

**Aspen Environmental Ltd**  
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Staffordshire, ST14 8AG.  
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[www.aspenenvironmental.co.uk](http://www.aspenenvironmental.co.uk)

Mr Sandy Stewart,  
Steel Construction Ltd,  
Bodmin Road,  
Coventry,  
CV2 5DB.

Date: 25/07/2015

Ref: L.2316

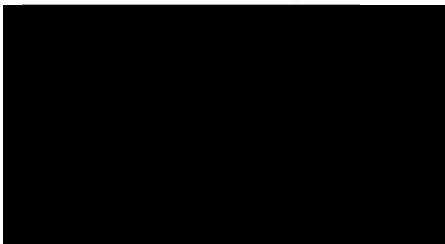
Dear Sandy,

**Testing at Coventry June 2016:**

I am pleased to present my report on the emissions testing undertaken on your site on the 30<sup>th</sup> June 2016.

If you have any queries on this report please do not hesitate to contact me

Yours sincerely,  
For Aspen Environmental Ltd,



Dr Geoff Buck.  
Director

**Emissions Testing Report:  
Part 1, Executive Summary:**



***UKAS Report***

**Emissions Testing from two Spraybooth Stacks**

Permit Number: Coventry CC  
Steel Construction Ltd  
Monitoring Date: 30/06/2016  
Aspen Reference Number: J.1278

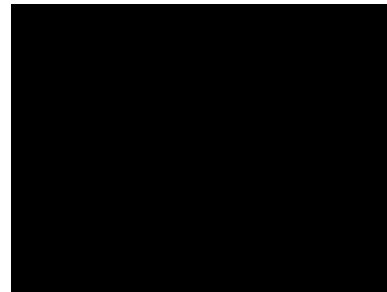
**Monitoring of:  
Spraybooth Stacks at  
Steel Construction Ltd, Bodmin Road, Coventry, CV2 5DB.**

**For:  
SGM Associates Ltd, 8 Woodland Way, Woburn Sands,  
Buckinghamshire, MK17 8QL.**

**by:  
Aspen Environmental Ltd,  
25A Church St, Uttoxeter, Staffordshire, ST14 8AG.**

Report Date: 25<sup>th</sup> July 2016

Prepared for Aspen Environmental Ltd by  
Dr G.W.Buck (Director)  
MCerts Registered MM 02 001 Level 2, TE1, TE3, TE4.



<b>Contents</b>		<b>Page Number</b>
<b>Part 1</b>	<b>Executive Summary</b>	<b>1 - 4</b>
	Cover Sheet	1
	Contents	2
	Introduction	3
	Emissions Monitoring	3
	Results	3
	Monitoring Deviations	3
	Results Summary Table	4
<b>Part 2</b>	<b>Supporting Information</b>	<b>5 - 21</b>
<b>Appendix 1</b>	<b>Personnel &amp; Methodologies</b>	<b>5</b>
	<b>Methodologies &amp; Equipment</b>	<b>6 - 8</b>
-		
<b>Appendix 2</b>	<b>Results Calculations &amp; Data LHS Stack</b>	<b>9 - 13</b>
	Particulates & Isokinetics	10
	Pitot Tube Data & Calculations	11
	Site Data Sheet – Flow Measurement	12
	Site Data Sheet – Sampling	13
<b>Appendix 3</b>	<b>Results Calculations &amp; Data RHS Stack</b>	<b>14 - 18</b>
	Particulates & Isokinetics	15
	Pitot Tube Data & Calculations	16
	Site Data Sheet – Flow Measurement	17
	Site Data Sheet – Sampling	18
<b>Appendix 4</b>	<b>Laboratory Results</b>	<b>19 - 21</b>
	Particulate Filters & Rinses	20 - 21
<b>Appendix 5</b>	<b>Uncertainty Calculations</b>	<b>22</b>

## **Introduction**

Steel Construction Ltd operate a factory manufacturing steel parts for the construction industry at their Coventry site.

Aspen Environmental Ltd (Dr G Buck & Mr J Buck) attended the site on the 30<sup>th</sup> June 2016, with Mr S Martin of SGM Associates to undertake emissions testing from two spray bays. Aspen Environmental Ltd are UKAS/MCerts accredited to perform tests to EN 13284-1 and EN 16911-1, which are the current particulate sampling, and flow rate measuring standards.

## **Emissions Monitoring**

Aspen monitored the particulate emissions from two exhausts, one from each spraybooth in the construction shop. These two exhausts were accessed from a permanent platform erected outside the factory. For the purposes of testing, the stacks were labelled as Right Hand Side & Left Hand Side, as viewed from outside the factory. At the time spray painting was being carried out on a series of steel parts, and each exhaust was sampled isokinetically for two thirty minute periods following Aspen's UKAS/MCerts accredited methodologies (Methods A1 & A5).

## **Results**

The results are presented as a summary table overleaf:

Details of sampling, pitot flow measurements and two sheets of site data for LHS stack are included in Appendix 2.

Details of sampling, pitot flow measurements and two sheets of site data for RHS stack are included in Appendix 3.

UKAS accredited filter & rinse weights are included as Appendix 4

Uncertainty calculations for the testing are included as Appendix 5

## **Monitoring Deviations**

Both exhausts were sampled using multiple sampling point methodology.

The isokinetic flow rate is required to be between 95 & 115 % of the theoretical rate, in this case one of the recorded results was just below this range.

Deviations from the method are highlighted in red in the appendices. There are no other deviations.

Steel Construction Ltd, Coventry											
Spray Area Emissions Testing 2016											
Aspen Environmental Ltd					Aspen Environmental Ltd						
Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Uncertainty	Units	Reference Conditions 273 K, 1013 mb	Date of Sampling	Start & End Times	Monitoring Method Reference	Accreditation for use of Method	Operating Status
LHS Spray Area	Particulates	50	< 1.7	± 6.1 %	mg/Nm <sup>3</sup>	Wet Gas	30/06/2016	11:16 - 11:36 12:28 - 13:02	EN 13284-1	MCerts	Normal Running
RHS Spray Area	Particulates	50	4.2	± 6.1 %	mg/Nm <sup>3</sup>	Wet Gas	30/06/2016	14:35 - 15:08 15:36 - 16:06	EN 13284-1	MCerts	Normal Running
<b>Notes</b>											
Dr G.W.Buck is personally MCertified to Level 2 with Technical Endorsements TE1 (Isokinetic Sampling), TE3 (Gases by manual techniques), & TE4 (Gases by Instrumental Methods)											
Aspen Environmental Ltd is a UKAS accredited Testing Laboratory No. 2395											

# Appendix 1: Personnel, Methodologies & Equipment

## Part 2 Supporting Information

### Aspen Personnel

Dr G.W.Buck	MCerts Reg. MM 02 001	Level 2	TE1, TE3, TE4 Team Leader (to Nov 2017)
Mr J Buck	MCerts Reg. MM 06 783	Level 1	(to June 2017)

### Relevant Tests for which Aspen is MCerts & UKAS accredited

- (A1) Flow in Ducts to EN 19611-1. 2014
- (A5) Particulates in Stacks to EN 13284-1. 2002

### General Description of Aspen Sampling Equipment:

Accredited Methods used by Aspen Environmental Ltd		
Method Number	Analyte & Procedure	Status
A1	Pressure, Temperature & Velocity to EN 16911-1.2013 & MID (Range 4 - 18 m/s)	MCerts
A2	Total Organics to EN 12619. 2013 (FID)	MCerts
A3	Speciated Organics to PD CEN/TS 13649. 2014 (Charcoal Tubes) 226-09	MCerts
A4.2	Oxygen to AM for EN 14789. 2005 (Zr cell)	MCerts
A4.2	Carbon monoxide to EN 15058. 2006 (NDIR)	MCerts
A4.2	Carbon dioxide to ISO 12039. 2001 (NDIR)	MCerts
A4.2	Nitrogen oxides (as NO <sub>x</sub> ) to EN 14792. 2005 & MID (Chemiluminescence)	MCerts
A5	Particulates to EN 13284-1. 2002 (Range 0 - 50 mg/m <sup>3</sup> )	MCerts
A5	Oil Mist, Tar & Bitumen fume (EN 13284-1. 2002 & MDHS 68 & 84)	MCerts
A6	Aliphatic Amines to PD CEN/TS 13649. 2014 (NIOSH Method 2010 Silica Gel Tube) 226-15	MCerts
A6	Aromatic Amines to PD CEN/TS 13649. 2014 (NIOSH Method 2002 Silica Gel Tube) 226-15	MCerts
A6	Aldehydes to PD CEN/TS 13649. 2014 (NIOSH Method 2539 XAD-2 Piperidine Tube) 226-117	MCerts
A6	Alcohols to PD CEN/TS 13649. 2014 (NIOSH 1400 & 2000 Charcoal & Silica Gel Tubes) 226-09 & 226-15	MCerts
A6	Phenols & Cresols to PD CEN/TS 13649. 2014 (NIOSH 2546 XAD-7 Tube) 226-95	MCerts
A6	Carboxylic Acids to PD CEN/TS 13649. 2014 (NIOSH 1603 Charcoal Tube) 226-09	MCerts
A6	Hydrogen sulphide (PD CEN/TS 13649. 2014 & NIOSH 6013 Charcoal tube) 226-09 & Zeffluor prefilter	MCerts
A8	Water vapour to EN 14790. 2005	MCerts
A9	Hydrogen chloride to EN 1911. 2010	MCerts
A9	Ammonia to EN 14791. 2005	MCerts
A9	Sulphur dioxide to EN 14791. 2005	MCerts
A3	Organic sulphides & thiols PD CEN/TS 13649. 2014 (Tenax ATD Tube & GCMS)	UKAS
A6	Ammonia to PD CEN/TS 13649. 2014 (NIOSH 6016 Sulphuric Acid Coated Silica Gel Tube) 226-10-06	UKAS
A6	Hydrogen cyanide to PD CEN/TS 13649. 2014 (NIOSH 6010 Soda Lime Tube) 226-28	UKAS
A6.2	Impregnated Filter Method PD CEN/TS 13649. 2014 H <sub>2</sub> SO <sub>4</sub> & H <sub>3</sub> PO <sub>4</sub> (NIOSH 7908)	UKAS
A6.2	Impregnated Filter Method PD CEN/TS 13649. 2014 HCl, HBr, & HNO <sub>3</sub> (NIOSH 7907)	UKAS
A6.2	Impregnated Filter Method PD CEN/TS 13649. 2014 Particulate Fluoride & HF (NIOSH 7906)	UKAS
A10	Speciated Organics using a Modified Water Trap to EA LFTGN08. 2011	UKAS
<b>Aspen accredited methodology complies with the requirements of the Environment Agency performance standard (MCerts) &amp; DD CEN/TS 15675. 2007 &amp; EN 15259. 2007, under EN 17025. 2005</b>		

**Method A1 Flow Measurement in Ducts to EN 16911-1:2013**

A US “S” type pitot tube, or UK “L” type pitot tube, each individually UKAS calibrated is used to measure Velocity Pressure (Pv) at a specified number of points across each traverse of the stack (usually 2), as set out in EN 13284-1 & EN 15259. Similarly the pitot is used to measure Static Pressure (Ps), and angle of flow at each of the points. Stack internal diameter is also measured.

A UKAS calibrated “K” type thermocouple system is used to measure temperature at each point above. Where isokinetic sampling is required water vapour content is also assessed. Exhaust velocity and volume flows are calculated according to the standard.

**Velocity & Static Pressure measuring equipment.**

A UKAS calibrated UK (BS 1042) type pitot tube (Aspen Ref 445), is used to calibrate other UK & US type pitot tubes (Aspen Refs 200, 331, 472).

A UKAS calibrated Airflow PVM 620 electronic micromanometer (Aspen Ref 501).

All pitot tubes are vacuum checked before usage.

**Temperature measuring equipment.**

A UKAS calibrated thermocouple (Annually changed).

A UKAS calibrated Digitron 3208 IS thermocouple reader (Aspen Ref 328).



**Method A5 Particulate Testing to EN 13284-1:2002.**

Testing is isokinetic to collect particulates onto 47mm glass fibre filter papers.

The filter papers are pre conditioned at 180 ° C and uniquely numbered.

The first requirement is to measure the exhaust velocity, stack size & geometry to determine the suitability of the location for sampling.

The sampling line is a modified Italian system, using numbered 4, 6 & 8 mm diameter tips, a 47 mm in line filter holder, and a supported probe to allow correct positioning. A pitot tube and thermocouple can be attached to the probe tip to allow continuous monitoring of the stack conditions.

A hose connects the high level probe to the low level equipment, which consists of a large in line silica gel trap, containing dry silica gel with a colour indicator. From here the line passes through an in line stainless steel mesh filter, (to prevent silica gel granules migrating into the sampling pump), to a sealed 110 (or 240V) diaphragm pump. The exhaust from the pump passes through a rotameter flow meter, to a calibrated dry gas meter (DGM), with an attached thermocouple, the final exhaust from the DGM is to atmosphere, so that the DGM reads at atmospheric pressure.

Sampling time is a minimum of 30 minutes per sample, and the system is arranged such that the maximum volume of sample air is collected.

Post sampling the filter paper is carefully extracted from the filter holder and returned to its uniquely labelled sample pot. Any residual filter fibres and pre filter probe contamination are rinsed out of the filter holder & probe into a clean bottle, using deionised water & an acetone final rinse.

The filter is reconditioned and reweighed by a UKAS accredited laboratory, and the retained rinse solution is evaporated and the residue weighed.

Results are presented as milligrams of particulates per cubic metre of sample air.

The whole line is constructed to EN 13284-1.

The line is flexible such that it can be reconfigured to allow the filter unit to be heated inside the flue, or located outside the flue with the line to the filter unit being heated also.

110 V Diaphragm Pump Aspen Ref No.129

Rotameter Flowmeters 0 – 10 l/m Aspen Ref No. 80


0 – 50 l/m Aspen Ref No. 82

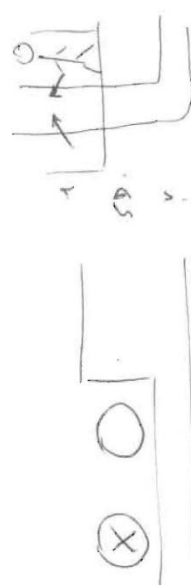
Dry Gas Meters Aspen Ref No. 97 & 102

Gas Meter Temperature Aspen Ref No. 83

## Appendix 2 – LHS Stack Results Calculations & Data

Steel Construction Ltd, Coventry										
Spray Area Particulate Emissions (30/06/2016)										
References		Dry Gas Meter:		Temperature ° C		Time		Particulate		
Filter	Rinse	DGM Correction Factor = 1.03		Stack	Gas Meter	Normal Sample	Initial	Elapsed	Filter	Concentration
Number	Number	Initial	Final	Stack	Gas Meter	Volume Litres	Initial	minutes	mg	mg/m <sup>3</sup>
<b>LHS Stack nearer front of building</b>										
Barometric Pressure = 999 mb										
126620	G11253	597171.7	597318.6	17	18	132.0	11:16	30	<0.04	< 2.046
126641	G11251	597325.8	597350.0	17	18	201.4	12:28	34	<0.04	< 1.341
Total Dry Gas						333.3			Mean Dry Gas < 1.693	
Total Wet Gas						336.9			Mean Wet Gas < 1.675	
<b>RHS Stack nearer back of building</b>										
Barometric Pressure = 999 mb										
126636	G11250	597557.0	597776.2	17	18	196.9	14:35	33	<0.04	< 4.215
126643	G11252	597783.8	597924.4	17	18	126.3	15:36	30	0.05	4.434
Total Dry Gas						323.2			Mean Dry Gas 4.325	
Total Wet Gas						326.7			Mean Wet Gas 4.279	
<b>Percentage Isokinetic Sampling Efficiency</b>										
<b>Near Side LHS Stack</b>										
Normal Duct Velocity						5.44 Nm / s	Theoretical		123.1	
Sampling Tip Diameter						4 mm	Actual		133.4	
Sampling Time						30 minutes	% Isokinetic		<b>108.4</b>	
<b>Far Side LHS Stack</b>										
Normal Duct Velocity						7.69 Nm / s	Theoretical		197.2	
Sampling Tip Diameter						4 mm	Actual		203.6	
Sampling Time						34 minutes	% Isokinetic		<b>103.2</b>	
<b>Near side RHS Stack</b>										
Normal Duct Velocity						5.46 Nm / s	Theoretical		135.9	
Sampling Tip Diameter						4 mm	Actual		127.7	
Sampling Time						33 minutes	% Isokinetic		<b>94.0</b>	
<b>Far Side RHS Stack</b>										
Normal Duct Velocity						7.69 Nm / s	Theoretical		174.0	
Sampling Tip Diameter						4 mm	Actual		199.0	
Sampling Time						30 minutes	% Isokinetic		<b>114.4</b>	


<b>Pitot Flow Measurements</b>			Aspen Environmental Ltd					
<b>Client:</b> Steel Construction Ltd, <b>Address:</b> Coventry			<b>Date:</b> 30/06/2016 <b>Operator:</b> GB, JB & SM <b>Job Number:</b> 1278 <b>Location:</b> Painting Area LHS Stack (nearer front of building)					
<b>Details of Duct</b>			<b>Atmospheric Pressure (Pa) millibars</b>					
						<b>Instrument</b>	<b>Correction</b>	<b>Corrected</b>
<b>Duct Shape:</b>	<b>Vertical</b>	<b>Circular</b>	<b>Initial:</b>	1002	-3	999		
<b>Dimension / Diameter: (cm)</b>		77	<b>Final:</b>	1002	-3	999		
<b>Area: sq metres</b>		0.466	<b>Mean:</b>			999		
<b>Pitot Tube stance into Duct</b>			<b>Axis 1:</b>			<b>Axis 2:</b>		
<b>Position: % Diameter</b>	<b>cm</b>		<b>Velocity</b>	<b>Static Pressure</b>	<b>Duct Temp</b>	<b>Velocity</b>	<b>Static Pressure</b>	<b>Duct Temp</b>
			<b>Pv</b>	<b>Ps</b>	<b>° Celsius</b>	<b>Pv</b>	<b>Ps</b>	<b>° Celsius</b>
			<b>Pascals</b>	<b>Pascals</b>		<b>Pascals</b>	<b>Pascals</b>	
3	15.3	11.8	15.7	147	17	22.1	147	17
Centre	50	38.5						
8	84.7	65.2	37.9	147	17	43.2	147	17
<b>RMS &amp; Means:</b>			29.0	147.0	17.0	34.3	147.0	17.0
<b>Mean Pv (Pascals)</b>	31.66	<b>Thermo &amp; Reader</b>		547 & 328	<b>Mean T in K (°C + 273)</b>			290
<b>Static Pressure (Pa)</b>	147	<b>Pitot Tube &amp; Manometer</b>			472 & 501	<b>K Factor</b>		1
<b>Duct Velocity (V) @ Temperature (T) in metres per second</b>								<b>7.26</b>
<b>Duct Velocity (V) @ 273K, 1013mb, in metres per second</b>								<b>6.74</b>
<b>Duct Volume Flow @ T in cubic metres per second</b>								<b>3.38</b>
<b>Duct Volume Flow @ 273K, 1013mb, in cubic metres per second</b>								<b>3.14</b>
<b>Duct Volume Flow @ 273K, 1013mb, in cubic feet per minute</b>								<b>6650</b>
<b>Duct Volume Flow @ Temperature (T) in cubic feet per minute</b>								<b>7163</b>
© Aspen Environmental Form 20 Version 7 (May 2013)								

Pitot & Isokinetic Sampling Data Form		Aspen Environmental Ltd							
Site & Stack Location		Steel Construct Coventry			LHS stack near foot of 6x18m			Sheet Number	1278
Date		30/6/16						Job Ref	1 of 4
Thermocouple & Reader		328 + 547			Pitot Tube & Micromanometer			472 + 501	
Pitot Checks:		Deformed?	X	Blocked?	X	Clean?	✓	Straight?	✓
Leak Check:		Vacuum leak check: (GB)							
S type pitot:		Static Pressure must be < 10 Pa on each side							
1st Traverse		1	2	3	4	5	6	7	8
Velocity pressure Pv		15.7	37.9						
Static Pressure Ps		+ 147							
Temp ° C		17							
Swirl Angle °									
Velocity m/s		22							
Sampling l/min									
Tip Diam mm									
Uncertainty Pv:									
2nd Traverse		1	2	3	4	5	6	7	8
Velocity pressure Pv		22.1	43.2						
Static Pressure Ps		+ 135							
Temp ° C		17							
Swirl Angle °									
Velocity m/s									
Sampling l/min									
Tip Diam mm									
Site Diagram, Sampling Details & Comments		<p>77 cm are vert ↑ 2 x ports at RL's.</p>  <p style="text-align: right;">6.74 Nm/s 3.14 Nm<sup>3</sup>/s</p>							
Operator		CB JB. SH.							




Aspen Environmental Ltd				Sampling Data Form						
Location & Drawing Steel Construction Ltd, Coventry				Sheet No: 2 of 4						
LHS Stack (Nearest front building)				Location						
				Time						
				Barometric Pressure						
				Temperature °C						
				Exhaust						
				Ambient						
				Gas Meter						
				Aspen Job Number						
				Notes						
Stack Dimensions (cm) & Aspect				77 cm circ vert ↑						
Sample Reference	Position	Time		Gas Meter / Counter		Vacuum %	Sampling Points	Comments	Notes	
		Initial	Final	Initial	Final					
126620		11-03	+1	67.6	67.8	✓✓	20 ft @ 17	40 ft @ 17	8 ft 9821	
		11-12	+1	597167.8	>1	✓✓	5.8 m/s	8.2 m/s	987.8.	
		11-16	+30	597171.7	597318.6	✓✓	44 ft @ 17 min @ 4 min	61 ft @ 17 min @ 4 min	Is the SiGel > 50 % Fresh Y	
		11-20	+1	22.0	22.2	✓✓	17 min @ 17 min		Stack Gas Homogeneity N/A	
		11-23	+1	25.6	25.8	✓✓			Equipment & Blank	
126641		12-28	+34	597323.8	597550.0	✓✓	17 min @ 17 min		Pump	
		13-06	+1	53.4	53.6	✓✓			Flowmeter	
									Gas meter	
									Gas Temp	
									Silica Gel	
									Thermocouple	
									Field Blank	
								Operator		Normal Flow
								GB + JB + SH		
Aspen Environmental Ltd Form 1C Sampling Data Form v1 (Dec 2014)										

## Appendix 3 – RHS Stack Results Calculations & Data

Steel Construction Ltd, Coventry										
Spray Area Particulate Emissions (30/06/2016)										
Aspen Environmental Ltd										
										
References		Dry Gas Meter:		Temperature °C		Time		Particulate		
Filter	Rinse	DCM Correction Factor =	Stack	Gas Meter	Normal Sample	Initial	Elapsed	Filter	Acetone	
Number	Number	Initial	Final	Stack	Volume Litres	Final	minutes	mg	mg	
		Elapsed							Concentration	
									mg/m <sup>3</sup>	
<b>LHS Stack nearer front of building</b>										
Barometric Pressure =										
126620	G11253	597171.7	597318.6	17	132.0	11:16	11:46	<0.04	<0.5	< 2.046
126641	G11251	597325.8	597550.0	17	201.4	12:28	13:02	<0.04	<0.5	< 1.341
					<b>Total Dry Gas</b>					<b>&lt; 1.693</b>
					<b>Total Wet Gas</b>					<b>&lt; 1.675</b>
<b>RHS Stack nearer back of building</b>										
Barometric Pressure =										
126636	G11250	597557.0	597776.2	17	196.9	14:35	15:08	<0.04	<0.5	< 4.215
126643	G11252	597783.8	597924.4	17	126.3	15:36	16:06	0.05	0.51	4.434
					<b>Total Dry Gas</b>					<b>Mean Dry Gas</b>
					<b>Total Wet Gas</b>					<b>Mean Wet Gas</b>
<b>Percentage Isokinetic Sampling Efficiency</b>										
<b>Near Side LHS Stack</b>										
Normal Duct Velocity		5.44 Nm / s		Wet Sample Volume in Litres						
Sampling Tip Diameter		4 mm		Theoretical		123.1				
Sampling Time		30 minutes		Actual		133.4				
				<b>% Isokinetic</b>		<b>108.4</b>				
<b>Far Side LHS Stack</b>										
Normal Duct Velocity		7.69 Nm / s		Wet Sample Volume in Litres						
Sampling Tip Diameter		4 mm		Theoretical		197.2				
Sampling Time		34 minutes		Actual		203.6				
				<b>% Isokinetic</b>		<b>103.2</b>				
<b>Near side RHS Stack</b>										
Normal Duct Velocity		5.46 Nm / s		Wet Sample Volume in Litres						
Sampling Tip Diameter		4 mm		Theoretical		135.9				
Sampling Time		33 minutes		Actual		127.7				
				<b>% Isokinetic</b>		<b>94.0</b>				
<b>Far Side RHS Stack</b>										
Normal Duct Velocity		7.69 Nm / s		Wet Sample Volume in Litres						
Sampling Tip Diameter		4 mm		Theoretical		174.0				
Sampling Time		30 minutes		Actual		199.0				
				<b>% Isokinetic</b>		<b>114.4</b>				



<b>Pitot Flow Measurements</b>			Aspen Environmental Ltd					
<b>Client:</b> Steel Construction Ltd, <b>Address:</b> Coventry			<b>Date:</b> 30/06/2016 <b>Operator:</b> GB, JB & SM <b>Job Number:</b> 1278 <b>Location:</b> Painting Area RHS Stack (nearer back of building)					
<b>Details of Duct</b>			<b>Atmospheric Pressure (Pa) millibars</b>					
					<b>Instrument</b>		<b>Correction</b>	<b>Corrected</b>
<b>Duct Shape:</b> Vertical    Circular			<b>Initial:</b>		1002		-3	999
<b>Dimension / Diameter: (cm)</b>			<b>Final:</b>		1002		-3	999
<b>Area: sq metres</b>			<b>Mean:</b>					999
			<b>Axis 1:</b>			<b>Axis 2:</b>		
<b>Pitot Tube stance into Duct</b>			<b>Velocity</b>			<b>Velocity</b>		
<b>Position: % Diameter</b>			<b>Static Pressure</b>			<b>Static Pressure</b>		
<b>cm</b>			<b>Pv</b>			<b>Pv</b>		
			<b>Pascals</b>			<b>Pascals</b>		
			<b>Ps</b>			<b>Ps</b>		
			<b>Pascals</b>			<b>Pascals</b>		
			<b>° Celsius</b>			<b>° Celsius</b>		
<b>3</b>			34.9			46.3		
<b>Centre</b>			150			160		
<b>50</b>			17			17		
<b>8</b>			26.3			19.1		
<b>84.7</b>			150			160		
<b>65.2</b>			17			17		
<b>RMS &amp; Means:</b>			30.9			35.4		
			150.0			160.0		
			17.0			17.0		
<b>Mean Pv (Pascals)</b>			<b>Thermo &amp; Reader</b>			<b>Mean T in K (°C + 273)</b>		
33.16			547 & 328			290		
<b>Static Pressure (Pa)</b>			<b>Pitot Tube &amp; Manometer</b>			<b>K Factor</b>		
155			472 & 501			1		
<b>Duct Velocity (V) @ Temperature (T) in metres per second</b>							<b>7.43</b>	
<b>Duct Velocity (V) @ 273K, 1013mb, in metres per second</b>							<b>6.90</b>	
<b>Duct Volume Flow @ T in cubic metres per second</b>							<b>3.46</b>	
<b>Duct Volume Flow @ 273K, 1013mb, in cubic metres per second</b>							<b>3.21</b>	
<b>Duct Volume Flow @ 273K, 1013mb, in cubic feet per minute</b>							<b>6805</b>	
<b>Duct Volume Flow @ Temperature (T) in cubic feet per minute</b>							<b>7330</b>	
© Aspen Environmental Form 20 Version 7 (May 2013)								

Pitot & Isokinetic Sampling Data Form		Aspen Environmental Ltd	
Site & Stack Location <i>Sec, Coventry Rh stack (furthest from van)</i>		Sheet Number <i>1278</i>	
Date <i>30/6/16</i>		Job Ref <i>30F4</i>	
Thermocouple & Reader			
Pitot Tube & Micromanometer		Straight?	
Pitot Checks: Deformed? Blocked? Clean?		Barometric Pressure mb <i>1002</i>	
Leak Check: Vacuum leak check: (GB)		Ambient Temperature °C <i>23</i>	
S type pitot: Static Pressure must be < 10 Pa on each side			
1st Traverse			
Velocity pressure Pv	1	2	3
Static Pressure Ps		<i>26.3</i>	
Temp °C		<i>+150</i>	
Swirl Angle °		<i>17</i>	
Velocity m/s			
Sampling l/min			
Tip Diam mm			
Uncertainty Pv:			
2nd Traverse			
Velocity pressure Pv	1	2	3
Static Pressure Ps		<i>19.1</i>	
Temp °C		<i>17</i>	
Swirl Angle °			
Velocity m/s			
Sampling l/min			
Tip Diam mm			
Site Diagram, Sampling Details & Comments			
			Operator
			<i>PS. JB. SM.</i>

Aspen Environmental Ltd		Sheet No: 4 of 4		Sampling Data Form				
Location & Drawing		Location		Time		Notes		
Rh stacks (fruitful from Jan)		30/6/16						
Temperature °C		mb						
Exhaust		Ambient						
Gas Meter		Gas Meter						
Stack Dimensions (cm) & Aspect		77cm circ Vert ↑		Aspen Job Number 1278				
Sample Reference	Position	Time		Gas Meter / Counter		Vacuum %	Sampling Points	Comments
		Initial	Final	Initial	Final			
126636		14.35	+1	57.2	57.6	✓	116 + 65.4	top @ 17
		15.13	+1	59857.4	59776.2	✓		5.8 m/s
				79.6	79.8			4.4 f/m @ 4m
								6.1 f/m @ 6m
126643		15.17	+1	83.6	83.8	✓		
		15.36	+30	59783.8	59776.4			
		16.10	+1	77.4	77.6	✓		
Is the SiGel >50 % Fresh								
Stack Gas Homogeneity								
Equipment & Blank								
Pump								
Flowmeter								
Gasmeter								
Gas Temp								
Silica Gel								
Thermocouple								
Field Blank								
Operator								GB/38/SAL
Normal Flow								

# Appendix 4 Laboratory Results



## Test Certificate

Date: 19/07/2018

<b>Client</b>	Aspen Environmental Ltd 25A Church Street Uttoxeter Staffordshire ST14 8AG	<b>Order No.</b>	1890
		<b>Certificate No.</b>	WK18-4115
		<b>Issue No.</b>	1
<b>Contact</b>	Dr Geoff Buck	<b>Date Received</b>	08/07/2018
<b>Description</b>	4 filters & 4 washes for TPM	<b>Technique</b>	Gravimetric Stack

Sample No.	889467	126836	Method
Total particulate matter		<0.04 mg	D9(U)
Sample No.	889468	126841	Method
Total particulate matter		<0.04 mg	D9(U)
Sample No.	889469	126843	Method
Total particulate matter		0.05 mg	D9(U)
Sample No.	889470	126820	Method
Total particulate matter		<0.04 mg	D9(U)
Sample No.	889471	G11250	Method
Total particulate matter		<0.5 mg	D9(U)
Sample No.	889472	G11251	Method
Total particulate matter		<0.5 mg	D9(U)
Sample No.	889473	G11252	Method
Total particulate matter		0.51 mg	D9(U)
Sample No.	889474	G11253	Method
Total particulate matter		<0.5 mg	D9(U)

Page 1 of 2

RPS Laboratories Ltd, Unit 12, Waters Edge Business Park, Modwen Road, Salford, M5 3EZ  
Tel: (0161) 872 2443 Fax: (0161) 877 3958




## Test Certificate

Date: 19/07/2016

<b>Client</b>	Aspen Environmental Ltd	<b>Certificate No.</b>	<b>WK15-4115</b>
		<b>Issue No.</b>	1

<b>Tested By</b>	Simon Doodson	<b>Date</b>	19/07/2016
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<b>Approved By</b>		<b>Date</b>	19/07/2016
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Joanna Dewhurst  
Operational 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 pp m) are calculated on the basis of information provided by the customer.  
Results stated as ml are relating to the sample volume.

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Analysis carried out on samples 'as received'

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Page 2 of 2

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## Appendix 5 Uncertainty Calculations

Uncertainty for Particulate Sampling to EN 13284: 2002			Aspen Environmental Ltd		
Principal Uncertainties for Particulate Sample of 10 mg					
Cahn Balance (PBS) at 100 mg	± 0.022mg	95 %		0.0220	0.0005
Volume Measurement (Schlumberger)(Labcal) 400 L	± 0.5 % of volume	2 litres	4	4.0000	16.0000
	+ resolution	0.2 litres	0.025	0.1200	0.0144
DGM Aspen 97	± 2.3 %			4.6000	21.1600
Change in DGM temperature	± 10/293			0.0341	0.0012
Change in atmospheric pressure	± 2/1013			0.0020	0.0000
No change in humidity (dry gas)					
No change in oxygen (LEV system)					
				Sum Sq <sub>s</sub>	37.1761
				sq rt	6.0972
				<b>Expanded Result</b>	<b>6.1 %</b>