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REPORT ON MONITORING OF EMISSIONS TO ATMOSPHERE FROM SPRAYBOOTH AND SURFACE TREATMENT PROCESS DUCTS

COVRAD HEAT TRANSFER LIMITED, COVENTRY

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1.0 EXECUTIVE SUMMARY

Mr. Bob Holmes of Covrad Heat Transfer Limited, requested RPS Health, Safety and Environment to undertake environmental monitoring at the Coventry site. This was in order to ascertain the emission concentrations of various pollutants from the metal coating and surface treatment processes undertaken there.

The purpose of the monitoring was to provide information to the Local Authority and determine compliance with the requirements of the site's Authorisation. The relevant Process Guidance (PG) Notes for the purpose of this report are understood to be PG Note 6/23 (04) "Secretary of State's Guidance Note for Coating of Metal and Plastic Processes" (Ref 9.1) and PG Note 6/45 (04) "Secretary of State's Guidance Note for Surface Cleaning" (Ref. 9.2).

Monitoring took place between the dates of 13th and 16th December 2004 and was undertaken by Mr. Glyn Harrison and Mr. Jethro Redmore of RPS Health, Safety and Environment.

The results of the monitoring are summarised in Tables 1.1 to 1.4, shown on the following pages. Full results are given in Section 6. All results are expressed at 101.3kPa, 273K (s.t.p.), without correction for water vapour.

Table 1.1 Total Particulate Matter Results

Emission Point	Emission Concentration at s.t.p. (mg/m^3)		Emission Limit at s.t.p. (mg/m^3)
	Run 1	Run 2	
Industrial Spraybooth 1 Stack A	1.4	1.7	50
Industrial Spraybooth 1 Stack B	2.0	1.3	
Industrial Spraybooth 2 Stack A	4.5	2.2	
Industrial Spraybooth 2 Stack B	2.7	1.9	
Assembly Shop Spraybooth LHS	2.5	2.3	
Assembly Shop Spraybooth Middle	0.9	2.0	
Assembly Shop Spraybooth RHS	4.4	1.9	
Red Oxide Spraybooth	10.3	2.4	

Table 1.2 Volatile Organic Compound Results

Emission Point	Emission Concentration at s.t.p. (mg/m^3)		Emission Limit at s.t.p. (mg/m^3)
	Run 1	Run 2	
Industrial Spraybooth 1 Stack A	26.3	34.8	N/A
Industrial Spraybooth 1 Stack B	96.5	95.4	
Industrial Spraybooth 2 Stack A	152.3	106.6	
Industrial Spraybooth 2 Stack B	120.2	109.7	
Assembly Shop Spraybooth LHS	17.4	36.5	
Assembly Shop Spraybooth Middle	13.8	11.7	
Assembly Shop Spraybooth RHS	17.9	21.4	
Red Oxide Spraybooth	111.1	62.2	

N/A – Due to the use of compliant coatings no emission limit is applicable

Table 1.3 Large Degreaser – Volatile Organic Compound Results – as Trichloroethylene

Sample Type	Emission Concentration at s.t.p. (mg/m^3)		Emission Limit at s.t.p. (mg/m^3)
	As Trike	As Carbon	
Short Term	6316.9	1154.7	2*
Long Term	3563.4	651.4	

* Taken from the PG Note 6/45 (04) (Ref. 9.2)

Table 1.4 Aluminium Degreaser - Volatile Organic Compound Results – as Perchloroethylene

Sample Type	Emission Concentration at s.t.p. (mg/m^3)		Emission Limit at s.t.p. (mg/m^3)
	As Trike	As Carbon	
Short Term	6071.3	879.7	20*
Long Term	1338.9	194.0	

* Taken from the PG Note 6/45 (04) (Ref. 9.2)

2.0 INTRODUCTION

Mr. Bob Holmes of Covrad Heat Transfer Limited, requested RPS Health, Safety and Environment to undertake environmental monitoring at the site in Coventry. This was in order to ascertain the emission concentrations of various pollutants from the metal coating and surface treatment processes carried out there. Monitoring took place between the dates of 13th and 16th December 2004. Mr. Glyn Harrison and Mr. Jethro Redmore of RPS Health, Safety and Environment carried out the survey.

This process is defined as prescribed for pollution control under section 6.5 of schedule 1 of the Environmental Protection (Prescribed Processes and Substances) Regulations 1991 and is regulated by the Local Authority. To assist in their task the Local Authority requires details of any emissions monitoring carried out on the process.

The purpose of the monitoring was to provide information to the Local Authority and determine compliance with the requirements of the site's Authorisation. The relevant Secretary of State's Guidance Notes for the purpose of this report are understood to be PG Note 6/23 (04) "Secretary of State's Guidance Note for Coating of Metal and Plastic Processes" (Ref 9.1) and PG Note 6/45 (04) "Secretary of State's Guidance Note for Surface Cleaning" (Ref. 9.2).

This report details the results of the survey and reflects conditions prevailing on the above dates.

3.0 PROCESS DETAILS

The site manufactures cooling solutions e.g. automotive radiators for a wide variety of industries that, as part of their manufacture, require surface treatment in the form of paints and protective coating application. The spraying facilities on site, are all similar in operation.

3.1 Industrial Spraybooths 1 and 2

The Industrial Spraybooth consists of two individual dry filtration systems positioned to face each other, approximately 4 metres apart. The space between the systems forms the spraying area, which is enclosed at the sides by plastic curtains, however the top is uncovered.

Each system is a 'wall', made up of filter media, approximately 6 metres in length and 3 metres tall. Each half of the 'wall' has it's own extraction system consisting of an ID fan, which draws overspray from the process through the filtration media, and vents it to atmosphere via ducting.

Spraying operations are conducted in the spraying area, with small items being placed directly in front of one of the filter 'walls' and large items being placed in the centre of the spraying area.

3.1.1 Sampling Location

The sampling location on Industrial Booth 1 was inside the factory building, located just behind the filter unit itself and was identical on both Stack A and Stack B. Two, 4" BSP ports, located on the same plane and after the ID fan, were provided to give access for sampling. However, the sampling plane was located less than 1 duct diameter upstream and downstream from a bend and therefore did not comply with the positional requirements of BS3405. However, due to the restrictions imposed by the surrounding structures and duct dimensions further downstream, this location was the only available position.

Sampling on Industrial Booth 2 was undertaken from 2, 4" BSP sockets located on the same horizontal plane, on a vertical section of duct located outside of the factory. This location met the requirements of BS3405 for sample plane location. The sample position was identical on both Stack A and Stack B.

3.2 Assembly Shop SprayBooth

The Assembly Shop Spraybooth is a dry filtration type booth used to spray both large and small items. The booth itself is enclosed at the sides and top, however it is open fronted. Spraying is undertaken within the booth, but not always directly in front of the filter backpanel. Depending upon the number and size of the items to be sprayed, some are sprayed on the threshold of the enclosure.

The filter backpanel is made up of three separate extraction systems located side by side. Each unit has it's own ID fan and extraction duct.

3.2.1 Sampling Location

Sampling was undertaken from a vertical section of duct, after the ID fan and prior to the final emission point using 2, 4" BSP sockets provided on the same horizontal plane and at 90° to each other. However, the sample plane location was less than 4 stack diameters downstream from the ID fan and under BS3405, this does not comply. The sampling locations were identical on all three ducts.

3.3 Red Oxide Booth

The Red Oxide booth is used to spray small to medium sized items. The booth uses dry filtration utilising a filter backpanel. It is enclosed on three sides and the top, but is open fronted. Items to be sprayed are either placed on trolleys and wheeled in to the booth or, if they are too big, attached to an overhead crane and lifted/suspended in the booth.

3.3.1 Sampling location

Sampling was undertaken on a vertical section of duct from 2, 4" BSP sockets located on the same horizontal plane and after the ID fan. The position of the sampling plane satisfied the requirements of BS3405.

3.4 Large Degreaser

The degreaser is used to remove surface contaminants from large items, mainly steel, prior to further treatments such as surface coating, using trichloroethylene.

The degreaser consists of a tank, approximately 4m long by 1m wide and 2m deep. Work items to be degreased are placed in baskets and lowered into the tank using an overhead crane. Items too big to fit inside a basket are attached directly to an overhead crane. The period of degreasing generally lasts for approximately 10 to 15 minutes but does vary depending upon the size of components placed in the tank.

Extraction of vapours from the tank is via lip extraction.

3.4.1 Sampling Location

Sampling was undertaken from a single 25mm hole drilled in to the extraction duct, after the ID fan.

3.5 Aluminium Degreaser

The degreaser is used to clean items of aluminium. It consists of a degreasing bath of approximate dimension of 1m by 1m by 1m deep with a roller shutter door on the top. The bath itself sits inside an enclosure that, when the loading and inspection hatches are closed, is fully sealed off to atmosphere. The enclosure is tall enough to allow a loading basket (containing the items to be degreaased) to be suspended inside it, but above the bath, with all doors closed, and with the shutter door on the bath also remaining closed. This prevents any fugitive emissions from the tank entering the workplace atmosphere whilst loading is in progress.

Once the basket is inside the enclosure and the loading doors are closed, the roller shutter door on top of the bath is opened remotely. It is at this point that the basket is lowered into the bath. Only a small inspection hatch is open at this time on the side of the enclosure to allow the operative to oversee the loading process. Once the basket has been loaded into the tank, the inspection hatch is closed.

The degreasing period is determined by the length of time it takes the solvent vapour level to rise to the top of the tank. Therefore, during the process, the inspection hatch is opened to allow the operative to assess the level of solvent vapour.

Extraction of solvent vapour/fume from the tank is by a system serving the enclosure. The extraction system is only operational when either the loading doors or the inspection hatch on the enclosure are opened. When they are both closed the extraction system automatically switches off.

3.5.1 Sampling Location

Sampling was undertaken from a single 25mm hole drilled in to the extraction duct, before the ID fan.

4.0 STRATEGY

The following emission parameters were measured from each of the spraybooth ducts monitored.

- gas flows;
- gas temperature;
- total particulate matter;
- total volatile organic compounds (as carbon, excluding particulate matter).

The degreaser ducts were sampled for the following emission parameters.

- gas flows;
- gas temperature;
- trichloroethylene/perchloroethylene solvent (as appropriate)
- total volatile organic compounds (as carbon, excluding particulate matter).

5.0 METHODOLOGY

The stack conditions and determinands were monitored as follows:

5.1 Gas Flows and Temperatures

Gas flows were measured using a pitot tube and manometer based on the requirements of BS 3405:1983 (Ref. 9.3). Gas temperatures were measured using a K-type thermocouple and temperature sensor based on the requirements of BS 3405:1983 (Ref. 9.3).

5.2 Total Particulate Matter

Total particulate matter was measured using an SKC Isokinetic stack sampling train attached to a Tecora sampling pump, operated in accordance with the requirements of BS 3405:1983 (Ref. 9.3). This method has a stated uncertainty of +/- 25%, at 95% confidence interval. The samples were analysed by gravimetric techniques.

The duration of the sample periods was decided upon after consulting with the process operator with regards to the length of time it would take to complete the spraying.

5.3 Trichloroethylene/Perchloroethylene Solvent

Monitoring was carried out using a modification of BS EN 13649 (Ref. 9.4). SKC Anasorb charcoal adsorption tubes (SKC 226-09) were used to sample for the individual solvents concerned. Monitoring was conducted over two scenarios: a short-term sample (a single, complete degrease cycle) and long-term sample (over a period of approximately one hour).

For the short-term sample, a tube was connected to a sampling pump by a length of Tygon tubing with the open end of the tube inside the stack. An SKC Sidekick personal sampling pump was used, which was calibrated to sample at a rate of 200ml/min.

At the end of monitoring the tube was removed from the stack and sealed using end caps. The flow rate of the pump was re-checked at the end to ensure it had not altered significantly.

For the long term sample, the same procedure for setting up the equipment for a short term sample was followed, with the exception that two tubes were placed in series due the extremely high VOC concentrations that would be expected from such a process. This would allow the capture of any carry over of solvent should the first tube become saturated.

Subsequent analysis of the tubes for trichloroethylene was undertaken by GC-FID.

5.4 Volatile Organic Compounds

5.4.1 Spraybooths

Volatile organic compounds (as total carbon excluding particulate matter) were measured using a Flame Ionisation Detector (FID) based on the requirements of BS EN 13526 (Ref. 9.5). The analyser was calibrated on site using a 100ppm propane standard prior to each test.

5.4.2 Degreasing Processes

Volatile organic compounds (as total carbon excluding particulate matter) were measured using a Flame Ionisation Detector (FID) based on the requirements of BS EN 13526 (Ref. 9.5). The analyser was calibrated on site using a 100ppm propane standard prior to each test.

Where the FID was used on the degreasing processes, monitoring was carried out over approximately 1 hour to provide a graphical profile of VOC emissions over the duration of the process

These results are provided for qualitative purposes only, to demonstrate the variability of the emissions during the cleaning cycles the data has only been used for emission profiling purposes.

5.5 General

An electronic barometer was used to measure local atmospheric pressure which, along with the temperature measurements, was used to express the results at the specified conditions.

Sampling was undertaken during what was understood to be normal operating conditions. For the spraying processes 'normal operation' means when only spraying is being undertaken in the booth, and excludes any cleaning or preparatory work. Normal spraying would include short stoppages in spraying to turn work round to spray the other side for example. For the degreasing processes, normal operation refers to the unit being used for degreasing. This assumption of 'normal operation' was based upon information provided by Covrad Heat Transfer Limited personnel.

All analysis was carried out at RPS Laboratories, UKAS accreditation certificate number 0605.

6.0 RESULTS

The results of the monitoring are detailed in Tables 6.1 to 6.4 below. All results are reported at 101.3kPa, 273K (s.t.p.), without correction for water vapour content.

For full details of the sampling data, please refer to Appendix B of the previous issue of this report (RPS Ref. FYS2993/gh/001) dated 5th January 2005.

TABLE 6.1 Total Particulate Matter Results

Emission Point	Run No.	Sample Duration (Date/Time)	Emission Concentration at s.t.p. (mg/m^3)	Mass Emission Rate at s.t.p. (g/hr)
Industrial Spraybooth 1 Stack A	1	14/12; 11:21 - 11:42	1.4	9.1
	2	14/12; 11:50 – 12:10	1.7	11.2
Industrial Spraybooth 1 Stack B	1	14/12; 10:22 – 10:42	2.0	18.7
	2	14/12; 10:48 – 11:08	1.3	12.6
Industrial Spraybooth 2 Stack A	1	13/12; 12:27 – 12:48	4.5	37.0
	2	13/12; 13:35 – 13:56	2.2	18.0
Industrial Spraybooth 2 Stack B	1	13/12; 11:17 – 11:38	2.7	25.3
	2	13/12; 11:46 – 12:07	1.9	18.5
Assembly Spraybooth LHS	1	15/12; 13:37 – 13:54	2.5	48.9
	2	15/12; 13:57 – 14:14	2.3	45.2
Assembly Spraybooth Middle	1	15/12; 11:43 – 12:01	0.9	17.1
	2	15/12; 12:23 – 12:39	2.0	37.3
Assembly Spraybooth RHS	1	15/12; 10:46 – 11:03	4.4	62.9
	2	15/12; 11:11 – 11:28	1.9	26.8
Red Oxide Spraybooth	1	16/12; 10:19 – 10:36	10.3	195.9
	2	16/12; 10:48 – 11:06	2.4	45.8

TABLE 6.2 Volatile Organic Compound Results

Emission Point	Run No.	Sample Duration (Date/Time)	Emission Concentration at s.t.p. (mg/m^3)	Mass Emission Rate at s.t.p. (g/hr)
Industrial Spraybooth 1 Stack A	1	14/12; 11:21 – 11:36	26.3	170.1
	2	14/12; 11:50 – 12:05	34.8	225.6
Industrial Spraybooth 1 Stack B	1	14/12; 10:22 – 10:37	96.5	903.1
	2	14/12; 10:47 – 11:02	95.4	892.5
Industrial Spraybooth 2 Stack A	1	13/12; 12:34 – 12:49	152.3	1261.0
	2	13/12; 13:41 – 13:56	106.6	882.3
Industrial Spraybooth 2 Stack B	1	13/12; 11:16 – 11:31	120.2	1168.0
	2	13/12; 11:46 – 12:01	109.7	1066.4
Assembly Spraybooth LHS	1	15/12; 13:36 – 13:51	17.4	337.4
	2	15/12; 13:56 – 14:11	36.5	710.3
Assembly Spraybooth Middle	1	15/12; 11:43 – 11:58	13.8	262.7
	2	15/12; 12:23 – 12:38	11.7	222.8
Assembly Spraybooth RHS	1	15/12; 10:46 – 11:01	17.9	251.2
	2	15/12; 11:10 – 11:25	21.4	300.1
Red Oxide Spraybooth	1	16/12; 10:19 – 10:34	111.1	2119.9
	2	16/12; 10:49 – 11:04	62.2	1186.7

Table 6.3 Large Degreaser – Volatile Organic Compound Results – as Trichloroethylene (14/12/04)

Sample Type	Sample Time	Emission Concentration at s.t.p. (mg/m^3)		Emission Rate at s.t.p. (g/hr)	
		As Trike	As Carbon	As Trike	As Carbon
Short Term	13:58 – 14:09	6316.9	1154.7	4026.6	736.1
Long Term	13:38 – 14:32	3563.4	651.4	2271.4	415.2

Table 6.4 Aluminium Degreaser - Volatile Organic Compound Results – as Perchloroethylene (16/12/04)

Sample Type	Sample Time	Emission Concentration at s.t.p. (mg/m^3)		Emission Rate at s.t.p. (g/hr)	
		As Perc	As Carbon	As Perc	As Carbon
Short Term	12:49 – 12:54	6071.3	879.7	2342.7	339.5
Long Term	12:49 – 13:32	1338.9	194.0	516.6	74.9

7.0 DISCUSSION OF RESULTS

7.1 Emission Limits

Table 7.1.1 below, details the emission concentration limits to which the results are to be compared. All limits are specified at s.t.p, without correction for water vapour content. Additionally, Table 7.1.1 details the emission concentration limit which, under the Solvent Emissions Directive (SED), will apply to surface cleaning processes, of which the degreasing baths are classed. All limits are based on the mass of specific compounds, in mg/m^3, and not total carbon, at s.t.p., without correction for water vapour content.

In the SED Box 5, p19 of PG 6/45 (Ref. 9.2), the general emission concentration limit for surface cleaning activities, with an annual solvent consumption of 1 tonne or more is $20mg/m^3$. However, since June 2001, trichloroethylene has been classified by the European Union as a Category 2 carcinogen (HSE Engineering Information Sheet No 34 (Ref 9.6)). Consequently, under the Chemicals (Hazard Information and Packaging for supply) Regulations (CHIP 3), trichloroethylene carries a Risk Phrase of R45 – 'May cause cancer'.

Due to the risk phrase associated with trichloroethylene, SED Box 6, p23 of PG 6/45 (Ref. 9.2) outlines a much stricter emission concentration limit of 2.0 mg/m^3. Therefore, it is taken that this lower emission limit will apply to the Large Degreaser only.

TABLE 7.1.1 Emission Concentration Limits

Parameter	Emission Concentration Limit (mg/m^3)
Total Particulate Matter	50
Surface Cleaning Processes using Trichloroethylene	2*
Surface Cleaning Processes using Perchloroethylene	20*
Volatile Organic Compounds (as Carbon) *	N/A

* - Taken from PG Note 6/45 (04) (Ref. 9.2)
N/A - Due to the use of compliant coatings, no emission limit is applicable

7.2 Spraybooth Emissions

7.2.1 Particulate Matter

Emission concentrations of particulate matter from all emission points monitored were low and below the emission concentration limit of 50 mg/m^3.

A maximum emission concentration of **10.3 mg/m^3** was measured from the **Red Oxide Spraybooth**. This corresponds to a mass emission rate of **195.9 g/hr**.

Emission concentrations from all other ducts were below **5.0 mg/m^3**.

7.2.2 Volatile Organic Compounds

The maximum emission concentration measured from all the ducts monitored was **152.3 mg/m^3** from **Industrial Spraybooth 2 Stack A.** This corresponds to a mass emission rate of **1261.0 g/hr**. However, emission concentrations of VOC were generally high from all stacks on both Industrial Spraybooths 1 and 2 and also the **Red Oxide Spraybooth**.

Emission concentrations from all other ducts monitored were below 40 mg/m^3.

7.3 Solvent Emissions (Degreasing Processes)

7.3.1 Trichloroethylene – Large Degreaser

Trichloroethylene emission concentrations from both the short and long term samples were in exceedance of the Emission Limit Value (ELV) in the PG Note.

The **short term** sample yielded an emission concentration of **6316.9 mg/m^3** (as trike) which equates to a mass emission rate of **4026.6 g/hr**. This exceeds the ELV by a factor of over three thousand one hundred and forty.

Emission concentration over the **long term** were lower than the short term at **3563.4 mg/m^3** (as trike), or **2271.4 g/hr** as a mass emission rate, but still exceeding the ELV by more than a factor of one thousand seven hundred and eighty.

The **VOC profiling** of the process, shows that the peak emission concentrations occur shortly after the basket is placed in the tank at the start of the degreasing process.

7.3.2 Perchloroethylene – Aluminium Degreaser

Perchloroethylene emission concentrations from both the short and long term samples were in exceedance of the ELV in the PG Note of 20.0 mg/m^3.

The **short term** sample yielded an emission concentration of **6071.3 mg/m^3** (as perc) which equates to a mass emission rate of **2342.7 g/hr**. This exceeds the ELV by a factor of over three hundred.

Emission concentration over the **long term** were lower than the short term at **1338.9 mg/m^3** (as perc), or **516.6 g/hr** as a mass emission rate, but still exceeding the ELV by more than a factor of sixty six.

The **VOC profile** obtained from this unit highlights that the peak emission concentration occurs shortly after the basket is removed from the tank and the shutter closed.

7.4 Deviations

7.4.1 Sampling Method – Particulate Matter

The method stated in PG Note 6/23 (04) (Ref. 9.1) for sampling particulates emissions is BS ISO 9096:2003 (Ref.9.7). However, due to restrictions in access with regards to the sample plane locations, the physical space available and the subsequent health and safety issues that arose, BS3405 was employed as the best available method.

BS ISO 9096:2003 (Ref.9.7) requires sampling equipment that is larger and heavier when compared to that needed for BS3405. As all of the spraybooths (except for the Assembly Shop Spraybooth and Industrial Booth 1 ducts) required the work to be carried out from a scissor lift and not a platform of suitable dimension, BS3405 was chosen due to safety implications.

7.4.2 Sample Time

In PG Note 6/23 (04) (Ref. 9.1), page 21, it states that the results for particulate matter should be expressed as 30 minute means. For the standard work items to be coated at the site, the spraying process generally only lasted for a maximum of 15 minutes under 'normal' operating conditions. With larger work items this lasted a few minutes longer, however the maximum time spent spraying at any one booth was around 15 - 20 minutes.

With the period of spraying only lasting for a maximum of 20 minutes, obtaining a 30 minute sample was prohibited by the process operation. Therefore, sample periods were based on the process operation.

7.4.3 Sampling Locations

On Industrial Booth 1, Stack B, the initial velocity profile across the duct on sample port B was found to be outside of the requirements of BS3405 (Ref. 9.3) in that zero/negative local velocity was found. Due to this sampling was conducted from sample port A only, however, the number of sampling positions along this sample line was increased to four.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

The monitoring survey has demonstrated particulate matter emission concentrations to be below the specified limit of 50 mg/m^3 for all emission points.

Monitoring has demonstrated that the emission concentrations of VOC as 'trike' from the Large Degreaser and perc from the Aluminium Degreaser exceed the relevant ELV as stated in the Solvent Emissions Directive section of PG 6/45 (04) (Ref. 9.2).

8.2 Recommendations

8.2.1 General

To remain compliant with the site Authorisation requirement for these stacks to be monitored annually, it is advised that the next survey should be scheduled for no later than December 2005.

8.2.2 VOC - Degreasers

Due to the high levels of VOC emitted from the units, abatement in the form of carbon filters/beds would be recommended to assist in meeting the ELV.

The Solvent Emissions Directive requires that where installations fall under the Directive, certain actions are carried out within set timescales. Such timescales can be found in the DEFRA Guidance Document AQ6(04) (Ref. 9.7). From this document, the following timescales are assumed to apply to those processes detailed in this report to which the SED is applicable.

- Compliance with the applicable emission limit – *by* 31st October 2007;
- Compliance with the use of the SED reduction scheme – *from* 31st October 2005;
- Submission of a *substitution plan* to the Local Authority, regarding the substitution of designated Risk Phrase materials – *by* 19th May 2004.

It would appear that the date for the submission of the substitution plan has passed.

8.2.3 Particulate Matter Sampling Method

The current process guidance note, PG6/23 (04) (Ref 9.1) specifies the use of BS ISO 9096:2003 (Ref 9.7) for the sampling of particulate matter, rather than BS 3405:1983 (Ref 9.3) as has been used for the current and previous surveys. However, with particulate concentrations being found to be less than 20 mg/m^3 at the time of testing, this is outside the scope of BS ISO 9096: 2003 (Ref 9.7), which was written for concentrations of 20 mg/m^3 and above.

Due to this there is scope for the use of BS EN 13284-1 (Ref: 9.9), which is the reference particulate standard as specified by the Environment Agency, for

concentrations up to 20 mg/m^3 (with the scope within the standard for measurements up to 50 mg/m^3). It should be noted that approval is required from the Local Authority prior to any change in methodology.

8.2.4 Sample Locations – Future Monitoring Surveys

Method Applicability

BS3405 (Ref. 9.3) has positional requirements for the location of the sampling ports, namely, that the sampling plane has to be located a certain number of stack diameters away from any bends, fans etc. BS ISO 9096:2003 (ref. 9.7) however, states that as long as the flow profile in the stack meets certain criteria (i.e. No negative flow, ratio of highest to lowest is <3:1 (as a velocity), angle of flow to duct axis is <15°) then this location will be suitable for sampling. This is regardless of it's proximity to any bends, fans etc.

Where sample locations have been identified as not meeting the positional requirements of BS3405 (Ref. 9.3), the measured velocity at the sample plane on all ducts, except Industrial Booth 1 Stack B, does meet the requirements for flow velocity of BS 9096 (Ref. 9.7). However, the angle of flow in the duct on the Assembly Shop Spraybooth and Industrial Booth 1 ducts was between 15° to 20° with regards to duct axis, and as such means that these two positions would not meet the requirement of BS ISO 9096:2003 (Ref. 9.7).

Sample Port location

Assessment of the Assembly Shop Spraybooth and the Industrial Booth 1 ducts has concluded that with the exception of sampling these ducts externally (i.e. on the building roof) no other appropriate sampling location can be found, that would potentially meet the requirements of BS ISO 9096:2003 (Ref. 9.7). Given the condition and material make up of the roof of the buildings (i.e. asbestos), sampling externally would be most problematic in terms of access.

The position of sampling locations on all other emission points is satisfactory.

Access Requirements

Previous sampling surveys, including this one, have been carried out under BS3405 (Ref.9.3). However the revised and updated PG Note now specifies the use of BS ISO 9096:2003 (Ref 9.7) for particulate testing. As stated in Section 8.2.3, the concentrations emitted from the ducts on site are much less than the minimum of the range for which the standard was intended and a more applicable standard would be BS EN 13284-1 (Ref: 9.9).

In terms of equipment used to undertake the sampling, the two recommended standards (BS ISO 9096:2003 (Ref.9.7 and BS EN 13284-1 (Ref.9.9)) require sampling equipment that is both larger and heavier than that used for sampling to BS3405 (Ref.9.3). Therefore, in both BS ISO 9096:2003 (Ref 9.7) and BS EN 13284-1 (Ref: 9.9) there is a requirement for sampling platforms to reach the standard specified in Technical Guidance Note M1, "Sampling requirements for monitoring of stack emissions to air from industrial installations" (Ref 9.10). A

copy of this document can be obtained from Environment can be downloaded from the following link:

www.environment-agency.gov.uk/business/444217/444661/444671/466158/monitoring/?version=1&lang=_e

The main requirement for platform dimension is that the **minimum size for a platform shall not be less than 5m^2**, with the minimum width at any point being not less than 2m. The minimum width in front of access ports shall not be less than 2m, or the length of the probe (including nozzles, suction/support tubes and associated filter holders) plus 1m. As all stacks detailed in this report would require a probe of 1m in length, a 2m platform in front of the sampling ports would be sufficient. Please refer to Fig 8.1 for the position of the platform in relation to the sampling ports.

The platforms must also be fitted with **1.0m high handrails**, **a centre rail** at 0.5m, **removable chains** across top access to cat ladders **and 0.23m high toe boards** (all values are approximate). The platforms must also **be positioned directly below the sample access points**.

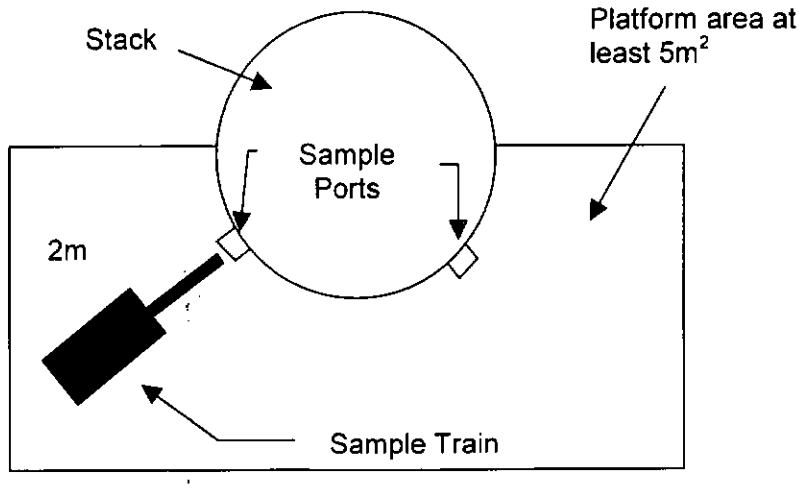


Figure 8.1 Sampling platform as recommended by M1 (Ref 9.10)

With regards to these requirements, the Red Oxide Booth and Industrial Booth 2 (external) will require at least a scaffold platform to be installed. it is recommended that access to the Industrial Booth 1 ducts (internal), should either be improved upon or replaced with a more adequate platform. Preferably this platform should be made much wider, perhaps using a scaffold platform, at the stack locations.

9.0 REFERENCES

9.1 PG 6/23 (04) "*Secretary of State's Guidance Note for Coating of Metal and Plastic Processes*"

9.2 PG6/45 (04) "*Secretary of State's Guidance Note for Surface Cleaning*". HMSO.

9.3 BS 3405:1983 (1989) "*Measurement of particulate emission including grit and dust (simplified method)*". British Standards Institution.

9.4 BS EN 13649 (2002). "*Determination of Individual Organic Compounds.*" British Standards Institution.

9.5 BS EN 13526 (2002). "Determination of the mass concentration of total gaseous organic carbon in flue gases from solvent using processes. Continuous flame ionisation detector method." British Standards Institution.

9.6 Engineering Information Sheet No 34 "*Surface cleaning: Solvent update including the reclassification of trichloroethylene*" HSE.

9.7 BS ISO 9096: 2003 *"Manual determination of mass concentration of particulate matter"* British Standards Institution.

9.8 AQ6(04) "How To Use The Process Guidance Notes for Solvent-Using Activities". DEFRA.

9.9 BS EN13284-1:2002. *"Determination of low range mass concentration of dust – Part 1"* British Standards Institution

9.10 Technical Guidance Document (Monitoring) M1, "*Sampling requirements for monitoring of stack emissions to air from industrial installations*", Environment Agency (England and Wales).

APPENDIX A:

STACK CONDITIONS

TABLE A.1.1 STACK CONDITIONS

Parameter	Industrial Spraybooth 1	
	Stack A	Stack B
Internal Dimensions (m)	0.60	0.60
Cross Sectional Area (m^2)	0.28	0.28
Stack Temperature (°C)	22.0	22.0
Velocity (m/s)	7.1	9.9
Volume Flow at s.t.p. (m^3/s)	1.8	2.6

TABLE A.1.2 STACK CONDITIONS

Parameter	Industrial Spraybooth 2	
	Stack A	Stack B
Internal Dimensions (m)	0.60	0.60
Cross Sectional Area (m^2)	0.28	0.28
Stack Temperature (°C)	23.0	22.0
Velocity (m/s)	8.7	10.1
Volume Flow at s.t.p. (m^3/s)	2.3	2.6

TABLE A.1.3 STACK CONDITIONS

Parameter	Assembly Shop Spraybooth		
	LHS	MIDDLE	RHS
Internal Dimensions (m)	0.79	0.79	0.79
Cross Sectional Area (m^2)	0.49	0.49	0.49
Stack Temperature (°C)	20.0	20.0	20.0
Velocity (m/s)	12.0	11.7	8.7
Volume Flow at s.t.p. (m^3/s)	5.4	5.3	3.9

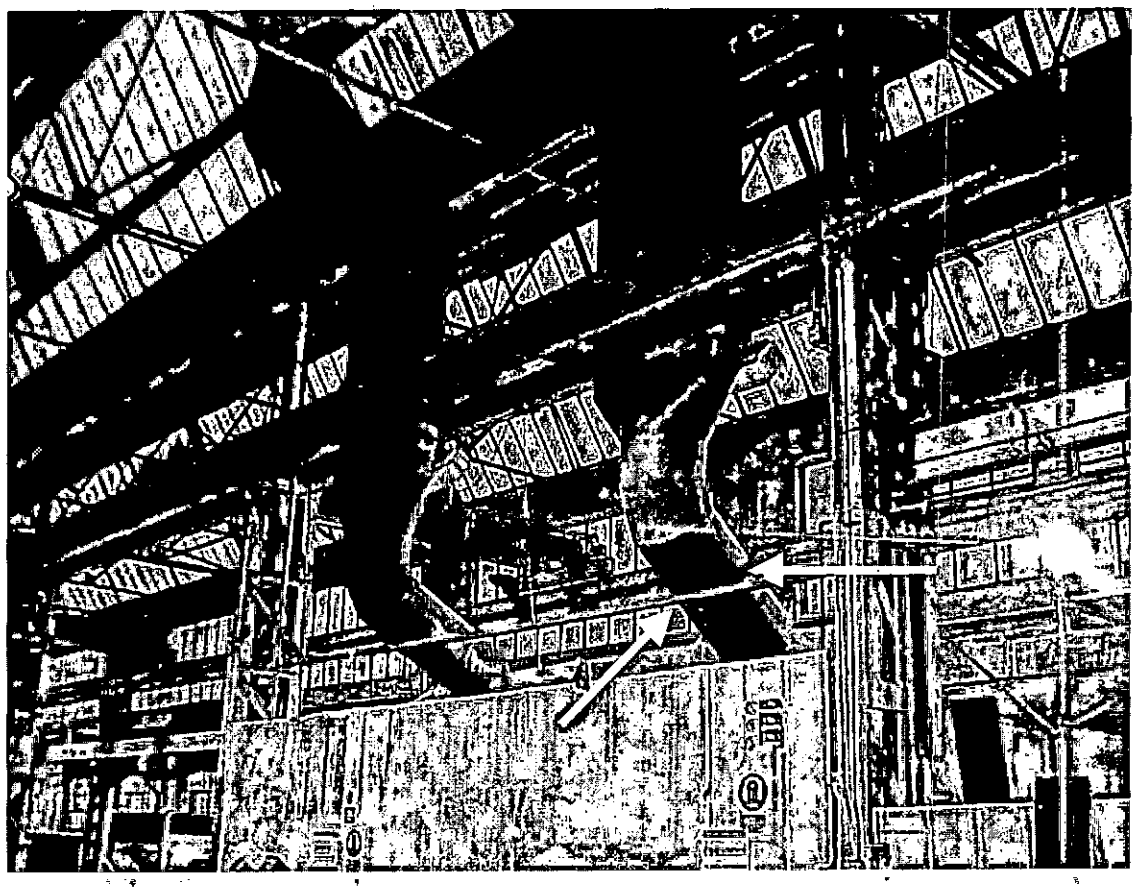
TABLE A.1.4 STACK CONDITIONS

Parameter	Red Oxide Spraybooth	Large Degreaser	Aluminium Degreaser
Internal Dimensions (m)	0.79	0.25	0.12
Cross Sectional Area (m^2)	0.49	0.05	0.01
Stack Temperature (°C)	22.0	21.0	22.0
Velocity (m/s)	11.9	3.9	10.5
Volume Flow at s.t.p. (m^3/s)	5.3	0.2	0.1

APPENDIX B:

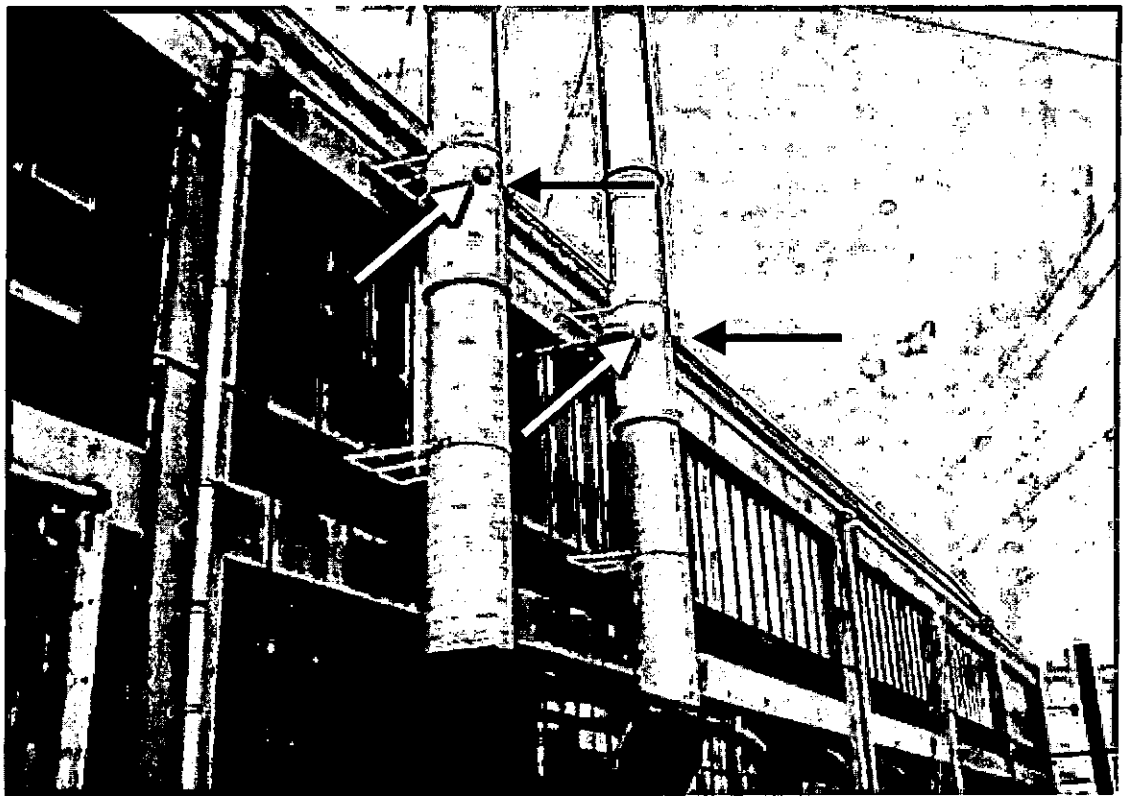
SPRAYBOOTH SAMPLE LOCATIONS

B1.1 Industrial Booth 1



The Industrial Booth 1 stacks are of circular cross section with the sample ports identified by the arrows. The port locations are identical on both stacks.

B.1.2 Industrial Booth 2

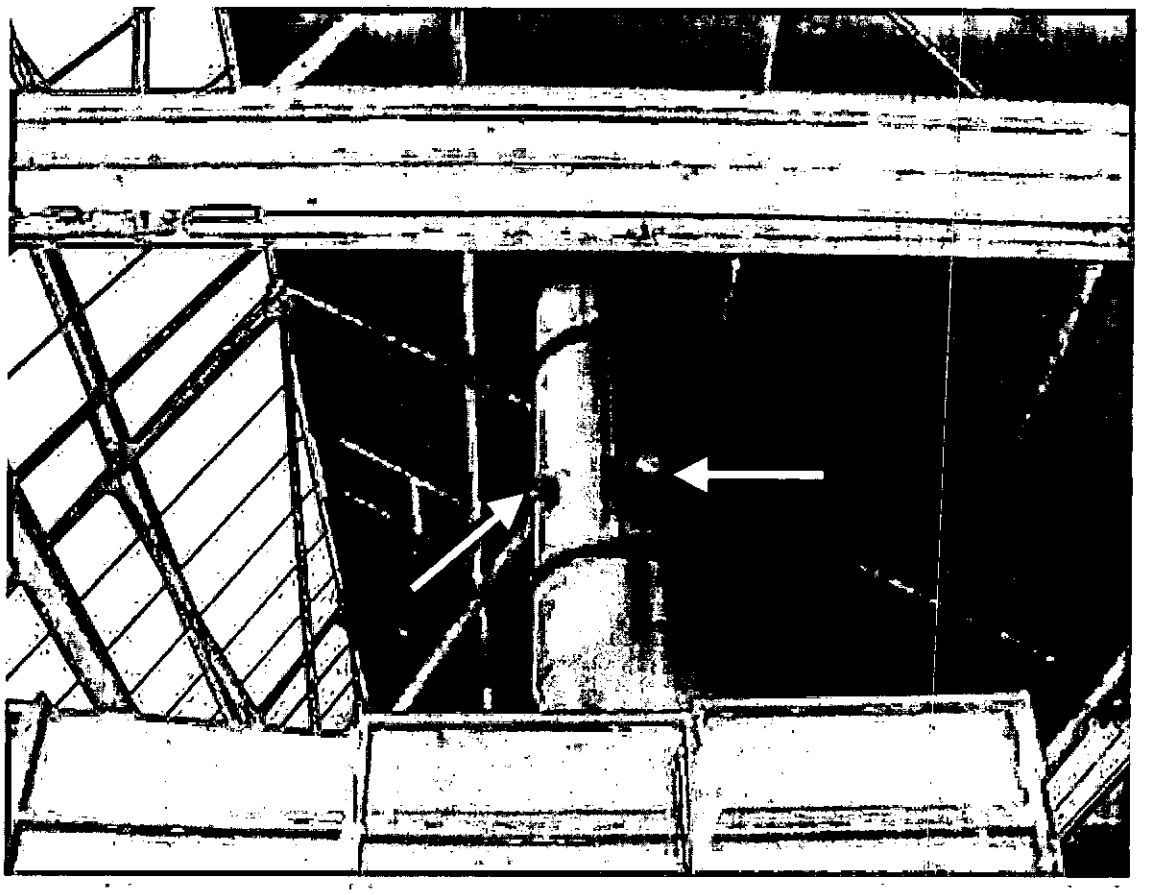


The Industrial Booth 2 stacks are both of circular cross section with the sampling ports identified by the arrows.

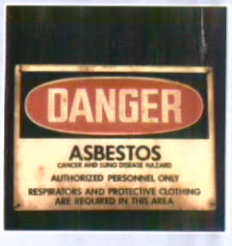
B.1.3 Assembly Shop Booths

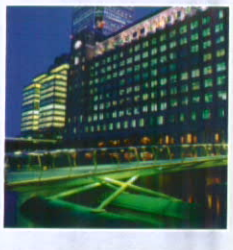
The three ducts that serve the Assembly Shop Spraybooth are all of circular cross section. The sample ports, identified by the arrows on the right hand stack, are just under the roof. The other two stacks are identical to this.

B.1.4 Red Oxide Booth



The Red Oxide Booth is of circular cross section with 2, 4"BSP sampling ports located as indicated above.





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REPORT ON MONITORING OF EMISSIONS TO ATMOSPHERE FROM SPRAYBOOTH AND SURFACE TREATMENT PROCESS DUCTS

COVRAD HEAT TRANSFER LIMITED, COVENTRY

DECEMBER, 2004

Report Reference:	FYS2993/gh /001	
Prepared By:	Glyn Harrison BEng (Hons) MCERTS LII	Date
Signed:	[redacted]	5/01/05
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Position:	Quality Manager – Stack Emissions	

CONTENTS

1.0 EXECUTIVE SUMMARY

Mr. Bob Holmes of Covrad Heat Transfer Limited, requested RPS Health, Safety and Environment to undertake environmental monitoring at the Coventry site. This was in order to ascertain the emission concentrations of various pollutants from the metal coating and treatment processes undertaken there.

The purpose of the monitoring was to provide information to the Local Authority and determine compliance with the requirements of the site's Authorisation. The relevant Process Guidance (PG) Notes for the purpose of this report are understood to be PG Note 6/23 (04) "Secretary of State's Guidance Note for Coating of Metal and Plastic Processes" (Ref 9.1) and PG Note 6/45 (04) "Secretary of State's Guidance Note for Surface Cleaning" (Ref. 9.2).

Monitoring took place between the dates of 13th and 16th December 2004 and was undertaken by Mr. Glyn Harrison and Mr. Jethro Redmore of RPS Health, Safety and Environment.

The results of the monitoring are summarised in Tables 1.1 to 1.4, shown on the following pages. Full results are given in Section 6. All results are expressed at 101.3kPa, 273K (s.t.p.), without correction for water vapour.

Table 1.1 Total Particulate Matter Results

Emission Point	Emission Concentration at s.t.p. (mg/m^3)		Emission Limit at s.t.p. (mg/m^3)
	Run 1	Run 2	
Industrial Spraybooth 1 Stack A	1.4	1.7	50
Industrial Spraybooth 1 Stack B	2.0	1.3	
Industrial Spraybooth 2 Stack A	4.5	2.2	
Industrial Spraybooth 2 Stack B	2.7	1.9	
New Spraybooth LHS	2.5	2.3	
New Spraybooth Middle	0.9	2.0	
New Spraybooth RHS	4.4	1.9	
Red Oxide Spraybooth	10.3	2.4	

Table 1.2 Volatile Organic Compound Results

Emission Point	Emission Concentration at s.t.p. (mg/m^3)		Emission Limit at s.t.p. (mg/m^3)
	Run 1	Run 2	
Industrial Spraybooth 1 Stack A	26.3	34.8	50
Industrial Spraybooth 1 Stack B	96.5	95.4	
Industrial Spraybooth 2 Stack A	152.3	106.6	
Industrial Spraybooth 2 Stack B	120.2	109.7	N/A
New Spraybooth LHS	17.4	36.5	
New Spraybooth Middle	13.8	11.7	
New Spraybooth RHS	17.9	21.4	
Red Oxide Spraybooth	111.1	62.2	

N/A – Due to the use of compliant coatings no emission limit is applicable — wrong.

Table 1.3 Large Degreaser – Volatile Organic Compound Results – as Trichloroethylene

no limit in auth

Sample Type	Emission Concentration at s.t.p. (mg/m^3)		Emission Limit at s.t.p. (mg/m^3)
	As Trike	As Carbon	
Short Term	6316.9	1154.7	2*
Long Term	3563.4	651.4	

* Taken from the PG Note 6/45 (04) (Ref. 9.2)

limits not specified in auth

Table 1.4 Aluminium Degreaser - Volatile Organic Compound Results – as Perchloroethylene

Sample Type	Emission Concentration at s.t.p. (mg/m^3)		Emission Limit at s.t.p. (mg/m^3)
	As Trike	As Carbon	
Short Term	6071.3	879.7	20*
Long Term	1338.9	194.0	

* Taken from the PG Note 6/45 (04) (Ref. 9.2)

Size top tank over a Time period + mass emmission

2.0 INTRODUCTION

Mr. Bob Holmes of Covrad Heat Transfer Limited, requested RPS Health, Safety and Environment to undertake environmental monitoring at the site in Coventry. This was in order to ascertain the emission concentrations of various pollutants from the coating and treatment processes carried out there. Monitoring took place between the dates of 13th and 16th December 2004. Mr. Glyn Harrison and Mr. Jethro Redmore of RPS Health, Safety and Environment carried out the survey.

This process is defined as prescribed for pollution control under section 6.5 of schedule 1 of the Environmental Protection (Prescribed Processes and Substances) Regulations 1991 and is regulated by the Local Authority. To assist in their task the Local Authority requires details of any emissions monitoring carried out on the process.

The purpose of the monitoring was to provide information to the Local Authority and determine compliance with the requirements of the site's Authorisation. The relevant Secretary of State's Guidance Notes for the purpose of this report are understood to be PG Note 6/23 (04) "Secretary of State's Guidance Note for Coating of Metal and Plastic Processes" (Ref 9.1) and PG Note 6/45 (04) "Secretary of State's Guidance Note for Surface Cleaning" (Ref. 9.2).

This report details the results of the survey and reflects conditions prevailing on the above dates.

3.0 PROCESS DETAILS

The site manufactures cooling solutions for a wide variety of industries that, as part of their manufacture, require surface treatment in the form of paints and protective coating application. The spraying facilities on site, are all similar in operation.

3.1 Industrial Spraybooths 1 and 2

The Industrial Spraybooth consists of two individual dry filtration systems positioned to face each other, approximately 4 metres apart. The space between the systems forms the spraying area, which is enclosed at the sides by plastic curtains, however the top is uncovered.

Each system is a 'wall', made up of filter media, approximately 6 metres in length and 3 metres tall. Each half of the 'wall' has it's own extraction system consisting of an ID fan, which draws overspray from the process through the filtration media, and vents it to atmosphere via ducting.

Spraying operations are conducted in the spraying area, with small items being placed directly in front of one of the filter 'walls' and large items being placed in the centre of the spraying area.

3.1.1 Sampling Location

The sampling location on Industrial Booth 1 was inside the factory building, located just behind the filter unit itself and was identical on both Stack A and Stack B. Two, 4" BSP ports, located on the same plane and after the ID fan, were provided to give access for sampling. However, the sampling plane was located less than 1 duct diameter upstream and downstream from a bend and therefore did not comply with requirements of BS3405. However, due to the restrictions imposed by the surrounding structures and duct dimensions further downstream, this location was the only available position.

Booth 1 location not meet req of BS3405

Sampling on the Industrial Booth 2 was undertaken from 2, 4" BSP sockets located on the same horizontal plane, on a vertical section of duct located outside of the factory. This location met the requirements of BS3405 for sample plane location. The sample position was identical on both Stack A and Stack B.

Booth 2 location met req of BS3405.

3.2 New Spray Booth

what's this ?.

The 'New' Spraybooth is a dry filtration type booth used to spray both large and small items. The booth itself is enclosed at the sides and top, however it is open fronted. Spraying is undertaken within the booth, but not always directly in front of the filter backpanel. Depending upon the number and size of the items to be sprayed, some are sprayed on the threshold of the enclosure.

Justification for use of BS3405 ?

The filter backpanel is made up of three separate extraction systems located side by side. Each unit has it's own ID fan and extraction duct.

3.2.1 Sampling Location

'New Spraybooth'

Sampling was undertaken from a vertical section of duct, after the ID and prior to the final emission point using 2, 4" BSP sockets provided on the same horizontal plane and at 90° to each other. However, the sample plane location was less than 4 stack diameters downstream from the ID fan and under BS3405, this does not comply. The sampling locations were identical on all three ducts.

3.3 Red Oxide Booth

The Red Oxide booth is used to spray small to medium sized items. The booth uses dry filtration utilising a filter backpanel. It is enclosed on three side and the top, but is open fronted. Items to be sprayed are either placed on trolleys and wheeled in to the booth or, if they are too big, attached to an overhead crane and lifted/suspended in the booth.

3.3.1 Sampling location

Sampling was undertaken on a vertical section of duct from 2, 4" BSP sockets located on the same horizontal plane and after the ID fan. The position of the sampling plane satisfied the requirements of BS3405.

N/A

3.4 Large Degreaser

The degreaser is used to remove surface contaminants from large items, mainly steel, prior to further treatments such as surface coating, using trichloroethylene.

The degreaser consists of a tank, approximately 4m long by 1m wide and 2m deep. Work items to be degreased are placed in baskets and lowered into the tank using an overhead crane. Items too big to fit inside a basket are attached directly to an overhead crane. The period of degreasing generally lasts for approximately 10 to 15 minutes but does vary depending upon the size of components placed in the tank.

Extraction of vapours from the tank is via lip extraction.

N/A

3.4.1 Sampling Location

Sampling was undertaken from a single 25mm hole drilled in to the extraction duct, after the ID fan.

N/A

3.5 Aluminium Degreaser

The degreaser is used to clean items of aluminium. It consists of a degreasing bath of approximate dimension of 1m by 1m by 1m deep with a roller shutter door on the top. The bath itself sits inside an enclosure that, when the loading and inspection hatches are closed, is fully sealed off to atmosphere. The enclosure is tall enough to allow a loading basket (containing the items to be degreaased) to be suspended inside it, but above the bath, with all doors closed, and with the shutter door on the bath also remaining closed. This prevents any fugitive emissions from the tank entering the workplace atmosphere whilst loading is in progress.

Once the basket is inside the enclosure and the loading doors are closed, the roller shutter door on top of the bath is opened remotely. It is at this point that the basket is lowered into the bath. Only a small inspection hatch is open at this time on the side of the enclosure to allow the operative to oversee the loading process. Once the basket has been loaded into the tank, the inspection hatch is closed.

The degreasing period is determined by the length of time it takes the solvent vapour level to rise to the top of the tank. Therefore, during the process, the inspection hatch is opened to allow the operative to assess the level of solvent vapour.

Extraction of solvent vapour/fume from the tank is by a system serving the enclosure. The extraction system is only operational when either the loading doors or the inspection hatch on the enclosure are opened. When they are both closed the extraction system automatically switches off.

3.5.1 Sampling Location

N/A

Sampling was undertaken from a single 25mm hole drilled in to the extraction duct, before the ID fan.

4.0 STRATEGY

The following emission parameters were measured from each of the spraybooth ducts monitored.

- gas flows;
- gas temperature;
- total particulate matter;
- total volatile organic compounds (as carbon, excluding particulate matter).

The degreaser ducts were sampled for the following emission parameters.

- gas flows;
- gas temperature;
- trichloroethylene/perchloroethylene solvent (as appropriate)
- total volatile organic compounds (as carbon, excluding particulate matter).

5.0 METHODOLOGY

The stack conditions and determinands were monitored as follows:

5.1 Gas Flows and Temperatures

Gas flows were measured using a pitot tube and manometer based on the requirements of BS 3405:1983 (Ref. 9.3). Gas temperatures were measured using a K-type thermocouple and temperature sensor based on the requirements of BS 3405:1983 (Ref. 9.3).

5.2 Total Particulate Matter

Total particulate matter was measured using an SKC Isokinetic stack sampling train attached to a Tecora sampling pump, operated in accordance with the requirements of BS 3405:1983 (Ref. 9.3). This method has a stated uncertainty of +/- 25%, at 95% confidence interval. The samples were analysed by gravimetric techniques.

5.3 Trichloroethylene/Perchloroethylene Solvent

Monitoring was carried out using a modification of BS EN 13649 (Ref. 9.4). SKC Anasorb charcoal adsorption tubes (SKC 226-09) were used to sample for the individual solvents concerned. Monitoring was conducted over two scenarios: a short-term sample (a single, complete degrease cycle) and long-term sample (over a period of approximately one hour).

For the short-term sample, a tube was connected to a sampling pump by a length of Tygon tubing with the open end of the tube inside the stack. An SKC Sidekick personal sampling pump was used, which was calibrated to sample at a rate of 200ml/min.

N/A

At the end of monitoring the tube was removed from the stack and sealed using end caps. The flow rate of the pump was re-checked at the end to ensure it had not altered significantly.

For the long term sample, the same procedure for setting up the equipment for a short term sample was followed, with the exception that two tubes were placed in series due the extremely high VOC concentrations that would be expected from such a process. This would allow the capture of any carry over of solvent should the first tube become saturated.

Subsequent analysis of the tubes for trichloroethylene was undertaken by GC-FID.

5.4 Volatile Organic Compounds

5.4.1 Spraybooths

Volatile organic compounds (as total carbon excluding particulate matter) were measured using a Flame Ionisation Detector (FID) based on the requirements of BS EN 13526 (Ref. 9.5). The analyser was calibrated on site using a 100ppm propane standard prior to each test.

N/A

5.4.2 Degreasing Processes

Volatile organic compounds (as total carbon excluding particulate matter) were measured using a Flame Ionisation Detector (FID) based on the requirements of BS EN 13526 (Ref. 9.5). The analyser was calibrated on site using a 100ppm propane standard prior to each test.

N/A

Where the FID was used on the degreasing processes, monitoring was carried out over approximately 1 hour to provide a graphical profile of VOC emissions over the duration of the process

These results are provided for qualitative purposes only, to demonstrate the variability of the emissions during the cleaning cycles the data has only been used for emission profiling purposes.

5.5 General

An electronic barometer was used to measure local atmospheric pressure which, along with the temperature measurements, was used to express the results at the specified conditions.

→ what is normal?

Sampling was undertaken during what was understood to be normal operating conditions. This assumption was based upon information provided by Covrad Heat Transfer Limited personnel.

All analysis was carried out at RPS Laboratories, UKAS accreditation certificate number 0605.

6.0 RESULTS

The results of the monitoring are detailed in Tables 6.1 to 6.4 below. All results are reported at 101.3kPa, 273K (s.t.p.), without correction for water vapour content.

Full details of the sampling can be found in Appendix B, which also includes the Solvent Emission FID Profiles for the two degreasers.

TABLE 6.1 Total Particulate Matter Results

Emission Point	Run No.	Sample Duration (Date/Time)	Emission Concentration at s.t.p. (mg/m³)	Mass Emission Rate at s.t.p. (g/hr)
Industrial Spraybooth 1 Stack A	1	14/12; 11:21 - 11:42	1.4	9.1
	2	14/12; 11:50 – 12:10	1.7	11.2
Industrial Spraybooth 1 Stack B	1	14/12; 10:22 – 10:42	2.0	18.7
	2	14/12; 10:48 – 11:08	1.3	12.6
Industrial Spraybooth 2 Stack A	1	13/12; 12:27 – 12:48	4.5	37.0
	2	13/12; 13:35 – 13:56	2.2	18.0
Industrial Spraybooth 2 Stack B	1	13/12; 11:17 – 11:38	2.7	25.3
	2	13/12; 11:46 – 12:07	1.9	18.5
New Spraybooth LHS	1	15/12; 13:37 – 13:54	2.5	48.9
	2	15/12; 13:57 – 14:14	2.3	45.2
New Spraybooth Middle	1	15/12; 11:43 – 12:01	0.9	17.1
	2	15/12; 12:23 – 12:39	2.0	37.3
New Spraybooth RHS	1	15/12; 10:46 – 11:03	4.4	62.9
	2	15/12; 11:11 – 11:28	1.9	26.8
Red Oxide Spraybooth	1	16/12; 10:19 – 10:36	10.3	195.9
	2	16/12; 10:48 – 11:06	2.4	45.8

Joshi Why not chosen 30 min mean as set in PG6/23.

TABLE 6.2 Volatile Organic Compound Results

Emission Point	Run No.	Sample Duration (Date/Time)	Emission Concentration at s.t.p. (mg/m^3)	Mass Emission Rate at s.t.p. (g/hr)
Industrial Spraybooth 1 Stack A	1	14/12; 11:21 – 11:36	26.3	170.1
	2	14/12; 11:50 – 12:05	34.8	225.6
Industrial Spraybooth 1 Stack B	1	14/12; 10:22 – 10:37	96.5	903.1
	2	14/12; 10:47 – 11:02	95.4	892.5
Industrial Spraybooth 2 Stack A	1	13/12; 12:34 – 12:49	152.3	1261.0
	2	13/12; 13:41 – 13:56	106.6	882.3
Industrial Spraybooth 2 Stack B	1	13/12; 11:16 – 11:31	120.2	1168.0
	2	13/12; 11:46 – 12:01	109.7	1066.4
New Spraybooth LHS	1	15/12; 13:36 – 13:51	17.4	337.4
	2	15/12; 13:56 – 14:11	36.5	710.3
New Spraybooth Middle	1	15/12; 11:43 – 11:58	13.8	262.7
	2	15/12; 12:23 – 12:38	11.7	222.8
New Spraybooth RHS	1	15/12; 10:46 – 11:01	17.9	251.2
	2	15/12; 11:10 – 11:25	21.4	300.1
Red Oxide Spraybooth	1	16/12; 10:19 – 10:34	111.1	2119.9
	2	16/12; 10:49 – 11:04	62.2	1186.7

Table 6.3 Large Degreaser – Volatile Organic Compound Results – as Trichloroethylene (14/12/04)

Sample Type	Sample Time	Emission Concentration at s.t.p. (mg/m^3)		Emission Rate at s.t.p. (g/hr)	
		As Trike	As Carbon	As Trike	As Carbon
Short Term	13:58 – 14:09	6316.9	1154.7	4026.6	736.1
Long Term	13:38 – 14:32	3563.4	651.4	2271.4	415.2

Table 6.4 Aluminium Degreaser - Volatile Organic Compound Results – as Perchloroethylene (16/12/04)

Sample Type	Sample Time	Emission Concentration at s.t.p. (mg/m^3)		Emission Rate at s.t.p. (g/hr)	
		As Perc	As Carbon	As Perc	As Carbon
Short Term	12:49 – 12:54	6071.3	879.7	2342.7	339.5
Long Term	12:49 – 13:32	1338.9	194.0	516.6	74.9

7.0 DISCUSSION OF RESULTS

7.1 Emission Limits

Table 7.1.1 below, details the emission concentration limits to which the results are to be compared. All limits are specified at s.t.p., without correction for water vapour content. Additionally, Table 7.1.1 details the emission concentration limit which, under the Solvent Emissions Directive (SED), will apply to surface cleaning processes, of which the degreasing baths are classed. All limits are based on the mass of specific compounds, in mg/m^3, and not total carbon, at s.t.p., without correction for water vapour content.

In the SED Box 5, p19 of PG 6/45 (Ref. 9.2), the general emission concentration limit for surface cleaning activities, with an annual solvent consumption of 1 tonne or more is $20mg/m^3$. However, since June 2001, trichloroethylene has been classified by the European Union as a Category 2 carcinogen (HSE Engineering Information Sheet No 34 (Ref 9.6)). Consequently, under the Chemicals (Hazard Information and Packaging for supply) Regulations (CHIP 3), trichloroethylene carries a Risk Phrase of R45 – 'May cause cancer'.

Due to the risk phrase associated with trichloroethylene, SED Box 6, p23 of PG 6/45 (Ref. 9.2) outlines a much stricter emission concentration limit of 2.0 mg/m^3. Therefore, it is taken that this lower emission limit will apply to the Large Degreaser only.

TABLE 7.1.1 Emission Concentration Limits

Parameter	Emission Concentration Limit (mg/m^3)
Total Particulate Matter	50
Surface Cleaning Processes using Trichloroethylene	2*
Surface Cleaning Processes using Perchloroethylene	20*
Volatile Organic Compounds (as Carbon) *	N/A

* - Taken from PG Note 6/45 (04) (Ref. 9.2)
N/A - Due to the use of compliant coatings, no emission limit is applicable

7.2 Spraybooth Emissions

7.2.1 Particulate Matter

Emission concentrations of particulate matter from all emission points monitored were low and below the emission concentration limit of 50 mg/m^3.

A maximum emission concentration of **10.3 mg/m^3** was measured from the **Red Oxide Spraybooth**. This corresponds to a mass emission rate of **195.9 g/hr**.

Emission concentrations from all other ducts were below **5.0 mg/m^3**.

7.2.2 Volatile Organic Compounds

The maximum emission concentration measured from all the ducts monitored was **152.3 mg/m^3** from **Industrial Spraybooth 2 Stack A.** This corresponds to a mass emission rate of **1261.0 g/hr**. However, emission concentrations of VOC were generally high from all stacks on both Industrial Spraybooths 1 and 2 and also the **Red Oxide Spraybooth**.

Emission concentrations from all other ducts monitored were below 40 mg/m^3.

7.3 Solvent Emissions (Degreasing Processes)

7.3.1 Trichloroethylene – Large Degreaser

Trichloroethylene emission concentrations from both the short and long term samples were in exceedance of the Emission Limit Value (ELV) in the PG Note.

The **short term** sample yielded an emission concentration of **6316.9 mg/m^3** (as trike) which equates to a mass emission rate of **4026.6 g/hr**. This exceeds the ELV by a factor of over three thousand one hundred and forty.

Emission concentration over the **long term** were lower than the short term at **3563.4 mg/m^3** (as trike), or **2271.4 g/hr** as a mass emission rate, but still exceeding the ELV by more than a factor of one thousand seven hundred and eighty.

The **VOC profiling** of the process, shows that the peak emission concentrations occur shortly after the basket is placed in the tank at the start of the degreasing process.

7.3.2 Perchloroethylene – Aluminium Degreaser

Perchloroethylene emission concentrations from both the short and long term samples were in exceedance of the ELV in the PG Note of 20.0 mg/m^3.

The **short term** sample yielded an emission concentration of **6071.3 mg/m^3** (as perc) which equates to a mass emission rate of **2342.7 g/hr**. This exceeds the ELV by a factor of over three hundred.

Emission concentration over the **long term** were lower than the short term at **1338.9 mg/m^3** (as perc), or **516.6 g/hr** as a mass emission rate, but still exceeding the ELV by more than a factor of sixty six.

The **VOC profile** obtained from this unit highlights that the peak emission concentration occurs shortly after the basket is removed from the tank and the shutter closed.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The monitoring survey has demonstrated particulate matter emission concentrations to be below the specified limit of 50 mg/m^3 for all emission points.

Monitoring has demonstrated that the emission concentrations of VOC as trike from the Large Degreaser and perc from the Aluminium Degreaser exceed the relevant ELV as stated in the Solvent Emissions Directive section of PG 6/45 (04) (Ref. 9.2).

Due to the high levels of VOC emitted from the units, abatement in the form of carbon filters/beds would be recommended to assist in meeting the ELV.

The Solvent Emissions Directive requires that where installations fall under the Directive, certain actions are carried out within set timescales. Such timescales can be found in the DEFRA Guidance Document AQ6(04) (Ref. 9.7). From this document, the following timescales are assumed to apply to those processes detailed in this report to which the SED is applicable.

- Compliance with the applicable emission limit – *by* 31st October 2007;
- Compliance with the use of the SED reduction scheme – *from* 31st October 2005;
- Submission of a *substitution plan* to the Local Authority, regarding the substitution of designated Risk Phrase materials – *by* 19th May 2004.

It would appear that the date for the submission of the substitution plan has passed.

Where sample locations have been identified as not meeting the positional requirements of BS3405, the flow profile at the sample plane on all ducts, except Industrial Booth 1 Stack B, does meet the requirements of BS 9096 (Ref. 9.8). As BS 9096 (Ref. 9.8) is the method stated in PG 6/23 (04) (Ref. 9.1) for particulate measurements, there should be no problems in utilising these sample locations in future emissions surveys.

To remain compliant with the site Authorisation requirement for these stacks to be monitored annually, it is advised that the next survey should be scheduled for no later than December 2005.

9.0 REFERENCES

9.1 PG 6/23 (04) "*Secretary of State's Guidance Note for Coating of Metal and Plastic Processes*"

9.2 PG6/45 (04) "*Secretary of State's Guidance Note for Surface Cleaning*". HMSO.

9.3 BS 3405:1983 (1989) "*Measurement of particulate emission including grit and dust (simplified method)*". British Standards Institution.

9.4 BS EN 13649 (2002). "*Determination of Individual Organic Compounds.*" British Standards Institution.

9.5 BS EN 13526 (2002). "Determination of the mass concentration of total gaseous organic carbon in flue gases from solvent using processes. Continuous flame ionisation detector method." British Standards Institution.

9.6 Engineering Information Sheet No 34 "*Surface cleaning: Solvent update including the reclassification of trichloroethylene*" HSE.

9.7 AQ6(04) "How To Use The Process Guidance Notes for Solvent-Using Activities". DEFRA.

9.8 BS ISO 9096: 2003 "*Manual determination of mass concentration of particulate matter*" British Standards Institution.

APPENDIX A:

STACK CONDITIONS

TABLE A.1.1 STACK CONDITIONS

Parameter	Industrial Spraybooth 1	
	Stack A	Stack B
Internal Dimensions (m)	0.60	0.60
Cross Sectional Area (m^2)	0.28	0.28
Stack Temperature (°C)	22.0	22.0
Velocity (m/s)	7.1	9.9
Volume Flow at s.t.p. (m^3/s)	1.8	2.6

TABLE A.1.2 STACK CONDITIONS

Parameter	Industrial Spraybooth 2	
	Stack A	Stack B
Internal Dimensions (m)	0.60	0.60
Cross Sectional Area (m^2)	0.28	0.28
Stack Temperature (°C)	23.0	22.0
Velocity (m/s)	8.7	10.1
Volume Flow at s.t.p. (m^3/s)	2.3	2.6

TABLE A.1.3 STACK CONDITIONS

Parameter	New Spraybooth		
	LHS	MIDDLE	RHS
Internal Dimensions (m)	0.79	0.79	0.79
Cross Sectional Area (m^2)	0.49	0.49	0.49
Stack Temperature (°C)	20.0	20.0	20.0
Velocity (m/s)	12.0	11.7	8.7
Volume Flow at s.t.p. (m^3/s)	5.4	5.3	3.9

TABLE A.1.4 STACK CONDITIONS

Parameter	Red Oxide Spraybooth	Large Degreaser	Aluminium Degreaser
Internal Dimensions (m)	0.79	0.25	0.12
Cross Sectional Area (m^2)	0.49	0.05	0.01
Stack Temperature (°C)	22.0	21.0	22.0
Velocity (m/s)	11.9	3.9	10.5
Volume Flow at s.t.p. (m^3/s)	5.3	0.2	0.1

APPENDIX B:

SITE DATA

TABLE B.1.1

Preliminary Velocity and Temperature Survey

Date : 14-Dec-04
Duct: Industrial Booth 1 Stack A
Stack Internal Diameter / length (m) : 0.6

Client: Covrad
Client Site: Coventry
Port Depth: 9 cm

Job No.: FYS2993
Operators: GH/JR
Atmos. Press.: 101.1 kPa

Velocity (m/s) 7.1
Act. Volume Flow (m3/s) 2.0
S.t.p. Volume flow (m3/s) 1.8

	First Sampling Line			Second Sampling Line			
Sampling Point	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)	Sampling Point No.	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)
1	0.030	13.8	22	1	0.030	11.4	22
2	0.090	10.9	22	2	0.090	10.9	22
3	0.150	8.3	22	3	0.150	9.4	22
4	0.210	6.2	22	4	0.210	7.2	22
5	0.270	3.5	22	5	0.270	3.9	22
6	0.330	6.7	22	6	0.330	4.1	22
7	0.390	7.4	22	7	0.390	2.9	22
8	0.450	7.0	22	8	0.450	5.0	22
9	0.510	6.3	22	9	0.510	3.9	22
10	0.570	8.5	22	10	0.570	3.9	22
			Mean (1) 22.00				Mean (2) 22.00

Mean Flue Gas Temp (in K) Tp = ((Mean (1)+Mean (2))/2)+273) = 295
Permitted range of gas temperature readings (C) = (0.9Tp - 273) to (1.1Tp - 273) = -8 to 52
Highest Velocity Reading (either sampling line) (in m/s) = 13.8
Lowest Velocity Reading (either sampling line) (in m/s) = 2.9
Ratio Highest/Lowest (Max Permitted = 9:1) 4.8 :1

On Site Checklist	
Pitot Head at Right Angles ?	Y
Manometer Tube Leak Check ?	Y
Static Pressure <2.5kPa ?	Y
Range of Gas Temps OK ?	Y
8 Point sampling due to stack >2.5 m^2 ?	N
8 point sampling due to ratio >4:1 ?	N
4 or 8 point sampling for BS3405	4
Actual No sampling points	4

Pre Site Ckecklist	
Stopwatch Accuracy OK ?	Y
Manometer Intermediate Check OK ?	Y
Temp Indicator Intermediate check OK?	Y
Nozzle Condition OK ?	Y
Probe cleaned out ?	Y
Spare seals and gaskets loaded ?	Y
Pitot Leak Check OK ?	Y
Gas Flow Angle < 20deg ?	Y

Pitot Inspection	Pre	Post
Clear of Blockages	Y	Y
Ends not Damaged	Y	Y

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TABLE B.1.2 GAS VELOCITY AND TEMPERATURE READINGS

Client: Covrad
Client Site: Coventry
Operators: GH/JR

Duct: Industrial Booth 1 Stack A
Date : 14-Dec-04
Job Number : FYS2993

FIRST SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
A1	0.09	22	22	10.9	14.9
A2	0.51	22	22	6.3	6.3
B1	0.09	22	22	10.9	10.9
B2	0.51	22	22	3.9	3.9
		MEAN t1 22.00	MEAN t2 22.00		
		MEAN t 22			

SECOND SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
1	0.09	22	22	14.9	14.9
2	0.51	22	22	6.3	6.3
3	0.09	22	22	10.9	10.9
4	0.51	22	22	3.9	3.9
		MEAN t1 22.00	MEAN t2 22.00		
		MEAN t 22			

TABLE B.1.3 SAMPLING RECORD

Client: Covrad
Client Site: Coventry
Duct: Industrial Booth 1 Stack A
Date : 14-Dec-04

Sampling: Internal
Job Number : FYS2993
Carried out by : GH/JR

FIRST SAMPLE

Nozzle Diam: 0.0065 (m) = 0.00003 (m2) Area

SAMPLE POINT	NOZZLE AREA (m^2)	TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 30135.8	11:21	300	21.7	309197	85554	0.00039	Y
A2	1/ 30135.8		300	12.5				
A3	1/ 30135.8		300	21.7				
A4	1/ 30135.8		300	7.8				
	END	11:42			309505			

Total Vol Sampled: 308 Litres

SECOND SAMPLE

SAMPLE POINT	NOZZLE AREA (m^2)	START TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 30135.8	11:50	300	21.7	309505	89608	0.00048	Y
A2	1/ 30135.8		300	12.5				
A3	1/ 30135.8		300	21.7				
A4	1/ 30135.8		300	7.8				
	END	12:10			309812			

Total Vol Sampled: 307 Litres

TABLE B.1.4 **Calculation of Particulate Results**

Duct:	Industrial Booth 1 Stack A	Client:	Covrad
Job Number :	FYS2993	Client Site:	Coventry
Operators:	GH/JR		
Date :	14-Dec-04		

Sample No. 1

Time Started :	0.47
Nozzle Size :	1/ 30135.7767
Duration of Sample :	1200
Cross Sectional Area :	0.28278
Volume Sampled:	0.308

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	1.2662		P	=	101.10
	VFR	=	2.00	Where	M	=	0.00
					V	=	0.31
					K	=	295

Mass Emission (g / hr) = **9.10** Concentration (mg/Nm^3) = **1.37**

Sample No. 2

Time Started :	0.49
Nozzle Size :	1/ 30135.7767
Duration of Sample :	1200
Cross Sectional Area :	0.28278
Volume Sampled:	0.307

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	1.5635		P	=	101.10
	VFR	=	2.00	Where	M	=	0.00
					V	=	0.31
					K	=	295

Mass Emission (g / hr) = **11.24** Concentration (mg/Nm^3) = **1.69**

Oxygen Reference% = 1

Measured Oxygen % Run 1 = 1 Oxygen Correction Factor Run 1 = 1

Measured Oxygen % Run 2 = 1 Oxygen Correction Factor Run 2 = 1

Run 1 Oxygen Referenced Particulate Concentration = 1.3709814

Run 2 Oxygen Referenced Particulate Concentration = 1.692858

TABLE B.1.5 SUMMARY OF PARTICULATE RESULTS

Client:	Covrad	Job No.:	FYS2993
Client Site:	Coventry	Operators:	GH/JR
Duct:	Industrial Booth 1 Stack A	Date:	14-Dec-04

TYPE OF RESULT	Mass Rate Of Emission, M (g /hr)	Concentration, at 0 deg C (mg / m^3)
Result of First Sampling	9.1	1.4
Result of Second Sampling	11.2	1.7
Ratio of Higher Result to Lower Result	1.2 : 1	
Mean Result if Ratio is Not More Than 1.5 : 1	10.2	

Conformance with Main Procedural Requirements of BS 3405	
Requirement	Compliance ?
Water droplets absent	Y
Gas velocity positive and > 5 Pa	Y
Gas flow within + or - 20deg of flue axis	Y
Preliminary velocity profile meets Standard	Y
Preliminary temperature profile meets Standard	Y
Flue Dimensions Measured to accuracy of 10mm per metre	Y
Area of sampling apparatus < 10% of flue area	Y
Sampling plane > 1diameter from bend, obstruction or exit	Y
Sampling from 4 or 8 points as per Standard	4
Minimum sampling time 3 minutes per point	Y
Constant time(s) and nozzle area (mm2) for each sample point	Y
Post-sampling pitot readings differ from pre-sampling readings by < 10%	Y
Mass sampled >0.3% tare weight	Y
Ratio of two determinations of M < or = 1.5 : 1	Y
Total Expanded uncertainty (95% confidence interval)	53.66

Note: The Mass Emissions given above are calculated from stack gas pressures measured during particulate sampling and not from pressures measured during the Preliminary Velocity and Temperature Survey.

TABLE B.1.6 **VOC SAMPLING DATA**

Client	Covrad	Job No.	FYS2993
Site	Coventry	Date	14/12/2004
Stack	Industrial Booth 1 Stack A	Operators	GH/JR
Run No.	1 + 2	Authorised Signature	

Parameters	VOCs

		ZERO				SPAN - PROPANE			
Instrument	Serial No.	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish
VOC	FYS031	Air	0	0	2		100	100	101

RUN 1							RUN 2			
Time	VOC ppm						Time	VOC ppm		
11:21:00	104						11:50:00	96		
11:21:30	44						11:50:30	62		
11:22:00	26						11:51:00	237		
11:22:30	36						11:51:30	53		
11:23:00	63						11:52:00	0		
11:23:30	47						11:52:30	2		
11:24:00	40						11:53:00	0		
11:24:30	21						11:53:30	0		
11:25:00	8						11:54:00	2		
11:25:30	2						11:54:30	7		
11:26:00	1						11:55:00	2		
11:26:30	2						11:55:30	11		
11:27:00	3						11:56:00	4		
11:27:30	2						11:56:30	33		
11:28:00	0						11:57:00	43		
11:28:30	5						11:57:30	11		
11:29:00	0						11:58:00	14		
11:29:30	0						11:58:30	15		
11:30:00	0						11:59:00	3		
11:30:30	1						11:59:30	3		
11:31:00	24						12:00:00	5		
11:31:30	24						12:00:30	10		
11:32:00	5						12:01:00	6		
11:32:30	0						12:01:30	4		
11:33:00	20						12:02:00	6		
11:33:30	0						12:02:30	6		
11:34:00	0						12:03:00	4		
11:34:30	0						12:03:30	4		
11:35:00	0						12:04:00	4		
11:35:30	12						12:04:30	3		

TABLE B.2.1

Preliminary Velocity and Temperature Survey

Date : 14-Dec-04
Duct: Industrial Booth 1 Stack B
Stack Internal Diameter / length (m) : 0.6

Client: Covrad
Client Site: Coventry
Port Depth: 9 cm

Job No.: FYS2993
Operators: GH/JR
Atmos. Press.: 101.1 kPa

Velocity (m/s) 9.9
Act. Volume Flow (m3/s) 2.8
S.t.p. Volume flow (m3/s) 2.6

	First Sampling Line			Second Sampling Line			
Sampling Point	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)	Sampling Point No.	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)
1	0.030	14.9	22	1	0.030	14.2	22
2	0.090	12.7	22	2	0.090	13.1	22
3	0.150	12.0	22	3	0.150	12.8	22
4	0.210	10.8	22	4	0.210	11.7	22
5	0.270	9.4	22	5	0.270	10.6	22
6	0.330	9.4	22	6	0.330	8.2	22
7	0.390	11.2	22	7	0.390	5.9	22
8	0.450	11.2	22	8	0.450	4.7	22
9	0.510	10.9	22	9	0.510	3.9	22
10	0.570	10.8	22	10	0.570	0	22
			Mean (1) 22.00				Mean (2) 22.00

Mean Flue Gas Temp (in K) Tp = ((Mean (1)+Mean (2))/2)+273) = 295
Permitted range of gas temperature readings (C) = (0.9Tp - 273) to (1.1Tp - 273) = -8 to 52
Highest Velocity Reading (either sampling line) (in m/s) = 14.9
Lowest Velocity Reading (either sampling line) (in m/s) = 0
Ratio Highest/Lowest (Max Permitted = 9:1) Exceeds Limit

On Site Checklist	
Pitot Head at Right Angles ?	Y
Manometer Tube Leak Check ?	Y
Static Pressure <2.5kPa ?	Y
Range of Gas Temps OK ?	Y
8 Point sampling due to stack >2.5 m^2 ?	N
8 point sampling due to ratio >4:1 ?	N
4 or 8 point sampling for BS3405	4
Actual No sampling points	4

Pre Site Ckecklist	
Stopwatch Accuracy OK ?	Y
Manometer Intermediate Check OK ?	Y
Temp Indicator Intermediate check OK?	Y
Nozzle Condition OK ?	Y
Probe cleaned out ?	Y
Spare seals and gaskets loaded ?	Y
Pitot Leak Check OK ?	Y
Gas Flow Angle < 20deg ?	Y

Pitot Inspection	Pre	Post
Clear of Blockages	Y	Y
Ends not Damaged	Y	Y

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TABLE B.2.2 GAS VELOCITY AND TEMPERATURE READINGS

Client: Covrad
Client Site: Coventry
Operators: GH/JR

Duct: Industrial Booth 1 Stack B
Date : 14-Dec-04
Job Number : FYS2993

FIRST SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
A1	0.09	22	22	14.9	14.9
A2	0.51	22	22	12.0	12.0
B1	0.09	22	22	11.2	11.2
B2	0.51	22	22	12.8	12.8
		MEAN t1 22.00	MEAN t2 22.00		
		MEAN t 22			

SECOND SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
1	0.09	22	22	14.9	14.9
2	0.51	22	22	12.0	12.0
3	0.09	22	22	11.2	11.2
4	0.51	22	22	12.8	12.8
		MEAN t1 22.00	MEAN t2 22.00		
		MEAN t 22			

TABLE B.2.3 SAMPLING RECORD

Client: Covrad
Client Site: Coventry
Duct: Industrial Booth 1 Stack B
Date : 14-Dec-04

Sampling: Internal
Job Number : FYS2993
Carried out by : GH/JR

FIRST SAMPLE

Nozzle Diam: 0.007 (m) = 0.00003 (m2) Area

SAMPLE POINT	NOZZLE AREA (m^2)	TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 30135.8	10:22	300	29.7	308297	89611	0.00082	Y
A2	1/ 30135.8		300	23.9				
A3	1/ 30135.8		300	22.3				
A4	1/ 30135.8		300	21.5				
	END	10:42			308739			
			Total Vol Sampled:		442	Litres		

SECOND SAMPLE

SAMPLE POINT	NOZZLE AREA (m^2)	START TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 30135.8	10:48	300	29.7	308739	89606	0.00057	Y
A2	1/ 30135.8		300	23.9				
A3	1/ 30135.8		300	22.3				
A4	1/ 30135.8		300	21.5	309197			
	END	11:08						
			Total Vol Sampled:		458	Litres		

TABLE B.2.4 **Calculation of Particulate Results**

Duct:	Industrial Booth 1 Stack B	Client:	Covrad
Job Number :	FYS2993	Client Site:	Coventry
Operators:	GH/JR		
Date :	14-Dec-04		

Sample No. 1

Time Started :	0.43
Nozzle Size :	1/ 30135.7767
Duration of Sample :	1200
Cross Sectional Area :	0.28278
Volume Sampled:	0.442

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	1.8552		P	=	101.10
	VFR	=	2.81	Where	M	=	0.00
					V	=	0.44
					K	=	295

Mass Emission (g / hr) = **18.74** Concentration (mg/Nm^3) = **2.01**

Sample No. 2

Time Started :	0.45
Nozzle Size :	1/ 30135.7767
Duration of Sample :	1200
Cross Sectional Area :	0.28278
Volume Sampled:	0.458

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	1.2445		P	=	101.10
	VFR	=	2.81	Where	M	=	0.00
					V	=	0.46
					K	=	295

Mass Emission (g / hr) = **12.57** Concentration (mg/Nm^3) = **1.35**

Oxygen Reference% = 1

Measured Oxygen % Run 1 = 1 Oxygen Correction Factor Run 1 = 1

Measured Oxygen % Run 2 = 1 Oxygen Correction Factor Run 2 = 1

Run 1 Oxygen Referenced Particulate Concentration = 2.008673

Run 2 Oxygen Referenced Particulate Concentration = 1.3474946

TABLE B.2.5 SUMMARY OF PARTICULATE RESULTS

Client:	Covrad	Job No.:	FYS2993
Client Site:	Coventry	Operators:	GH/JR
Duct:	Industrial Booth 1 Stack B	Date:	14-Dec-04

TYPE OF RESULT	Mass Rate Of Emission, M (g /hr)	Concentration, at 0 deg C (mg / m^3)
Result of First Sampling	18.7	2.0
Result of Second Sampling	12.6	1.3
Ratio of Higher Result to Lower Result	1.5 : 1	
Mean Result if Ratio is Not More Than 1.5 : 1	15.7	

Conformance with Main Procedural Requirements of BS 3405	
Requirement	Compliance ?
Water droplets absent	Y
Gas velocity positive and > 5 Pa	Y
Gas flow within + or - 20deg of flue axis	Y
Preliminary velocity profile meets Standard	N
Preliminary temperature profile meets Standard	Y
Flue Dimensions Measured to accuracy of 10mm per metre	Y
Area of sampling apparatus < 10% of flue area	Y
Sampling plane > 1diameter from bend, obstruction or exit	Y
Sampling from 4 or 8 points as per Standard	4
Minimum sampling time 3 minutes per point	Y
Constant time(s) and nozzle area (mm2) for each sample point	Y
Post-sampling pitot readings differ from pre-sampling readings by < 10%	Y
Mass sampled >0.3% tare weight	Y
Ratio of two determinations of M < or = 1.5 : 1	Y
Total Expanded uncertainty (95% confidence interval)	57.13

Note: The Mass Emissions given above are calculated from stack gas pressures measured during particulate sampling and not from pressures measured during the Preliminary Velocity and Temperature Survey.

TABLE B.2.6 **VOC SAMPLING DATA**

Client	Covrad	Job No.	FYS2993
Site	Coventry	Date	14/12/2004
Stack	Industrial Booth 1 Stack B	Operators	GH/JR
Run No.	1 + 2	Authorised Signature	

Parameters	VOCs

		ZERO				SPAN - PROPANE			
Instrument	Serial No.	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish
VOC	FYS031	Air	0	0	2		100	100	101

RUN 1							RUN 2			
Time	VOC ppm						Time	VOC ppm		
10:22:00	2						10:47:00	14		
10:22:30	96						10:47:30	120		
10:23:00	147						10:48:00	20		
10:23:30	106						10:48:30	57		
10:24:00	49						10:49:00	71		
10:24:30	61						10:49:30	85		
10:25:00	51						10:50:00	15		
10:25:30	31						10:50:30	25		
10:26:00	38						10:51:00	22		
10:26:30	113						10:51:30	40		
10:27:00	279						10:52:00	252		
10:27:30	111						10:52:30	195		
10:28:00	42						10:53:00	279		
10:28:30	20						10:53:30	49		
10:29:00	48						10:54:00	20		
10:29:30	28						10:54:30	48		
10:30:00	82						10:55:00	59		
10:30:30	50						10:55:30	85		
10:31:00	41						10:56:00	74		
10:31:30	68						10:56:30	72		
10:32:00	95						10:57:00	47		
10:32:30	62						10:57:30	20		
10:33:00	35						10:58:00	18		
10:33:30	35						10:58:30	31		
10:34:00	29						10:59:00	16		
10:34:30	30						10:59:30	11		
10:35:00	18						11:00:00	12		
10:35:30	15						11:00:30	12		
10:36:00	11						11:01:00	9		
10:36:30	8						11:01:30	2		

TABLE B.3.1

Preliminary Velocity and Temperature Survey

Date : 13-Dec-04
Duct: Industrial Booth 2 Stack A
Stack Internal Diameter / length (m) : 0.6

Client: Covrad
Client Site: Coventry
Port Depth: 9 cm

Job No.: FYS2993
Operators: GH/JR
Atmos. Press.: 101.6 kPa

Velocity (m/s) 8.7
Act. Volume Flow (m3/s) 2.5
S.t.p. Volume flow (m3/s) 2.3

	First Sampling Line			Second Sampling Line			
Sampling Point	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)	Sampling Point No.	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)
1	0.030	9.5	23	1	0.030	7.8	23
2	0.090	9.4	23	2	0.090	7.1	23
3	0.150	9.4	23	3	0.150	6.9	23
4	0.210	9.9	23	4	0.210	0	23
5	0.270	9.4	23	5	0.270	7.3	23
6	0.330	9.2	23	6	0.330	8.5	23
7	0.390	8.9	23	7	0.390	9.3	23
8	0.450	9.1	23	8	0.450	10.8	23
9	0.510	9.8	23	9	0.510	10.9	23
10	0.570	10.3	23	10	0.570	10.1	23
			Mean (1) 23.00				Mean (2) 23.00

Mean Flue Gas Temp (in K) Tp = ((Mean (1)+Mean (2))/2)+273) = 296
Permitted range of gas temperature readings (C) = (0.9Tp - 273) to (1.1Tp - 273) = -7 to 53
Highest Velocity Reading (either sampling line) (in m/s) = 10.9
Lowest Velocity Reading (either sampling line) (in m/s) = 0
Ratio Highest/Lowest (Max Permitted = 9:1) N/A

On Site Checklist	
Pitot Head at Right Angles ?	Y
Manometer Tube Leak Check ?	Y
Static Pressure <2.5kPa ?	Y
Range of Gas Temps OK ?	Y
8 Point sampling due to stack >2.5 m^2 ?	N
8 point sampling due to ratio >4:1 ?	N
4 or 8 point sampling for BS3405	4
Actual No sampling points	4

Pre Site Ckecklist	
Stopwatch Accuracy OK ?	Y
Manometer Intermediate Check OK ?	Y
Temp Indicator Intermediate check OK?	Y
Nozzle Condition OK ?	Y
Probe cleaned out ?	Y
Spare seals and gaskets loaded ?	Y
Pitot Leak Check OK ?	Y
Gas Flow Angle < 20deg ?	Y

Pitot Inspection	Pre	Post
Clear of Blockages	Y	Y
Ends not Damaged	Y	Y

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TABLE B.3.2 GAS VELOCITY AND TEMPERATURE READINGS

Client: Covrad
Client Site: Coventry
Operators: GH/JR

Duct: Industrial Booth 2 Stack A
Date : 13-Dec-04
Job Number : FYS2993

FIRST SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
1	0.09	22	22	9.4	9.4
2	0.51	22	22	9.8	9.8
3	0.09	22	22	7.1	7.1
4	0.51	22	22	10.9	10.9
		MEAN t1 22.00	MEAN t2 22.00		
		MEAN t 22			

SECOND SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
1	0.09	22	22	9.4	9.4
2	0.51	22	22	9.8	9.8
3	0.09	22	22	7.1	7.1
4	0.51	22	22	10.9	10.9
		MEAN t1 22.00	MEAN t2 22.00		
		MEAN t 22			

TABLE B.3.3

SAMPLING RECORD

Client: Covrad
Client Site: Coventry
Duct: Industrial Booth 2 Stack A
Date : 13-Dec-04

Sampling: Internal
Job Number : FYS2993
Carried out by : GH/JR

FIRST SAMPLE

Nozzle Diam: 0.007 (m) = 0.00003 (m2) Area

SAMPLE POINT	NOZZLE AREA (m^2)	TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 30135.8	12:27	300	18.7	307279	89610	0.00144	Y
A2	1/ 30135.8		300	19.5				
B1	1/ 30135.8		300	14.1				
B2	1/ 30135.8		300	21.7				
	END	12:48			307623			

Total Vol Sampled: 344 Litres

SECOND SAMPLE

SAMPLE POINT	NOZZLE AREA (m^2)	START TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 30135.8	13:35	300	18.7	307623	89607	0.0007	Y
A2	1/ 30135.8		300	19.5				
B1	1/ 30135.8		300	14.1				
B2	1/ 30135.8		300	21.7				
	END	13:56			307967			

Total Vol Sampled: 344 Litres

TABLE B.3.4 **Calculation of Particulate Results**

Duct:	Industrial Booth 2 Stack A	Client:	Covrad
Job Number :	FYS2993	Client Site:	Coventry
Operators:	GH/JR		
Date :	13-Dec-04		

Sample No. 1

Time Started :	0.52
Nozzle Size :	1/ 30135.7767
Duration of Sample :	1200
Cross Sectional Area :	0.28278
Volume Sampled:	0.344

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	4.1860		P	=	101.60
	VFR	=	2.45	Where	M	=	0.00
					V	=	0.34
					K	=	295

Mass Emission (g / hr) = **36.99**

Concentration (mg/Nm^3) = **4.51**

Sample No. 2

Time Started :	0.57
Nozzle Size :	1/ 30135.7767
Duration of Sample :	1200
Cross Sectional Area :	0.28278
Volume Sampled:	0.344

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	2.0349		P	=	101.60
	VFR	=	2.45	Where	M	=	0.00
					V	=	0.34
					K	=	295

Mass Emission (g / hr) = **17.98**

Concentration (mg/Nm^3) = **2.19**

Oxygen Reference% = 1

Measured Oxygen % Run 1 = 1

Oxygen Correction Factor Run 1 = 1

Measured Oxygen % Run 2 = 1

Oxygen Correction Factor Run 2 = 1

Run 1 Oxygen Referenced Particulate Concentration = 4.5100271

Run 2 Oxygen Referenced Particulate Concentration = 2.1923743

TABLE B.3.5 SUMMARY OF PARTICULATE RESULTS

Client:	Covrad	Job No.:	FYS2993
Client Site:	Coventry	Operators:	GH/JR
Duct:	Industrial Booth 2 Stack A	Date:	13-Dec-04

TYPE OF RESULT	Mass Rate Of Emission, M (g /hr)	Concentration, at 0 deg C (mg / m^3)
Result of First Sampling	37.0	4.5
Result of Second Sampling	18.0	2.2
Ratio of Higher Result to Lower Result	2.1 : 1	
Mean Result if Ratio is Not More Than 1.5 : 1	N/A	

Conformance with Main Procedural Requirements of BS 3405	
Requirement	Compliance ?
Water droplets absent	Y
Gas velocity positive and > 5 Pa	Y
Gas flow within + or - 20deg of flue axis	Y
Preliminary velocity profile meets Standard	N
Preliminary temperature profile meets Standard	Y
Flue Dimensions Measured to accuracy of 10mm per metre	Y
Area of sampling apparatus < 10% of flue area	Y
Sampling plane > 1diameter from bend, obstruction or exit	Y
Sampling from 4 or 8 points as per Standard	4
Minimum sampling time 3 minutes per point	Y
Constant time(s) and nozzle area (mm2) for each sample point	Y
Post-sampling pitot readings differ from pre-sampling readings by < 10%	Y
Mass sampled >0.3% tare weight	Y
Ratio of two determinations of M < or = 1.5 : 1	N
Total Expanded uncertainty (95% confidence interval)	41.56

Note: The Mass Emissions given above are calculated from stack gas pressures measured during particulate sampling and not from pressures measured during the Preliminary Velocity and Temperature Survey.

TABLE B.3.6 **VOC SAMPLING DATA**

Client	Covrad	Job No.	FYS2993
Site	Coventry	Date	13/12/2004
Stack	Industrial Booth 2 Stack A	Operators	GH/JR
Run No.	1 + 2	Authorised Signature	

Parameters	VOCs

		ZERO				SPAN - PROPANE			
Instrument	Serial No.	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish
VOC	FYS031	Air	0	0	0		100	100	102

RUN 1							RUN 2			
Time	VOC ppm						Time	VOC ppm		
12:34:29	41						13:41:10	114		
12:34:59	25						13:41:40	380		
12:35:29	7						13:42:10	46		
12:35:59	12						13:42:40	178		
12:36:29	13						13:43:10	128		
12:36:59	21						13:43:40	10		
12:37:29	17						13:44:10	1		
12:37:59	12						13:44:40	115		
12:38:29	210						13:45:10	198		
12:38:59	218						13:45:40	67		
12:39:29	47						13:46:10	222		
12:39:59	36						13:46:40	164		
12:40:29	51						13:47:10	80		
12:40:59	124						13:47:40	24		
12:41:29	103						13:48:10	29		
12:41:59	107						13:48:40	46		
12:42:29	126						13:49:10	22		
12:42:59	30						13:49:40	15		
12:43:29	72						13:50:10	9		
12:43:59	27						13:50:40	5		
12:44:29	412						13:51:10	9		
12:44:59	365						13:51:40	1		
12:45:29	88						13:52:10	1		
12:45:59	195						13:52:40	1		
12:46:29	96						13:53:10	1		
12:46:59	53						13:53:40	1		
12:47:29	65						13:54:10	1		
12:47:59	72						13:54:40	1		
12:48:29	112						13:55:10	82		
12:48:59	86						13:55:40	36		

TABLE B.4.1

Preliminary Velocity and Temperature Survey

Date : 13-Dec-04
Duct: Industrial Booth 2 Stack B
Stack Internal Diameter / length (m) : 0.6

Client: Covrad
Client Site: Coventry
Port Depth: 9 cm

Job No.: FYS2993
Operators: GH/JR
Atmos. Press.: 101.6 kPa

Velocity (m/s) 10.1
Act. Volume Flow (m3/s) 2.9
S.t.p. Volume flow (m3/s) 2.6

	First Sampling Line			Second Sampling Line			
Sampling Point	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)	Sampling Point No.	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)
1	0.030	11.4	23	1	0.030	10.7	23
2	0.090	11.1	23	2	0.090	10.7	23
3	0.150	10.8	23	3	0.150	10.8	23
4	0.210	10.4	23	4	0.210	10.8	23
5	0.270	10.2	23	5	0.270	10.8	23
6	0.330	9.9	23	6	0.330	10.7	23
7	0.390	9.9	23	7	0.390	10.1	23
8	0.450	9.2	23	8	0.450	10.0	23
9	0.510	9.2	23	9	0.510	9.3	23
10	0.570	7.8	23	10	0.570	8.5	23
			Mean (1) 23.00				Mean (2) 23.00

Mean Flue Gas Temp (in K) Tp = ((Mean (1)+Mean (2))/2)+273) = 296
Permitted range of gas temperature readings (C) = (0.9Tp - 273) to (1.1Tp - 273) = -7 to 53
Highest Velocity Reading (either sampling line) (in m/s) = 11.4
Lowest Velocity Reading (either sampling line) (in m/s) = 7.8
Ratio Highest/Lowest (Max Permitted = 9:1) 1.5 :1

On Site Checklist	
Pitot Head at Right Angles ?	Y
Manometer Tube Leak Check ?	Y
Static Pressure <2.5kPa ?	Y
Range of Gas Temps OK ?	Y
8 Point sampling due to stack >2.5 m^2 ?	N
8 point sampling due to ratio >4:1 ?	N
4 or 8 point sampling for BS3405	4
Actual No sampling points	4

Pre Site Ckecklist	
Stopwatch Accuracy OK ?	Y
Manometer Intermediate Check OK ?	Y
Temp Indicator Intermediate check OK?	Y
Nozzle Condition OK ?	Y
Probe cleaned out ?	Y
Spare seals and gaskets loaded ?	Y
Pitot Leak Check OK ?	Y
Gas Flow Angle < 20deg ?	Y

Pitot Inspection	Pre	Post
Clear of Blockages	Y	Y
Ends not Damaged	Y	Y

TABLE B.4.2 GAS VELOCITY AND TEMPERATURE READINGS

Client: Covrad
Client Site: Coventry
Operators: GH/JR

Duct: Industrial Booth 2 Stack B
Date : 13-Dec-04
Job Number : FYS2993

FIRST SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
A1	0.09	22	22	11.1	11.1
A2	0.51	22	22	9.2	9.2
B1	0.09	22	22	10.7	10.7
B2	0.51	22	22	9.3	9.3
		MEAN t1 22.00	MEAN t2 22.00		
		MEAN t 22			

SECOND SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
1	0.09	22	22	11.1	11.1
2	0.51	22	22	9.2	9.2
3	0.09	22	22	10.7	10.7
4	0.51	22	22	9.3	9.3
		MEAN t1 22.00	MEAN t2 22.00		
		MEAN t 22			

TABLE B.4.3 SAMPLING RECORD

Client: Covrad
Client Site: Coventry
Duct: Industrial Booth 2 Stack B
Date : 13-Dec-04

Sampling: Internal
Job Number : FYS2993
Carried out by : GH/JR

FIRST SAMPLE

Nozzle Diam: 0.007 (m) = 0.00003 (m2) Area

SAMPLE POINT	NOZZLE AREA (m^2)	TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 30135.8	11:17	300	22.1	306526	89613	0.00092	Y
A2	1/ 30135.8		300	18.3				
B1	1/ 30135.8		300	21.3				
B2	1/ 30135.8		300	18.5	306900			
	END	11:38						

Total Vol Sampled: 374 Litres

SECOND SAMPLE

SAMPLE POINT	NOZZLE AREA (m^2)	START TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 30135.8	11:46	300	22.1	306900	89612	0.00068	Y
A2	1/ 30135.8		300	18.3				
B1	1/ 30135.8		300	21.3				
B2	1/ 30135.8		300	18.5	307279			
	END	12:07						

Total Vol Sampled: 379 Litres

TABLE B.4.4 **Calculation of Particulate Results**

Duct:	Industrial Booth 2 Stack B	Client:	Covrad
Job Number :	FYS2993	Client Site:	Coventry
Operators:	GH/JR		
Date :	13-Dec-04		

Sample No. 1

Time Started :	0.47
Nozzle Size :	1/ 30135.7767
Duration of Sample :	1200
Cross Sectional Area :	0.28278
Volume Sampled:	0.374

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	2.4599		P	=	101.60
	VFR	=	2.86	Where	M	=	0.00
					V	=	0.37
					K	=	295

Mass Emission (g / hr) = **25.33** Concentration (mg/Nm^3) = **2.65**

Sample No. 2

Time Started :	0.49
Nozzle Size :	1/ 30135.7767
Duration of Sample :	1200
Cross Sectional Area :	0.28278
Volume Sampled:	0.379

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	1.7942		P	=	101.60
	VFR	=	2.86	Where	M	=	0.00
					V	=	0.38
					K	=	295

Mass Emission (g / hr) = **18.48** Concentration (mg/Nm^3) = **1.93**

Oxygen Reference% = 1

Measured Oxygen % Run 1 = 1 Oxygen Correction Factor Run 1 = 1

Measured Oxygen % Run 2 = 1 Oxygen Correction Factor Run 2 = 1

Run 1 Oxygen Referenced Particulate Concentration = 2.6502774

Run 2 Oxygen Referenced Particulate Concentration = 1.9330577

TABLE B.4.5 SUMMARY OF PARTICULATE RESULTS

Client:	Covrad	Job No.:	FYS2993
Client Site:	Coventry	Operators:	GH/JR
Duct:	Industrial Booth 2 Stack B	Date:	13-Dec-04

TYPE OF RESULT	Mass Rate Of Emission, M (g /hr)	Concentration, at 0 deg C (mg / m^3)
Result of First Sampling	25.3	2.7
Result of Second Sampling	18.5	1.9
Ratio of Higher Result to Lower Result	1.4 : 1	
Mean Result if Ratio is Not More Than 1.5 : 1	21.9	

Conformance with Main Procedural Requirements of BS 3405	
Requirement	Compliance ?
Water droplets absent	Y
Gas velocity positive and > 5 Pa	Y
Gas flow within + or - 20deg of flue axis	Y
Preliminary velocity profile meets Standard	Y
Preliminary temperature profile meets Standard	Y
Flue Dimensions Measured to accuracy of 10mm per metre	Y
Area of sampling apparatus < 10% of flue area	Y
Sampling plane > 1diameter from bend, obstruction or exit	Y
Sampling from 4 or 8 points as per Standard	4
Minimum sampling time 3 minutes per point	Y
Constant time(s) and nozzle area (mm2) for each sample point	Y
Post-sampling pitot readings differ from pre-sampling readings by < 10%	Y
Mass sampled >0.3% tare weight	Y
Ratio of two determinations of M < or = 1.5 : 1	Y
Total Expanded uncertainty (95% confidence interval)	36.65

Note: The Mass Emissions given above are calculated from stack gas pressures measured during particulate sampling and not from pressures measured during the Preliminary Velocity and Temperature Survey.

TABLE B.4.6 **VOC SAMPLING DATA**

Client	Covrad	Job No.	FYS2993
Site	Coventry	Date	13/12/2004
Stack	Industrial Booth 2 Stack B	Operators	GH/JR
Run No.	1 + 2	Authorised Signature	

Parameters	VOCs

Instrument	Serial No.	ZERO				SPAN - PROPANE			
		Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish
VOC	FYS031	Air	0	0	0		100	100	102

RUN 1							RUN 2			
Time	VOC ppm						Time	VOC ppm		
11:16:00	50						11:46:00	77		
11:16:30	287						11:46:30	158		
11:17:00	280						11:47:00	110		
11:17:30	55						11:47:30	207		
11:18:00	25						11:48:00	140		
11:18:30	115						11:48:30	54		
11:19:00	32						11:49:00	106		
11:19:30	15						11:49:30	80		
11:20:00	13						11:50:00	76		
11:20:30	30						11:50:30	36		
11:21:00	92						11:51:00	30		
11:21:30	62						11:51:30	29		
11:22:00	65						11:52:00	27		
11:22:30	25						11:52:30	13		
11:23:00	26						11:53:00	15		
11:23:30	23						11:53:30	10		
11:24:00	23						11:54:00	11		
11:24:30	27						11:54:30	5		
11:25:00	56						11:55:00	23		
11:25:30	102						11:55:30	20		
11:26:00	103						11:56:00	26		
11:26:30	155						11:56:30	89		
11:27:00	150						11:57:00	84		
11:27:30	108						11:57:30	82		
11:28:00	56						11:58:00	46		
11:28:30	35						11:58:30	48		
11:29:00	32						11:59:00	38		
11:29:30	80						11:59:30	175		
11:30:00	65						12:00:00	165		
11:30:30	56						12:00:30	68		

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TABLE B.5.1

Preliminary Velocity and Temperature Survey

Date : 15-Dec-04
Duct: New Spray Booth LHS
Stack Internal Diameter / length (m) : 0.79

Client: Covrad
Client Site: Coventry
Port Depth: 9 cm

Job No.: FYS2993
Operators: GH/JR
Atmos. Press.: 100.5 kPa

Velocity (m/s) 12.0
Act. Volume Flow (m3/s) 5.9
S.t.p. Volume flow (m3/s) 5.4

	First Sampling Line			Second Sampling Line			
Sampling Point	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)	Sampling Point No.	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)
1	0.040	10.4	20	1	0.040	17.2	20
2	0.119	11.1	20	2	0.119	14.1	20
3	0.198	11.3	20	3	0.198	12.8	20
4	0.277	12.1	20	4	0.277	11.8	20
5	0.356	12.3	20	5	0.356	11.5	20
6	0.435	11.7	20	6	0.435	11.1	20
7	0.514	12.1	20	7	0.514	11.3	20
8	0.593	12.7	20	8	0.593	10.0	20
9	0.672	13.7	20	9	0.672	9.5	20
10	0.751	13.9	20	10	0.751	9.6	20
			Mean (1) 20.00				Mean (2) 20.00

Mean Flue Gas Temp (in K) Tp = ((Mean (1)+Mean (2))/2)+273) = 293
Permitted range of gas temperature readings (C) = (0.9Tp - 273) to (1.1Tp - 273) = -9 to 49
Highest Velocity Reading (either sampling line) (in m/s) = 17.2
Lowest Velocity Reading (either sampling line) (in m/s) = 9.5
Ratio Highest/Lowest (Max Permitted = 9:1) 1.8 :1

On Site Checklist	
Pitot Head at Right Angles ?	Y
Manometer Tube Leak Check ?	Y
Static Pressure <2.5kPa ?	Y
Range of Gas Temps OK ?	Y
8 Point sampling due to stack >2.5 m^2 ?	N
8 point sampling due to ratio >4:1 ?	N
4 or 8 point sampling for BS3405	4
Actual No sampling points	4

Pre Site Ckecklist	
Stopwatch Accuracy OK ?	Y
Manometer Intermediate Check OK ?	Y
Temp Indicator Intermediate check OK?	Y
Nozzle Condition OK ?	Y
Probe cleaned out ?	Y
Spare seals and gaskets loaded ?	Y
Pitot Leak Check OK ?	Y
Gas Flow Angle < 20deg ?	Y

Pitot Inspection	Pre	Post
Clear of Blockages	Y	Y
Ends not Damaged	Y	Y

TABLE B.5.2 GAS VELOCITY AND TEMPERATURE READINGS

Client: Covrad
Client Site: Coventry
Operators: GH/JR

Duct: New Spray Booth LHS
Date : 15-Dec-04
Job Number : FYS2993

FIRST SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
A1	0.12	20	20	11.1	11.1
A2	0.67	20	20	13.7	13.7
B1	0.12	20	20	14.1	14.1
B2	0.67	20	20	9.5	9.5
		MEAN t1 20.00	MEAN t2 20.00		
		MEAN t 20			

SECOND SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
1	0.12	20	20	11.1	11.1
2	0.67	20	20	13.7	13.7
3	0.12	20	20	14.1	14.1
4	0.67	20	20	9.5	9.5
		MEAN t1 20.00	MEAN t2 20.00		
		MEAN t 20			

TABLE B.5.3 SAMPLING RECORD

Client: Covrad
Client Site: Coventry
Duct: New Spray Booth LHS
Date : 15-Dec-04

Sampling: Internal
Job Number : FYS2993
Carried out by : GH/JR

FIRST SAMPLE

Nozzle Diam: 0.0060 (m) = 0.00003 (m2) Area

SAMPLE POINT	NOZZLE AREA (m^2)	TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 35367.7	13:37	240	18.8	310969	85551	0.00068	Y
A2	1/ 35367.7		240	23.2				
B1	1/ 35367.7		240	23.8				
B2	1/ 35367.7		240	16.1				
	END	13:54			311264			

Total Vol Sampled: 295 Litres

SECOND SAMPLE

SAMPLE POINT	NOZZLE AREA (m^2)	START TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 35367.7	13:57	240	18.8	311264	85560	0.00065	Y
A2	1/ 35367.7		240	23.2				
B1	1/ 35367.7		240	23.8				
B2	1/ 35367.7		240	16.1				
	END	14:14			311569			

Total Vol Sampled: 305 Litres

TABLE B.5.4 **Calculation of Particulate Results**

Duct:	New Spray Booth LHS	Client:	Covrad
Job Number :	FYS2993	Client Site:	Coventry
Operators:	GH/JR		
Date :	15-Dec-04		

Sample No. 1

Time Started :	0.57
Nozzle Size :	1/ 35367.6824
Duration of Sample :	960
Cross Sectional Area :	0.49023055
Volume Sampled:	0.295

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	2.3051		P	=	100.50
	VFR	=	5.89	Where	M	=	0.00
					V	=	0.30
					K	=	293

Mass Emission (g / hr) = **48.86** Concentration (mg/Nm^3) = **2.49**

Sample No. 2

Time Started :	0.58
Nozzle Size :	1/ 35367.6824
Duration of Sample :	960
Cross Sectional Area :	0.49023055
Volume Sampled:	0.305

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	2.1311		P	=	100.50
	VFR	=	5.89	Where	M	=	0.00
					V	=	0.31
					K	=	293

Mass Emission (g / hr) = **45.17** Concentration (mg/Nm^3) = **2.31**

Oxygen Reference% = 1

Measured Oxygen % Run 1 = 1 Oxygen Correction Factor Run 1 = 1

Measured Oxygen % Run 2 = 1 Oxygen Correction Factor Run 2 = 1

Run 1 Oxygen Referenced Particulate Concentration = 2.4936486

Run 2 Oxygen Referenced Particulate Concentration = 2.3054827

TABLE B.5.5 SUMMARY OF PARTICULATE RESULTS

Client:	Covrad	Job No.:	FYS2993
Client Site:	Coventry	Operators:	GH/JR
Duct:	New Spray Booth LHS	Date:	15-Dec-04

TYPE OF RESULT	Mass Rate Of Emission, M (g /hr)	Concentration, at 0 deg C (mg / m^3)
Result of First Sampling	48.9	2.5
Result of Second Sampling	45.2	2.3
Ratio of Higher Result to Lower Result	1.1 : 1	
Mean Result if Ratio is Not More Than 1.5 : 1	47.0	

Conformance with Main Procedural Requirements of BS 3405	
Requirement	Compliance ?
Water droplets absent	Y
Gas velocity positive and > 5 Pa	Y
Gas flow within + or - 20deg of flue axis	Y
Preliminary velocity profile meets Standard	Y
Preliminary temperature profile meets Standard	Y
Flue Dimensions Measured to accuracy of 10mm per metre	Y
Area of sampling apparatus < 10% of flue area	Y
Sampling plane > 1diameter from bend, obstruction or exit	Y
Sampling from 4 or 8 points as per Standard	4
Minimum sampling time 3 minutes per point	Y
Constant time(s) and nozzle area (mm2) for each sample point	Y
Post-sampling pitot readings differ from pre-sampling readings by < 10%	Y
Mass sampled >0.3% tare weight	Y
Ratio of two determinations of M < or = 1.5 : 1	Y
Total Expanded uncertainty (95% confidence interval)	42.40

Note: The Mass Emissions given above are calculated from stack gas pressures measured during particulate sampling and not from pressures measured during the Preliminary Velocity and Temperature Survey.

TABLE B.5.6 **VOC SAMPLING DATA**

Client	Covrad	Job No.	FYS2993
Site	Coventry	Date	15/12/2004
Stack	New Booth LHS	Operators	GH/JR
Run No.	1 + 2	Authorised Signature	

Parameters	VOCs

		ZERO				SPAN - PROPANE			
Instrument	Serial No.	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish
VOC	FYS031	Air	0	0	-1		100	100	101

RUN 1							RUN 2			
Time	VOC ppm						Time	VOC ppm		
13:36:00	28						13:56:00	40		
13:36:30	65						13:56:30	26		
13:37:00	45						13:57:00	18		
13:37:30	22						13:57:30	20		
13:38:00	22						13:58:00	29		
13:38:30	15						13:58:30	29		
13:39:00	9						13:59:00	27		
13:39:30	7						13:59:30	32		
13:40:00	8						14:00:00	28		
13:40:30	12						14:00:30	10		
13:41:00	15						14:01:00	15		
13:41:30	9						14:01:30	25		
13:42:00	3						14:02:00	12		
13:42:30	6						14:02:30	2		
13:43:00	0						14:03:00	4		
13:43:30	5						14:03:30	0		
13:44:00	5						14:04:00	7		
13:44:30	5						14:04:30	0		
13:45:00	5						14:05:00	0		
13:45:30	4						14:05:30	0		
13:46:00	5						14:06:00	0		
13:46:30	2						14:06:30	1		
13:47:00	3						14:07:00	3		
13:47:30	6						14:07:30	3		
13:48:00	0						14:08:00	0		
13:48:30	0						14:08:30	0		
13:49:00	2						14:09:00	0		
13:49:30	2						14:09:30	269		
13:50:00	11						14:10:00	36		
13:50:30	3						14:10:30	46		

TABLE B.6.1

Preliminary Velocity and Temperature Survey

Date : 15-Dec-04 | Client: Covrad | Job No.: FYS2993 | Velocity (m/s) 11.7
Duct: New Spray Booth Middle | Client Site: Coventry | Operators: GH/JR | Act. Volume Flow (m3/s) 5.7
Stack Internal Diameter / length (m) : 0.79 | Port Depth: 9 cm | Atmos. Press.: 100.5 kPa | S.t.p. Volume flow (m3/s) 5.3

	First Sampling Line			Second Sampling Line			
Sampling Point	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)	Sampling Point No.	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)
1	0.040	16.8	20	1	0.040	7.6	20
2	0.119	15.8	20	2	0.119	8.6	20
3	0.198	12.6	20	3	0.198	10.5	20
4	0.277	11.1	20	4	0.277	10.2	20
5	0.356	10.8	20	5	0.356	10.6	20
6	0.435	11.4	20	6	0.435	10.8	20
7	0.514	11.8	20	7	0.514	11.0	20
8	0.593	11.0	20	8	0.593	13.0	20
9	0.672	10.4	20	9	0.672	13.6	20
10	0.751	9.9	20	10	0.751	15.7	20
			Mean (1) 20.00				Mean (2) 20.00

Mean Flue Gas Temp (in K) Tp = ((Mean (1)+Mean (2))/2)+273) = 293
Permitted range of gas temperature readings (C) = (0.9Tp - 273) to (1.1Tp - 273) = -9 to 49
Highest Velocity Reading (either sampling line) (in m/s) = 16.8
Lowest Velocity Reading (either sampling line) (in m/s) = 7.6
Ratio Highest/Lowest (Max Permitted = 9:1) 2.2 :1

On Site Checklist	
Pitot Head at Right Angles ?	Y
Manometer Tube Leak Check ?	Y
Static Pressure <2.5kPa ?	Y
Range of Gas Temps OK ?	Y
8 Point sampling due to stack >2.5 m^2 ?	N
8 point sampling due to ratio >4:1 ?	N
4 or 8 point sampling for BS3405	4
Actual No sampling points	4

Pre Site Ckecklist	
Stopwatch Accuracy OK ?	Y
Manometer Intermediate Check OK ?	Y
Temp Indicator Intermediate check OK?	Y
Nozzle Condition OK ?	Y
Probe cleaned out ?	Y
Spare seals and gaskets loaded ?	Y
Pitot Leak Check OK ?	Y
Gas Flow Angle < 20deg ?	Y

Pitot Inspection	Pre	Post
Clear of Blockages	Y	Y
Ends not Damaged	Y	Y

RPS Health, Safety and Environment

TABLE B.6.2 GAS VELOCITY AND TEMPERATURE READINGS

Client: Covrad
Client Site: Coventry
Operators: GH/JR

Duct: New Spray Booth Middle
Date : 15-Dec-04
Job Number : FYS2993

FIRST SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
A1	0.12	20	20	15.8	15.8
A2	0.67	20	20	10.4	10.4
B1	0.12	20	20	8.6	8.6
B2	0.67	20	20	13.6	13.6
		MEAN t1 20.00	MEAN t2 20.00		
		MEAN t 20			

SECOND SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
1	0.12	20	20	15.8	15.8
2	0.67	20	20	10.4	10.4
3	0.12	20	20	8.6	8.6
4	0.67	20	20	13.6	13.6
		MEAN t1 20.00	MEAN t2 20.00		
		MEAN t 20			

TABLE B.6.3 SAMPLING RECORD

Client: Covrad
Client Site: Coventry
Duct: New Spray Booth Middle
Date : 15-Dec-04

Sampling: Internal
Job Number : FYS2993
Carried out by : GH/JR

FIRST SAMPLE

Nozzle Diam: 0.0060 (m) = 0.00003 (m2) Area

SAMPLE POINT	NOZZLE AREA (m^2)	TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 35367.7	11:43	240	26.7	310347	83046	0.00026	Y
A2	1/ 35367.7		240	17.6				
B1	1/ 35367.7		240	14.5				
B2	1/ 35367.7		240	23.0				
	END	12:01			310660			

Total Vol Sampled: 313 Litres

SECOND SAMPLE

SAMPLE POINT	NOZZLE AREA (m^2)	START TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 35367.7	12:23	240	26.7	310660	83047	0.00056	Y
A2	1/ 35367.7		240	17.6				
B1	1/ 35367.7		240	14.5				
B2	1/ 35367.7		240	23.0				
	END	12:39			310969			

Total Vol Sampled: 309 Litres

TABLE B.6.4 **Calculation of Particulate Results**

Duct:	New Spray Booth Middle	Client:	Covrad
Job Number :	FYS2993	Client Site:	Coventry
Operators:	GH/JR		
Date :	15-Dec-04		

Sample No. 1

Time Started :	0.49
Nozzle Size :	1/ 35367.6824
Duration of Sample :	960
Cross Sectional Area :	0.49023055
Volume Sampled:	0.313

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	0.8307		P	=	100.50
	VFR	=	5.72	Where	M	=	0.00
					V	=	0.31
					K	=	293

Mass Emission (g / hr) = **17.09** Concentration (mg/Nm^3) = **0.90**

Sample No. 2

Time Started :	0.52
Nozzle Size :	1/ 35367.6824
Duration of Sample :	960
Cross Sectional Area :	0.49023055
Volume Sampled:	0.309

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	1.8123		P	=	100.50
	VFR	=	5.72	Where	M	=	0.00
					V	=	0.31
					K	=	293

Mass Emission (g / hr) = **37.29** Concentration (mg/Nm^3) = **1.96**

Oxygen Reference% = 1

Measured Oxygen % Run 1 = 1 Oxygen Correction Factor Run 1 = 1

Measured Oxygen % Run 2 = 1 Oxygen Correction Factor Run 2 = 1

Run 1 Oxygen Referenced Particulate Concentration = 0.8986227

Run 2 Oxygen Referenced Particulate Concentration = 1.9605499

TABLE B.6.5 SUMMARY OF PARTICULATE RESULTS

Client:	Covrad	Job No.:	FYS2993
Client Site:	Coventry	Operators:	GH/JR
Duct:	New Spray Booth Middle	Date:	15-Dec-04

TYPE OF RESULT	Mass Rate Of Emission, M (g /hr)	Concentration, at 0 deg C (mg / m^3)
Result of First Sampling	17.1	0.9
Result of Second Sampling	37.3	2.0
Ratio of Higher Result to Lower Result	2.2 : 1	
Mean Result if Ratio is Not More Than 1.5 : 1	N/A	

Conformance with Main Procedural Requirements of BS 3405	
Requirement	Compliance ?
Water droplets absent	Y
Gas velocity positive and > 5 Pa	Y
Gas flow within + or - 20deg of flue axis	Y
Preliminary velocity profile meets Standard	Y
Preliminary temperature profile meets Standard	Y
Flue Dimensions Measured to accuracy of 10mm per metre	Y
Area of sampling apparatus < 10% of flue area	Y
Sampling plane > 1diameter from bend, obstruction or exit	Y
Sampling from 4 or 8 points as per Standard	4
Minimum sampling time 3 minutes per point	Y
Constant time(s) and nozzle area (mm2) for each sample point	Y
Post-sampling pitot readings differ from pre-sampling readings by < 10%	Y
Mass sampled >0.3% tare weight	Y
Ratio of two determinations of M < or = 1.5 : 1	N
Total Expanded uncertainty (95% confidence interval)	42.40

Note: The Mass Emissions given above are calculated from stack gas pressures measured during particulate sampling and not from pressures measured during the Preliminary Velocity and Temperature Survey.

TABLE B.6.6 **VOC SAMPLING DATA**

Client	Covrad	Job No.	FYS2993
Site	Coventry	Date	15/12/2004
Stack	New Booth Middle	Operators	GH/JR
Run No.	1 + 2	Authorised Signature	

Parameters	VOCs

		ZERO				SPAN - PROPANE			
Instrument	Serial No.	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish
VOC	FYS031	Air	0	0	-1		100	100	99

RUN 1							RUN 2			
Time	VOC ppm						Time	VOC ppm		
11:43:00	34						12:23:00	3		
11:43:30	42						12:23:30	8		
11:44:00	32						12:24:00	2		
11:44:30	21						12:24:30	2		
11:45:00	13						12:25:00	0		
11:45:30	8						12:25:30	8		
11:46:00	5						12:26:00	28		
11:46:30	6						12:26:30	8		
11:47:00	10						12:27:00	9		
11:47:30	4						12:27:30	12		
11:48:00	3						12:28:00	0		
11:48:30	1						12:28:30	0		
11:49:00	2						12:29:00	20		
11:49:30	5						12:29:30	1		
11:50:00	14						12:30:00	33		
11:50:30	4						12:30:30	30		
11:51:00	4						12:31:00	4		
11:51:30	3						12:31:30	3		
11:52:00	1						12:32:00	6		
11:52:30	1						12:32:30	5		
11:53:00	1						12:33:00	6		
11:53:30	10						12:33:30	0		
11:54:00	5						12:34:00	0		
11:54:30	1						12:34:30	3		
11:55:00	1						12:35:00	0		
11:55:30	0						12:35:30	4		
11:56:00	1						12:36:00	2		
11:56:30	1						12:36:30	3		
11:57:00	16						12:37:00	10		
11:57:30	8						12:37:30	8		

TABLE B.7.1

Preliminary Velocity and Temperature Survey

Date : 15-Dec-04
Duct: New Spray Booth RHS
Stack Internal Diameter / length (m) : 0.79

Client: Covrad
Client Site: Coventry
Port Depth: 9 cm

Job No.: FYS2993
Operators: GH/JR
Atmos. Press.: 100.5 kPa

Velocity (m/s) 8.7
Act. Volume Flow (m3/s) 4.3
S.t.p. Volume flow (m3/s) 3.9

	First Sampling Line			Second Sampling Line			
Sampling Point	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)	Sampling Point No.	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)
1	0.040	7.8	20	1	0.040	12.8	20
2	0.119	8.5	20	2	0.119	9.8	20
3	0.198	8.4	20	3	0.198	9.8	20
4	0.277	8.8	20	4	0.277	8.8	20
5	0.356	9.2	20	5	0.356	7.9	20
6	0.435	8.4	20	6	0.435	7.8	20
7	0.514	8.1	20	7	0.514	7.8	20
8	0.593	8.0	20	8	0.593	7.8	20
9	0.672	9.5	20	9	0.672	7.9	20
10	0.751	12.4	20	10	0.751	4.5	20
			Mean (1) 20.00				Mean (2) 20.00

Mean Flue Gas Temp (in K) Tp = ((Mean (1)+Mean (2))/2)+273) = 293
Permitted range of gas temperature readings (C) = (0.9Tp - 273) to (1.1Tp - 273) = -9 to 49
Highest Velocity Reading (either sampling line) (in m/s) = 12.8
Lowest Velocity Reading (either sampling line) (in m/s) = 4.5
Ratio Highest/Lowest (Max Permitted = 9:1) 2.8 :1

On Site Checklist	
Pitot Head at Right Angles ?	Y
Manometer Tube Leak Check ?	Y
Static Pressure <2.5kPa ?	Y
Range of Gas Temps OK ?	Y
8 Point sampling due to stack >2.5 m^2 ?	N
8 point sampling due to ratio >4:1 ?	N
4 or 8 point sampling for BS3405	4
Actual No sampling points	4

Pre Site Ckecklist	
Stopwatch Accuracy OK ?	Y
Manometer Intermediate Check OK ?	Y
Temp Indicator Intermediate check OK?	Y
Nozzle Condition OK ?	Y
Probe cleaned out ?	Y
Spare seals and gaskets loaded ?	Y
Pitot Leak Check OK ?	Y
Gas Flow Angle < 20deg ?	Y

Pitot Inspection	Pre	Post
Clear of Blockages	Y	Y
Ends not Damaged	Y	Y

TABLE B.7.2 GAS VELOCITY AND TEMPERATURE READINGS

Client: Covrad
Client Site: Coventry
Operators: GH/JR

Duct: New Spray Booth RHS
Date : 15-Dec-04
Job Number : FYS2993

FIRST SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
A1	0.12	20	20	8.5	8.5
A2	0.67	20	20	9.5	9.5
B1	0.12	20	20	9.8	9.8
B2	0.67	20	20	7.9	7.9
		MEAN t1 20.00	MEAN t2 20.00		
		MEAN t 20			

SECOND SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
1	0.12	20	20	8.5	8.5
2	0.67	20	20	9.5	9.5
3	0.12	20	20	9.8	9.8
4	0.67	20	20	7.9	7.9
		MEAN t1 20.00	MEAN t2 20.00		
		MEAN t 20			

TABLE B.7.3 SAMPLING RECORD

Client: Covrad
Client Site: Coventry
Duct: New Spray Booth RHS
Date : 15-Dec-04

Sampling: Internal
Job Number : FYS2993
Carried out by : GH/JR

FIRST SAMPLE

Nozzle Diam: 0.0065 (m) = 0.00003 (m2) Area

SAMPLE POINT	NOZZLE AREA (m^2)	TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 30135.8	10:46	240	16.9	309812	83045	0.00109	Y
A2	1/ 30135.8		240	18.9				
B1	1/ 30135.8		240	19.5				
B2	1/ 30135.8		240	15.7				
	END	11:03			310078			

Total Vol Sampled: 266 Litres

SECOND SAMPLE

SAMPLE POINT	NOZZLE AREA (m^2)	START TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 30135.8	11:11	240	16.9	310078	85561	0.00047	Y
A2	1/ 30135.8		240	18.9				
B1	1/ 30135.8		240	19.5				
B2	1/ 30135.8		240	15.7				
	END	11:28			310347			

Total Vol Sampled: 269 Litres

TABLE B.7.4 **Calculation of Particulate Results**

Duct:	New Spray Booth RHS	Client:	Covrad
Job Number :	FYS2993	Client Site:	Coventry
Operators:	GH/JR		
Date :	15-Dec-04		

Sample No. 1

Time Started :	0.45
Nozzle Size :	1/ 30135.7767
Duration of Sample :	960
Cross Sectional Area :	0.49023055
Volume Sampled:	0.266

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	4.0977		P	=	100.50
	VFR	=	4.27	Where	M	=	0.00
					V	=	0.27
					K	=	293

Mass Emission (g / hr) = **62.92** Concentration (mg/Nm^3) = **4.43**

Sample No. 2

Time Started :	0.47
Nozzle Size :	1/ 30135.7767
Duration of Sample :	960
Cross Sectional Area :	0.49023055
Volume Sampled:	0.269

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	1.7472		P	=	100.50
	VFR	=	4.27	Where	M	=	0.00
					V	=	0.27
					K	=	293

Mass Emission (g / hr) = **26.83** Concentration (mg/Nm^3) = **1.89**

Oxygen Reference% = 1

Measured Oxygen % Run 1 = 1 Oxygen Correction Factor Run 1 = 1

Measured Oxygen % Run 2 = 1 Oxygen Correction Factor Run 2 = 1

Run 1 Oxygen Referenced Particulate Concentration = 4.4329539

Run 2 Oxygen Referenced Particulate Concentration = 1.8901398

TABLE B.7.5 SUMMARY OF PARTICULATE RESULTS

Client:	Covrad	Job No.:	FYS2993
Client Site:	Coventry	Operators:	GH/JR
Duct:	New Spray Booth RHS	Date:	15-Dec-04

TYPE OF RESULT	Mass Rate Of Emission, M (g /hr)	Concentration, at 0 deg C (mg / m^3)
Result of First Sampling	62.9	4.4
Result of Second Sampling	26.8	1.9
Ratio of Higher Result to Lower Result	2.3 : 1	
Mean Result if Ratio is Not More Than 1.5 : 1	N/A	

Conformance with Main Procedural Requirements of BS 3405	
Requirement	Compliance ?
Water droplets absent	Y
Gas velocity positive and > 5 Pa	Y
Gas flow within + or - 20deg of flue axis	Y
Preliminary velocity profile meets Standard	Y
Preliminary temperature profile meets Standard	Y
Flue Dimensions Measured to accuracy of 10mm per metre	Y
Area of sampling apparatus < 10% of flue area	Y
Sampling plane > 1diameter from bend, obstruction or exit	Y
Sampling from 4 or 8 points as per Standard	4
Minimum sampling time 3 minutes per point	Y
Constant time(s) and nozzle area (mm2) for each sample point	Y
Post-sampling pitot readings differ from pre-sampling readings by < 10%	Y
Mass sampled >0.3% tare weight	Y
Ratio of two determinations of M < or = 1.5 : 1	N
Total Expanded uncertainty (95% confidence interval)	42.40

Note: The Mass Emissions given above are calculated from stack gas pressures measured during particulate sampling and not from pressures measured during the Preliminary Velocity and Temperature Survey.

TABLE B.7.6 **VOC SAMPLING DATA**

Client	Covrad	Job No.	FYS2993
Site	Coventry	Date	15/12/2004
Stack	New Booth RHS	Operators	GH/JR
Run No.	1 + 2	Authorised Signature	

Parameters	VOCs

Instrument	Serial No.	ZERO				SPAN - PROPANE			
		Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish
VOC	FYS031	Air	0	0	-1		100	100	99

RUN 1							RUN 2			
Time	VOC ppm						Time	VOC ppm		
10:46:30	31						11:10:00	3		
10:47:00	27						11:10:30	8		
10:47:30	16						11:11:00	12		
10:48:00	12						11:11:30	6		
10:48:30	5						11:12:00	23		
10:49:00	0						11:12:30	25		
10:49:30	0						11:13:00	16		
10:50:00	0						11:13:30	13		
10:50:30	0						11:14:00	13		
10:51:00	7						11:14:30	12		
10:51:30	2						11:15:00	11		
10:52:00	8						11:15:30	16		
10:52:30	25						11:16:00	19		
10:53:00	33						11:16:30	8		
10:53:30	4						11:17:00	8		
10:54:00	7						11:17:30	16		
10:54:30	6						11:18:00	7		
10:55:00	20						11:18:30	10		
10:55:30	18						11:19:00	10		
10:56:00	6						11:19:30	6		
10:56:30	7						11:20:00	11		
10:57:00	4						11:20:30	12		
10:57:30	13						11:21:00	27		
10:58:00	25						11:21:30	28		
10:58:30	23						11:22:00	21		
10:59:00	15						11:22:30	12		
10:59:30	0						11:23:00	11		
11:00:00	3						11:23:30	14		
11:00:30	5						11:24:00	8		
11:01:00	12						11:24:30	13		

TABLE B.8.1

Preliminary Velocity and Temperature Survey

Date : 16-Dec-04 | Client: Covrad | Job No.: FYS2993 | Velocity (m/s) 11.9
Duct: Red Oxide Booth | Client Site: Coventry | Operators: GH/JR | Act. Volume Flow (m3/s) 5.8
Stack Internal Diameter / length (m) : 0.79 | Port Depth: 9 cm | Atmos. Press.: 98.9 kPa | S.t.p. Volume flow (m3/s) 5.3

	First Sampling Line			Second Sampling Line			
Sampling Point	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)	Sampling Point No.	Distance Along Line (m)	PitotStatic Reading (m/s)	Gas Temperature (C)
1	0.040	10.9	22	1	0.040	12.6	22
2	0.119	11.4	22	2	0.119	12.8	22
3	0.198	11.4	22	3	0.198	12.6	22
4	0.277	12.4	22	4	0.277	12.6	22
5	0.356	12.3	22	5	0.356	12.8	22
6	0.435	11.7	22	6	0.435	13.0	22
7	0.514	11.2	22	7	0.514	12.6	22
8	0.593	11.2	22	8	0.593	12.4	22
9	0.672	11.2	22	9	0.672	11.8	22
10	0.751	10.8	22	10	0.751	10.9	22
			Mean (1) 22.00				Mean (2) 22.00

Mean Flue Gas Temp (in K) Tp = ((Mean (1)+Mean (2))/2)+273) = 295
Permitted range of gas temperature readings (C) = (0.9Tp - 273) to (1.1Tp - 273) = -8 to 52
Highest Velocity Reading (either sampling line) (in m/s) = 13
Lowest Velocity Reading (either sampling line) (in m/s) = 10.8
Ratio Highest/Lowest (Max Permitted = 9:1) 1.2 :1

On Site Checklist	
Pitot Head at Right Angles ?	Y
Manometer Tube Leak Check ?	Y
Static Pressure <2.5kPa ?	Y
Range of Gas Temps OK ?	Y
8 Point sampling due to stack >2.5 m^2 ?	N
8 point sampling due to ratio >4:1 ?	N
4 or 8 point sampling for BS3405	4
Actual No sampling points	4

Pre Site Ckecklist	
Stopwatch Accuracy OK ?	Y
Manometer Intermediate Check OK ?	Y
Temp Indicator Intermediate check OK?	Y
Nozzle Condition OK ?	Y
Probe cleaned out ?	Y
Spare seals and gaskets loaded ?	Y
Pitot Leak Check OK ?	Y
Gas Flow Angle < 20deg ?	Y

Pitot Inspection	Pre	Post
Clear of Blockages	Y	Y
Ends not Damaged	Y	Y

TABLE B.8.2 GAS VELOCITY AND TEMPERATURE READINGS

Client: Covrad
Client Site: Coventry
Operators: GH/JR

Duct: Red Oxide Booth
Date : 16-Dec-04
Job Number : FYS2993

FIRST SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
A1	0.12	22	22	11.4	11.4
A2	0.67	22	22	11.2	11.2
B1	0.12	22	22	12.8	12.8
B2	0.67	22	22	11.8	11.8
		MEAN t1 22.00	MEAN t2 22.00		
		MEAN t 22			

SECOND SAMPLING RUN

SAMPLE POINT		FLUE GAS TEMP.		PITOT-STATIC READINGS	
ID No.	DIST. (m)	START t1 deg c	FINAL t2 deg c	START h1 m/s	FINAL h2 m/s
1	0.12	22	22	11.4	11.4
2	0.67	22	22	11.2	11.2
3	0.12	22	22	12.8	12.8
4	0.67	22	22	11.8	11.8
		MEAN t1 22.00	MEAN t2 22.00		
		MEAN t 22			

TABLE B.8.3

SAMPLING RECORD

Client: Covrad
Client Site: Coventry
Duct: Red Oxide Booth
Date : 16-Dec-04

Sampling: Internal
Job Number : FYS2993
Carried out by : GH/JR

FIRST SAMPLE

Nozzle Diam: 0.0060 (m) = 0.00003 (m2) Area

SAMPLE POINT	NOZZLE AREA (m^2)	TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 35367.7	10:19	240	19.3	311569	85889	0.00281	Y
A2	1/ 35367.7		240	18.9				
B1	1/ 35367.7		240	21.6				
B2	1/ 35367.7		240	19.9				
	END	10:36			311871			

Total Vol Sampled: 302 Litres

SECOND SAMPLE

SAMPLE POINT	NOZZLE AREA (m^2)	START TIME	DURATION (S)	FLOW RATE (l/min)	GAS METER (l)	FILTER No.	MASS OF SOLIDS (g)	MASS >0.3% TARE (Y/N)
A1	1/ 35367.7	10:48	240	19.3	311871	81978	0.00067	Y
A2	1/ 35367.7		240	18.9				
B1	1/ 35367.7		240	21.6				
B2	1/ 35367.7		240	19.9				
	END	11:06			312179			

Total Vol Sampled: 308 Litres

TABLE B.8.4 **Calculation of Particulate Results**

Duct:	Red Oxide Booth	Client:	Covrad
Job Number :	FYS2993	Client Site:	Coventry
Operators:	GH/JR		
Date :	16-Dec-04		

Sample No. 1

Time Started :	0.43
Nozzle Size :	1/ 35367.6824
Duration of Sample :	960
Cross Sectional Area :	0.49023055
Volume Sampled:	0.302

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	9.3046		P	=	98.90
	VFR	=	5.85	Where	M	=	0.00
					V	=	0.30
					K	=	295

Mass Emission (g / hr) = **195.90** Concentration (mg/Nm^3) = **10.30**

Sample No. 2

Time Started :	0.45
Nozzle Size :	1/ 35367.6824
Duration of Sample :	960
Cross Sectional Area :	0.49023055
Volume Sampled:	0.308

Mass Emission (g / s) = Conc * VFR

Concentration (mg/Nm^3) = $\frac{(M * 1000)}{V * (273 / K) * (P/101.3)}$

Where	Conc	=	2.1753		P	=	98.90
	VFR	=	5.85	Where	M	=	0.00
					V	=	0.31
					K	=	295

Mass Emission (g / hr) = **45.80** Concentration (mg/Nm^3) = **2.41**

Oxygen Reference% = 1

Measured Oxygen % Run 1 = 1 Oxygen Correction Factor Run 1 = 1

Measured Oxygen % Run 2 = 1 Oxygen Correction Factor Run 2 = 1

Run 1 Oxygen Referenced Particulate Concentration = 10.298451

Run 2 Oxygen Referenced Particulate Concentration = 2.407668

TABLE B.8.5 SUMMARY OF PARTICULATE RESULTS

Client:	Covrad	Job No.:	FYS2993
Client Site:	Coventry	Operators:	GH/JR
Duct:	Red Oxide Booth	Date:	16-Dec-04

TYPE OF RESULT	Mass Rate Of Emission, M (g /hr)	Concentration, at 0 deg C (mg / m^3)
Result of First Sampling	195.9	10.3
Result of Second Sampling	45.8	2.4
Ratio of Higher Result to Lower Result	4.3 : 1	
Mean Result if Ratio is Not More Than 1.5 : 1	N/A	

Conformance with Main Procedural Requirements of BS 3405	
Requirement	Compliance ?
Water droplets absent	Y
Gas velocity positive and > 5 Pa	Y
Gas flow within + or - 20deg of flue axis	Y
Preliminary velocity profile meets Standard	Y
Preliminary temperature profile meets Standard	Y
Flue Dimensions Measured to accuracy of 10mm per metre	Y
Area of sampling apparatus < 10% of flue area	Y
Sampling plane > 1diameter from bend, obstruction or exit	Y
Sampling from 4 or 8 points as per Standard	4
Minimum sampling time 3 minutes per point	Y
Constant time(s) and nozzle area (mm2) for each sample point	Y
Post-sampling pitot readings differ from pre-sampling readings by < 10%	Y
Mass sampled >0.3% tare weight	Y
Ratio of two determinations of M < or = 1.5 : 1	N
Total Expanded uncertainty (95% confidence interval)	42.22

Note: The Mass Emissions given above are calculated from stack gas pressures measured during particulate sampling and not from pressures measured during the Preliminary Velocity and Temperature Survey.

TABLE B.8.6 **VOC SAMPLING DATA**

Client	Covrad	Job No.	FYS2993
Site	Coventry	Date	16/12/2004
Stack	Red Oxide Booth	Operators	GH/JR
Run No.	1 + 2	Authorised Signature	

Parameters	VOCs

Instrument	Serial No.	ZERO				SPAN - PROPANE			
		Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish
VOC	FYS031	Air	0	0	-1		100	100	99

RUN 1							RUN 2			
Time	VOC ppm						Time	VOC ppm		
10:19:00	63						10:49:00	78		
10:19:30	39						10:49:30	66		
10:20:00	50						10:50:00	63		
10:20:30	30						10:50:30	47		
10:21:00	33						10:51:00	73		
10:21:30	30						10:51:30	20		
10:22:00	9						10:52:00	16		
10:22:30	19						10:52:30	120		
10:23:00	32						10:53:00	97		
10:23:30	33						10:53:30	20		
10:24:00	46						10:54:00	4		
10:24:30	45						10:54:30	148		
10:25:00	9						10:55:00	26		
10:25:30	227						10:55:30	40		
10:26:00	164						10:56:00	149		
10:26:30	279						10:56:30	80		
10:27:00	40						10:57:00	25		
10:27:30	50						10:57:30	19		
10:28:00	196						10:58:00	8		
10:28:30	111						10:58:30	8		
10:29:00	75						10:59:00	6		
10:29:30	230						10:59:30	5		
10:30:00	203						11:00:00	4		
10:30:30	23						11:00:30	5		
10:31:00	12						11:01:00	5		
10:31:30	12						11:01:30	8		
10:32:00	12						11:02:00	8		
10:32:30	0						11:02:30	5		
10:33:00	0						11:03:00	5		
10:33:30	2						11:03:30	3		

TABLE B.9.1

Preliminary Velocity and Temperature Survey

Date : 14-Dec-04
Duct: Large Degreaser
Stack Internal Diameter / length (m) : 0.25

Client: Covrad
Client Site: Coventry
Port Depth: 0 cm

Job No.: FYS2993
Operators: GH/JR
Atmos. Press.: 100.9 kPa

Velocity (m/s) 3.9
Act Volume Flow (m3/s) 0.2
S.t.p. Volume Flow (m3/s) 0.2

	First Sampling Line			Second Sampling Line			
Sampling Point	Distance Along Line (m)	Velocity (m/s)	Gas Temperature (C)	Sampling Point No.	Distance Along Line (m)	Velocity (m/s)	Gas Temperature (C)
1	0.013	3.9	21	1	0.013	Only one port	
2	0.038	3.9	21	2	0.038		
3	0.063	3.9	21	3	0.063		
4	0.088	3.9	21	4	0.088		
5	0.113	3.9	21	5	0.113		
6	0.138	4.1	21	6	0.138		
7	0.163	3.9	21	7	0.163		
8	0.188	3.9	21	8	0.188		
9	0.213	4.1	21	9	0.213		
10	0.238	3.9	21	10	0.238		
			Mean (1) 21.00				

Mean Flue Gas Temp (in K) Tp = ((Mean (1)+Mean (2))/2)+273) = 294
Permitted range of gas temperature readings (C) = (0.9Tp - 273) to (1.1Tp - 273) = -8 to 50
Highest Pitot Static Reading (either sampling line) (in Pa) = 4.1
Lowest Pitot Static Reading (either sampling line) (in Pa) = 3.9
Ratio Highest/Lowest (Max Permitted = 9:1) 1.1 :1

On Site Checklist	
Pitot Head at Right Angles ?	Y
Manometer Tube Leak Check ?	Y
Static Pressure <2.5kPa ?	Y
Range of Gas Temps OK ?	Y

Pre Site Ckecklist	
Stopwatch Accuracy OK ?	Y
Manometer Intermediate Check OK ?	Y
Temp Indicator Intermediate check OK?	Y
Pitot Leak Check OK ?	Y
Gas Flow Angle < 20deg ?	Y

Pitot Inspection	Pre	Post
Clear of Blockages	Y	Y
Ends not Damaged	Y	Y

RPS Health, Safety and Environment

TABLE B.9.2

TRICHLOROETHYLENE SAMPLING DATA

Client	**Covrad**		Job Number	FYS2993	
Site	**Coventry**		Date	14-Dec-04	
Stack	**Large Degreaser**		Operators	GH/JR	
Pollutant	**Trichloroethylene**		Sample Method	BS EN 13649	
Absorbent(s)	2 x SKC 226-09 Charcoal Tube		Analysis Method	GC	
Gas Velocity	3.90	m/s	Duct dimensions.	0.25	m
Gas Temp	21	°C	Duct Area	0.05	m^2
Act. Vol. Flow	0.19	m^3/s	S.t.p. Volume Flow	0.18	m^3/s

Run	**Short Term**	Start	Finish		Sample	
Leak Check OK?		Y	Y			
Time		13.58	14.09			
Sample Flow Rate (ml/min)		200	200	Net Total Analyte (mg)	13.000	
DGM Temp (°C)		20	20	Atmos Pressure (kPa)	100.9	
Volume Gas Sampled (l)		0.0022		S.t.p. Volume sampled (m^3)	0.0021	
No. mins sampling (mins)		11		DGM / Flowmeter error (%)	****	
		As solvent (Trike)	**As total carbon**		**As solvent (Trike)**	**As total carbon**
Mass Emission Rate (g/hr)		**4026.6**	**736.1**	**S.t.p. Emission Conc. (mg/m^3)**	**6316.9**	**1154.7**

Run	**Long Term**	Start	Finish		Sample	
Leak Check OK?		Y	Y			
Time		13.38	14.32			
Sample Flow Rate (ml/min)		200	200	Net Total Analyte (mg)	36.0	
DGM Temp (°C)		20	20	Atmos. Pressure (kPa)	100.9	
Volume Gas Sampled (l)		10.8		S.t.p. Volume sampled (m^3)	0.01	
No. mins sampling (mins)		54		DGM / Flowmeter error (%)	****	
		As solvent (Trike)	**As total carbon**		**As solvent (Trike)**	**As total carbon**
Mass Emission Rate (g/hr)		**2271.4**	**415.2**	**S.t.p. Emission Conc. (mg/m^3)**	**3563.4**	**651.4**

TABLE B.9.3 **VOC SAMPLING DATA**

Client	Covrad	Job No.	FYS2993
Site	Coventry	Date	14/12/2004
Stack	Large Degreasing Tank (Trichloroethylene)	Operators	GH/JR
Run No.	1 + 2	Authorised Signature	

Parameters	VOCs

		ZERO				SPAN - PROPANE			
Instrument	Serial No.	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish
VOC	FYS031	Air	0	0	-1		100	100	99

Time	VOC ppm	Procedure Undertaken	Time	VOC ppm	Procedure Undertaken		Time	VOC ppm		
13:39:00	243	Degrease	13:55:00	284			14:11:00	418		
13:39:30	249		13:55:30	355			14:11:30	501		
13:40:00	213		13:56:00	411			14:12:00	436		
13:40:30	224		13:56:30	461			14:12:30	380		
13:41:00	205		13:57:00	439			14:13:00	321		
13:41:30	256		13:57:30	441			14:13:30	547		
13:42:00	231		13:58:00	478	Degrease		14:14:00	372		
13:42:30	304	Items Out	13:58:30	440			14:14:30	389		
13:43:00	271		13:59:00	444			14:15:00	352		
13:43:30	328		13:59:30	537			14:15:30	332		
13:44:00	418		14:00:00	543			14:16:00	381		
13:44:30	290		14:00:30	686			14:16:30	515		
13:45:00	285		14:01:00	691			14:17:00	266		
13:45:30	338		14:01:30	636			14:17:30	289		
13:46:00	246		14:02:00	648			14:18:00	375		
13:46:30	314		14:02:30	639			14:18:30	528		
13:47:00	401		14:03:00	501			14:19:00	534		
13:47:30	439		14:03:30	433			14:19:30	294		
13:48:00	364		14:04:00	502			14:20:00	265		
13:48:30	277		14:04:30	626			14:20:30	243		
13:49:00	283		14:05:00	622			14:21:00	356		
13:49:30	287		14:05:30	628			14:21:30	314		
13:50:00	333		14:06:00	521			14:22:00	189		
13:50:30	397		14:06:30	346			14:22:30	173		
13:51:00	405		14:07:00	554			14:23:00	249		
13:51:30	346		14:07:30	601			14:23:30	223		
13:52:00	321		14:08:00	595			14:24:00	269		
13:52:30	332		14:08:30	433			14:24:30	233		
13:53:00	288		14:09:00	668			14:25:00	215		
13:53:30	426		14:09:30	520			14:25:30	167		
13:54:00	331		14:10:00	613			14:26:00	240	Item out	
13:54:30	355		14:10:30	584			14:26:30	260		
Min								167		
Max								691		
Mean								391		

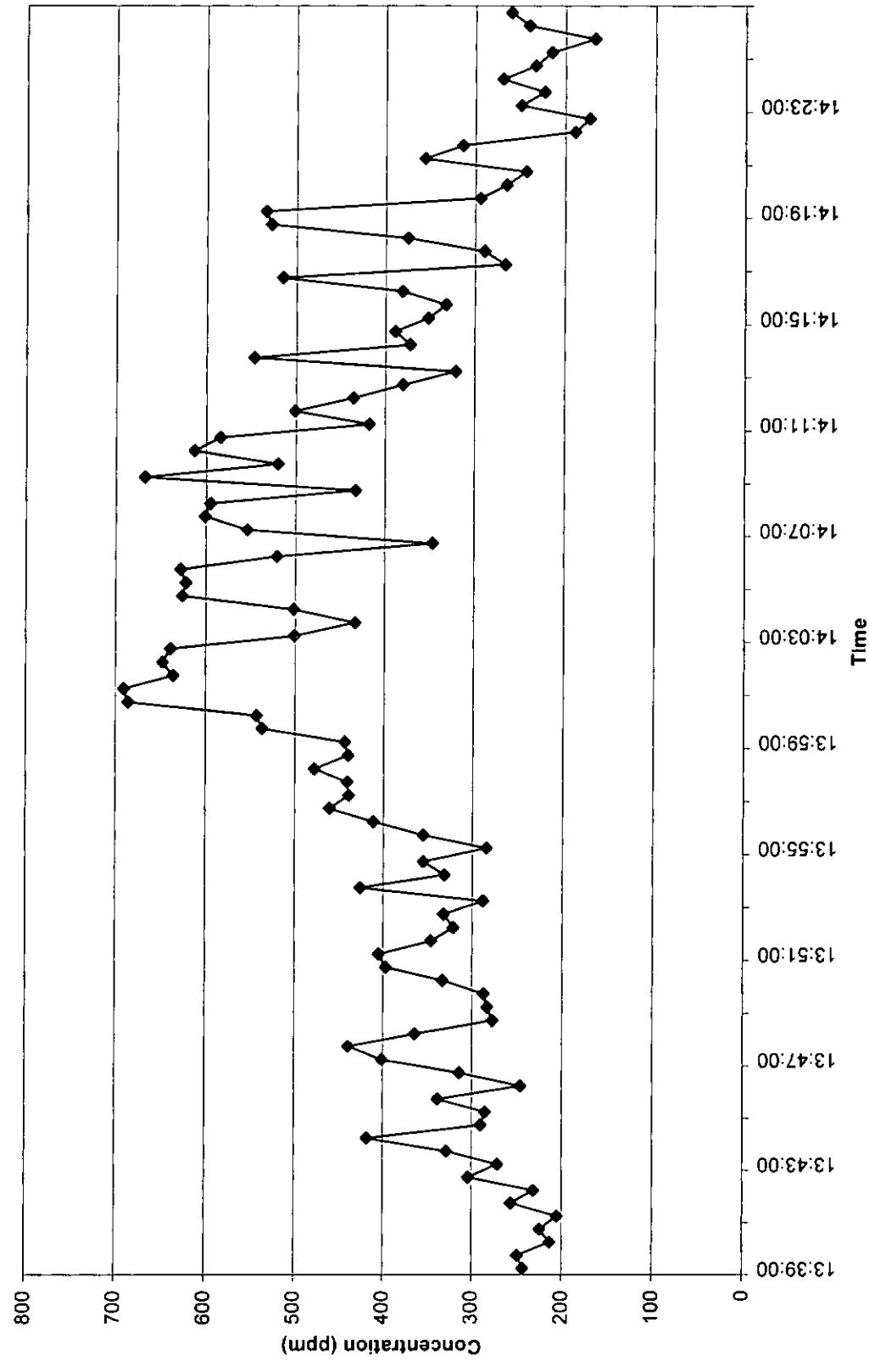


Fig 9.1 - VOC Emission Profile from the Large Degreaser Unit at Covrad Heat Transfer Limited, Monitored on 14 December 2004

TABLE B.10.1

Preliminary Velocity and Temperature Survey

Date : 16-Dec-04
Duct: Aluminium Degreaser
Stack Internal Diameter / length (m) : 0.12

Client: Covrad
Client Site: Coventry
Port Depth: 0 cm

Job No.: FYS2993
Operators: GH/JR
Atmos. Press.: 98.8 kPa

Velocity (m/s) 10.5
Act Volume Flow (m3/s) 0.1
S.t.p. Volume Flow (m3/s) 0.1

	First Sampling Line			Second Sampling Line			
Sampling Point	Distance Along Line (m)	Velocity (m/s)	Gas Temperature (C)	Sampling Point No.	Distance Along Line (m)	Velocity (m/s)	Gas Temperature (C)
1	0.006	9.5	22	1	0.006	Only one port	
2	0.018	10.4	22	2	0.018		
3	0.030	10.7	22	3	0.030		
4	0.042	10.8	22	4	0.042		
5	0.054	10.9	22	5	0.054		
6	0.066	10.8	22	6	0.066		
7	0.078	10.8	22	7	0.078		
8	0.090	10.7	22	8	0.090		
9	0.102	10.5	22	9	0.102		
10	0.114	9.7	22	10	0.114		
			Mean (1) 22.00				

Mean Flue Gas Temp (in K) Tp = ((Mean (1)+Mean (2))/2)+273) = 295
Permitted range of gas temperature readings (C) = (0.9Tp - 273) to (1.1Tp - 273) = -8 to 52
Highest Pitot Static Reading (either sampling line) (in Pa) = 10.9
Lowest Pitot Static Reading (either sampling line) (in Pa) = 9.5
Ratio Highest/Lowest (Max Permitted = 9:1) 1.1 :1

On Site Checklist	
Pitot Head at Right Angles ?	Y
Manometer Tube Leak Check ?	Y
Static Pressure <2.5kPa ?	Y
Range of Gas Temps OK ?	Y

Pre Site Ckecklist	
Stopwatch Accuracy OK ?	Y
Manometer Intermediate Check OK ?	Y
Temp Indicator Intermediate check OK?	Y
Pitot Leak Check OK ?	Y
Gas Flow Angle < 20deg ?	Y

Pitot Inspection	Pre	Post
Clear of Blockages	Y	Y
Ends not Damaged	Y	Y

TABLE B.10.2

PERCHLOROETHYLENE SAMPLING DATA

Client	**Covrad**		Job Number	FYS2993	
Site	**Coventry**		Date	16-Dec-04	
Stack	**Aluminium Degreaser**		Operators	GH/JR	
Pollutant	**Perchloroethylene**		Sample Method	BS EN 13649	
Absorbent(s)	2 x SKC 226-09 Charcoal Tube		Analysis Method	GC	
Gas Velocity	10.50	m/s	Duct dimensions.	0.12	m
Gas Temp	22	°C	Duct Area	0.01	m^2
Act. Vol. Flow	0.12	m^3/s	S.t.p. Volume Flow	0.11	m^3/s

Run	**Short Term**	Start	Finish		Sample	
Leak Check OK?		Y	Y			
Time		12.49	12.54			
Sample Flow Rate (ml/min)		200	200	Net Total Analyte (mg)	5.8	
DGM Temp (°C)		20	20	Atmos Pressure (kPa)	98.8	
Volume Gas Sampled (l)		1.0		S.t.p. Volume sampled (m^3)	0.001	
No. mins sampling (mins)		5		DGM / Flowmeter error (%)	****	
		As solvent (Perc)	**As total carbon**		**As solvent (Perc)**	**As total carbon**
Mass Emission Rate (g/hr)		**2342.7**	**339.5**	**S.t.p. Emission Conc. (mg/m^3)**	**6071.3**	**879.7**

Run	**Long Term**	Start	Finish		Sample	
Leak Check OK?		Y	Y			
Time		12.49	13.32			
Sample Flow Rate (ml/min)		200	200	Net Total Analyte (mg)	11.0	
DGM Temp (°C)		20	20	Atmos. Pressure (kPa)	98.8	
Volume Gas Sampled (l)		8.6		S.t.p. Volume sampled (m^3)	0.01	
No. mins sampling (mins)		43		DGM / Flowmeter error (%)	****	
		As solvent (Perc)	**As total carbon**		**As solvent (Perc)**	**As total carbon**
Mass Emission Rate (g/hr)		**516.6**	**74.9**	**S.t.p. Emission Conc. (mg/m^3)**	**1338.9**	**194.0**

TABLE B.10.3 **VOC SAMPLING DATA**

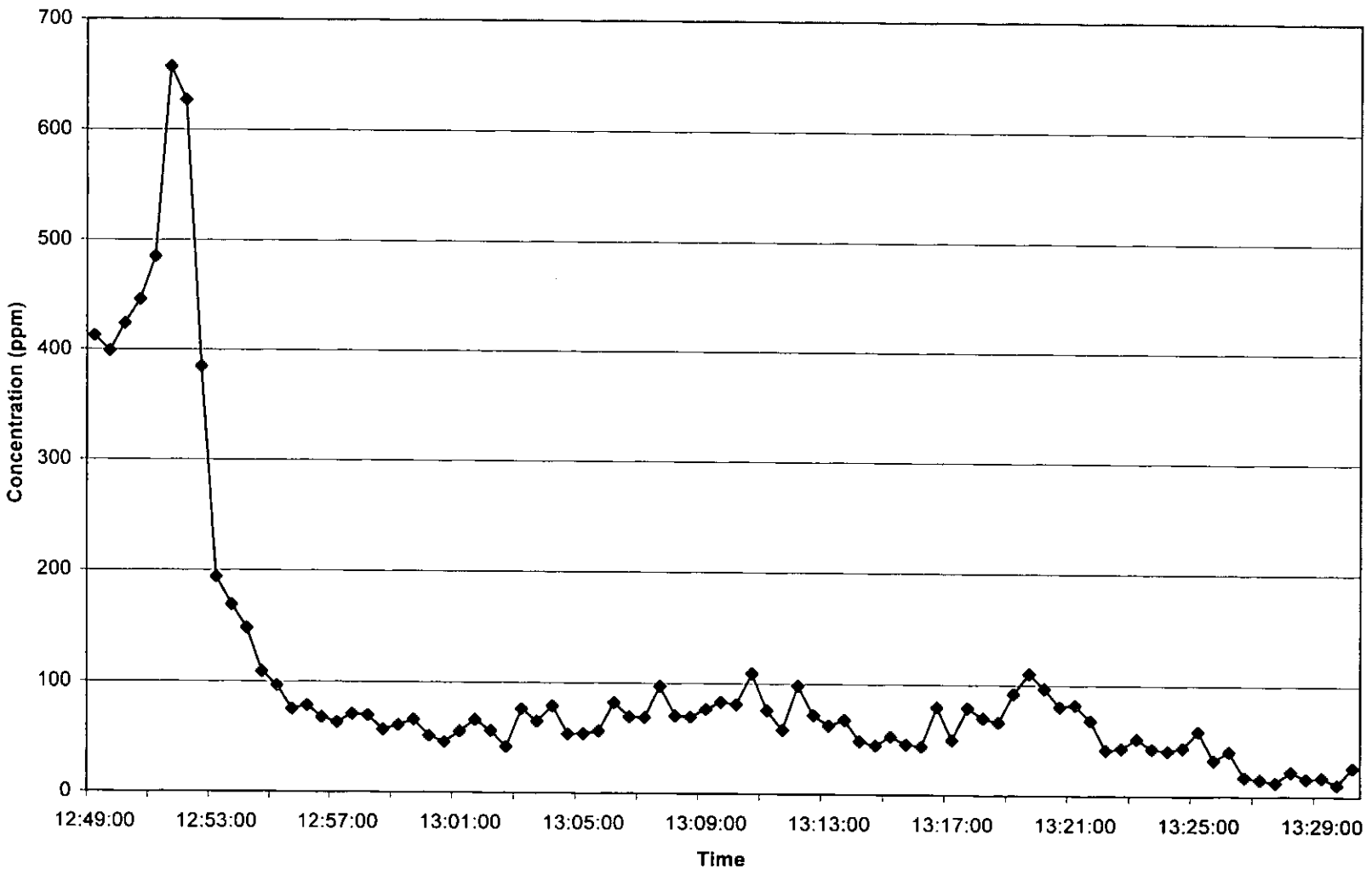
Client	Covrad	Job No.	FYS2993
Site	Coventry	Date	16/12/2004
Stack	Aluminium Degreaser (Perchloroethylene)	Operators	GH/JR
Run No.	1 + 2	Authorised Signature	

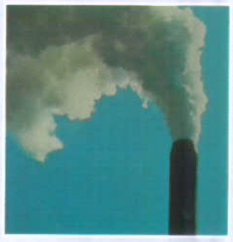
Parameters	VOCs

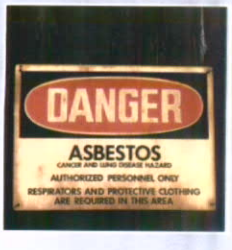
		ZERO				SPAN - PROPANE			
Instrument	Serial No.	Cylinder No.	Cylinder Value	Analyser Start	Analyser Finish	Cylinder No.	Cylinder Value	Analyser Start	Analyser FInish
VOC	FYS031	Air	0	0	-1		100	100	99

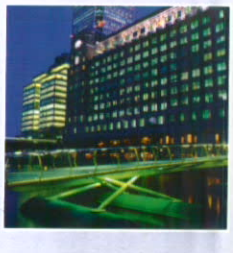
Time	VOC ppm	Procedure Undertaken	Time	VOC ppm			Time	VOC ppm		
12:49:00	413	Basket Out	13:05:00	54			13:21:00	82		
12:49:30	399		13:05:30	56			13:21:30	68		
12:50:00	424		13:06:00	82			13:22:00	42		
12:50:30	446		13:06:30	70			13:22:30	43		
12:51:00	485		13:07:00	69			13:23:00	52		
12:51:30	657		13:07:30	97			13:23:30	43		
12:52:00	627	Shutter	13:08:00	71			13:24:00	41		
12:52:30	385	Closed	13:08:30	70			13:24:30	44		
12:53:00	194		13:09:00	77			13:25:00	59		
12:53:30	169		13:09:30	83			13:25:30	33		
12:54:00	148		13:10:00	81			13:26:00	41		
12:54:30	109		13:10:30	109			13:26:30	17		
12:55:00	96	Large Loading	13:11:00	76			13:27:00	15		
12:55:30	75	door open	13:11:30	58			13:27:30	13		
12:56:00	79		13:12:00	98			13:28:00	23		
12:56:30	68		13:12:30	72			13:28:30	16		
12:57:00	63		13:13:00	62			13:29:00	17		
12:57:30	71		13:13:30	68			13:29:30	11		
12:58:00	70		13:14:00	49			13:30:00	26		
12:58:30	57		13:14:30	45						
12:59:00	61		13:15:00	53						
12:59:30	66		13:15:30	46						
13:00:00	52		13:16:00	44						
13:00:30	46		13:16:30	80						
13:01:00	56		13:17:00	50						
13:01:30	66		13:17:30	79						
13:02:00	56		13:18:00	70						
13:02:30	42		13:18:30	66						
13:03:00	76		13:19:00	92						
13:03:30	65		13:19:30	110						
13:04:00	79		13:20:00	97						
13:04:30	54		13:20:30	80						
Min								11		
Max								657		
Mean								105		

Fig 10.1 - VOC Emission Profile from the Aluminium Degreaser Unit at Covrad Heat Transfer Limited, Monitored on 16 December 2004









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