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Mr Tim Growcott,  
Halcyon Environmental,  
27 Brunel Grove,  
Perton,  
Wolverhampton.  
WV6 7YD.

Ref: L.2156

Date: 08/12/2013

Dear Tim,

**Emissions Testing at Wessex Crystal:**

I am pleased to present our report of the testing of the emissions from the caustic scrubber at Wessex Crystal in Brierley Hill on the 7<sup>th</sup> November 2013.

If you have any queries on any part of 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:**



**Emissions Testing from:  
Caustic Scrubber at Wessex Crystal.**

Permit Number:

**Wessex Crystal, Unit 4, Silver End Industrial Estate, Silver End, Brierley Hill.  
DY5 3LA.**

**Halcyon Environmental, 27 Brunel Grove, Perton, Wolverhampton.  
WV6 7YD.**

Previous Monitoring Dates:

**Monitoring Date:  
07/11/2013**

Aspen Reference Number J.1121

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

Report Compiled on 8<sup>th</sup> December 2013 (v1)  
Prepared for Aspen Environmental Ltd by  
Dr G.W.Buck (Director)  
MCerts Registered MM 02 001 Team Leader  
Level 2, TE1, TE3, TE4.



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## Monitoring Objectives

Wessex Crystal at Brierley Hill are a small company which polishes cut crystal glass. The process utilises a hydrofluoric acid bath and a rinsing system. The glassware is placed into racks submerged in the acid, and hand agitated, before lifting the rack out into several water rinses. There is an overhead extraction system, which draws the fumes from the acid bath through a caustic scrubber, where the HF fume reacts with the sodium hydroxide of the scrubber to become sodium fluoride. The gaseous effluent escaping to atmosphere potentially contains some hydrogen fluoride gas, and also some small amount of sodium fluoride dissolved in water droplets. For the purposes of The Pollution Prevention & Control Act 1999, this is a Schedule B process, controlled by the Environmental Health Department of the Dudley Metropolitan Borough Council, under the Environmental Permitting (England & Wales) Regulations 2007, and DEFRA's Process Guidance Note Process Guidance Note 3/6 (04), Secretary of State's Guidance for Polishing or Etching Glass or Glass Products using Hydrofluoric Acid. The process guidance note sets the following Emission standards standardised to 273.1 K, 101.3 kPa:

Total fluoride (expressed as hydrogen fluoride)  
new limit for agitated acid dipping processes of 2 mg/m<sup>3</sup>  
new parameter for etching and still acid dipping processes of 5 mg/m<sup>3</sup>.

Dr G Buck of Aspen Environmental Ltd visited the site on the 7<sup>th</sup> November with Mr T Growcott of Halcyon Environmental Ltd to undertake the emissions sampling for compliance with the 5 mg/m<sup>3</sup> limit, which is applied to Wessex.

Aspen Environmental is accredited by the United Kingdom Accreditation Service (Testing Laboratory No. 2395), to undertake sampling and analysis of hydrogen fluoride to UKAS standards.

There are two c 1" holes in the plastic exhaust pipe at Wessex. The exhaust is located around the back of the shop in a lean to building, with very little operating space, which precludes the use of a method 5 sampling line. Sampling was therefore undertaken using low flow pumps to draw the sample gas through a PTFE probe (inserted into the exhaust), and through a water washed silica gel tube as specified by NIOSH method 7903.

There are no special requirements of the sampling.

<b>Operating Information.</b>	
<b>Type &amp; Description of Process</b>	A caustic scrubber exhaust, used to dispose of escaping hydrogen fluoride from a glass dipping process. The process ran throughout the testing period.
<b>Batch process</b>	None.
<b>Fuel Type &amp; Feedstock</b>	No fuel or feedstock is used.
<b>Normal Load</b>	The scrubber fan runs continuously when rinsing is in progress.
<b>Unusual Occurrences</b>	None
<b>Abatement System</b>	There is no other abatement system.
<b>CEM system</b>	There is no CEM system.
<b>Process Details Collected</b>	The production was running throughout the test.


### **Monitoring Deviations**

All substances listed in the monitoring objectives were sampled.

There were no non compliances.

### **Results**

The results are presented overleaf.

Wessex Crystal, Brierley Hill			Aspen Environmental Ltd									
Emissions Testing 2013												
Emission Point Reference	Location	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
Caustic Scrubber Exhaust		Hydrogen fluoride as HF	5	<b>1.46</b>	± 4.4 %	mg/Nm <sup>3</sup>	Wet Gas	07/11/2013	10:11 - 12:00	EN 13649 NIOSH 7903	UKAS	Normal Working
<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												

**Part 2 Supporting Information**

# Appendix 1:

**Aspen Personnel**

Dr G.W.Buck	MCerts Reg MM 02 001	Level 2 Team Leader TE1, TE3, TE4 (to 05/2015)
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**Method Statements**

**A1 Flow Measurement in Ducts to EN 13284-1:2002**

A US “S” type pitot tube, or UK “L” type pitot tube, each individually UKAS calibrated is used to measure Velocity Pressure (Pv) at 10 points across each traverse of the stack (usually 2), as specified in EN 13284-1. 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.

**Aspen Method A1 & A5**

Pressure, Temperature & Velocity in Stacks & Ducts to EN 13284-1:2002 & BS 9096:2003

Velocity & Static Pressure measuring equipment.

A UKAS calibrated UK (BS 1042) type pitot tubes (Aspen Ref 193 & 445), are 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).

**A3 Speciated Organic Compounds to EN 13649: 2002**

Stack velocity & dimensions are usually required.

This methodology uses low flow occupational hygiene sampling pumps and NIOSH standard charcoal tubes to collect organic vapours for subsequent gas chromatography.

The pumps are set up with a stainless steel sampling probe, attached to the NIOSH tube, and a length of hose connected to the sampling pump.

The NIOSH tube consists of two beds of activated charcoal, with foam separators. Direction of flow through these tubes is critical, so they are marked with a directional arrow by the manufacturers.

The whole sampling line is checked for integrity by blocking the end of the probe, such that a change of note can be heard from the sampling pump.

The pumps are equipped with a stroke counter, which records each stroke of the diaphragm pump, and each is individually calibrated against a soap bubble in a grade A burette, so the volume drawn by each pump stroke is known.

The sample gas is drawn through the NIOSH tube for about 30 minutes. At each stage sampling data is recorded to a series of standard forms.

The UKAS analysts utilise retention time in the chromatography column to determine species, and individual peak response to quantify, such that a whole series of different analytes can be identified and quantified.

This method is only applicable for dry gas.

**Aspen Method A6**

Individual gases in stacks & ducts

These methods are identical to method A3, except that the sampling tubes are changed to method specific tubes.

<b>Analyte</b>	<b>Tube Content</b>	<b>Tube Ref</b>	<b>Method Ref</b>
HCl & HF	Water washed silica gel	SKC 226-10-3	NIOSH 7903
Ammonia	Acid washed silica gel	SKC 226-10-6	NIOSH 6016
Hydrogen cyanide	Soda lime	SKC 226-28	NIOSH 6010
Formaldehyde	XAD-2	SKC 226-118	NIOSH 2541
Aliphatic Amines	Silica Gel	SKC 226-15	NIOSH 2010
Aromatic Amines	Silica Gel	SKC 226-15	NIOSH 2002

Where applicable the sampling probe is water rinsed, and the rinse solution separately analysed.

All analyses are carried out by UKAS accredited laboratories.


Results in all cases are presented as milligrams of analyte per Normal volume of exhaust gas sampled, without correction for water vapour.




## Appendix 2: Caustic Scrubber Exhaust

<b>Sample Locations.</b>	
<b>Stack base Location</b>	Accessed from a low level platform, Sampling point about 3 m above ground Two 1” holes.

<b>Current Measurements for Flow Criteria</b>	
<b>Pitot Tube Traverse</b>	Vertical Duct. Pv: 54, 52, 50, 55, 54, 54, 52, 54, 56, 42. Pa Ps: -96, -95, -96, -98, -86, -98, -100, -100, -96, -98. Pa Temperature 10 ° C across.
<b>Moisture &amp; Homogeneity</b>	Moisture: Not required data presented as wet gas. Homogeneity – Not Required (Stack diameter < 1.13 m)

<b>Wessex Crystal, Brierley Hill</b> <b>Main Exhaust Hydrogen fluoride (07/11/2013)</b>														
 Aspen Environmental Ltd														
Sample Ref	Pump Number	Volume Counter			Temperature °C		Sample Volume		Sampling Time		Total Fluoride as F			
		Initial	Final	Elapsed	Pump Factor	Stack	Ambient	Ambient	Normal	Initial	Final	Elapsed	Sample Concentration	
								Litres		Minutes		µg		
Barometric Pressure														
G10273	271	182012	203686	21674	0.73	10	9	15.9	15.1	10:11	12:00	109	< 5	< 0.33
G10276	Rinse Solution													
G10274	436	92740	123090	30350	0.60	10	9	18.3	17.4	10:11	12:00	109	< 5	1.04
G10277	Rinse Solution													
G10275	Control													
												24.8	1.43	
												< 5	1.57	
												<b>Overall Mean</b>		<b>1.39</b>

Pitot Flow Measurements			Aspen Environmental Ltd					
Client: Wessex Crystal Address: Brierley Hill			Time & Date: 07/11/2013 (09:30) Operator: GB + TG Job Number: 1121 Location: Main Exhaust					
Details of Duct			Absolute Atmospheric Pressure (millibars)					
Duct Shape: Vertical Circular			Instrument		Correction	Corrected		
Dimension / Diameter: (cm) 34			Initial: 996		-2	994		
Area: sq metres 0.09			Final: 996		-2	994		
			Mean: 994					
Pitot Tube Position:	Distance into Duct % Diameter	cm	Axis 1:			Axis 2:		
			Velocity Pressure Pv Pascals	Static Pressure Ps Pascals	Duct Temp ° Celsius	Velocity Pressure Pv Pascals	Static Pressure Ps Pascals	Duct Temp ° Celsius
1	1.9	0.6	54	-96	10	60	-94	10
2	7.7	2.6	52	-95	10	58	-98	10
3	15.3	5.2	50	-96	10	56	-94	10
4	21.7	7.4	55	-97	10	56	-96	10
5	36.1	12.3	54	-96	10	54	-94	10
6	63.9	21.7	54	-98	10	55	-96	10
7	78.3	26.6	52	-100	10	56	-98	10
8	84.7	28.8	54	-100	10	60	-98	10
9	92.3	31.4	50	-96	10	64	-100	10
10	98.1	33.4	42	-98	10	60	-98	10
RMS & Means:			51.83	-97.2	10	57.97	-96.6	10
Mean Pv (Pascals)			54.90	Temp Reader	73	Mean T in K (°C + 273)		283
Static Pressure (Pa)			-96.9	Pitot Tube & Manometer		472 & 501	K Factor	1.03
Duct Velocity (V) @ Temperature (T) in metres per second								9.76
Duct Velocity (V) @ 273K, 1013mb, in metres per second								9.24
Duct Volume Flow @ T in cubic metres per second								0.89
Duct Volume Flow @ 273K, 1013mb, in cubic metres per second								0.84
Duct Volume Flow @ 273K, 1013mb, in cubic feet per minute								1778
Duct Volume Flow @ Temperature (T) in cubic feet per minute								1878
© Aspen Environmental Form 19 Version 5 (December 2005)								

Aspen Environmental Ltd										General Sampling Data Form													
Location & Drawing Wessex Crystal Brockley Hill										Sheet No: _____													
Date					Location					Time													
7/11/13					Wessex Crystal					10:00													
Barometric Pressure					Exhaust					Ambient					Gas Meter								
996 mb					100°C					10.00%													
Pitot Tube Traverses (Measurements in Pa)										Aspen Job Number													
Stack Dimensions (cm) & Aspect										34cm circ Vert ↑													
Position	Time	1	2	3	4	5	6	7	8	9	10	Mean	Notes										
Pv	09:30	54	52	50	55	54	54	52	54	50	42		172										
Ps		-96	-95	-96	-97	-96	-98	-100	-98	-96	-98		72										
T		10	10	10	10	10	10	10	10	10	10												
Angle																							
Pv		60	58	56	56	54	55	56	60	64	60			Is the SiGel >50 % Fresh <i>NA</i>									
Ps		-94	-98	-94	-96	-94	-96	-98	-98	-100	-98			Stack Gas Homogeneity <i>NA</i>									
T		10	10	10	10	10	10	10	10	10	10												
Angle																							
Flow @ Ambient										Equipment & Blank													
Sample Reference	Position	m / s Sampling Flow		L / min		Tip Diameter		mm		Pitot Tube & Manometer		cm											
		Initial	Final	Initial	Final	Vacuum	%	Sampling Points	Comments														
P271		10.11	12.00	18.2012	203686	✓								Flowmeter									
P436		10.11	12.00	097740	123090	✓								Gas meter									
														Gas Temp									
														Silica Gel									
														Thermocouple									
														Field Blank									
														Operator									
														<i>GS</i>									
														Normal Flow									
														4.24 Nm <sup>3</sup> /s									
														0.84 Nm <sup>3</sup> /s									
Form 1										Version 11 (Dec 2012)													
© Aspen Environmental Ltd										© Aspen Environmental Ltd													



**Test Certificate**

Date 22/11/2013

<b>Client</b>	Aspen Environmental Ltd 25A Church Street Uttoxeter Staffordshire ST14 8AG	<b>Order No.</b>	1785
		<b>Certificate No.</b>	<b>WK13-7178</b>
		<b>Issue No.</b>	1

<b>Contact</b>	Dr Geoff Buck	<b>Date Received</b>	13/11/2013
<b>Description</b>	3 tubes for fluoride	<b>Technique</b>	IC

Sample No.	787903	G10273	Method
Fluoride		<5 µg	C27(U)
Sample No.	787904	G10274	Method
Fluoride		<5 µg	C27(U)
Sample No.	787905	G10275	Method
Fluoride		<5 µg	C27(U)



## Test Certificate

Date 22/11/2013

<b>Client</b>	Aspen Environmental Ltd	<b>Certificate No.</b>	<b>WK13-7178</b>
		<b>Issue No.</b>	<b>1</b>

Tested By: Nicholas Lynch      Date: 22/11/2013

Approved By:       Date: 22/11/2013

Joanna 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 calculated on the basis of information provided by the customer.  
Results stated as  $\mu$ l/l are relating to the sample volume.

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Analysis carried out on samples 'as received'

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**Test Certificate**

Date 20/11/2013

**Client** Aspen Environmental Ltd  
25A Church Street  
Uttoxeter  
Staffordshire  
ST14 8AG

**Order No.** 1785  
**Certificate No.** WK13-7179  
**Issue No.** 1

**Contact** Dr Geoff Buck

**Date Received** 13/11/2013

**Description** 2 solutions for fluoride

**Technique** IC

Parameter	Analysis Method	Accreditation	Method LOD	Uncertainty
Fluoride	C27	UKAS	0.05ug/ml	7.00%

Sample No.	787806	G10276	Method
Fluoride	1.21 µg/ml	13 ml	C27(U)
Sample No.	787807	G10277	Method
Fluoride	1.91 µg/ml	13 ml	C27(U)



## Test Certificate

Date 20/11/2013

<b>Client</b>	Aspen Environmental Ltd	<b>Certificate No.</b>	<b>WK13-7178</b>
		<b>Issue No.</b>	<b>1</b>

Tested By: Nicholas Lynch      Date: 20/11/2013

Approved By:       Date: 20/11/2013

Joanna Dawhurst  
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 calculated on the basis of information provided by the customer.  
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