

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

Date: 30/03/2017

Ref: L.2357

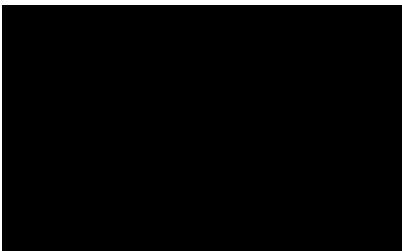
Dear Sandy,

**Testing at Coventry March 2017:**

I am pleased to present my report on the emissions testing undertaken on your site on the 9<sup>th</sup> March 2017.

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: 09/03/2017  
Aspen Reference Number: J.1318

**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: 30<sup>th</sup> March 2017



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

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## **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 9<sup>th</sup> March 2017, 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 a thirty minute period 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 both stacks are included in Appendix 2.

UKAS accredited filter & rinse weights are also included in Appendix 2


Uncertainty calculations for the testing are included as Appendix 3

## **Monitoring Deviations**

Both exhausts were sampled using centre point sampling methodology.

Sampling was undertaken using 4 mm tips.

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

<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;"> <b>Steel Construction Ltd, Coventry</b>  <b>Spray Area Emissions Testing 2017</b> </div> <div style="text-align: center;">   <b>Aspen Environmental Ltd</b> </div> </div>											
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	< 1.8	± 6.1 %	mg/Nm <sup>3</sup>	Wet Gas	09/03/2017	12:46 - 13:31	EN 13284-1	MCerts	Normal Running
RHS Spray Area	Particulates	50	< 2.4	± 6.1 %	mg/Nm <sup>3</sup>	Wet Gas	09/03/2017	11:24 - 11:57	EN 13284-1	MCerts	Normal Running
<b>Notes</b> Dr G.W.Buck is personally MCerted 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

# Stack Results Calculations & Data

Steel Construction Ltd, Coventry										Aspen Environmental Ltd			
Spray Area Particulate Emissions (09/03/2017)													
References		Dry Gas Meter:		Temperature °C		Time		Particulate					
Filter Number	Rinse Number	DGM Correction Factor =	Stack	Gas Meter	Normal Sample Volume Litres	Initial	Final	Elapsed minutes	Filter mg	Acetone mg	Concentration mg/m3		
		Initial	Final	Elapsed									
<b>LHS Stack nearer front of building</b>													
Barometric Pressure =													
137644	G11558	616494.8	616815.2	1016	mb	11	13	297.8	12:46	13:31	45	< 0.5	< 1.813
					Total Dry Gas			297.8				Mean Dry Gas	< 1.813
					Total Wet Gas			299.9				Mean Wet Gas	< 1.800
<b>RHS Stack nearer back of building</b>													
Barometric Pressure =													
137641	G11557	616247.1	616487.0	1016	mb	12	12	223.8	11:24	11:57	33	< 0.5	< 2.413
					Total Dry Gas			223.8				Mean Dry Gas	< 2.413
					Total Wet Gas			225.4				Mean Wet Gas	< 2.396
<b>Percentage Isokinetic Sampling Efficiency</b>													
<b>LHS Stack nearer front of building</b>													
Normal Duct Velocity		7.79 Nm / s		Wet Sample Volume in Litres		Initial Silica Gel Weight		1004 g					
Sampling Tip Diameter		4 mm		Theoretical		Final Silica Gel Weight		1007 g					
Sampling Time		45 minutes		Actual		Weight of Water Vapour		3 g					
				<b>% Isokinetic</b>		<b>112.7</b>		<b>Volume of Water Vapour</b>				<b>3.73 litres</b>	
<b>RHS Stack nearer back of building</b>													
Normal Duct Velocity		8.14 Nm / s		Wet Sample Volume in Litres		Theoretical		202.6					
Sampling Tip Diameter		4 mm		Actual		223.8							
Sampling Time		33 minutes		<b>% Isokinetic</b>		<b>110.4</b>							

<b>Pitot Flow Measurements</b>			<b>Aspen Environmental Ltd</b>					
<b>Client:</b> Steel Construction Ltd, <b>Address:</b> Coventry			<b>Date:</b> 09/03/2017 <b>Operator:</b> GB, JB & SM <b>Job Number:</b> 1318 <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>	1019	-3	1016		
<b>Dimension / Diameter: (cm)</b>		77	<b>Final:</b>	1019	-3	1016		
<b>Area: sq metres</b>		0.466	<b>Mean:</b>			1016		
<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	16.2	140	11	22.4	140	11
Centre	50	38.5	40.9					
8	84.7	65.2	33.5	140	11	53	140	11
<b>RMS &amp; Means:</b>			31.9	140.0	11.0	40.7	140.0	11.0
<b>Mean Pv (Pascals)</b>		36.31	<b>Thermo &amp; Reader</b>		547 & 328	<b>Mean T in K (°C + 273)</b>		284
<b>Static Pressure (Pa)</b>		140	<b>Pitot Tube &amp; Manometer</b>			472 & 501	<b>K Factor</b>	1
<b>Duct Velocity (V) @ 289 K 101.3 kPa in metres per second</b>								<b>7.63</b>
<b>Duct Velocity (V) @ Exhaust Temperature (T) in metres per second</b>								<b>7.50</b>
<b>Duct Velocity (V) @ 273K, 1013mb, in metres per second</b>								<b>7.23</b>
<b>Duct Volume Flow @ 289 K in cubic metres per second</b>								<b>3.55</b>
<b>Duct Volume Flow @ 273K, 1013mb, in cubic metres per second</b>								<b>3.37</b>
<b>Duct Volume Flow @ 273K, 1013mb, in cubic feet per minute</b>								<b>7131</b>
<b>Duct Volume Flow @ Temperature (T) in cubic feet per minute</b>								<b>7527</b>
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<b>Pitot Flow Measurements</b>			<b>Aspen Environmental Ltd</b>					
<b>Client:</b> Steel Construction Ltd, <b>Address:</b> Coventry			<b>Date:</b> 09/03/2017 <b>Operator:</b> GB, JB & SM <b>Job Number:</b> 1318 <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>	<b>Vertical</b>	<b>Circular</b>	<b>Initial:</b>	1019	-3	1016		
<b>Dimension / Diameter: (cm)</b>		77	<b>Final:</b>	1019	-3	1016		
<b>Area: sq metres</b>		0.466	<b>Mean:</b>			1016		
<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</b>	<b>Duct</b>	<b>Velocity</b>	<b>Static</b>	<b>Duct</b>
			<b>Pressure</b>	<b>Pressure</b>	<b>Temp</b>	<b>Pressure</b>	<b>Pressure</b>	<b>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	33	140	12	50.3	140	12
Centre	50	38.5	44.4	140	12			
8	84.7	65.2	32.6	140	12	24	140	12
<b>RMS &amp; Means:</b>			37.1	140.0	12.0	39.4	140.0	12.0
<b>Mean Pv (Pascals)</b>	38.24	<b>Thermo &amp; Reader</b>		547 & 328	<b>Mean T in K (°C + 273)</b>		285	
<b>Static Pressure (Pa)</b>	140	<b>Pitot Tube &amp; Manometer</b>			472 & 501	<b>K Factor</b>	1	
<b>Duct Velocity (V) @ 289 K 101.3 kPa in metres per second</b>								<b>7.84</b>
<b>Duct Velocity (V) @ Exhaust Temperature (T) in metres per second</b>								<b>7.73</b>
<b>Duct Velocity (V) @ 273K, 1013mb, in metres per second</b>								<b>7.43</b>
<b>Duct Volume Flow @ 289 K in cubic metres per second</b>								<b>3.65</b>
<b>Duct Volume Flow @ 273K, 1013mb, in cubic metres per second</b>								<b>3.46</b>
<b>Duct Volume Flow @ 273K, 1013mb, in cubic feet per minute</b>								<b>7332</b>
<b>Duct Volume Flow @ Temperature (T) in cubic feet per minute</b>								<b>7739</b>
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**Test Certificate**

Date 27/03/2017

<b>Client</b>	Aspen Environmental Ltd 25A Church Street Uttoxeter Staffordshire ST14 8AG	<b>Order No.</b>	1925
		<b>Certificate No.</b>	<b>WK17-1802</b>
		<b>Issue No.</b>	1
<b>Contact</b>	Dr Geoff Buck	<b>Date Received</b>	14/03/2017
<b>Description</b>	4 filters & 4 washes for TPM	<b>Technique</b>	Gravimetric Stack

Sample No.	927131	137841	Method
Total particulate matter	<0.04 mg		D9(U)

Sample No.	927132	137844	Method
Total particulate matter	<0.04 mg		D9(U)

Sample No.	927135	G11557	Method
Total particulate matter	<0.5 mg		D9(U)

Sample No.	927136	G11558	Method
Total particulate matter	<0.5 mg		D9(U)



Date 27/03/2017

## Test Certificate

<b>Client</b>	Aspen Environmental Ltd	<b>Certificate No.</b>	<b>WK17-1802</b>
		<b>Issue No.</b>	1

<b>Tested By</b>	Kirstie Davenport	<b>Date</b>	23/03/2017 27/03/2017
------------------	-------------------	-------------	--------------------------

<b>Approved By</b>	 	<b>Date</b>	27/03/2017
	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 ppm) are calculated on the basis of information provided by the customer.  
Results stated as ml are relating 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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Aspen Environmental Ltd		Sheet No: 1 of 4		Sampling Data Form			
Location & Drawing <i>SCC</i> <i>NORTH WOODS</i> <i>RHS Stack</i>		Location Date <i>09/3/17</i> Time <i>1019</i> Barometric Pressure mb Temperature °C Exhaust Ambient Gas Meter <i>12</i>					
Stack Dimensions (cm) & Aspect		Aspen Job Number <i>1318</i>					
Sample Reference	Position	Time		Gas Meter / Counter	Vacuum %	Sampling Points	Notes
		Initial	Final				
		<i>1112</i>	<i>+1</i>	<i>46.9</i> <i>671</i>	<i>&lt;2</i>	<i>6.6 L/m</i>	<i>1004.0</i>
<i>137641</i>		<i>1124</i>	<i>+33</i>	<i>66247.1</i> <i>616487.0</i>			Is the SiGel >50 % Fresh <i>yes</i> Stack Gas Homogeneity <i>N/A</i>
		<i>12.04</i>	<i>+1</i>	<i>90.6</i> <i>90.8</i>			
Equipment & Blank							
						Pump <i>129</i>	
						Flowmeter <i>80</i>	
						Gasmeter <i>97</i>	
						Gas Temp <i>83</i>	
						Silica Gel <i>1</i>	
						Thermocouple	
						Field Blank	
Operator							
<i>GB FJB</i>							
Normal Flow							
<i>7.43 Nm<sup>3</sup>/s</i>							
<i>3.46 Nm<sup>3</sup>/s</i>							
Aspen Environmental Ltd Form 1C Sampling Data Form v1 (Dec 2014)							



Pitot & Isokinetic Sampling Data Form				Aspen Environmental Ltd			
Site & Stack Location		SCL Coventry - Langmore Side		RHS Stack		Sheet Number 2 of 4 Job Ref 1318	
Date		9/5/17		547 + 328		Pitot Tube & Micromanometer 472 + 501	
Thermocouple & Reader		Deformed? <input checked="" type="checkbox"/>		Blocked? <input checked="" type="checkbox"/>		Clean? <input checked="" type="checkbox"/>	
Leak Check:		Vacuum leak check: (GB) -2000		Barometric Pressure mb 1018		Straight? <input checked="" type="checkbox"/>	
S type pitot:		Static Pressure must be < 10 Pa on each side		Ambient Temperature °C 14			
1st Traverse		1		2		3	
Velocity pressure Pv		33.0		32.6		44.6	
Static Pressure Ps							
Temp °C		12					
Swirl Angle °							
Velocity m/s							
Sampling l/min							
Tip Diam mm							
Uncertainty Pv:							
2nd Traverse		1		2		3	
Velocity pressure Pv		50.3		26.0			
Static Pressure Ps				1140			
Temp °C							
Swirl Angle °							
Velocity m/s							
Sampling l/min							
Tip Diam mm							
Site Diagram, Sampling Details & Comments							
<p> </p>							
Operator							GB + SM + JB

Aspen Environmental Ltd		Sheet No: 3 of 4		Sampling Data Form			
Location & Drawing		Location		Time		Notes	
SCL		09/13/17		mb		10070	
FORMER Iron LADDER LHS Stack		Barometric Pressure		Exhaust		Is the SiGel >50 % Fresh Y	
		Temperature °C		Ambient		Stack Gas Homogeneity N/A	
		Gas Meter		Gas Meter		Equipment & Blank	
		13		13		As 1	
						Pump	
						Flowmeter	
						Gasmeter	
						Gas Temp	
						Silica Gel	
						Thermocouple	
						Field Blank	
						Operator	
						68 tJB	
						Normal Flow	
						7.23 Nm <sup>3</sup> /s	
						3.37 Nm <sup>3</sup> /s	
Stack Dimensions (cm) & Aspect		Vacuum %		Sampling Points		cm	
Sample Reference	Position	Initial	Final	<2	Comments		
		12.19	16.8	✓	611/m.		
137644		12.46	16.8				
		13.34	22.6				

Pitot & Isokinetic Sampling Data Form				Aspen Environmental Ltd			
Site & Stack Location		LHS Stack		Sheet Number		4 of 4	
Date		9/3/17		Job Ref		1318	
Thermocouple & Reader		AS2		Pitot Tube & Micromanometer		AS 2	
Pitot Checks:		Deformed? <input checked="" type="checkbox"/>		Blocked? <input checked="" type="checkbox"/>		Straight? <input checked="" type="checkbox"/>	
Leak Check:		Vacuum leak check: (GB)		Barometric Pressure mb			
S type pitot:		Static Pressure must be < 10 Pa on each side		Ambient Temperature °C		14	
1st Traverse		1		2		3	
Velocity pressure Pv		11.2		33.5		10.9	
Static Pressure Ps						+1140	
Temp °C						11	
Swirl Angle °		A					
Velocity m/s							
Sampling l/min							
Tip Diam mm							
Uncertainty Pv:							
2nd Traverse		1		2		3	
Velocity pressure Pv		72.4		55.0			
Static Pressure Ps							
Temp °C							
Swirl Angle °		B					
Velocity m/s							
Sampling l/min							
Tip Diam mm							
Site Diagram, Sampling Details & Comments							
							Operator
							CB+JS

## Appendix 3 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>