 Channel # : 1

DT-770/SC-600

Instrument Checks : Pass
Correct Time : Corrected
Sensitivity : Md
Old Cal Factor : 002.9500
(in use during sampling)
Flow Compensation : OFF
O2 Compensation : OFF

DT-200

Course Gain Position : _____
Fine Gain Display : _____

Filter Position : _____

Course Gain : _____
Fine Gain : _____

Instrument Results

Run	Start Time	Finish Time	Duration (Mins)	Instrument Average (Y)	Instrument Max	Dust Conc mg/m^3 (X)
1.	12.00	12.30	30	7.23	9.09	5.45
2.	12.57	13.27	30	6.36	8.64	7.04
3.						
4.						
Time Weighted Average	- - - -	- - - -	- - - -	6.80	- - - -	6.25

Calibration Calculations

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

Scaling factor = X = _____ =

New Gain Cal Factor = scaling fctor = Gain x old Cal Factor =

Instrument Settings for Calibration

DT-770/SC-600

Cal Factor : _____

DT-200

CG Position : _____
FG Display : _____
Course Gain : _____
Fine Gain : _____

Product/Process : Removal of plastic residue from steel tooling

Table A

Process Conditions

Arrestment Type :	Cyclone Filter
Particulate Type :	Plastic
Gas Temperature :	82°C
Gas Flow Rate :	4.84 m^3/sec
Appearance of Plume :	Invisible
Load of Plant :	Average

Table B

Results

	Run 1	Run 2
Date :	17.08.00	17.08.00
Test Period	12.00-12.30	12.57-13.27
Duration	30 mins	30 mins
Gas Temperature :	82°C	82°C
Mean Velocity at Sampling Points	17.5 m/sec	17.5 m/sec
Particulates at STP (1)	5.45 mg/m^3	7.04 mg/m^3
Particulates at normalised conditions (2)	5.49 mg/Nm^3	7.09 mg/Nm^3

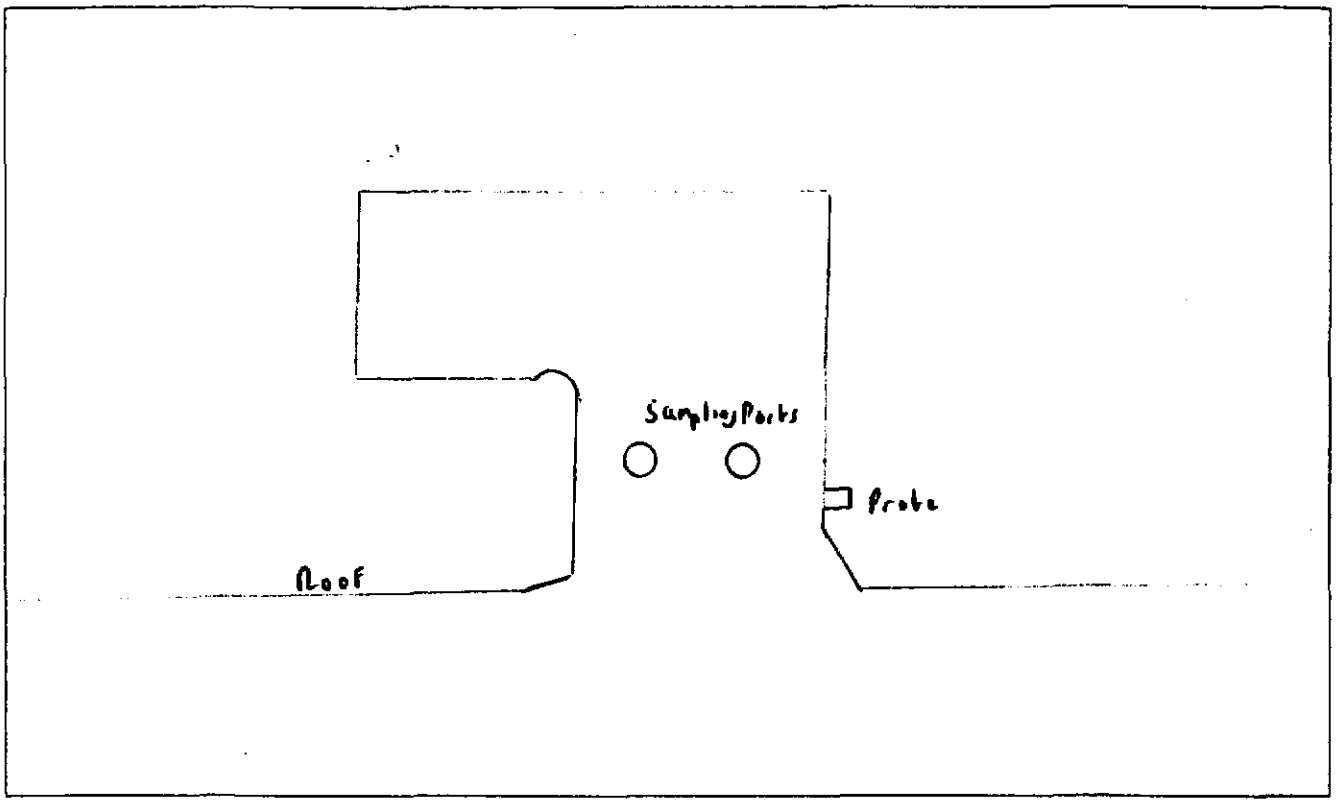
(1) Particulates stated at 273K, 101.3kPa.

(2) Normalised conditions are 273K, 101.3kPa, dry gas.

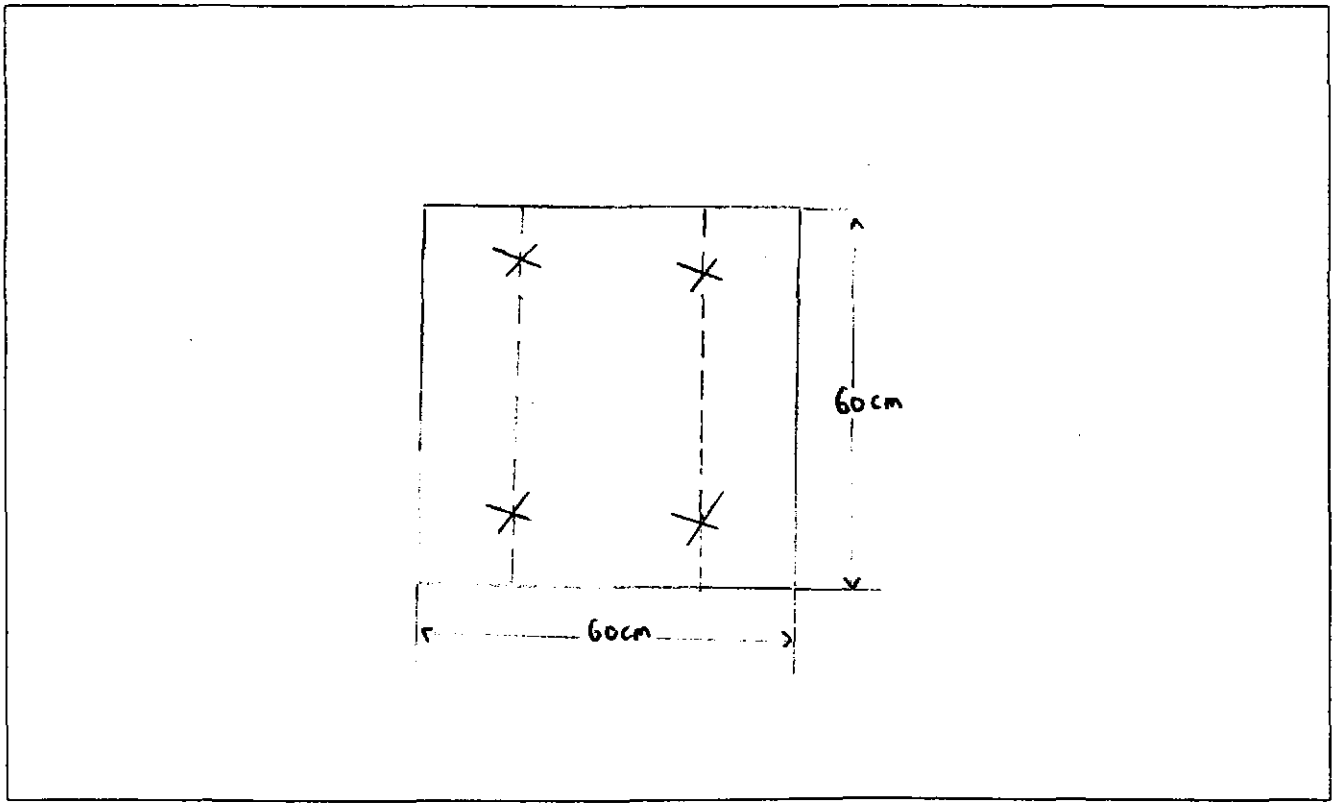
PLANT LAYOUT

Site	Glynwed Pipe Systems Ltd Huntingdon, Cambridgeshire	Plant	Fluidised Bed Furnace

1) Plant layout showing instrument location and sample place



2) Section of duct at sample place and dimensions



STACK PARTICULATES MEASUREMENT

Client : Glynwed Pipe Systems Ltd
Site : St Peters Road, Huntingdon Cambridgeshire

Date : 17 August 2000
Time : 11.15 hrs
Operator : PDH Willcock

Plant : Cyclone Filter
Plant Load: Normal

Appearance of Plume Invisible
Product/Process Removal of plastic residue from steel tooling

Details of Duct		Atmospheric Conditions		
		Time	Pressure (Pa) in mb	Temperature °C
Shape	Square	Initial	1010	24.8
Dimension/Diameter	60cm	Final	1008	25.2
Area	0.36^2	Average	1009	25.0

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	195	81.5	3	170	81.3
2.	9	190	81.5	9	170	81.3
3.	15	190	81.5	15	175	81.4
4.	21	180	81.6	21	130	81.4
5.	27	175	81.6	27	105	81.4
6.	33	165	81.6	33	110	81.5
7.	39	160	81.6	39	100	81.5
8.	45	160	81.7	45	105	81.6
9.	51	150	81.7	51	105	81.6
10.	57	140	81.7	57	105	81.6
	Average	170.5	81.6	Average	127.5	81.5
	Mean Pv (in Pascals) : 149			Mean Tp (in °K = °C + 273): 355		
	Static Pressure, Ps (in Pascals): 280					

High gas temperature = 81.7 Lowest gas temperature = 81.3

Permitted range of gas temperature readings (in °C) = (0.9Tp - 273) to (1.1Tp - 273) = 47°C to 118°C

Highest Pv = 195 pascals Lowest Pv = 100 pascals

Ratio $\frac{\text{Pv highest}}{\text{Pv lowest}}$ = 2/1 (maximum permitted ratio = 9/1)

Stack Particulates Measurements

2) Readings at Sampling

Axis	Distance into Duct (cm)	Gas Temperature °C		Velocity Pressure (Pascals)			
		Initial	Final	Initial	Final	Average	√Average
1	15	81.5	91.2	190	180	185	13.6
	45	81.7	91.3	160	160	160	12.6
2	15	81.4	91.1	175	170	172.5	13.1
	45	81.6	91.0	105	100	102.5	10.1
	Totals	326.2	364.6	630	610	-------	49.4
	Average	81.6	91.2	-------	-------	-------	12.4

Permitted range of total Pv final = 0.9 x total Pv initial to 1.1 x total Pv initial
= 567 pascals to 693 pascals

3) Sampling Conditions

Sample Reference	Axis	Time			Nozzle Diameter mm	Sample Rate l/min	Gas Meter Volme (litres)		
		Initial	Final	Elapsed			Initial	Final	Total
1	A	12.00	12.30	30 mins	4	11	331933	332321	388
2	B	12.57	13.27	30 mins	4	11	332321	332710	389

STACK PARTICULATES MEASUREMENTS

4) Weighing Results

Sample No.	Filter No.	Weights (mg)		
		Before	After	Solids Collected
A	1	91.81	93.74	1.93
B	2	93.11	95.61	2.50

5) Calculations

5.1 Mean Gas Velocity at Gas Temperature

V mean = 0.075 √Pv average √(T average + 273) m/sec

where Pv average = mean velocity pressure (pascals) } see 2
T average = mean gas temperature at the sampling points} above

V mean = 0.075 x 12.4√355

= 17.5 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 mean = mean gas velocity (see 5.1 above)
A = internal area of duct in m²
T average = mean gas temperature at the sampling points

$$Q = 17.5 \times 0.36 \times \frac{273}{(273 + 82)}$$

= 4.84 m³/sec

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - MOISTURE

Date of Sampling 17 August 2000
Sample Location *St Peters Road, Huntingdon, Cambridgeshire*
Plant Fluidised Bed Furnace
Ambient Conditions 1009 mbar 25°C

Sample Reference	Time			Sampling Rate l/min	Sampling Volume litres		Wt of water gm	Moisture Level	
	Initial	Final	Elapsed		Recorded	Normalised		gm/litre	% vol/vol*
M1	12.00	12.30	00.30	11	388	354	2.12	0.0060	0.75
M2	12.57	13.27	00.30	11	389	354	1.75	0.0050	0.61

Normalised at 273°K and 1013 mbar.
* 1 mole of water occupies 22.4 litre at normalised conditions.
Determined by absorption onto silica gel in accordance with general requirements of US EPA Method 4.

For and on behalf of
ASSOCIATED LABORATORY SERVICES LIMITED

29 August 2000

K S Axon

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - PARTICULATES

Date of Sampling 17 August 2000
Sample Location St Peters Road, Huntingdon, Cambridgeshire
Plant Fluidised Bed Furnace
Ambient Conditions 1009 mbar 25°C

Sampling Location	Sampling Reference	Sampling Volume m^3		Moisture Level % vol/vol	Particulates		
		Recorded	Normalised		On Filter mg	Concentration at 273°K, 1013 mbar mg/m^3	Concentration at 273°K, 1013 mbar, dry gas mg/m^3
1	A	0.388	0.354	0.7	1.93	5.45	5.49
2	B	0.389	0.355	0.7	2.50	7.04	7.09

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

29 August 2000

K S Axon

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	17 August 2000
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	1009 mbar 25°C

Run	Time	Instrument Reading	Total VOC's as C at 273°K & 1013mbar mg/m	Total VOC's as C at 273°K, 1013 mbar, dry gas mg/m^3
1	12.04	260	255	
	12.06	230	225	
	12.08	220	216	
	12.10	220	216	
	12.12	250	245	
	12.14	220	216	
	12.16	180	176	
	12.18	180	176	
	12.20	150	147	
	12.22	240	235	
	12.24	400	392	
	12.26	480	470	
	12.28	550	539	
	12.30	620	608	
	12.32	900	882	
	12.34	900	882	
Run 1 Average			368	370*
2	13.00	1000	980	
	13.02	1100	1078	
	13.04	1000	980	
	13.06	1000	980	
	13.08	1000	784	
	13.10	800	686	
	13.12	700	588	
	13.14	600	686	
	13.16	700	735	
	13.18	750	735	
	13.20	700	686	
	13.22	700	686	
	13.24	750	735	
	13.26	750	735	
	13.28	750	735	
	13.30	700	686	
Run 2 Average			781	786*

Direct stack readings using a Gas Tec Analyser with flame ionisation detection. Calibration factor = 1.077 (n-Hexane standard). Nomalised at 273°K & 1013mbar.
* Corrected for 0.7% moisture.

For and on behalf of
ASSOCIATED LABORATORY SERVICES LIMITED 29 August 2000

K S Axon

STACK MONITORING – GLYNWED PIPE SYSTEMS LTD

ANALYSIS RESULTS - VOLATILE ORGANIC COMPOUNDS

Date of Sampling	17 August 2000
Sample Location	St Peters Road, Huntingdon, Cambridgeshire
Plant	Fluidised Bed Furnace
Ambient Conditions	1009 mbar 25°C

Run	Time	Instrument Reading	Total VOC's as C at 273°K & 1013mbar mg/m	Total VOC's as C at 273°K, 1013 mbar, dry gas mg/m^3
3	13.58	900	882	
	14.00	900	882	
	14.02	1000	980	
	14.04	1000	980	
	14.06	1000	980	
	14.08	1000	980	
	14.10	1000	980	
	14.14	1000	980	
	14.14	1000	980	
	14.16	1000	980	
	14.18	1000	980	
	14.20	1000	980	
	14.22	1000	980	
	14.24	1100	1078	
	14.26	1200	1176	
	14.28	1200	1176	
Run 3 Average			998	1005*
4	14.30	1100	1078	
	14.32	1200	1176	
	14.34	1100	1078	
	14.36	1300	1274	
	14.38	1200	1176	
	14.40	1300	1274	
	14.42	1300	1274	
	14.44	1200	1176	
	14.46	1300	1274	
	14.48	1300	1274	
	14.50	1200	1176	
	14.52	1300	1274	
	14.54	1300	1274	
	14.56	1300	1274	
	14.58	1200	1176	
	15.00	1300	1274	
Run 2 Average			1219	1227*

Direct stack readings using a Gas Tec Analyser with flame ionisation detection. Calibration factor = 1.077(n-Hexane standard). Nomalised at 273°K & 1013mbar.

* Corrected for 0.7% moisture.

For and on behalf of
ASSOCIATED LABORATORY SERVICES LIMITED 29 August 2000

KSAx

K S Axon