

**Aspen Environmental Ltd**  
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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: 17/05/2015

Ref: L.2253

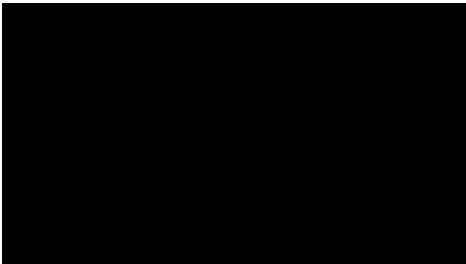
Dear Sandy,

**Testing at Coventry April 2015:**

I am pleased to present my report on the emissions testing undertaken on your site on the 24<sup>th</sup> April 2015.

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: 24/04/2015  
Aspen Reference Number: J.1205

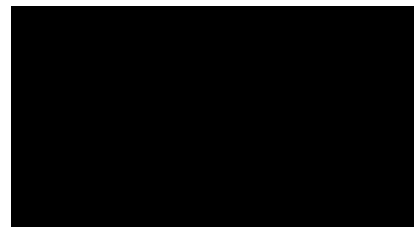
**Monitoring of:  
Spraybooth Stacks at  
Steel Construction Ltd, Bodmin Road, Coventry, CV2 5DB.**

**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: 17<sup>th</sup> May 2015

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 24<sup>th</sup> April 2015, 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 bays were labelled as Bay 1 (Right Hand Side) & Bay 2 (Left Hand Side), as viewed from inside the factory. At the time spray painting was being carried out on a series of steel parts, and each exhaust was sampled isokinetically for one 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 Bay 1 (RHS) are included in Appendix 2.

Details of sampling, pitot flow measurements and two sheets of site data for Bay 2 (LHS) 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 a centre point methodology.

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

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

Steel Construction Ltd, Coventry											
Spraybooth Emissions Testing: April 2015											
Aspen Environmental Ltd											
											
Emission Point Reference	Substance to be Monitored	Emission Limit Value PG 6/23 (2014)	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
Spray Bay 1 (RHS)	Particulates	50	< 1	± 6.1 %	mg/Nm <sup>3</sup>	Wet Gas	24/01/2015	13:03 - 13:33	EN 13281 1	MCerts	Normal Running
Spray Bay 2 (LHS)	Particulates	50	< 1	± 6.1 %	mg/Nm <sup>3</sup>	Wet Gas	24/01/2015	12:00 - 12:30	EN 13281 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 Dec 2015)
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:**

### **Aspen Method A1**

Pressure, Temperature & Velocity in Stacks & Ducts to EN 16911-1 & 13284-1.

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 198, 200, 201, 236, 331, 472).

A UKAS calibrated Airflow PVM620 electronic micromanometer (Aspen Ref 501).

All pitot tubes are vacuum checked before usage.

Temperature measuring equipment.

2 UKAS calibrated thermocouples (Annually changed).

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

### **Aspen Method A5**

Particulates in stacks & ducts


Exhaust gas is drawn isokinetically through custom made stainless steel sampling tips to a stainless steel or delrin in line filter holder, containing a suitable preweighed & conditioned glass or quartz fibre filter. A pitot tube and thermocouple can be attached to the filter to allow continuous readings of velocity pressure. The whole assembly is supported on a stainless steel probe, the whole being attached to the sampling port. The filter tip is accurately positioned & held in several places (as required), within the exhaust by a compression joint with teflon ferrules. Post filtration the gas is carried down a heavy duty hose to ground level, where it passes through a large silica gel trap and a fine filter to a vacuum pump. The exhaust from the vacuum pump passes through a flowmeter (indicative) via a thermocouple to a calibrated dry gas meter (Aspen Ref 97 & 102), and thence direct to atmosphere. **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.

## Appendix 2 – Bay 1 (RHS) Results Calculations & Data



Steel Construction Ltd, Coventry										Aspen Environmental Ltd									
Particulate Emissions (24/04/2015)																			
References		Dry Gas Meter:				Temperature °C		Time		Particulate									
Filter	Rinse	DGM Correction Factor =	1.03			Stack	Gas Meter	Normal Sample	Initial	Elapsed	Filter	Acetone	Concentration						
Number	Number	Initial	Final	Elapsed				Volume Litres		minutes	mg	mg	mg/m <sup>3</sup>						
<b>Spray Booth Bay 1 (RHS)</b>																			
Barometric Pressure = 1001 mb																			
117066	G10794	564863.9	565225.0	361.1	14.5	17.8		325.2	13:03	13:33	<0.04	<0.5	<0.830						
Total Dry Gas								325.22					Mean Dry Gas	<0.830					
Total Wet Gas								325.29						Mean Wet Gas	<0.830				
<b>Spray Booth Bay 2 (LHS)</b>																			
Barometric Pressure = 1002 mb																			
117078	G10793	564518.5	564857.0	338.5	13	16		307.1	12:00	12:30	<0.04	<0.5	<0.879						
Total Dry Gas								307.08					Mean Dry Gas	<0.879					
Total Wet Gas								307.14					Mean Wet Gas	<0.879					
117076	G10795	Field Blank																	
<b>Percentage Isokinetic Sampling Efficiency</b>																			
<b>Spray Booth Bay 1 (RHS)</b>																			
Normal Duct Velocity										Sample Volume in Litres									
6.74 Nm / s										Theoretical									
6 mm										Actual									
30 minutes										94.8									
<b>Spray Booth Bay 2 (LHS)</b>																			
Normal Duct Velocity										Sample Volume in Litres									
6.49 Nm / s										Theoretical									
6 mm										Actual									
30 minutes										93.0									

<b>Pitot Flow Measurements</b>			<b>Aspen Environmental Ltd</b>					
<b>Client:</b> Steel Construction Ltd <b>Address:</b> Coventry			<b>Date:</b> 24/04/2015 <b>Operator:</b> GB, JB & SM <b>Job Number:</b> 1205 <b>Location:</b> Spray Booth Bay 1 RHS					
<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>	1003	-2	1001		
<b>Dimension / Diameter: (cm)</b>		77	<b>Final:</b>	1003	-2	1001		
<b>Area: sq metres</b>		0.47	<b>Mean:</b>			1001		
<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>	
1	14.6	11.2	18.8	155	14.5	26.2	150	14.5
2	85.4	65.8	43.5	152	14.5	39.8	153	14.5
<b>RMS &amp; Means:</b>			33.51	153.50	14.50	33.69	151.50	14.50
<b>Mean Pv (Pascals)</b>			33.60	<b>Thermo &amp; Reader</b> 541 & 328		<b>Mean T in K (°C + 273)</b>		287.5
<b>Static Pressure (Pa)</b>			152.5	<b>Pitot Tube &amp; Manometer</b>		431 & 501	<b>K Factor</b>	1
<b>Duct Velocity (V) @ Temperature (T) in metres per second</b>								7.44
<b>Duct Velocity (V) @ 273K, 1013mb, in metres per second</b>								6.98
<b>Duct Volume Flow @ T in cubic metres per second</b>								3.46
<b>Duct Volume Flow @ 273K, 1013mb, in cubic metres per second</b>								3.25
<b>Duct Volume Flow @ 273K, 1013mb, in cubic feet per minute</b>								6887
<b>Duct Volume Flow @ Temperature (T) in cubic feet per minute</b>								7340


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Pitot & Isokinetic Sampling Data Form				Aspen Environmental Ltd			
Site & Stack Location		SCL CEMENT 7 BAY 1 (LIGHT)		Sheet Number		3 of 4	
Date		24/4/15		Job Ref		1205	
Thermocouple & Reader		541 + 328		Pitot Tube & Micromanometer		Clean? <input checked="" type="checkbox"/> Straight? <input checked="" type="checkbox"/>	
Pitot Checks:		Deformed? <input checked="" type="checkbox"/>		Blocked? <input checked="" type="checkbox"/>			
Leak Check:		Vacuum leak check: (GB)					
S type pitot: Static Pressure must be < 10 Pa on each side							
1st Traverse		2		3		4	
Velocity pressure Pv	18	45	18.8	43.5			
Static Pressure Ps	155	152					
Temp °C	14.5	14.5					
Swirl Angle °	-0.5	-1					
Velocity m/s							
Sampling l/min							
Tip Diam mm							
Uncertainty Pv:							
2nd Traverse		2		3		4	
Velocity pressure Pv	25	40	26.2	39.8			
Static Pressure Ps	150	153					
Temp °C	14.5	14.5					
Swirl Angle °	-1	-1					
Velocity m/s							
Sampling l/min							
Tip Diam mm							
Site Diagram, Sampling Details & Comments							
<p>TEST Ø. 34 mm @ 14.5 7.1 l/min 12 l/min @ 6 mm.</p> <p>7035 PAINTS - LIGHT GREY. INDELLAC 789. VOC 2026 per kg.</p>							
						Operator	
						GB + JB + Jm.	

Aspen Environmental Ltd										Sampling Data Form				
Location & Drawing SCL (R1600 BH). BAY 1										Sheet No: L R 4				
Stack Dimensions (cm) & Aspect 77cm dia vert ↑										Aspen Job Number 1205				
Sample Reference	Position	Time		Gas Meter / Counter		Vacuum %	Sampling Points			Notes				
		Initial	Final	Initial	Final		< 2	Comments	cm					
117066	VAC.	12.57	+	63.7	63.9	✓								
	SAMPLE			56.6569	56.525.0									
		13.03	+	28.6	28.8					Is the SiGel >50 % Fresh				
	VAC.	13.37	+							Stack Gas Homogeneity				
Equipment & Blank														
Pump Flowmeter Gasmeter Gas Temp Silica Gel Thermocouple Field Blank														
Operator CB or JBR Sign.														
Normal Flow 698 Nm <sup>3</sup> /S 3.25 Nm <sup>3</sup> /S														
Aspen Environmental Ltd Form 1C Sampling Data Form v1 (Dec 2014)														

## Appendix 3 – Bay 2 (LHS) Results Calculations & Data

Steel Construction Ltd, Coventry										Aspen Environmental Ltd									
Particulate Emissions (24/04/2015)																			
References		Dry Gas Meter:			Temperature °C		Time		Particulate										
Filter Number	Rinse Number	DGM Correction Factor =	Initial	Final	Elapsed	Stack	Gas Meter	Normal Sample Volume Litres	Initial	Final	Elapsed	Filter	Acetone	Concentration					
												mg	mg	mg/m <sup>3</sup>					
<b>Spray Booth Bay 1 (RHS)</b>																			
Barometric Pressure -																			
117066	G10794	564863.9	565225.0	361.1	1001	mb	14.5	325.2	13:03	13:33	30	<0.04	<0.5	< 0.830					
							Total Dry Gas	325.22				Mean Dry Gas		< 0.830					
							Total Wet Gas	325.29				Mean Wet Gas		< 0.830					
<b>Spray Booth Bay 2 (LHS)</b>																			
Barometric Pressure =																			
117078	G10793	564518.5	564857.0	338.5	1002	mb	13	307.1	12:00	12:30	30	<0.04	<0.5	< 0.879					
							Total Dry Gas	307.08				Mean Dry Gas		< 0.879					
							Total Wet Gas	307.14				Mean Wet Gas		< 0.879					
117076	G10795	Field Blank																	
<b>Percentage Isokinetic Sampling Efficiency</b>																			
<b>Spray Booth Bay 1 (RHS)</b>																			
Normal Duct Velocity		6.74 Nm / s																	
Sampling Tip Diameter		6 mm																	
Sampling Time		30 minutes																	
		Sample Volume in Litres																	
		Theoretical		343.2															
		Actual		325.3															
		% Isokinetic		94.8															
<b>Spray Booth Bay 2 (LHS)</b>																			
Normal Duct Velocity		6.49 Nm / s																	
Sampling Tip Diameter		6 mm																	
Sampling Time		30 minutes																	
		Sample Volume in Litres																	
		Theoretical		330.4															
		Actual		307.1															
		% Isokinetic		93.0															

<b>Pitot Flow Measurements</b>			<b>Aspen Environmental Ltd</b>					
<b>Client:</b> Steel Construction Ltd <b>Address:</b> Coventry			<b>Date:</b> 24/04/2015 <b>Operator:</b> GB, JB & SM <b>Job Number:</b> 1205 <b>Location:</b> Spray Booth Bay 2 LHS					
<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>	1003	-2	1001		
<b>Dimension / Diameter: (cm)</b>		77	<b>Final:</b>	1003	-2	1001		
<b>Area: sq metres</b>		0.47	<b>Mean:</b>			1001		
<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>	
1	14.6	11.2	25.2	150	13	45.9	150	13
2	85.4	65.8	26.2	150	13	20.1	150	13
<b>RMS &amp; Means:</b>			25.70	150.00	13.00	35.43	150.00	13.00
<b>Mean Pv (Pascals)</b>			30.57	<b>Thermo &amp; Reader</b>		<b>Mean T in K (°C + 273)</b>		286
<b>Static Pressure (Pa)</b>			150	<b>Pitot Tube &amp; Manometer</b>		431 & 501	<b>K Factor</b>	1
<b>Duct Velocity (V) @ Temperature (T) in metres per second</b>							7.08	
<b>Duct Velocity (V) @ 273K, 1013mb, in metres per second</b>							6.67	
<b>Duct Volume Flow @ T in cubic metres per second</b>							3.30	
<b>Duct Volume Flow @ 273K, 1013mb, in cubic metres per second</b>							3.11	
<b>Duct Volume Flow @ 273K, 1013mb, in cubic feet per minute</b>							6586	
<b>Duct Volume Flow @ Temperature (T) in cubic feet per minute</b>							6983	

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Aspen Environmental Ltd			
<b>Pitot &amp; Isokinetic Sampling Data Form</b>		<b>Data Should be Entered in all fields</b>	
Site & Stack Location	SKL COVENTRY - BAY 2 (LEFT)	Sheet Number	1 of 4
Date	14/1/15	Job Ref	1205
Thermocouple & Reader	541 + 328	Pitot Tube & Micromanometer	472 + 501
Pitot Checks:	Deformed? <input checked="" type="checkbox"/> Blocked? <input checked="" type="checkbox"/>	Clean? <input checked="" type="checkbox"/>	Straight? <input checked="" type="checkbox"/>
Leak Check:	Vacuum leak check: (GB) <input checked="" type="checkbox"/> - 2.50	Barometric Pressure mb	1004
S type pitot:	Static Pressure must be < 10 Pa on each side	Ambient Temperature °C	16.0°C
1st Traverse	1 2 3	5	7 8
Velocity pressure Pv	25 28	25.4 26.2	
Static Pressure Ps	+150		
Temp °C	13		
Swirl Angle °	-2		
Velocity m/s			
Sampling l/min			
Tip Diam mm			
Uncertainty Pv:			
2nd Traverse	1 2 3	4	5 6 7 8
Velocity pressure Pv	48	22	45.9 20.1
Static Pressure Ps	+150		
Temp °C	13°C	13°C	
Swirl Angle °	-1	-2	
Velocity m/s			
Sampling l/min			
Tip Diam mm			
Site Diagram, Sampling Details & Comments	<p>w 30 Pa @ 13°C 6.8 m/s. 11.6 l/min.</p> <p>TEST 7.</p> <p><del>BAY 1</del> BAY 2 GB</p> <p>BAY 1   BAY 2   WALL   PLATFORM OUTSIDE</p> <p>INSIDE BUILDING</p>		
Operator	GB + JBS + Jm.		
Aspen Environmental Ltd Form IB Flow Measurement EN 16911 v1 Dec 2014			



Aspen Environmental Ltd										Sampling Data Form											
Location & Drawing 500 BAT 2 (LOFT)										Sheet No: 2 of 4											
										Date		Time		Location		Time		mb		Exhaust	
Stack Dimensions (cm) & Aspect    770x400    C.15C    V.12x5										12.35 1056.3 1056.2											
Sample Reference 11-078 VAC SAMPLE CP VAC										Vacuum % <2 ✓ ✓											
Position		Time		Gas Meter / Counter		Initial		Final		Initial		Final		Initial		Final		Initial		Final	
						11.19		+1		18.4		18.5		564516.5		564857.0		60.4		60.4	
						12.00		+30													
						12.36		+1													
Is the SiGel >50 % Fresh Stack Gas Homogeneity										Equipment & Blank Pump Flowmeter Gasmeter Gas Temp Silica Gel Thermocouple Field Blank											
Operator GB + JB										Normal Flow 6.98 Nm <sup>3</sup> /s    6.67 3.03 Nm <sup>3</sup> /s    3.11											
Aspen Environmental Ltd Form 1C Sampling Data Form v1 (Dec 2014)																					

# Appendix 4 Laboratory Results



## Test Certificate

Date: 12/05/2015

<b>Client</b>	Aspen Environmental Ltd 25A Church Street Uttoxeter Staffordshire ST14 8AG	<b>Order No.</b>	1822
		<b>Certificate No.</b>	WK15-2389
		<b>Issue No.</b>	1
<b>Contact</b>	Dr Geoff Buck	<b>Date Received</b>	01/05/2015
<b>Description</b>	19 samples for TPM	<b>Technique</b>	Gravimetric

Sample No.	834834	117068	Method
Total particulate matter	<0.04 mg		D9(U)

Sample No.	834837	117078	Method
Total particulate matter	<0.04 mg		D9(U)

Sample No.	834538	117078	Method
Total particulate matter	<0.04 mg		D9(U)



Date: 12/05/2015

## Test Certificate

<b>Client</b>	Aspen Environmental Ltd		<b>Certificate No.</b>	WK15-2369
			<b>Issue No.</b>	1
<b>Sample No.</b>	<b>634542</b>	<b>G10783</b>	<b>Method</b>	
Total particulate matter	<0.5 mg		D9(U)	
<b>Sample No.</b>	<b>834543</b>	<b>G10794</b>	<b>Method</b>	
Total particulate matter	<0.5 mg		D9(U)	
<b>Sample No.</b>	<b>834544</b>	<b>G10785</b>	<b>Method</b>	
Total particulate matter	0.1 mg		D9(U)	




## Test Certificate

Date 12/05/2015

<b>Client</b>	Aspen Environmental Ltd	<b>Certificate No.</b>	WK15-2369
		<b>Issue No.</b>	1

<b>Tested By</b>	Ashley Lunt Tammy Illingworth	<b>Date</b>	12/05/2015
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<b>Approved By</b>	 Joanne Dawhurst Laboratory Manager	<b>Date</b>	12/05/2015
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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 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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## 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 Sqs	37.1761
				sq rt	6.0972
				<b>Expanded Result</b>	<b>6.1 %</b>