

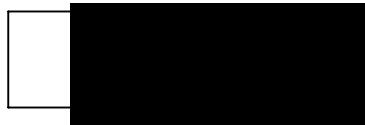
**Report for Periodic Monitoring of Emissions to Atmosphere**

Part 1: **Executive Summary**  
Permit Number: **067, var 002**  
Operator: **Covrad Heat Transfer Ltd**  
Installation: **Coventry**  
Emission Point(s): **Assembly Shop Booth (LH, Middle, RH)**  
**Industrial Spray Booth 1 (LH, RH)**  
**Industrial Spray Booth 2 (LH, RH)**  
Monitoring Date(s): **16<sup>th</sup> – 18<sup>th</sup> January 2012**



Contract Reference: FTBS19360  
Operator: Covrad Heat Transfer Ltd  
Address: Sir Henry Parkes Road  
Canley  
Coventry  
CV5 6BN  
Monitoring Organisation: RPS Consultants  
Address: Unit A1, Lowfields Business Park  
Old Power Way, Elland HX5 9DE  
Report Date: 15<sup>th</sup> February 2012  
Report Approved By: Glyn Harrison  
Position: Operations Manager (Stack Emissions)  
MCERTS Registration Number: MM 03 228  
MCERTS Certification Level: Level 2  
Technical Endorsements: TE1 – TE4

Signature:



RPS Consultants has produced this report within the term of the contract with the client and taking account of the resources devoted to it by agreement with the client.

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## Monitoring Objectives

At the request of Bob Holmes of Covrad Heat Transfer Ltd, RPS Consultants conducted stack emission monitoring at the Coventry site in January 2012.

The monitoring programme at this installation was carried out to provide data on emissions to atmosphere for comparison with the limits specified in the air emission criteria for this site.

The following tables detail the parameters requested for monitoring at each emission point and the actual monitoring conducted.

**Table 1.1**

Parameters Requested to be Monitored	Emission Point
	Assembly Shop
	LH
Total Particulate Matter	✓
<b>Specific Requirements</b>	Normal

Notes:

✓ Represents pollutants sampled

**Table 1.2**

Parameters Requested to be Monitored	Emission Point
	Assembly Shop
	Middle
Total Particulate Matter	✓
<b>Specific Requirements</b>	Normal

Notes:

✓ Represents pollutants sampled

**Table 1.3**

Parameters Requested to be Monitored	Emission Point
	Assembly Shop
	RH
Total Particulate Matter	✓
<b>Specific Requirements</b>	Normal

Notes:

✓ Represents pollutants sampled

**Table 1.4**

Parameters Requested to be Monitored	Emission Point
	Industrial Spray Booth 1
	LH
Total Particulate Matter	✓
<b>Specific Requirements</b>	Normal

Notes:

✓ Represents pollutants sampled

**Table 1.5**

Parameters Requested to be Monitored	Emission Point
	Industrial Spray Booth 1
	RH
Total Particulate Matter	✓
<b>Specific Requirements</b>	Normal

Notes:

✓ Represents pollutants sampled

**Table 1.6**

Parameters Requested to be Monitored	Emission Point
	Industrial Spray Booth 2
	LH
Total Particulate Matter	✓
<b>Specific Requirements</b>	Normal

Notes:

✓ Represents pollutants sampled

**Table 1.7**

Parameters Requested to be Monitored	Emission Point
	Industrial Spray Booth 2
	RH
Total Particulate Matter	✓
<b>Specific Requirements</b>	Normal

Notes:

✓ Represents pollutants sampled

## Monitoring Results

**Table 2.1 Monitoring results for the Assembly Shop - LH, Carried out on 18/01/2012**

Substance Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty (Expressed expanded k=2)	Reference Conditions 273K, 101.3kPa	Sampling Date	Sampling Times	Monitoring Reference Method	Accreditation Status	Operating Status
Total Particulate Matter	50	0.74	mg/m <sup>3</sup>	+/- 0.23	273K, 101.3kPa, Wet	18/01/2012	10:37 - 11:40	BS EN 13284-1:2002	MCERTS	Normal
	N/a	0.013	kg/hr							

**Table 2.2 Monitoring results for the Assembly Shop - Middle, Carried out on 18/01/2012**

Substance Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty (Expressed expanded k=2)	Reference Conditions 273K, 101.3kPa	Sampling Date	Sampling Times	Monitoring Reference Method	Accreditation Status	Operating Status
Total Particulate Matter	50	2.6	mg/m <sup>3</sup>	+/- 0.25	273K, 101.3kPa, Wet	18/01/2012	11:59 - 13:03	BS EN 13284-1:2002	MCERTS	Normal
	N/a	0.043	kg/hr							

**Table 2.3 Monitoring results for the Assembly Shop - RH, Carried out on 18/01/2012**

Substance Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty (Expressed expanded k=2)	Reference Conditions 273K, 101.3kPa	Sampling Date	Sampling Times	Monitoring Reference Method	Accreditation Status	Operating Status
Total Particulate Matter	50	1.9	mg/m <sup>3</sup>	+/- 0.26	273K, 101.3kPa, Wet	18/01/2012	13:52 - 14:55	BS EN 13284-1:2002	MCERTS	Normal
	N/a	0.030	kg/hr							

**Table 2.4 Monitoring results for the Industrial Spray Booth 1 LH, Carried out on 17/01/2012**

Substance Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty (Expressed expanded k=2)	Reference Conditions 273K, 101.3kPa	Sampling Date	Sampling Times	Monitoring Reference Method	Accreditation Status	Operating Status
Total Particulate Matter	50	2.4	mg/m <sup>3</sup>	+/- 0.20	273K, 101.3kPa, Wet	17/01/2012	10:31 - 11:33	BS EN 13284-1:2002	MCERTS	Normal
	N/a	0.027	kg/hr							

**Table 2.5 Monitoring results for the Industrial Spray Booth 1 RH, Carried out on 17/01/2012**

Substance Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty (Expressed expanded k=2)	Reference Conditions 273K, 101.3kPa	Sampling Date	Sampling Times	Monitoring Reference Method	Accreditation Status	Operating Status
Total Particulate Matter	50	0.66	mg/m <sup>3</sup>	+/- 0.19	273K, 101.3kPa, Wet	17/01/2012	11:46 - 12:49	BS EN 13284-1:2002	MCERTS	Normal
	N/a	0.0072	kg/hr							

**Table 2.6 Monitoring results for the Industrial Spray Booth 2 LH, Carried out on 16/01/2012**

Substance Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty (Expressed expanded k=2)	Reference Conditions 273K, 101.3kPa	Sampling Date	Sampling Times	Monitoring Reference Method	Accreditation Status	Operating Status
Total Particulate Matter	50	0.72	mg/m <sup>3</sup>	+/- 0.23	273K, 101.3kPa, Wet	16/01/2012	11:57 - 13:00	BS EN 13284-1:2002	MCERTS	Normal
	N/a	0.007	kg/hr							

**Table 2.7 Monitoring results for the Industrial Spray Booth 2 RH, Carried out on 16/01/2012**

Substance Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty (Expressed expanded k=2)	Reference Conditions 273K, 101.3kPa	Sampling Date	Sampling Times	Monitoring Reference Method	Accreditation Status	Operating Status
Total Particulate Matter	50	2.9	mg/m <sup>3</sup>	+/- 0.29	273K, 101.3kPa, Wet	16/01/2012	14:00 - 15:04	BS EN 13284-1:2002	MCERTS	Normal
	N/a	0.023	kg/hr							



## Operating Information

**Table 3.1 Operating conditions during the monitoring of the Assembly Shop LH emission point, carried out on 18/01/2012**

Parameter	Result
Sample Date	18/01/2012
Process Type	Batch
Process Duration	60 Minutes
If 'Batch', was monitoring carried out over the whole batch?	No
Abatement/Operational?	Dry Filtration / Operational
Paint Ref. Number	Black Primer 395 P9003
Item Sprayed	2 x medium radiators, 1 x large cooler unit

Comparison of Operator CEM and Periodic Monitoring Results		
Substance	CEMs Results (mg/m <sup>3</sup> )	Periodic Monitoring Results (mg/m <sup>3</sup> )
No CEMS Installed/Data Available		

**Table 3.2 Operating conditions during the monitoring of the Assembly Shop Middle emission point, carried out on 18/01/2012**

Parameter	Result
Sample Date	18/01/2012
Process Type	Batch
Process Duration	60 Minutes
If 'Batch', was monitoring carried out over the whole batch?	No
Abatement/Operational?	Dry Filtration / Operational
Paint Ref. Number	Black Primer 395 P9003
Item Sprayed	Large Cooler Units x 2

Comparison of Operator CEM and Periodic Monitoring Results		
Substance	CEMs Results (mg/m <sup>3</sup> )	Periodic Monitoring Results (mg/m <sup>3</sup> )
No CEMS Installed/Data Available		

**Table 3.3 Operating conditions during the monitoring of the Assembly Shop RH emission point, carried out on 18/01/2012**

Parameter	Result
Sample Date	18/01/2012
Process Type	Batch
Process Duration	60 Minutes
If 'Batch', was monitoring carried out over the whole batch?	No
Abatement/Operational?	Dry Filtration / Operational
Paint Ref. Number	Black primer 395 P9003
Item Sprayed	2 x large cooler units, 5 x small cooler units

Comparison of Operator CEM and Periodic Monitoring Results		
Substance	CEMs Results (mg/m <sup>3</sup> )	Periodic Monitoring Results (mg/m <sup>3</sup> )
No CEMS Installed/Data Available		

**Table 3.4 Operating conditions during the monitoring of the Industrial Spray Booth 1 LH emission point, carried out on 17/01/2012**

Parameter	Result
Sample Date	17/01/2012
Process Type	Batch
Process Duration	60 Minutes
If 'Batch', was monitoring carried out over the whole batch?	No
Abatement/Operational?	Not Installed
Paint Ref. Number	Black primer 395 P9003
Item Sprayed	3 x 48" Aluminium coolers

Comparison of Operator CEM and Periodic Monitoring Results		
Substance	CEMs Results (mg/m <sup>3</sup> )	Periodic Monitoring Results (mg/m <sup>3</sup> )
No CEMS Installed/Data Available		

**Table 3.5 Operating conditions during the monitoring of the Industrial Spray Booth 1 RH emission point, carried out on 17/01/2012**

Parameter	Result
Sample Date	17/01/2012
Process Type	Batch
Process Duration	60 Minutes
If 'Batch', was monitoring carried out over the whole batch?	No
Abatement/Operational?	Dry Filtration / Operational
Paint Ref. Number	Black primer 395 P9003
Item Sprayed	3 x 48" coolers

Comparison of Operator CEM and Periodic Monitoring Results		
Substance	CEMs Results (mg/m <sup>3</sup> )	Periodic Monitoring Results (mg/m <sup>3</sup> )
No CEMS Installed/Data Available		

**Table 3.6 Operating conditions during the monitoring of the Industrial Spray Booth 2 LH emission point, carried out on 16/01/2012**

Parameter	Result
Sample Date	16/01/2012
Process Type	Batch
Process Duration	60 Minutes
If 'Batch', was monitoring carried out over the whole batch?	No
Abatement/Operational?	Dry Filtration / Operational
Paint Ref. Number	Black Primer 395 P9003
Item Sprayed	48" Aluminium coolers x 6

Comparison of Operator CEM and Periodic Monitoring Results		
Substance	CEMs Results (mg/m <sup>3</sup> )	Periodic Monitoring Results (mg/m <sup>3</sup> )
No CEMS Installed/Data Available		

**Table 3.7 Operating conditions during the monitoring of the Industrial Spray Booth 2 RH emission point, carried out on 16/01/2012**

Parameter	Result
Sample Date	16/01/2012
Process Type	Batch
Process Duration	60 Minutes
If 'Batch', was monitoring carried out over the whole batch?	No
Abatement/Operational?	Dry Filtration / Operational
Paint Ref. Number	Black primer 395 P9003
Item Sprayed	4 x 48" coolers, 1 x large cooler unit

Comparison of Operator CEM and Periodic Monitoring Results		
Substance	CEMs Results (mg/m <sup>3</sup> )	Periodic Monitoring Results (mg/m <sup>3</sup> )
No CEMS Installed/Data Available		

## Monitoring Deviations

**Table 4.1 Monitoring Deviations for Assembly Shop LH Emission Point**

Pollutant	Substance Deviations	Monitoring Deviations	Other Relevant Issues
Total Particulate Matter	None	None	None

**Table 4.2 Monitoring Deviations for Assembly Shop Middle Emission Point**

Pollutant	Substance Deviations	Monitoring Deviations	Other Relevant Issues
Total Particulate Matter	None	<ul style="list-style-type: none"> <li>Ratio of Highest to Lowest duct Velocities &gt; 3:1</li> </ul>	None



**Table 4.3 Monitoring Deviations for assembly Shop RH Emission Point**

Pollutant	Substance Deviations	Monitoring Deviations	Other Relevant Issues
Total Particulate Matter	None	<ul style="list-style-type: none"> <li>Ratio of Highest to Lowest duct Velocities &gt; 3:1</li> </ul>	None

**Table 4.4 Monitoring Deviations for Industrial Spray Booth 1 LH Emission Point**

Pollutant	Substance Deviations	Monitoring Deviations	Other Relevant Issues
Total Particulate Matter	None	None	None

**Table 4.5 Monitoring Deviations for Industrial Spray Booth 1 RH Emission Point**

Pollutant	Substance Deviations	Monitoring Deviations	Other Relevant Issues
Total Particulate Matter	None	None	None

**Table 4.6 Monitoring Deviations for Industrial Spray Booth 2 LH Emission Point**

Pollutant	Substance Deviations	Monitoring Deviations	Other Relevant Issues
Total Particulate Matter	None	<ul style="list-style-type: none"> <li>Ratio of Highest to Lowest duct Velocities &gt; 3:1</li> </ul>	None

**Table 4.7 Monitoring Deviations for Industrial Spray Booth 2 RH Emission Point**

Pollutant	Substance Deviations	Monitoring Deviations	Other Relevant Issues
Total Particulate Matter	None	<ul style="list-style-type: none"> <li>Ratio of Highest to Lowest duct Velocities &gt; 3:1</li> </ul>	None

**Report for Periodic Monitoring of Emissions to Atmosphere**

Part 2: **Supporting Information**

Permit Number: **067, var 002**

Operator: **Covrad Heat Transfer Ltd**

Installation: **Coventry**

Emission Point(s): **Assembly Shop Booth (LH, Middle, RH)  
Industrial Spray Booth 1 (LH, RH)  
Industrial Spray Booth 2 (LH, RH)**

Monitoring Date(s): **16<sup>th</sup> – 18<sup>th</sup> January 2012**



Contract Reference: FTBS19360

Operator: Covrad Heat Transfer Ltd

Address: Sir Henry Parkes Road  
Canley  
Coventry  
CV5 6BN

Monitoring Organisation: RPS Consultants

Address: Unit A1, Lowfields Business Park  
Old Power Way, Elland HX5 9DE

Report Date: 15<sup>th</sup> February 2012

Report Approved By: Glyn Harrison

Position: Operations Manager (Stack Emissions)

MCERTS Registration Number: MM 03 228

MCERTS Certification Level: Level 2

Technical Endorsements: TE1 – TE4

Signature:

RPS Consultants has produced this report within the term of the contract with the client and taking account of the resources devoted to it by agreement with the client.

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**Appendix 4- Assembly Shop RH Sampling, Analysis & Uncertainty Data**

**Appendix 5- Industrial Spray Booth 1 LH Sampling, Analysis & Uncertainty Data**

**Appendix 6- Industrial Spray Booth 1 RH Sampling, Analysis & Uncertainty Data**

**Appendix 7- Industrial Spray Booth 2 LH Sampling, Analysis & Uncertainty Data**

**Appendix 8- Industrial Spray Booth 2 RH Sampling, Analysis & Uncertainty Data**

**Appendix 9- Laboratory Results**

## **APPENDIX 1: General Information**

## Monitoring Organisation Staff Details

**Table 5.1 Sampling Personnel**

Sampling Personnel	Position	MCERTS Level	Technical Endorsements	MCERTS Registration Number
Ian Bagglely	Consultant	Level 2	TE1, TE2, TE4	MM 05 653
Martin Brown	Consultant	Level 2	TE1, TE2, TE3, TE4	MM 05 642

**Table 5.2 Report Author**

Report Author	Position	MCERTS Level	Technical Endorsements	MCERTS Registration Number
Ian Bagglely	Consultant	Level 2	TE1, TE2, TE4	MM 05 653

**Table 5.3 Report Reviewer**

Report Reviewer	Position	MCERTS Level	Technical Endorsements	MCERTS Registration Number
Glyn Harrison	Operations Manager (Stack Emissions)	Level 2	TE1, TE2, TE3, TE4	MM 03 228

## Monitoring Organisation Method Details

**Table 6.1 Monitoring Methods**

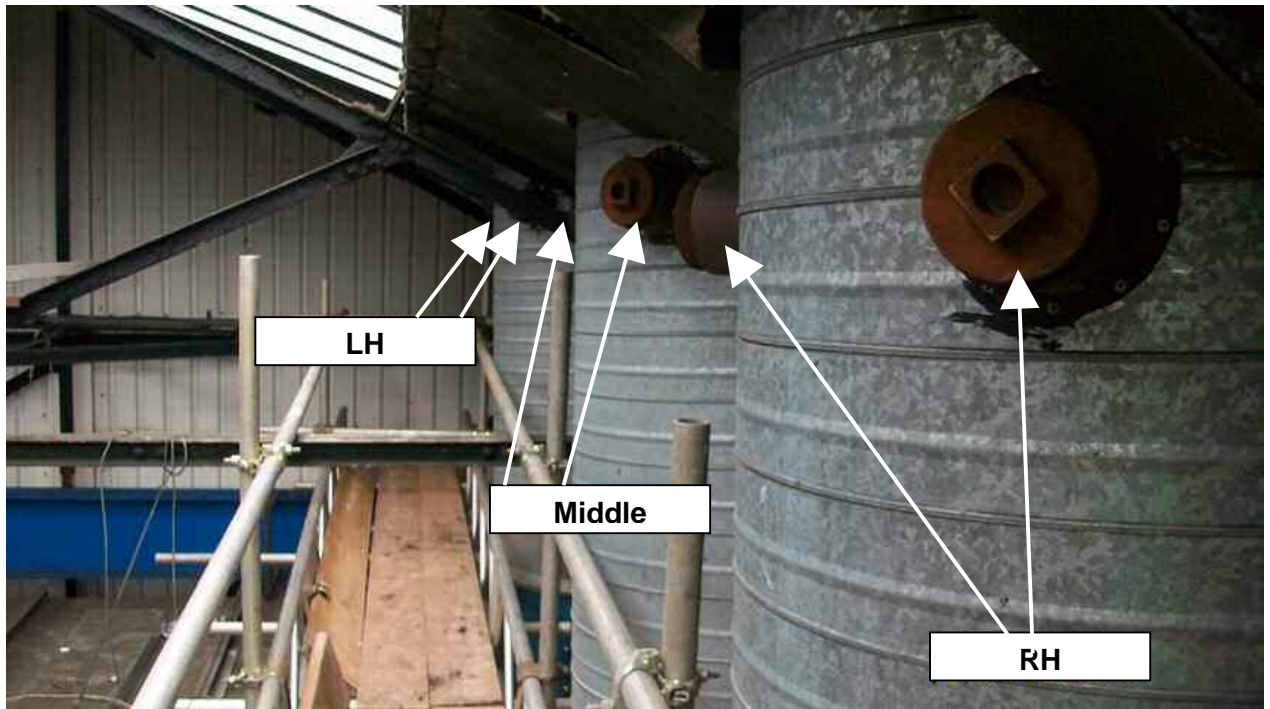
Emission Parameter	Standard Method	Monitoring Procedure No.	Monitoring Accreditation	Analysis	Analysis Procedure No.	Analytical Laboratory	Analysis Accreditation
Practical Considerations Prior to Monitoring	N/A	RPSCE/1/1	UKAS	N/A	N/A	N/A	N/A
Gas Flows	BS-EN 13284-1:2001	RPSCE/1/2	MCERTS	N/A	N/A	N/A	N/A
Gas Temperatures	BS-EN 13284-1:2001	RPSCE/1/2	MCERTS	N/A	N/A	N/A	N/A
Low Concentration Total Particulate Matter	BS EN 13284-1:2002	RPSCE/1/7c	MCERTS	Gravimetric	D9	RPS Laboratories	UKAS

**Table 7.1 – Checklist Used**

Equipment Checklist Used	File Location Address
FTBS19360 Checklist	FTBS19360 Electronic & Work File

**APPENDIX 2:**  
**Assembly Shop LH Sampling, Analysis & Uncertainty Data**





**Schematic Photograph  
Assembly Shop Spray Booth Emission Points LH, Middle & RH.**

Each point had identical diameters of 0.89m, accessed from the top of the booth by scaffold and lashed ladder.

The size and position of the sample ports were adequate for sampling and are indicated by the white arrows.

Company Name: TS COVRAD Heat Transfer Date: 18/01/12  
 Site Name: Canley Run: Particulate Matter  
 Sampling Point Ref: Assembly Shop Booth - LH  
 Project Reference: FTBS 19360

Traverse Point No	Port A			Port B		
	$\Delta p$ , mm H <sub>2</sub> O	Root $\Delta p$	Stack Temp °C	$\Delta p$ , mm H <sub>2</sub> O	Root $\Delta p$	Stack Temp °C
1	5.8	2.408	12	12.4	3.521	12
2	6.4	2.530	12	10.8	3.286	12
3	6.6	2.569	12	8.4	2.898	12
4	6.6	2.569	12	6.8	2.608	12
5	6	2.449	12	5.8	2.408	12
6	5.8	2.408	12	6.8	2.608	12
7	5.8	2.408	12	8	2.828	12
8	6.8	2.608	13	8.6	2.933	12
9	11	3.317	13	9.6	3.098	13
10	13	3.606	13	9.8	3.130	13
Minimum	5.8	2.408	12	5.8	2.408	12
Maximum	13.0	3.606	13	12.4	3.521	13
Mean	7.4	2.687	12.3	8.7	2.932	12.2
Sum	73.8	26.872	123	87	29.320	122
Total Sum						

Max. pitot press. = 13.0  
 Min. pitot press. = 5.8  
 Ratio Max:Min = 2.2 :1

Gas Data	
Oxygen %	21.0
CO <sub>2</sub> %	0.04
CO %	

Oxygen Correction	
Required Correction Value	0
Actual Oxygen Factor	1
Enter 0 if correction is not required	0

BS EN 13284-1 & M1 Sample Point Requirements	Requirement Met?
Duct gas flow: angle with regard to duct access <15°?	Y
Duct Gas Flow Negative Velocity: Not Permitted	Y
Duct Gas Flow: Ratio of max to min velocity <3:1?	Y
Working Area > 5m <sup>2</sup> ?	Y
Handrails with removable chains / self closing gates across the top of the ladder?	Y
Handrails (approx 0.5 and 1.0 m high) and vertical baseboards (approx 0.25m high)?	Y
Scaffold Built to 'Heavy Duty' Scafftag Rating or at least 2.5kN/m <sup>2</sup> loading	Y
Handrails not restricting access to ports?	Y
Room opposite sampling port equal or greater than the length of the sampling probe plus 1 metre?	Y
Sufficient Power (Waterproof 110V BS4343 Standard) close or on the platform?	Y

Company Name:	TS COVRAD	In-stack Filter?	<input type="checkbox"/> Y	Bar. Press.mm Hg	<input type="text" value="759.06"/>	K Factor	<input type="text" value="5.14"/>	Ambient Temp.	<input type="text" value="8"/>	Leak Rate (in / %)	<input type="text" value="&lt;0.05"/>
Site Name:	Heat Transfer	Outstack Filter?	<input type="checkbox"/> N	Cp	<input type="text" value="0.823"/>	Dn used	<input type="text" value="6.86"/>	Start Time	<input type="text" value="10:37"/>	Leak Rate (start / %)	<input type="text" value="&lt;0.05"/>
Sampling Point Ref:	Carley	Particulate Matter	<input type="checkbox"/> IB	Bws%	<input type="text" value="0.015"/>	Nozzle No.	<input type="text" value="FYS367-7"/>	Stop Time	<input type="text" value="11:40"/>	Probe setting	<input type="text" value="160 +/- 5 oC"/>
Date:	18/01/12	Project Reference:		Meter Correction Yd	<input type="text" value="0.97"/>						

**Sample Filter Weights**

	Reference	Laboratory	Increase, mg
<b>Filter</b>	80448	RPS	0.21
<b>Probe Washings</b>	T20001369	RPS	0.7

**Sample Filter Blank Weighings**

	Reference	Laboratory	Increase, mg
<b>Filter</b>	81058	RPS	<b>0.04</b>
<b>Probe Wash</b>	T20001368	RPS	1.1

**Note: Results in Bold are reported at the L.O.D.**

**Impinger Weights**

Weights	Initial	Final	Increase, g
<b>Impinger 1</b>	634.2	632	-2.2
<b>Impinger 2</b>	492.4	494.8	2.4
<b>Impinger 3</b>			
<b>Impinger 4</b>			
<b>Impinger 5</b>			
<b>Silica Gel</b>	859.6	878.7	19.1
<b>Total</b>			19.3

Sample Point	Clock Time min	Pitot Δ p, mm H <sub>2</sub> O	Stack Temp, °C	Orifice Δ H, mm H <sub>2</sub> O		Gas Meter Reading m <sup>3</sup>	Temp at Gas Meter Outlet °C	Condenser Temp. °C	Filter Box Temp °C	Probe Temp °C	Pump Vacuum Inches Hg	Impinger Stem Temp. °C	Root Δ p, °C
				Desired	Actual								
A1	0	6.4	13	32.9	32.9	<b>9786.4</b>	11	.	.	160	2	11	2.530
	5	6.4	13	32.9	32.9		11	.	.	160	1.5	13	2.530
	10	6.4	13	32.9	32.9		11	.	.	160	1.5	15	2.530
	15	10.6	14	54.5	54.5		11	.	.	160	2.5	17	3.256
	20	10.8	14	55.5	55.5		12	.	.	160	2.5	19	3.286
Endpoint	30												
B1	0	10.8	13	55.5	55.5	<b>11074</b>	13	.	.	160	2.5	13	3.286
	5	10.6	13	54.5	54.5		14	.	.	160	2.5	14	3.256
	10	10.6	13	54.5	54.5		14	.	.	160	2.5	15	3.256
	15	9.6	13	49.3	49.3		14	.	.	160	2	16	3.098
	20	9.4	13	48.3	48.3		14	.	.	160	2	17	3.066
Endpoint	30												
<b>60.00</b>	<b>9.3</b>	<b>13.2</b>	<b>47.9</b>	<b>47.9</b>	<b>1.288</b>	<b>12.5</b>	<b>160.0</b>	<b>2.2</b>	<b>14.8</b>	<b>3.0</b>			

Company Name: TS COVRAD Heat Transfer  
Site Name: Canley  
Project Reference: FTBS 19360

Date: 18/01/12

Sampling Point Ref:	Particulate Matter
Meter Volume Sampled, acm	1.288
Sample Run Start Time	10:37
Sample Run End Time	11:40
Total Actual Sampling Time, min	60.0
Barometric Pressure, mm Hg	759.06
Stack Pressure, mm Hg	759.19
Average Stack Temp, °C	13.2
Meter Volume at Wet STP, scm	1.222
Stack Moisture Content, %	2.0
Average Stack Velocity, m/sec	10.026
Stack Flow Rate, scms wet, STP	4.800
Nozzle Diameter, mm	6.86
<b>% Isokinetic Variation</b>	<b>95.9</b>
Total Mass of Particulate, mg	0.9
Percentage of Total Particulate Collected on Filter	23.1
<b>Stack Particulate Concentration, mg/m<sup>3</sup></b>	<b>0.7</b>
Particulate Mass rate, kg/hour	0.013
Emission Limit value mg/m <sup>3</sup>	<b>50</b>

Sample Train Blank Results	
Sample Blank Particulate Concentration, mg/m <sup>3</sup>	0.9
Total Weight Gain, mg (Sample Train Blank)	1.1
Blank Result Less than 10% of Limit Value	Y

**Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1**

Determined Concentration 0.7 mg/m<sup>3</sup> (at Reference Cond)

**Measured Values**

Sampled Volume	1.2876	m <sup>3</sup>
Sampled gas Temperature	285.5	K
Sampled gas Pressure	101.22	kPa
Sampled gas Humidity	0	% by volume
Oxygen content	21	% by volume
Mass	0.91	mg

Leak	0.05	%
Uncollected Mass	0	mg

**Standard Uncertainties for Measured Values**

Sampled Volume	0.001	m <sup>3</sup>
Sampled gas Temperature	2	K
Sampled gas Pressure	1	kPa
Sampled gas Humidity	1	% by volume
Oxygen content	0.1	% by volume
Mass	0.14152385	mg

Uncertainty Calculation for Volume Correction				Uncertainty Calculation for Oxygen Correction			
Volume Correction Factor	0.955			Oxygen Correction Factor	1.0000		
	<b>Sensitivity Coefficient</b>		<b>Uncertainty, U<sub>v</sub></b>		<b>Sensitivity Coefficient</b>		<b>Uncertainty, U<sub>o</sub></b>
Sampled gas Temperature	0.0033		0.0067	Oxygen Measurement	N/A		N/A
Sampled gas Pressure	0.0094		0.0094				
Sampled gas Humidity	0.0096		0.0096				
		<b>Sqrt (U<sub>v</sub>)<sup>2</sup></b>	0.0150				
		<b>Total U<sub>v</sub></b>	0.019			<b>Total U<sub>o</sub></b>	N/A

Uncertainty Contributions (Itemised)					
	Value		Sensitivity coefficient	Uncertainty Contribution	
				Concentration	%
Volume Correction	1.198	m <sup>3</sup>	0.62	0.01 mg.m <sup>-3</sup>	1.62 %
Mass (weighing)	0.91	mg	0.92	0.12 mg.m <sup>-3</sup>	15.55 %
Oxygen Correction	N/A		0.00	0.00 mg.m <sup>-3</sup>	0.00 %
System Leak	0.00	mg.m <sup>3</sup>	1.00	0.00 mg.m <sup>-3</sup>	0.03 %
Uncollected Mass	0.00	mg	0.92	0.00 mg.m <sup>-3</sup>	0.00 %
			<b>Total Uncertainty</b>	<b>0.12 mg.m<sup>-3</sup></b>	

Uncertainty Result	
(Uncertainty has been expanded with a coverage factor of 2 (K=2))	
<b>Expanded Uncertainty =</b>	<b>0.23 mg.m<sup>-3</sup></b>
<b>=&gt;</b>	<b>31.27 % of Result</b>
<b>=&gt;</b>	<b>0.00 % of ELV</b>

**APPENDIX 3:**  
**Assembly Shop Middle Sampling, Analysis & Uncertainty Data**

For 'Assembly Shop Middle' emission point schematic see Appendix 2

Company Name: TS COVRAD Heat Transfer Date: 18/01/12  
Site Name: Canley Run: Particulate Matter  
Sampling Point Ref: Assembly Shop Booth - MID  
Project Reference: FTBS 19360

Stack Static press mm H <sub>2</sub> O:	4.8	Stack Diameter (m)	0.80			
		Stack Area (m <sup>2</sup> )	0.503			
Traverse Point No	Port A			Port B		
	Δ p, mm H <sub>2</sub> O	Root Δ p	Stack Temp °C	Δ p, mm H <sub>2</sub> O	Root Δ p	Stack Temp °C
1	19	4.359	12	4.2	2.049	13
2	13.4	3.661	12	5.2	2.280	13
3	9.6	3.098	12	5.6	2.366	13
4	8	2.828	13	6	2.449	13
5	7.4	2.720	13	6.4	2.530	13
6	7.4	2.720	13	6.6	2.569	13
7	8	2.828	13	6.8	2.608	13
8	7.4	2.720	13	7.8	2.793	13
9	7	2.646	13	9.6	3.098	13
10	6.4	2.530	13	14.2	3.768	13
Minimum	6.4	2.530	12	4.2	2.049	13
Maximum	19.0	4.359	13	14.2	3.768	13
Mean	9.4	3.011	12.7	7.2	2.651	13.0
Sum	93.6	30.111	127	72.4	26.512	130
Total Sum						

Max. pitot press. =	19.0
Min. pitot press. =	4.2
Ratio Max:Min =	4.5 :1

**Gas Data**

Oxygen %	21.0
CO <sub>2</sub> %	0.04
CO %	

**Oxygen Correction**

Required Correction Value	0
Actual Oxygen Factor	1
Enter 0 if correction is not required	0

BS EN 13284-1 & M1 Sample Point Requirements	Requirement Met?
Duct gas flow: angle with regard to duct access <15°?	Y
Duct Gas Flow Negative Velocity: Not Permitted	Y
Duct Gas Flow: Ratio of max to min velocity <3.1?	N
Working Area > 5m <sup>2</sup> ?	Y
Handrails with removable chains / self closing gates across the top of the ladder?	Y
Handrails (approx 0.5 and 1.0 m high) and vertical baseboards (approx 0.25m high)?	Y
Scaffold Built to 'Heavy Duty' Scafftag Rating or at least 2.5kN/m <sup>2</sup> loading	Y
Handrails not restricting access to ports?	Y
Room opposite sampling port equal or greater than the length of the sampling probe plus 1 metre?	Y
Sufficient Power (Waterproof 110V BS4343 Standard) close or on the platform?	Y

Company Name: TS COVRAD  
Site Name: Heat Transfer  
Sampling Point Ref: Carley  
Date: 18/01/12  
Run: Particulate Matter Operators  
Project Reference:

In-stack Filter?  Y  N  
Bar. Press.mm Hg 759.06  
K Factor 5.15  
Dn used 6.86  
Nozzle No. FYS367-7  
Meter Correction Yd 0.97

Ambient Temp. 8  
Start Time 11:59  
Stop Time 13:03  
Leak Rate (in / %) <0.05  
Leak Rate (start / %) <0.05  
Probe setting 160 +/- 5 oC

Sample Filter Weights

	Reference	Laboratory	Increase, mg
Filter	81057	RPS	1.78
Probe Washings	T20001370	RPS	1.3

Sample Filter Blank Weighings

	Reference	Laboratory	Increase, mg
Filter	81058	RPS	<b>0.04</b>
Probe Wash	T20001368	RPS	1.1

Note: Results in Bold are reported at the L.O.D.

Impinger Weights

Weights	Initial	Final	Increase, g
Impinger 1	764.4	763.3	-1.1
Impinger 2	556.3	559.2	2.9
Impinger 3			
Impinger 4			
Impinger 5			
Silica Gel	878.7	890.8	12.1
Total			13.9

Sample Point	Clock Time min	Pitot Δ p, mm H <sub>2</sub> O	Stack Temp, °C	Orifice Δ H, mm H <sub>2</sub> O		Gas Meter Reading m <sup>3</sup>	Temp at Gas Meter Outlet °C	Condenser Temp. °C	Filter Box Temp °C	Probe Temp °C	Pump Vacuum Inches Hg	Impinger Stem Temp. °C	Root Δ p, °C
				Desired	Actual								
A1	0	12.2	13	62.8	62.8	<b>1085.8</b>	13	-	-	160	3	13	3.493
	5	12.0	14	61.8	61.8		13	-	-	160	3	13	3.484
	10	12.0	14	61.8	61.8		14	-	-	160	3	11	3.484
A2	15	7.0	15	36.1	36.1	14	-	-	160	2	11	2.646	
	20	7.4	14	38.1	38.1	15	-	-	160	2	11	2.720	
	25	7.2	14	37.1	37.1	15	-	-	160	2	12	2.693	
Endpoint	30												
B1	0	5.4	14	27.8	27.8	15	-	-	160	1.5	12	2.324	
	5	5.4	14	27.8	27.8	15	-	-	160	1.5	12	2.324	
	10	5.2	14	26.8	26.8	15	-	-	160	1.5	13	2.280	
B2	15	9.8	15	50.5	48.4	15	-	-	160	2.5	14	3.130	
	20	10.0	15	51.5	51.5	16	-	-	160	2.5	14	3.182	
	25	10.0	15	51.5	51.5	16	-	-	160	2.5	15	3.182	
Endpoint	30					<b>2355.8</b>							
	<b>60.00</b>	<b>8.6</b>	<b>14.3</b>	<b>44.5</b>	<b>44.1</b>	<b>1270</b>	<b>14.7</b>			<b>160.0</b>	<b>2.3</b>	<b>12.6</b>	<b>2.9</b>



Company Name: **TS COVRAD Heat Transfer**  
 Site Name: **Canley**  
 Project Reference: **FTBS 19360**

Date: 18/01/12

Sampling Point Ref:	Particulate Matter
Meter Volume Sampled, acm	1.270
Sample Run Start Time	11:59
Sample Run End Time	13:03
Total Actual Sampling Time, min	60.0
Barometric Pressure, mm Hg	759.06
Stack Pressure, mm Hg	759.41
Average Stack Temp, °C	14.3
Meter Volume at Wet STP, scm	1.189
Stack Moisture Content, %	1.5
Average Stack Velocity, m/sec	9.596
Stack Flow Rate, scms wet, STP	4.578
Nozzle Diameter, mm	6.86
<b>% Isokinetic Variation</b>	<b>97.9</b>
Total Mass of Particulate, mg	3.1
Percentage of Total Particulate Collected on Filter	57.8
<b>Stack Particulate Concentration, mg/m<sup>3</sup></b>	<b>2.6</b>
Particulate Mass rate, kg/hour	0.043
Emission Limit value mg/m <sup>3</sup>	<b>50</b>

Sample Train Blank Results	
Sample Blank Particulate Concentration, mg/m <sup>3</sup>	1.0
Total Weight Gain, mg (Sample Train Blank)	1.1
Blank Result Less than 10% of Limit Value	Y

**Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1**

Determined Concentration **2.6** mg/m<sup>3</sup> (at Reference Cond)

**Measured Values**

Sampled Volume	1.27	m <sup>3</sup>
Sampled gas Temperature	287.666667	K
Sampled gas Pressure	101.25	kPa
Sampled gas Humidity	0	% by volume
Oxygen content	21	% by volume
Mass	3.06	mg

Leak	0.05	%
Uncollected Mass	0	mg

**Standard Uncertainties for Measured Values**

Sampled Volume	0.001	m <sup>3</sup>
Sampled gas Temperature	2	K
Sampled gas Pressure	1	kPa
Sampled gas Humidity	1	% by volume
Oxygen content	0.1	% by volume
Mass	0.14152385	mg

Uncertainty Calculation for Volume Correction				Uncertainty Calculation for Oxygen Correction			
Volume Correction Factor	0.949			Oxygen Correction Factor	1.0000		
	<b>Sensitivity Coefficient</b>		<b>Uncertainty, U<sub>v</sub></b>		<b>Sensitivity Coefficient</b>		<b>Uncertainty, U<sub>o</sub></b>
Sampled gas Temperature	0.0033		0.0066	Oxygen Measurement	N/A		N/A
Sampled gas Pressure	0.0094		0.0094				
Sampled gas Humidity	0.0065		0.0065				
	<b>Sqrt (U<sub>v</sub>)<sup>2</sup></b>		0.0149				
	<b>Total U<sub>v</sub></b>		<b>0.019</b>			<b>Total U<sub>o</sub></b>	<b>N/A</b>

	Value		Sensitivity coefficient	Uncertainty Contribution	
				Concentration	%
Volume Correction	1.172	m <sup>3</sup>	2.21	0.04 mg.m <sup>-3</sup>	1.61 %
Mass (weighing)	3.06	mg	0.04	0.12 mg.m <sup>-3</sup>	4.59 %
Oxygen Correction	N/A		0.00	0.00 mg.m <sup>-3</sup>	0.00 %
System Leak	0.00	mg.m <sup>3</sup>	1.00	0.00 mg.m <sup>-3</sup>	0.03 %
Uncollected Mass	0.00	mg	0.04	0.00 mg.m <sup>-3</sup>	0.00 %
			<b>Total Uncertainty</b>	<b>0.13 mg.m<sup>-3</sup></b>	

<b>Uncertainty Result</b>	(Uncertainty has been expanded with a coveragefactor of 2 (K=2))
<b>Expanded Uncertainty =</b>	<b>0.25 mg.m<sup>-3</sup></b>
<b>=&gt;</b>	<b>9.74 % of Result</b>
<b>=&gt;</b>	<b>0.00 % of ELV</b>

**APPENDIX 4:**  
**Assembly Shop RH Sampling, Analysis & Uncertainty Data**

For 'Assembly Shop RH' emission point schematic see Appendix 2

Company Name: TS COVRAD Heat Transfer Date: 18/01/12  
 Site Name: Canley Run: Particulate Matter  
 Sampling Point Ref: Assembly Shop Booth - RH  
 Project Reference: FTBS 19360

Stack Static press mm H <sub>2</sub> O:	1.2	Stack Diameter (m)	0.80			
		Stack Area (m <sup>2</sup> )	0.503			
Traverse Point No	Port A			Port B		
	Δ p, mm H <sub>2</sub> O	Root Δ p	Stack Temp °C	Δ p, mm H <sub>2</sub> O	Root Δ p	Stack Temp °C
1	3.8	1.949	13	15	3.873	13
2	4.2	2.049	13	15.4	3.924	13
3	4.8	2.191	13	11.2	3.347	13
4	5	2.236	13	8.6	2.933	13
5	5.4	2.324	13	7.4	2.720	13
6	5.6	2.366	13	6	2.449	13
7	6	2.449	13	6	2.449	13
8	5.8	2.408	13	6.6	2.589	13
9	6	2.449	13	7	2.646	13
10	7.4	2.720	13	8.4	2.898	13
Minimum	3.8	1.949	13	6.0	2.449	13
Maximum	7.4	2.720	13	15.4	3.924	13
Mean	5.4	2.314	13.0	9.2	2.981	13.0
Sum	54	23.144	130	91.6	29.809	130
Total Sum						

Max. pitot press. =	15.4
Min. pitot press. =	3.8
Ratio Max:Min =	4.1 :1

Gas Data	
Oxygen %	21.0
CO <sub>2</sub> %	0.04
CO %	

Oxygen Correction	
Required Correction Value	0
Actual Oxygen Factor	1
Enter 0 if correction is not required	0

BS EN 13284-1 & M1 Sample Point Requirements	Requirement Met?
Duct gas flow: angle with regard to duct access <15°?	Y
Duct Gas Flow Negative Velocity: Not Permitted	Y
Duct Gas Flow: Ratio of max to min velocity <3.1?	N
Working Area > 5m <sup>2</sup> ?	Y
Handrails with removable chains / self closing gates across the top of the ladder?	Y
Handrails (approx 0.5 and 1.0 m high) and vertical baseboards (approx 0.25m high)?	Y
Scaffold Built to 'Heavy Duty' Scafftag Rating or at least 2.5kN/m <sup>2</sup> loading	Y
Handrails not restricting access to ports?	Y
Room opposite sampling port equal or greater than the length of the sampling probe plus 1 metre?	Y
Sufficient Power (Waterproof 110V BS4343 Standard) close or on the platform?	Y

Company Name: TS COVRAD  
 Site Name: Heat Transfer  
 Sampling Point Ref: ambly Shop Booth - Outstack Filter?  
 Date: 18/01/12  
 Run: Particulate Matter Operators  
 Project Reference:

In-stack Filter?  Y  N  
 Bar. Press.mm Hg   
 Cp   
 Bws%   
 Meter Correction Yd

K Factor   
 Dn used   
 Nozzle No.

Ambient Temp.   
 Start Time   
 Stop Time

Leak Rate (in / %)   
 Leak Rate (start / %)   
 Probe setting

Sample Filter Weights

	Reference	Laboratory	Increase, mg
Filter	81255	RPS	1.01
Probe Washings	T20001371	RPS	1.1

Sample Filter Blank Weighings

	Reference	Laboratory	Increase, mg
Filter	81058	RPS	<b>0.04</b>
Probe Wash	T20001368	RPS	1.1

Note: Results in Bold are reported at the L.O.D.

Impinger Weights

Weights	Initial	Final	Increase, g
Impinger 1	632	626	-6.0
Impinger 2	494.8	495	0.2
Impinger 3			
Impinger 4			
Impinger 5			
Silica Gel	888.2	900.5	12.3
Total			6.5

Sample Point	Clock Time min	Pitot Δ p, mm H <sub>2</sub> O	Stack Temp, °C	Orifice Δ H, mm H <sub>2</sub> O		Gas Meter Reading m <sup>3</sup>	Temp at Gas Meter Outlet °C	Condenser Temp. °C	Filter Box Temp °C	Probe Temp °C	Pump Vacuum Inches Hg	Impinger Stem Temp. °C	Root Δ p, °C
				Desired	Actual								
A1	0	13.4	16	68.9	68.9	<b>2361.2</b>	15	-	-	160	2.5	12	3.661
	5	13.8	15	70.9	70.9		15	-	-	160	2.5	16	3.715
	10	13.8	15	70.9	70.9		16	-	-	160	2.5	14	3.715
A2	15	6.0	14	30.8	30.8	16	-	-	160	1.5	11	2.449	
	20	6.2	15	31.9	31.9	16	-	-	160	1.5	7	2.490	
	25	6.2	17	31.9	31.9	16	-	-	160	1.5	8	2.490	
Endpoint	30												
B1	0	7.0	17	36.0	35.6	16	-	-	160	1.5	6	2.646	
	5	6.2	15	31.9	31.9	17	-	-	160	1.5	6	2.490	
	10	7.0	15	36.0	35.6	16	-	-	160	1.5	6	2.646	
B2	15	6.0	14	30.8	30.8	16	-	-	160	1	7	2.449	
	20	6.0	13	30.8	30.8	16	-	-	160	1	7	2.449	
	25	6.0	13	30.8	30.8	16	-	-	160	1	8	2.449	
Endpoint	30					<b>3587.8</b>							
	<b>60.00</b>	<b>8.1</b>	<b>14.9</b>	<b>41.8</b>	<b>41.7</b>	<b>1.227</b>	<b>16.0</b>			<b>160.0</b>	<b>1.6</b>	<b>8.8</b>	<b>2.8</b>

Company Name: TS COVRAD Heat Transfer  
Site Name: Canley  
Project Reference: FTBS 19360

Date: 18/01/12

Sampling Point Ref:	Particulate Matter
Meter Volume Sampled, acm	1.227
Sample Run Start Time	13:52
Sample Run End Time	14:55
Total Actual Sampling Time, min	60.0
Barometric Pressure, mm Hg	759.06
Stack Pressure, mm Hg	759.15
Average Stack Temp, °C	14.9
Meter Volume at Wet STP, scm	1.135
Stack Moisture Content, %	0.7
Average Stack Velocity, m/sec	9.264
Stack Flow Rate, scms wet, STP	4.408
Nozzle Diameter, mm	6.86
<b>% Isokinetic Variation</b>	<b>97.0</b>
Total Mass of Particulate, mg	2.1
Percentage of Total Particulate Collected on Filter	47.9
<b>Stack Particulate Concentration, mg/m<sup>3</sup></b>	<b>1.9</b>
Particulate Mass rate, kg/hour	0.030
Emission Limit value mg/m <sup>3</sup>	<b>50</b>

Sample Train Blank Results	
Sample Blank Particulate Concentration, mg/m <sup>3</sup>	1.0
Total Weight Gain, mg (Sample Train Blank)	1.1
Blank Result Less than 10% of Limit Value	Y

**Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1**

Determined Concentration	1.9	mg/m <sup>3</sup> (at Reference Cond)
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**Measured Values**

Sampled Volume	1.2266	m <sup>3</sup>
Sampled gas Temperature	289	K
Sampled gas Pressure	101.22	kPa
Sampled gas Humidity	0	% by volume
Oxygen content	21	% by volume
Mass	2.11	mg

Leak	0.05	%
Uncollected Mass	0	mg

**Standard Uncertainties for Measured Values**

Sampled Volume	0.001	m <sup>3</sup>
Sampled gas Temperature	2	K
Sampled gas Pressure	1	kPa
Sampled gas Humidity	1	% by volume
Oxygen content	0.1	% by volume
Mass	0.14152395	mg

Uncertainty Calculation for Volume Correction				Uncertainty Calculation for Oxygen Correction			
Volume Correction Factor	0.944			Oxygen Correction Factor	1.0000		
	<b>Sensitivity Coefficient</b>		<b>Uncertainty, U<sub>v</sub></b>		<b>Sensitivity Coefficient</b>		<b>Uncertainty, U<sub>o</sub></b>
Sampled gas Temperature	0.0033		0.0065	Oxygen Measurement	N/A		N/A
Sampled gas Pressure	0.0093		0.0093				
Sampled gas Humidity	0.0064		0.0064				
		<b>Sqrt (U<sub>v</sub>)<sup>2</sup></b>	0.0148				
		<b>Total U<sub>v</sub></b>	0.018			<b>Total U<sub>o</sub></b>	N/A

Uncertainty Contributions (Itemised)					
	Value		Sensitivity coefficient	Uncertainty Contribution	
				Concentration	%
Volume Correction	1.126	m <sup>3</sup>	1.65	0.03 mg.m <sup>-3</sup>	1.61 %
Mass (weighing)	2.11	mg	0.88	0.12 mg.m <sup>-3</sup>	6.71 %
Oxygen Correction	N/A		0.00	0.00 mg.m <sup>-3</sup>	0.00 %
System Leak	0.00	mg.m <sup>3</sup>	1.00	0.00 mg.m <sup>-3</sup>	0.03 %
Uncollected Mass	0.00	mg	0.88	0.00 mg.m <sup>-3</sup>	0.00 %
			<b>Total Uncertainty</b>	<b>0.13 mg.m<sup>-3</sup></b>	

Uncertainty Result	
(Uncertainty has been expanded with a coveragefactor of 2 (K=2))	
<b>Expanded Uncertainty =</b>	<b>0.26 mg.m<sup>-3</sup></b>
<b>=&gt;</b>	<b>13.80 % of Result</b>
<b>=&gt;</b>	<b>0.00 % of ELV</b>

**APPENDIX 5:**  
**Industrial Spray Booth 1 LH Sampling, Analysis & Uncertainty Data**





**Schematic Photograph  
Industrial Spray Booth 1 Emission Points LH & RH.**

Each point had identical diameters of 0.59m, externally accessed by scaffold and lashed ladder.

The size and position of the sample ports were adequate for sampling and are indicated by the white arrows.

Company Name: TS COVRAD Heat Transfer Date: 17/01/12  
 Site Name: Canley Run: Particulate Matter  
 Sampling Point Ref: Industrial Spray Booth 1 - LH  
 Project Reference: FTBS 19360

Traverse Point No	Port A			Port B		
	$\Delta p$ , mm H <sub>2</sub> O	Root $\Delta p$	Stack Temp °C	$\Delta p$ , mm H <sub>2</sub> O	Root $\Delta p$	Stack Temp °C
1	18.8	4.313	14	10.2	3.194	14
2	19	4.359	14	13	3.606	14
3	16.4	4.050	14	14	3.742	14
4	14.2	3.768	14	15.2	3.899	14
5	13.8	3.715	14	16.8	4.099	14
6	13.4	3.661	14	16.4	4.050	14
7	12.2	3.493	14	16	4.000	14
8	12	3.464	14	15.8	3.975	14
9	11.8	3.435	14	16	4.000	14
10	11.8	3.435	14	15.2	3.899	14
Minimum	11.8	3.435	14	10.2	3.194	14
Maximum	19.0	4.359	14	16.8	4.099	14
Mean	14.3	3.769	14.0	14.9	3.846	14.0
Sum	143.2	37.692	140	148.6	38.462	140
Total Sum						

Max. pitot press. = 19.0  
 Min. pitot press. = 10.2  
 Ratio Max:Min = 1.9 :1

Gas Data	
Oxygen %	21.0
CO <sub>2</sub> %	0.04
CO %	

Oxygen Correction	
Required Correction Value	0
Actual Oxygen Factor	1
Enter 0 if correction is not required	0

BS EN 13284-1 & M1 Sample Point Requirements	Requirement Met?
Duct gas flow: angle with regard to duct access <15°?	Y
Duct Gas Flow Negative Velocity: Not Permitted	Y
Duct Gas Flow: Ratio of max to min velocity <3:1?	Y
Working Area > 5m <sup>2</sup> ?	Y
Handrails with removable chains / self closing gates across the top of the ladder?	Y
Handrails (approx 0.5 and 1.0 m high) and vertical baseboards (approx 0.25m high)?	Y
Scaffold Built to 'Heavy Duty' Scafftag Rating or at least 2.5kN/m <sup>2</sup> loading	Y
Handrails not restricting access to ports?	Y
Room opposite sampling port equal or greater than the length of the sampling probe plus 1 metre?	Y
Sufficient Power (Waterproof 110V BS4343 Standard) close or on the platform?	Y

Company Name: TS COVRAD  
Site Name: Heat Transfer  
Sampling Point Ref: Carley  
Date: 17/01/12  
Run: Particulate Matter Operators  
Project Reference:

In-stack Filter?  Y  N  
Bar. Press.mm Hg   
Outstack Filter?  N  Y  
Cp   
Bws%   
K Factor   
Dn used   
Nozzle No.   
Meter Correction Yd

Ambient Temp.   
Start Time   
Stop Time

Leak Rate (in / %)  
Leak Rate (start / %)  
Probe setting

Sample Filter Weights

	Reference	Laboratory	Increase, mg
Filter	80433	RPS	3.23
Probe Washings	T20001366	RPS	0.5

Sample Filter Blank Weighings

	Reference	Laboratory	Increase, mg
Filter	80437	RPS	0.82
Probe Wash	T20001365	RPS	<b>0.5</b>

Note: Results in Bold are reported at the L.O.D.

Impinger Weights

Weights	Initial	Final	Increase, g
Impinger 1	636.1	634.2	-1.9
Impinger 2	493.3	492.4	-0.9
Impinger 3			
Impinger 4			
Impinger 5			
Silica Gel	851.9	859.6	7.7
Total			4.9

Sample Point	Clock Time min	Pitot Δ p, mm H <sub>2</sub> O	Stack Temp, °C	Orifice Δ H, mm H <sub>2</sub> O		Gas Meter Reading m <sup>3</sup>	Temp at Gas Meter Outlet °C	Condenser Temp. °C	Filter Box Temp °C	Probe Temp °C	Pump Vacuum Inches Hg	Impinger Stem Temp. °C	Root Δ p, °C
				Desired	Actual								
A1	0	15.8	16	79.3	79.3	<b>6620.2</b>	0	-	-	160	4	0	3.975
	5	15.8	16	79.3	79.3		0	-	-	160	4	0	3.975
	10	16.0	16	80.3	80.3		0	-	-	160	3.5	3	4.000
	15	12.2	16	61.2	61.2		1	-	-	160	3	5	3.493
	20	12.2	17	61.2	61.2		1	-	-	160	3	6	3.493
A2	25	12.0	18	60.2	60.2	2	-	-	160	3	6	3.464	
	Endpoint	30											
	B1	0	13.0	19	65.3	65.3	2	-	-	160	3	6	3.808
B2	5	13.0	20	65.3	65.3	3	-	-	160	3	8	3.808	
	10	14.0	19	70.3	70.3	3	-	-	160	3	8	3.742	
	15	15.4	20	77.3	77.3	4	-	-	160	3.5	9	3.824	
	20	15.6	18	79.3	79.3	4	-	-	160	3.5	9	3.950	
	25	15.4	18	77.3	77.3	5	-	-	160	3.5	10	3.924	
Endpoint	30					<b>8243.4</b>							
	<b>60.00</b>	<b>14.2</b>	<b>17.8</b>	<b>71.3</b>	<b>71.3</b>	<b>1.623</b>	<b>2.1</b>	-	-	<b>160.0</b>	<b>3.3</b>	<b>6.8</b>	<b>3.8</b>

Company Name: **TS COVRAD Heat Transfer**  
 Site Name: **Canley**  
 Project Reference: **FTBS 19360**

Date: 17/01/12

Sampling Point Ref:	Particulate Matter
Meter Volume Sampled, acm	1.623
Sample Run Start Time	10:31
Sample Run End Time	11:33
Total Actual Sampling Time, min	60.0
Barometric Pressure, mm Hg	759.06
Stack Pressure, mm Hg	759.15
Average Stack Temp, °C	17.8
Meter Volume at Wet STP, scm	1.577
Stack Moisture Content, %	0.4
Average Stack Velocity, m/sec	12.483
Stack Flow Rate, scms wet, STP	3.199
Nozzle Diameter, mm	6.86
<b>% Isokinetic Variation</b>	<b>101.1</b>
Total Mass of Particulate, mg	3.7
Percentage of Total Particulate Collected on Filter	86.6
<b>Stack Particulate Concentration, mg/m<sup>3</sup></b>	<b>2.4</b>
Particulate Mass rate, kg/hour	0.027
Emission Limit value mg/m <sup>3</sup>	<b>50</b>

Sample Train Blank Results	
Sample Blank Particulate Concentration, mg/m <sup>3</sup>	0.8
Total Weight Gain, mg (Sample Train Blank)	1.3
Blank Result Less than 10% of Limit Value	Y

**Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1**

Determined Concentration 2.4 mg/m<sup>3</sup> (at Reference Cond)

**Measured Values**

Sampled Volume	1.8292	m <sup>3</sup>
Sampled gas Temperature	275.0833333	K
Sampled gas Pressure	101.22	kPa
Sampled gas Humidity	0	% by volume
Oxygen content	21	% by volume
Mass	3.73	mg

Leak	0.05	%
Uncollected Mass	0	mg

**Standard Uncertainties for Measured Values**

Sampled Volume	0.001	m <sup>3</sup>
Sampled gas Temperature	2	K
Sampled gas Pressure	1	kPa
Sampled gas Humidity	1	% by volume
Oxygen content	0.1	% by volume
Mass	0.14152385	mg

Uncertainty Calculation for Volume Correction				Uncertainty Calculation for Oxygen Correction			
Volume Correction Factor	0.992			Oxygen Correction Factor	1.0000		
	<b>Sensitivity Coefficient</b>		<b>Uncertainty, U<sub>v</sub></b>		<b>Sensitivity Coefficient</b>		<b>Uncertainty, U<sub>o</sub></b>
Sampled gas Temperature	0.0036		0.0072	Oxygen Measurement	N/A		N/A
Sampled gas Pressure	0.0098		0.0098				
Sampled gas Humidity	0.0099		0.0099				
		<b>Sqrt (U<sub>v</sub>)<sup>2</sup></b>	0.0157				
		<b>Total U<sub>v</sub></b>	0.025			<b>Total U<sub>o</sub></b>	N/A

Uncertainty Contributions (Itemised)					
	Value		Sensitivity coefficient	Uncertainty Contribution	
				Concentration	%
Volume Correction	1.571	m <sup>3</sup>	1.51	0.04 mg.m <sup>-3</sup>	1.62 %
Mass (weighing)	3.73	mg	0.83	0.09 mg.m <sup>-3</sup>	3.79 %
Oxygen Correction	N/A		0.00	0.00 mg.m <sup>-3</sup>	0.00 %
System Leak	0.00	mg.m <sup>3</sup>	1.00	0.00 mg.m <sup>-3</sup>	0.03 %
Uncollected Mass	0.00	mg	0.83	0.00 mg.m <sup>-3</sup>	0.00 %
			<b>Total Uncertainty</b>	<b>0.10 mg.m<sup>-3</sup></b>	

Uncertainty Result	
(Uncertainty has been expanded with a coveragefactor of 2 (K=2))	
<b>Expanded Uncertainty =</b>	<b>0.20 mg.m<sup>-3</sup></b>
<b>=&gt;</b>	<b>8.25 % of Result</b>
<b>=&gt;</b>	<b>0.00 % of ELV</b>

**APPENDIX 6:**  
**Industrial Spray Booth 1 RH Sampling, Analysis & Uncertainty Data**

For 'Industrial Spray Booth 1 RH' emission point schematic see Appendix 5

Company Name: TS COVRAD Heat Transfer Date: 17/01/12  
 Site Name: Canley Run: Particulate Matter  
 Sampling Point Ref: Industrial Spray Booth 1 - RH  
 Project Reference: FTBS 19360

Stack Static press mm H <sub>2</sub> O:	1.2	Stack Diameter (m)	0.59			
		Stack Area (m <sup>2</sup> )	0.273			
Traverse Point No	Port A			Port B		
	Δ p, mm H <sub>2</sub> O	Root Δ p	Stack Temp °C	Δ p, mm H <sub>2</sub> O	Root Δ p	Stack Temp °C
1	9.6	3.098	18	10.8	3.286	16
2	10	3.162	18	11.6	3.406	16
3	9.4	3.066	18	13.4	3.661	16
4	9	3.000	18	14	3.742	16
5	8.8	2.966	18	13.8	3.715	16
6	10.6	3.256	18	14	3.742	17
7	12.4	3.521	18	15.4	3.924	17
8	14	3.742	18	16.4	4.050	17
9	15.4	3.924	18	16	4.000	17
10	17	4.123	18	15	3.873	17
Minimum	8.8	2.966	18	10.8	3.286	16
Maximum	17.0	4.123	18	16.4	4.050	17
Mean	11.6	3.386	18.0	14.0	3.740	16.5
Sum	116.2	33.859	180	140.4	37.398	165
Total Sum						

Max. pitot press. =	17.0
Min. pitot press. =	8.8
Ratio Max:Min =	1.9 :1

Gas Data	
Oxygen %	21.0
CO <sub>2</sub> %	0.04
CO %	

Oxygen Correction	
Required Correction Value	0
Actual Oxygen Factor	1
Enter 0 if correction is not required	0

BS EN 13284-1 & M1 Sample Point Requirements	Requirement Met?
Duct gas flow: angle with regard to duct access <15°	Y
Duct Gas Flow Negative Velocity: Not Permitted	Y
Duct Gas Flow: Ratio of max to min velocity <3.1?	Y
Working Area > 5m <sup>2</sup> ?	Y
Handrails with removable chains / self closing gates across the top of the ladder?	Y
Handrails (approx 0.5 and 1.0 m high) and vertical baseboards (approx 0.25m high)?	Y
Scaffold Built to 'Heavy Duty' Scafftag Rating or at least 2.5kN/m <sup>2</sup> loading	Y
Handrails not restricting access to ports?	Y
Room opposite sampling port equal or greater than the length of the sampling probe plus 1 metre?	Y
Sufficient Power (Waterproof 110V BS4343 Standard) close or on the platform?	Y

Company Name:	TS COVRAD	In-stack Filter?	<input type="checkbox"/> Y	Bar. Press.mm Hg	<input type="text" value="759.06"/>	K Factor	<input type="text" value="4.96"/>	Ambient Temp.	<input type="text" value="2"/>	Leak Rate (in / %)	<input type="text" value="&lt;0.05"/>
Site Name:	Heat Transfer Canley	Outstack Filter?	<input type="checkbox"/> N	Cp	<input type="text" value="0.823"/>	Dn used	<input type="text" value="6.86"/>	Start Time	<input type="text" value="11:46"/>	Leak Rate (start / %)	<input type="text" value="=0.05"/>
Sampling Point Ref:	Industrial Spray Booth 1	Particulate Matter	<input type="checkbox"/> IB	Operators	<input type="checkbox"/> MB	Bws%	<input type="text" value="0.015"/>	Stop Time	<input type="text" value="12:49"/>	Probe setting	<input type="text" value="160 +/- 5 oC"/>
Date:	17/01/12	Project Reference:									
Run:	Particulate Matter	Meter Correction Yd	<input type="text" value="0.97"/>								

Sample Filter Weights

	Reference	Laboratory	Increase, mg
Filter	80432	RPS	0.48
Probe Washings	T20001367	RPS	0.5

Sample Filter Blank Weighings

	Reference	Laboratory	Increase, mg
Filter	80437	RPS	0.82
Probe Wash	T20001365	RPS	<b>0.5</b>

Note: Results in Bold are reported at the L.O.D.

Impinger Weights

Weights	Initial	Final	Increase, g
Impinger 1	766.2	764.4	-1.8
Impinger 2	557	556.3	-0.7
Impinger 3			
Impinger 4			
Impinger 5			
Silica Gel	895.9	904.2	8.3
Total			5.8

Sample Point	Clock Time min	Pitot Δ p, mm H <sub>2</sub> O	Stack Temp, °C	Orifice Δ H, mm H <sub>2</sub> O		Gas Meter Reading m <sup>3</sup>	Temp at Gas Meter Outlet °C	Condenser Temp. °C	Filter Box Temp °C	Probe Temp °C	Pump Vacuum Inches Hg	Impinger Stem Temp. °C	Root Δ p, °C
				Desired	Actual								
A1	0	9.2	21	45.6	45.6	<b>8248.4</b>	3	-	-	160	2	3	3.033
	5	9.2	20	45.6	45.6		4	-	-	160	2	3	3.033
	10	9.2	20	45.6	45.6		3	-	-	160	2	5	3.033
	15	14.2	21	70.4	70.4		4	-	-	160	3	7	3.768
	20	14.8	24	73.4	73.4		5	-	-	160	3	9	3.847
Endpoint	30						5	-	-	160	3	9	3.847
B1	0	12.0	23	59.5	59.5	<b>9782.2</b>	5	-	-	160	2.5	10	3.484
	5	12.4	24	61.5	61.5		5	-	-	160	2.5	10	3.521
	10	12.4	22	61.5	61.5		5	-	-	160	2.5	11	3.521
	15	16.0	24	79.4	79.4		6	-	-	160	3.5	11	4.000
	20	16.0	24	79.4	79.4		6	-	-	160	3.5	12	4.000
Endpoint	30						6	-	-	160	3.5	12	4.025
Endpoint	<b>60.00</b>	<b>13.0</b>	<b>22.6</b>	<b>64.6</b>	<b>64.6</b>	<b>1.534</b>	<b>4.8</b>	-	-	<b>160.0</b>	<b>2.8</b>	<b>8.5</b>	<b>3.6</b>



Company Name: **TS COVRAD Heat Transfer**  
 Site Name: **Canley**  
 Project Reference: **FTBS 19360**

Date: 17/01/12

Sampling Point Ref:	Particulate Matter
Meter Volume Sampled, acm	1.534
Sample Run Start Time	11:46
Sample Run End Time	12:49
Total Actual Sampling Time, min	60.0
Barometric Pressure, mm Hg	759.06
Stack Pressure, mm Hg	759.15
Average Stack Temp, °C	22.6
Meter Volume at Wet STP, scm	1.476
Stack Moisture Content, %	0.5
Average Stack Velocity, m/sec	12.015
Stack Flow Rate, scms wet, STP	3.029
Nozzle Diameter, mm	6.86
<b>% Isokinetic Variation</b>	<b>99.9</b>
Total Mass of Particulate, mg	1.0
Percentage of Total Particulate Collected on Filter	49.0
<b>Stack Particulate Concentration, mg/m<sup>3</sup></b>	<b>0.7</b>
Particulate Mass rate, kg/hour	0.007
Emission Limit value mg/m <sup>3</sup>	<b>50</b>

Sample Train Blank Results	
Sample Blank Particulate Concentration, mg/m <sup>3</sup>	0.9
Total Weight Gain, mg (Sample Train Blank)	1.3
Blank Result Less than 10% of Limit Value	Y

**Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1**

Determined Concentration	0.7	mg/m <sup>3</sup> (at Reference Cond)
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**Measured Values**

Sampled Volume	1.5398	m <sup>3</sup>
Sampled gas Temperature	277.75	K
Sampled gas Pressure	101.22	kPa
Sampled gas Humidity	0	% by volume
Oxygen content	21	% by volume
Mass	0.98	mg

Leak	0.05	%
Uncollected Mass	0	mg

**Standard Uncertainties for Measured Values**

Sampled Volume	0.001	m <sup>3</sup>
Sampled gas Temperature	2	K
Sampled gas Pressure	1	kPa
Sampled gas Humidity	1	% by volume
Oxygen content	0.1	% by volume
Mass	0.14152395	mg

Uncertainty Calculation for Volume Correction				Uncertainty Calculation for Oxygen Correction			
Volume Correction Factor	0.982			Oxygen Correction Factor	1.0000		
	<b>Sensitivity Coefficient</b>		<b>Uncertainty, U<sub>v</sub></b>		<b>Sensitivity Coefficient</b>		<b>Uncertainty, U<sub>o</sub></b>
Sampled gas Temperature	0.0035		0.0071	Oxygen Measurement	N/A		N/A
Sampled gas Pressure	0.0097		0.0097				
Sampled gas Humidity	0.0098		0.0098				
		<b>Sqrt (U<sub>v</sub>)<sup>2</sup></b>	0.0155				
		<b>Total U<sub>v</sub></b>	0.024			<b>Total U<sub>o</sub></b>	N/A

Uncertainty Contributions (Itemised)					
	Value		Sensitivity coefficient	Uncertainty Contribution	
				Concentration	%
Volume Correction	1.459	m <sup>3</sup>	0.45	0.01 mg.m <sup>-3</sup>	1.62 %
Mass (weighing)	0.98	mg	0.98	0.10 mg.m <sup>-3</sup>	14.44 %
Oxygen Correction	N/A		0.00	0.00 mg.m <sup>-3</sup>	0.00 %
System Leak	0.00	mg.m <sup>3</sup>	1.00	0.00 mg.m <sup>-3</sup>	0.03 %
Uncollected Mass	0.00	mg	0.98	0.00 mg.m <sup>-3</sup>	0.00 %
			<b>Total Uncertainty</b>	<b>0.10 mg.m<sup>-3</sup></b>	

Uncertainty Result	
(Uncertainty has been expanded with a coverage factor of 2 (K=2))	
<b>Expanded Uncertainty =</b>	<b>0.19 mg.m<sup>-3</sup></b>
<b>=&gt;</b>	<b>29.06 % of Result</b>
<b>=&gt;</b>	<b>0.00 % of ELV</b>

**APPENDIX 7:**  
**Industrial Spray Booth 2 LH Sampling, Analysis & Uncertainty Data**



**Schematic Photograph  
Industrial Spray Booth 2 Emission Point LH.**

Each point had identical diameters of 0.60m, internally accessed by scaffold and lashed ladder.

The position of the sample ports were not ideal for sampling due to the proximity of a bend and are indicated by the white arrows.

Company Name: TS COVRAD Heat Transfer Date: 16/01/12  
 Site Name: Canley Run: Particulate Matter  
 Sampling Point Ref: Industrial Spray Booth 2 - LH  
 Project Reference: FTBS 19360

Traverse Point No	Port A			Port B		
	$\Delta p$ , mm H <sub>2</sub> O	Root $\Delta p$	Stack Temp °C	$\Delta p$ , mm H <sub>2</sub> O	Root $\Delta p$	Stack Temp °C
1	15	3.873	18	16	4.000	18
2	16.8	4.099	18	15.8	3.975	18
3	16.8	4.099	18	13.4	3.681	18
4	16.8	4.099	19	10.2	3.194	18
5	15	3.873	19	9	3.000	18
6	12.4	3.521	19	7.4	2.720	18
7	9	3.000	19	5.4	2.324	18
8	6.8	2.608	19	3.2	1.789	18
9	4.2	2.049	19	2.4	1.549	18
10	2.6	1.612	19	1.8	1.342	18
Minimum	2.6	1.612	18	1.8	1.342	18
Maximum	16.8	4.099	19	16.0	4.000	18
Mean	11.5	3.283	18.7	8.5	2.755	18.0
Sum	115.4	32.833	187	84.6	27.553	180
Total Sum						

Max. pitot press. = 16.8  
 Min. pitot press. = 1.8  
 Ratio Max:Min = 9.3 :1

Gas Data	
Oxygen %	21.0
CO <sub>2</sub> %	0.04
CO %	

Oxygen Correction	
Required Correction Value	0
Actual Oxygen Factor	1
Enter 0 if correction is not required	0

BS EN 13284-1 & M1 Sample Point Requirements	Requirement Met?
Duct gas Flow: angle with regard to duct access <15°?	Y
Duct Gas Flow Negative Velocity: Not Permitted	Y
Duct Gas Flow: Ratio of max to min velocity <3:1?	N
Working Area > 5m <sup>2</sup> ?	Y
Handrails with removable chains / self closing gates across the top of the ladder?	Y
Handrails (approx 0.5 and 1.0 m high) and vertical baseboards (approx 0.25m high)?	Y
Scaffold Built to 'Heavy Duty' Scafftag Rating or at least 2.5kN/m <sup>2</sup> loading	Y
Handrails not restricting access to ports?	Y
Room opposite sampling port equal or greater than the length of the sampling probe plus 1 metre?	Y
Sufficient Power (Waterproof 110V BS4343 Standard) close or on the platform?	Y

Company Name: TS COVRAD  
 Site Name: Heat Transfer  
 Sampling Point Ref: Canley  
 Date: 18/01/12  
 Run: Particulate Matter Operators  
 Project Reference:

In-stack Filter?  Y  N  
 Bar. Press.mm Hg   
 Cp   
 Bws%   
 Meter Correction Yd

K Factor   
 Dn used   
 Nozzle No.

Ambient Temp.   
 Start Time   
 Stop Time

Leak Rate (in / %)   
 Leak Rate (start / %)   
 Probe setting

**Sample Filter Weights**

	Reference	Laboratory	Increase, mg
Filter	78699	RPS	0.28
Probe Washings	T20001363	RPS	0.6

**Sample Filter Blank Weighings**

	Reference	Laboratory	Increase, mg
Filter	76924	RPS	0.07
Probe Wash	T20001362	RPS	0.6

**Impinger Weights**

Weights	Initial	Final	Increase, g
Impinger 1	797.5	796.5	-1.0
Impinger 2	554.3	557	2.7
Impinger 3			
Impinger 4			
Impinger 5			
Silica Gel	884.9	895.9	11.0
<b>Total</b>			<b>12.7</b>

Sample Point	Clock Time min	Pitot Δ p, mm H <sub>2</sub> O	Stack Temp, °C	Orifice Δ H, mm H <sub>2</sub> O		Gas Meter Reading m <sup>3</sup>	Temp at Gas Meter Outlet °C	Condenser Temp. °C	Filter Box Temp °C	Probe Temp °C	Pump Vacuum Inches Hg	Impinger Stem Temp. °C	Root Δ p, °C
				Desired	Actual								
A1	0	15.6	21	79.9	79.9	3852.4	14	.	.	160	3.5	13	3.950
	5	16.0	20	81.9	81.9		14	.	.	160	3.5	13	4.000
	10	16.0	20	81.9	81.9		14	.	.	160	3.5	14	4.000
A2	15	5.0	21	25.6	25.6		15	.	.	160	1.5	15	2.236
	20	4.8	24	24.6	24.6		15	.	.	160	1.5	16	2.191
	25	4.8	24	24.6	24.6		16	.	.	160	1.5	17	2.191
Endpoint	30												
B1	0	15.0	23	78.8	78.8		16	.	.	160	3.5	17	3.873
	5	15.4	24	78.8	78.8		16	.	.	160	3.5	18	3.924
	10	15.8	22	80.9	80.9		16	.	.	160	3.5	18	3.975
B2	15	3.2	24	18.4	18.4		17	.	.	160	1.5	18	1.789
	20	3.6	24	18.4	18.4		17	.	.	160	1.5	18	1.897
	25	3.6	24	18.4	18.4		18	.	.	160	1.5	18	1.897
Endpoint	30					5.158							
	60.00	9.9	22.6	60.7	60.7	1.306	15.7	.	.	160.0	2.6	16.3	3.0

Company Name: **TS COVRAD Heat Transfer**  
 Site Name: **Canley**  
 Project Reference: **FTBS 19360**

Date: 16/01/12

Sampling Point Ref:	Particulate Matter
Meter Volume Sampled, acm	1.306
Sample Run Start Time	11:57
Sample Run End Time	13:00
Total Actual Sampling Time, min	60.0
Barometric Pressure, mm Hg	757.56
Stack Pressure, mm Hg	758.06
Average Stack Temp, °C	22.6
Meter Volume at Wet STP, scm	1.215
Stack Moisture Content, %	1.3
Average Stack Velocity, m/sec	10.039
Stack Flow Rate, scms wet, STP	2.613
Nozzle Diameter, mm	6.86
<b>% Isokinetic Variation</b>	<b>98.6</b>
Total Mass of Particulate, mg	0.9
Percentage of Total Particulate Collected on Filter	31.8
<b>Stack Particulate Concentration, mg/m<sup>3</sup></b>	<b>0.7</b>
Particulate Mass rate, kg/hour	0.007
Emission Limit value mg/m <sup>3</sup>	<b>50</b>

Sample Train Blank Results	
Sample Blank Particulate Concentration, mg/m <sup>3</sup>	0.6
Total Weight Gain, mg (Sample Train Blank)	0.7
Blank Result Less than 10% of Limit Value	Y

**Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1**

Determined Concentration 0.7 mg/m<sup>3</sup> (at Reference Cond)

**Measured Values**

Sampled Volume	1.3056	m <sup>3</sup>
Sampled gas Temperature	286.666667	K
Sampled gas Pressure	101.07	kPa
Sampled gas Humidity	0	% by volume
Oxygen content	21	% by volume
Mass	0.66	mg

Leak	0.05	%
Uncollected Mass	0	mg

**Standard Uncertainties for Measured Values**

Sampled Volume	0.001	m <sup>3</sup>
Sampled gas Temperature	2	K
Sampled gas Pressure	1	kPa
Sampled gas Humidity	1	% by volume
Oxygen content	0.1	% by volume
Mass	0.14152385	mg

Uncertainty Calculation for Volume Correction				Uncertainty Calculation for Oxygen Correction			
Volume Correction Factor	0.944			Oxygen Correction Factor	1.0000		
	<b>Sensitivity Coefficient</b>		<b>Uncertainty, U<sub>v</sub></b>		<b>Sensitivity Coefficient</b>		<b>Uncertainty, U<sub>o</sub></b>
Sampled gas Temperature	0.0033		0.0065	Oxygen Measurement	N/A		N/A
Sampled gas Pressure	0.0093		0.0093				
Sampled gas Humidity	0.0064		0.0064				
	<b>Sqrt (U<sub>v</sub>)<sup>2</sup></b>		0.0148				
	<b>Total U<sub>v</sub></b>		0.019		<b>Total U<sub>o</sub></b>		N/A

Uncertainty Contributions (Itemised)					
	Value		Sensitivity coefficient	Uncertainty Contribution	
				Concentration	%
Volume Correction	1.189	m <sup>3</sup>	0.60	0.01 mg.m <sup>-3</sup>	1.61 %
Mass (weighing)	0.66	mg	0.92	0.12 mg.m <sup>-3</sup>	16.00 %
Oxygen Correction	N/A		0.00	0.00 mg.m <sup>-3</sup>	0.00 %
System Leak	0.00	mg.m <sup>3</sup>	1.00	0.00 mg.m <sup>-3</sup>	0.03 %
Uncollected Mass	0.00	mg	0.92	0.00 mg.m <sup>-3</sup>	0.00 %
			<b>Total Uncertainty</b>	<b>0.12 mg.m<sup>-3</sup></b>	

Uncertainty Result	
(Uncertainty has been expanded with a coverage factor of 2 (K=2))	
<b>Expanded Uncertainty =</b>	<b>0.23 mg.m<sup>-3</sup></b>
<b>=&gt;</b>	<b>32.33 % of Result</b>
<b>=&gt;</b>	<b>0.00 % of ELV</b>



**APPENDIX 8:**  
**Industrial Spray Booth 2 RH Sampling, Analysis & Uncertainty Data**



**Schematic Photograph  
Industrial Spray Booth 2 Emission Point RH.**

Each point had identical diameters of 0.60m, internally accessed by scaffold and lashed ladder.

The position of the sample ports were not ideal for sampling due to the proximity of a bend and are indicated by the white arrows.

Company Name: TS COVRAD Heat Transfer Date: 16/01/12  
 Site Name: Canley Run: Particulate Matter  
 Sampling Point Ref: Industrial Spray Booth 2 - RH  
 Project Reference: FTBS 19360

Traverse Point No	Port A			Port B		
	$\Delta p$ , mm H <sub>2</sub> O	Root $\Delta p$	Stack Temp °C	$\Delta p$ , mm H <sub>2</sub> O	Root $\Delta p$	Stack Temp °C
1	5	2.236	15	14.8	3.847	19
2	5	2.236	15	15	3.873	18
3	5.2	2.280	15	13.8	3.715	18
4	4.2	2.049	19	12.5	3.536	19
5	3.8	1.949	19	10.6	3.256	19
6	3.6	1.897	19	9.6	3.098	19
7	3.2	1.789	19	7.8	2.793	19
8	3	1.732	19	6	2.449	19
9	2.4	1.549	19	4.2	2.049	19
10	2	1.414	19	2.8	1.673	20
Minimum	2.0	1.414	15	2.8	1.673	18
Maximum	5.2	2.280	19	15.0	3.873	20
Mean	<b>3.7</b>	<b>1.913</b>	<b>17.8</b>	<b>9.7</b>	<b>3.029</b>	<b>18.9</b>
Sum	37.4	19.133	178	97.1	30.290	189
Total Sum						

Max. pitot press. =	15.0
Min. pitot press. =	2.0
Ratio Max:Min =	7.5 :1

Gas Data	
Oxygen %	21.0
CO <sub>2</sub> %	0.04
CO %	

Oxygen Correction	
Required Correction Value	0
Actual Oxygen Factor	1
Enter 0 if correction is not required	0

BS EN 13284-1 & M1 Sample Point Requirements	Requirement Met?
Duct gas flow: angle with regard to duct access <15°?	Y
Duct Gas Flow Negative Velocity: Not Permitted	Y
Duct Gas Flow: Ratio of max to min velocity <3:1?	N
Working Area > 5m <sup>2</sup> ?	Y
Handrails with removable chains / self closing gates across the top of the ladder?	Y
Handrails (approx 0.5 and 1.0 m high) and vertical baseboards (approx 0.25m high)?	Y
Scaffold Built to 'Heavy Duty' Scafftag Rating or at least 2.5kN/m <sup>2</sup> loading	Y
Handrails not restricting access to ports?	Y
Room opposite sampling port equal or greater than the length of the sampling probe plus 1 metre?	Y
Sufficient Power (Waterproof 110V BS4343 Standard) close or on the platform?	Y

Company Name:	TS COVRAD	In-stack Filter?	<input type="checkbox"/> Y	Bar. Press.mm Hg	<input type="text" value="757.58"/>	K Factor	<input type="text" value="5.13"/>	Ambient Temp.	<input type="text" value="18"/>	Leak Rate (in / %)	<input type="text" value="&lt;0.05"/>
Site Name:	Heat Transfer Canley										
Sampling Point Ref:	Industrial Spray Booth 2 - RH	Outstack Filter?	<input type="checkbox"/> N	Cp	<input type="text" value="0.823"/>	Dn used	<input type="text" value="6.86"/>	Start Time	<input type="text" value="14:00"/>	Leak Rate (start / %)	<input type="text" value="&lt;0.05"/>
Date:	16/01/12							Stop Time	<input type="text" value="15:04"/>	Probe setting	<input type="text" value="160 +/- 5 oC"/>
Run:	Particulate Matter Operators		<input type="checkbox"/> IB <input type="checkbox"/> MB	Bws%	<input type="text" value="0.015"/>	Nozzle No.	<input type="text" value="FYS367-7"/>				
Project Reference:						Meter Correction Yq	<input type="text" value="0.97"/>				

**Sample Filter Weights**

	Reference	Laboratory	Increase, mg
Filter	76713	RPS	0.79
Probe Washings	T20001364	RPS	2.2

**Sample Filter Blank Weighings**

	Reference	Laboratory	Increase, mg
Filter	76924	RPS	0.07
Probe Wash	T20001362	RPS	0.6

**Impinger Weights**

Weights	Initial	Final	Increase, g
Impinger 1	642.6	639.2	-3.4
Impinger 2	493.2	493.4	0.2
Impinger 3			
Impinger 4			
Impinger 5			
Silica Gel	837.1	851.7	14.6
		Total	11.4

Sample Point	Clock Time min	Pitot Δ p, mm H <sub>2</sub> O	Stack Temp, °C	Orifice Δ H, mm H <sub>2</sub> O		Gas Meter Reading m <sup>3</sup>	Temp at Gas Meter Outlet °C	Condenser Temp, °C	Filter Box Temp °C	Probe Temp °C	Pump Vacuum Inches Hg	Impinger Stem Temp. °C	Root Δ p,
				Desired	Actual								
A1	0	5.0	18	25.7	25.7	5485	14	.	.	160	1.5	14	2.236
	5	4.8	18	24.6	24.6		15	.	.	160	1.5	16	2.191
	10	4.8	18	24.6	24.6		16	.	.	160	1.5	16	2.191
A2	15	15.0	18	77.0	77.0		17	.	.	160	2.5	16	3.873
	20	14.4	18	73.9	73.9		17	.	.	160	2.5	17	3.795
	25	14.6	18	74.9	74.9		17	.	.	160	2.5	17	3.821
Endpoint	30												
B1	0	5.0	18	25.7	25.7		17	.	.	160	1.5	17	2.236
	5	4.8	16	24.6	24.6		18	.	.	160	1.5	18	2.191
	10	4.8	15	24.6	24.6		18	.	.	160	1.5	18	2.191
B2	15	2.8	15	14.4	14.4		18	.	.	160	1	18	1.673
	20	2.8	15	14.4	14.4		18	.	.	160	1	19	1.673
	25	2.8	15	14.4	14.4		18	.	.	160	1	19	1.673
Endpoint	30					6609.4							
	60.00	6.8	16.8	34.9	34.9	1.124	16.9	.	.	160.0	1.6	17.1	2.5

Company Name: TS COVRAD Heat Transfer  
 Site Name: Canley  
 Project Reference: FTBS 19360

Date: 16/01/12

Sampling Point Ref:	Particulate Matter
Meter Volume Sampled, acm	1.124
Sample Run Start Time	14:00
Sample Run End Time	15:04
Total Actual Sampling Time, min	60.0
Barometric Pressure, mm Hg	757.56
Stack Pressure, mm Hg	758.28
Average Stack Temp, °C	16.8
Meter Volume at Wet STP, scm	1.041
Stack Moisture Content, %	1.4
Average Stack Velocity, m/sec	8.230
Stack Flow Rate, scms wet, STP	2.186
Nozzle Diameter, mm	6.86
<b>% Isokinetic Variation</b>	<b>101.0</b>
Total Mass of Particulate, mg	3.0
Percentage of Total Particulate Collected on Filter	26.4
<b>Stack Particulate Concentration, mg/m<sup>3</sup></b>	<b>2.9</b>
Particulate Mass rate, kg/hour	0.023
Emission Limit value mg/m <sup>3</sup>	<b>50</b>

Sample Train Blank Results	
Sample Blank Particulate Concentration, mg/m <sup>3</sup>	0.6
Total Weight Gain, mg (Sample Train Blank)	0.7
Blank Result Less than 10% of Limit Value	Y

**Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1**

Determined Concentration **2.9** mg/m<sup>3</sup> (at Reference Cond)

**Measured Values**

Sampled Volume	1.1244	m <sup>3</sup>
Sampled gas Temperature	289.916667	K
Sampled gas Pressure	101.10	kPa
Sampled gas Humidity	0	% by volume
Oxygen content	21	% by volume
Mass	2.99	mg

Leak	0.05	%
Uncollected Mass	0	mg

**Standard Uncertainties for Measured Values**

Sampled Volume	0.001	m <sup>3</sup>
Sampled gas Temperature	2	K
Sampled gas Pressure	1	kPa
Sampled gas Humidity	1	% by volume
Oxygen content	0.1	% by volume
Mass	0.14152395	mg

Uncertainty Calculation for Volume Correction				Uncertainty Calculation for Oxygen Correction			
Volume Correction Factor	0.940			Oxygen Correction Factor	1.0000		
	<b>Sensitivity Coefficient</b>		<b>Uncertainty, U<sub>v</sub></b>		<b>Sensitivity Coefficient</b>		<b>Uncertainty, U<sub>o</sub></b>
Sampled gas Temperature	0.0032		0.0065	Oxygen Measurement	N/A		N/A
Sampled gas Pressure	0.0093		0.0093				
Sampled gas Humidity	0.0064		0.0064				
		<b>Sqrt (U<sub>v</sub>)<sup>2</sup></b>	0.0147				
		<b>Total U<sub>v</sub></b>	0.017			<b>Total U<sub>o</sub></b>	N/A

Uncertainty Contributions (Itemised)					
	Value		Sensitivity coefficient	Uncertainty Contribution	
				Concentration	%
Volume Correction	1.027	m <sup>3</sup>	2.80	0.05 mg.m <sup>-3</sup>	1.62 %
Mass (weighing)	2.99	mg	0.96	0.14 mg.m <sup>-3</sup>	4.73 %
Oxygen Correction	N/A		0.00	0.00 mg.m <sup>-3</sup>	0.00 %
System Leak	0.00	mg.m <sup>3</sup>	1.00	0.00 mg.m <sup>-3</sup>	0.03 %
Uncollected Mass	0.00	mg	0.96	0.00 mg.m <sup>-3</sup>	0.00 %
			<b>Total Uncertainty</b>	<b>0.14 mg.m<sup>-3</sup></b>	

Uncertainty Result	
(Uncertainty has been expanded with a coverage factor of 2 (K=2))	
<b>Expanded Uncertainty =</b>	<b>0.29 mg.m<sup>-3</sup></b>
<b>=&gt;</b>	<b>10.00 % of Result</b>
<b>=&gt;</b>	<b>0.00 % of ELV</b>

## **APPENDIX 9: Laboratory Results**



Test Certificate

Date 09/02/2012

Client	RPS Elland Unit 1 Lowfields Business Park Old Power Way Elland West Yorkshire HX5 9DE	Order No.	FTBS 19360
		Certificate No.	WK12-0496
		Issue No.	1
Contact	I Baggley	Date Received	26/01/2012
Description	10 filters and 10 washes for TPM	Technique	Gravimetric

Sample No.	681572	076924	Method
Total particulate matter		0.07 mg	D9(U)
Sample No.	681573	T20001362	Method
Total particulate matter		0.6 mg	D9(U)
Sample No.	681574	076713	Method
Total particulate matter		0.79 mg	D9(U)
Sample No.	681575	T20001363	Method
Total particulate matter		0.6 mg	D9(U)
Sample No.	681576	076699	Method
Total particulate matter		0.28 mg	D9(U)
Sample No.	681577	T20001364	Method
Total particulate matter		2.2 mg	D9(U)
Sample No.	681578	080437	Method
Total particulate matter		0.82 mg	D9(U)
Sample No.	681579	T20001365	Method
Total particulate matter		0.3 mg	D9(U)





Test Certificate

Date 09/02/2012

Client	RPS Eiland		Certificate No.	WK12-0496
			Issue No.	1
Sample No.	681580	080433	Method	
Total particulate matter	3.23 mg		D9(U)	
Sample No.	681581	T20001366	Method	
Total particulate matter	<0.5 mg		D9(U)	
Sample No.	681582	080432	Method	
Total particulate matter	0.48 mg		D9(U)	
Sample No.	681583	T20001367	Method	
Total particulate matter	0.5 mg		D9(U)	
Sample No.	681584	081058	Method	
Total particulate matter	<0.04 mg		D9(U)	
Sample No.	681585	T20001368	Method	
Total particulate matter	1.1 mg		D9(U)	
Sample No.	681586	080448	Method	
Total particulate matter	0.21 mg		D9(U)	
Sample No.	681587	T20001369	Method	
Total particulate matter	0.7 mg		D9(U)	
Sample No.	681588	081057	Method	
Total particulate matter	1.78 mg		D9(U)	
Sample No.	681589	T20001370	Method	
Total particulate matter	1.3 mg		D9(U)	
Sample No.	681590	081255	Method	
Total particulate matter	1.01 mg		D9(U)	

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Test Certificate

Date 09/02/2012

Client	RPS Elland		Certificate No.	WK12-0496
			Issue No.	1
Sample No.	681591	T20001371	Method	
Total particulate matter	1.1 mg			D9(U)

Tested By John McKeown Date 31/01/2012

Approved By [Redacted] Date 03/02/2012

Joanne Dewhurst  
Laboratory Manager

For and on authority of RPS Laboratories Ltd.

Method Symbols (U) Analysis is UKAS Accredited  
(N) Analysis is not UKAS Accredited

Concentration values (mg/m<sup>3</sup> and ppm) are provided to assist with interpretation only, they are not covered by the scope of UKAS accreditation.

Results stated as ml are referring to the sample volume.

RPS Laboratories terms and conditions apply - a copy is available on request.

Analysis carried out on samples 'as received'

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End of Report