Nuttall

storefitting

PART OF THE NUTTALL GROUP

Our ref: PB

12/11/2012


Mr G Levett
Directorate of the Urban Environment
Claughton House
Blowers Green Road
Dudley
West Midlands
DY2 8UZ

Dear Mr Levett,

**Re: Stack Monitoring Results**

Please find enclosed a copy of the above; I have had to send a hard copy because it is double sided.

If you need any other information please don't hesitate to contact me.

Yours faithfully

**P Bradley**
**H&S manager**

ALAN NUTTALL LTD
Store Fitting, National Works, Hall Street, Dudley, West Midlands, DY2 7DQ, United Kingdom
[t] +44 (0)1384 245100 [f] +44 (0)1384 245102 [e] storefitting@nuttalls.co.uk [w] www.nuttalls.co.uk
Registered in England No. 1191211

Aspen Environmental Ltd
**25A Church Street, Uttoxeter, ST14 8AG.**
**Tel: 01889 568124. Mobile: 07976 646757**
www.Aspenenvironmental.co.uk

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

Ref: L.2082

Date: 18/10/2012

Dear Tim,

**Emissions Testing at Nuttalls:**

I am pleased to present our report of the emissions testing of the wood burning boiler at Nuttalls in Dudley on the 12th September 2012.

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.

Aspen Environmental Ltd

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

**Emissions Testing from:**
**Wood Burning Boiler at A.Nuttall Ltd.**

Permit Number:

**A.Nuttall Ltd,**
**National Works,**
**Hall Street,**
**Dudley.**
**DY2 7DQ.**

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

Previous Monitoring Dates:

**Monitoring Date:**
**12/09/2012**
Aspen Reference Number J.1058

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

Report Compiled on 18th October 2012 (v1)
Prepared for Aspen Environmental Ltd by
Dr G.W.Buck (Director)
MCerts Registered MM 02 001 Team Leader
Level 2, TE1, TE3, TE4.

## Contents


| | | Page Number: |
|---|---|---|
| **Part 1** | **Executive Summary** | |
| Cover Sheet | | 1 |
| Contents | | 2 |
| Monitoring Objectives | | 3 |
| Operating Information | | 4 |
| Monitoring Deviations | | 4 |
| Results | | 4 |
| EA Results Summary | | 5 |
| **Part 2** | **Supporting Information** | |
| Appendix 1 | Personnel & Methodology | 6 - 7 |
| Appendix 2 | Wood Burning Boiler | 8 |
| | Site Description | 8 |
| | Bernath, Horiba & Overall Results Summary | 9 |
| | Particulate Results Summary | 10 |
| | Hydrogen chloride & Sulphur dioxide Results Summary | 11 |
| | Hydrogen cyanide & Formaldehyde Results Summary | 12 |
| | Pitot Tube Flow Measurements | 13 |
| | Particulate Weighing Certificate | 14 – 15 |
| | Hydrogen chloride & Sulphate Analysis Certificate | 16 – 17 |
| | Hydrogen cyanide Analysis Certificate | 18 - 19 |
| | Formaldehyde Analysis Certificate | 20 - 21 |
| | Site Data Sheets | |
| | General | 22 |
| | Impingers | 23 |
| | Horiba | 24 |
| | Bernath | 25 |
| | Uncertainty Calculations | 26 - 28 |

**Monitoring Objectives**

Alan Nuttall Ltd operate a shop fitting design & manufacturing service at their Dudley site. The process utilises a wood burning boiler to dispose of sawdust and offcut timber. For the purposes of The Pollution Prevention & Control Act 1999, this is a Schedule B process, controlled by the Environmental Health Department of Dudley Metropolitan District Council, under the Environmental Permitting (England & Wales) Regulations 2007, and DEFRA's Process Guidance Note PG 1/12 (2012) *Statutory Guidance for Combustion of Waste Wood.* The process guidance note sets the following Emission standards standardised to 273.1 K, 101.3 kPa & 11% Oxygen.

| | | |
|---|---|---|
| Carbon monoxide | (other processes < 1 MW) | 250 mg/m$^3$ |
| Total Particulate Matter | (existing plant) | 200 mg/m$^3$ |
| Oxides of Nitrogen (NOx) | (New plant) | 400 mg/m$^3$ |
| Organic Compounds | | 50 mg/m$^3$ |
| Chlorine as HCl | | 100 mg/m$^3$ |
| Hydrogen cyanide | | 5 mg/m$^3$ |
| Formaldehyde | | 5 mg/m$^3$ |

Dr G Buck & Mr J Buck of Aspen Environmental Ltd visited the site on the 25th July 2012 to undertake the emissions sampling for compliance with the above limits. Unfortunately the boiler was not performing correctly, and the testing was deferred until the 12th September 2012, when the testing was finally completed.

Aspen Environmental is accredited by the United Kingdom Accreditation Service (Testing Laboratory No. 2395), to undertake sampling and analysis of combustion gases, organics, particulates and hydrogen chloride to UKAS/MCerts standards.

There is only one non standard sampling point at Nuttalls, so the sampling had to be done sequentially.

Carbon monoxide, Nitrogen oxides, Oxygen & Carbon dioxide were tested first using Aspen's Horiba PG-250 gas analyser, at the same time as Total organic carbon was tested using Aspen's Bernath 3006 flame ionisation detector. Hydrogen chloride & Formaldehyde were tested using specific tubes during the instrumental sampling period, then removed to allow Hydrogen chloride, Sulphur dioxide & Water vapour sampling. After these were all completed and removed Particulate sampling could take place.

There are no special requirements of the sampling.

| Operating Information. | |
|---|---|
| **Type & Description of Process** | A wood burning boiler, used to dispose of waste timber and sawdust. The boiler runs continuously. |
| **Batch process** | None. |
| **Fuel Type & Feedstock** | The boiler is fired using timber waste. No other feedstock is used. |
| **Normal Load** | The boiler runs on a continuously metered auger supply from a silo. |
| **Unusual Occurrences** | None |
| **Abatement System** | There is no other abatement system. |
| **CEM system** | There is no CEM system. |
| **Process Details Collected** | The is no log kept by Nuttalls |

## Monitoring Deviations

All substances listed in the monitoring objectives were sampled, including sulphur dioxide which is not required by the process guidance note.

Only one sampling port is available and the exhaust is hot.

Only one pitot traverse was possible.

Particulate sampling was using a centre point protocol.

The impingers were filled with hydrogen peroxide, as for SO2 sampling, and the solutions were analysed for both SO2 & HCl.

There were no other non compliances.

## Results

The results are presented overleaf.

The Emission Limit Values given in the Table may be at variance with those in the operating permit Issued by Dudley MBC, because the limits quoted are from PG1/12 (12), and the permit may predate this guidance note.

## A.Nuttall Ltd, Dudley

Aspen Environmental Ltd

### Wood Burning Boiler Emissions

| Emission Point Reference | Location | Substance to be Monitored | Emission Limit Value | Periodic Monitoring Result | Uncertainty | Units | Reference Conditions 273 K 101.3 kPa | Date of Sampling | Start and End Times | Monitoring Method Reference | Accreditation for use of Method | Operating Status |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wood Burning Boiler | | Carbon monoxide | 250 | 115 | = 5.1 % | mg/Nm$^3$ | Wet Gas 11% Oxygen | 12/09/2012 | 11:25 - 14:20 | EN 15058 | MCerts | Normal |
| Wood Burning Boiler | | Total Particulate Matter | 200 | 150 | = 6.1 % | mg/Nm$^3$ | Wet Gas 11% Oxygen | 12/09/2012 | 14:36 - 15:06 | EN 13284-1 | MCerts | Normal |
| Wood Burning Boiler | | Nitrogen oxides (as NO2) | 400 | 873 | = 5.1 % | mg/Nm$^3$ | Wet Gas 11% Oxygen | 12/09/2012 | 11:25 - 14:20 | EN 14792 | MCerts | Normal |
| Wood Burning Boiler | | Total Organic Carbon | 50 | 12 | = 4.3 % | mg/Nm$^3$ | Wet Gas 11% Oxygen | 12/09/2012 | 11:48 - 14:20 | EN 13526 | MCerts | Normal |
| Wood Burning Boiler | | Sulphur dioxide | | 32 | = 4.3 % | mg/Nm$^3$ | Wet Gas 11% Oxygen | 12/09/2012 | 13:49 - 14:19 | EN 14791 | MCerts | Normal |
| Wood Burning Boiler | | Chlorine as HCl | 100 | 117 | = 4.3 % | mg/Nm$^3$ | Wet Gas 11% Oxygen | 12/09/2012 | 13:49 - 14:19 | EN 1911-1 * | MCerts * | Normal |
| Wood Burning Boiler | | Hydrogen cyanide | 5 | 0.1 | = 4.4 % | mg/Nm$^3$ | Wet Gas 11% Oxygen | 12/09/2012 | 11:28 - 12:50 | EN 13649 (NIOSH 6010) | MCerts | Normal |
| Wood Burning Boiler | | Formaldehyde | 5 | < 0.1 | = 4.4 % | mg/Nm$^3$ | Wet Gas 11% Oxygen | 12/09/2012 | 11:28 - 12:50 | EN 13649 (NIOSH 2541) | MCerts | Normal |
| Wood Burning Boiler | | Water | | 7.2 | = 5.2 % | % | | 12/09/2012 | 13:49 - 14:19 | EN 14790 | MCerts | Normal |

Aspen Environmental Ltd is UKAS / MCerts Accredited for these methods (Lab No 2395) Dr G.W.Buck is personally MCerted to TE1, TE3 & TE4.

* Note: The Hydrogen chloride was collected and analysed in the peroxide solution used for sulphur dioxide sampling

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**Part 2 Supporting Information**

# Appendix 1:

**Aspen Personnel**

| | | |
|---|---|---|
| Dr G.W.Buck | MCerts Reg MM 02 001 | Level 2 Team Leader<br>TE1, TE3, TE4 (to 11/2012) |
| Mr J. Buck | MCerts Reg MM 06 783 | Level 1 Technician (to 08/06/2017) |

| Tests for which Aspen is MCerts & UKAS accredited | | |
|---|---|---|
| **Method Number** | **Analyte & Procedure** | **Status** |
| **A5** | Particulates to BS 9096. 2003 | **MCerts** |
| **A5** | **Particulates to EN 13284. 2002** | **MCerts** |
| **A1** | **Flow in Ducts to EN 13284.2002 (Range 4 - 18 m/s)** | **MCerts** |
| **A2** | **Total Organics using a Bernath 3005 FID to EN 13526. 2002** | **MCerts** |
| **A3** | Speciated Organics using Charcoal tubes to EN 13649. 2002 | **MCerts** |
| **A10** | Speciated Organics using a Modified Water Trap to EA LFTGN08 | **UKAS** |
| **A4.2** | **Combustion Gases using a Horiba PG-250 Gas Analyser** | |
| **A4.2** | **Oxygen to EN 14789. 2005** | **MCerts** |
| **A4.2** | **Carbon monoxide to EN 15058. 2006** | **MCerts** |
| **A4.2** | **Carbon dioxide to ISO 12039. 2001** | **MCerts** |
| **A4.2** | **Nitrogen oxides (as NOx) to EN 14792. 2005** | **MCerts** |
| **A8** | **Water vapour to EN 14790. 2005** | **MCerts** |
| **A9** | **Hydrogen chloride to EN 1911-1. 1998** | **MCerts** |
| **A9** | Hydrogen sulphide to USEPA Method 11 | **MCerts** |
| **A9** | **Sulphur dioxide to EN 14791. 2005** | **MCerts** |
| **A6** | Aliphatic Amines to EN 13649 (NIOSH Method 2010) | **MCerts** |
| **A6** | Aromatic Amines to EN 13649 (NIOSH Method 2002) | **MCerts** |
| **A6** | Ammonia to EN 13649 (NIOSH 6016) | **UKAS** |
| **A6** | **Formaldehyde to EN 13649 (NIOSH Method 2541)** | **MCerts** |
| **A6** | **Hydrogen cyanide to EN 13649 (NIOSH 6010)** | **MCerts** |
| A6 | Hydrogen chloride to EN 13649 (NIOSH 7903) | UKAS |
| **A6** | Hydrogen fluoride to EN 13649 (NIOSH 7903) | **UKAS** |
| Methods in use at Nuttalls are highlighted in red. | | |

| Aspen Forms & Documents relating to Accredited Methods above | | |
|---|---|---|
| Form Number | Description | Application |
| 1 | General Sampling Data Form | A1, A2, A3, A4, A5, A6, A8, A9 |
| 1A | Additional Isokinetic Sampling Data Form | A1, A5 |
| 2 | Bernath 3005 FID Sampling Data Form | A2 |
| 4 | Horiba PG-250 Sampling Data Form | A4 |
| 6 | Site Risk Assessment Form | A1, A2, A3, A4, A5, A6, A8, A9 |
| 8 | Velocity of Flow at Ambient Conditions for Sampling | A5 |
| 9 | Isokinetic Sampling Rates | A5 |
| 10/11 | BS 9096 Sampling Locations | A5 |
| 14/15 | EN 13284 Sampling Locations | A5 |
| 19 | Airflow Pitot Measuring Positions | A1 |
| 37 | Water Vapour Sampling Data & Calculation Table | A5, A8 |
| 38 | Molar Gas Density Calculation & Isokinetic Adjustment | A5 |
| 40 | Impinger Line Sampling Data | A8, A9 |
| 42 | Impinger method variations ($H_2S$, $SO_2$, HCl) | A9 |
| | | |
| 22 | Pitot Flow Measurement Protocol | A1 |
| 23 | Bernath 3005 TOC Sampling Protocol | A2 |
| 24 | EN 13649 NMVOC Protocol | A3 |
| 24A | EN 13649 Tubes Protocol | A6 |
| 24B | EN 13649 Catch Pot Protocol | A10 |
| 30 | Isokinetic Particulate Sampling Protocol | A5 |
| 36 | Horiba PG-250 Combustion Gas Protocol | A4 |
| 39 | Water Vapour Sampling Protocol | A8 |
| 41 | Impinger Line Sampling Protocol | A9 |

# Appendix 2:
## Wood Burning Boiler

| **Sample Locations.** | |
|---|---|
| **Stack base Location** | Accessed from ground level, Sampling point about 1.8 m above ground<br>A single 1" port . |

| **Current Measurements for Flow Criteria** | |
|---|---|
| **Pitot Tube Traverse** | Stack Base.<br>Pv: 52, 52, 63, 61, 58, 58, 62, 64, 61, 70. Pa<br>Ps; -27, -27, -33, -38, -38, -40, -36, -39, -33, -30. Pa<br>Temperature 166 ° C across. |
| **Moisture & Homogeneity** | Moisture: 7.2 %<br>Homogeneity – Not Required (Stack diameter < 1.13 m) |

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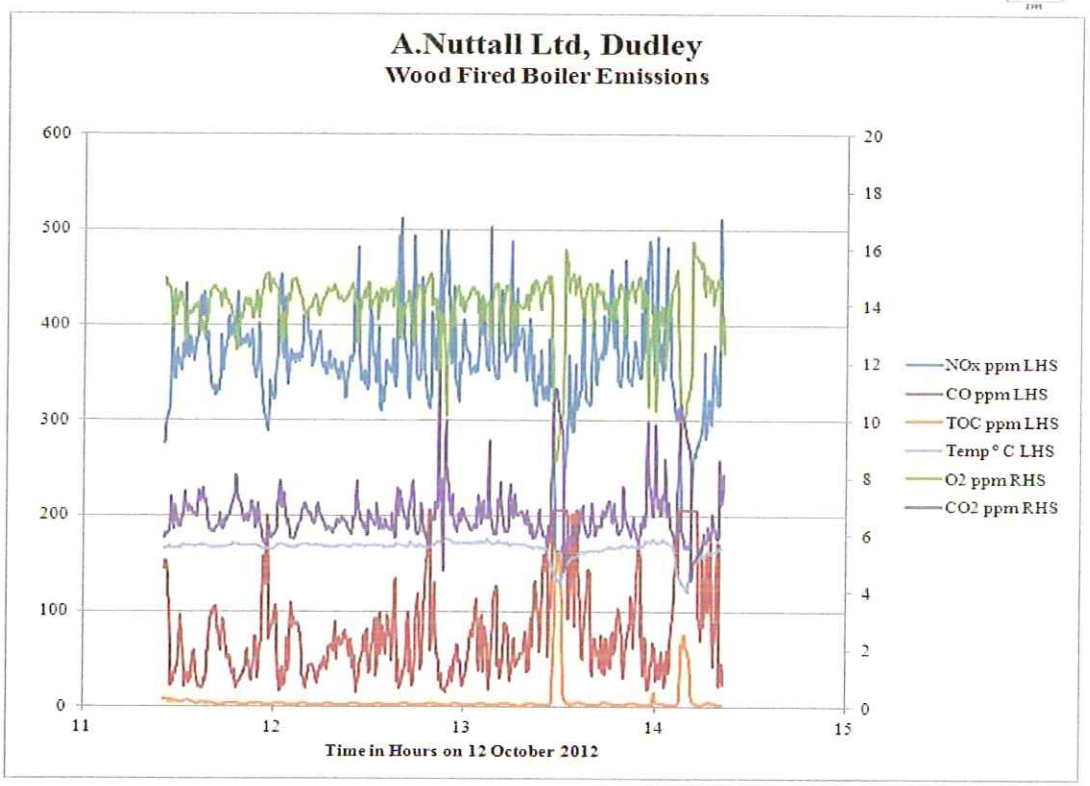


| Instrumental Means as Dry Gas | | | | |
|---|---|---|---|---|
| Nitrogen Oxides (as NO2) | 359.9 | ppm | = | 739.1 mg/Nm$^3$ |
| Carbon monoxide | 77.7 | ppm | = | 97.1 mg/Nm$^3$ |
| Oxygen | 14.0 | % | = | 14.0 % |
| Carbon Dioxide | 6.7 | % | = | 6.7 % |
| Total Organic Carbon | 6.3 | ppm as propane | = | 10.1 mg/Nm$^3$ as Carbon |
| **Temperature ° C** | **166.0** | **° C** | | |

| Summary as Wet Gas (Water = 7.21 %) | | Summary Corrected to 11 % Oxygen | |
|---|---|---|---|
| **Nitrogen Oxides (as $NO_2$)** | 689.4 mg/Nm$^3$ | **872.6** | **mg/Nm$^3$** |
| **Carbon monoxide** | 90.6 mg/Nm$^3$ | **114.6** | **mg/Nm$^3$** |
| **Oxygen** | **13.1 %** | | |
| **Carbon Dioxide** | **6.2 %** | | |
| **Total Organic Carbon** | 9.4 mg/Nm$^3$ as Carbon | **11.9** | **mg/Nm$^3$ as Carbon** |
| **Hydrogen cyanide** | 0.10 mg/Nm$^3$ | **0.13** | **mg/Nm$^3$** |
| **Formaldehyde** | < 0.04 mg/Nm$^3$ | **< 0.05** | **mg/Nm$^3$** |
| **Hydrogen chloride** | 92.4 mg/Nm$^3$ | **117.0** | **mg/Nm$^3$** |
| **Sulphur dioxide** | 25.1 mg/Nm$^3$ | **31.8** | **mg/Nm$^3$** |
| **Total Particulate Matter** | 118.3 mg/Nm$^3$ | **149.7** | **mg/Nm$^3$** |

# A.Nuttall Ltd, Dudley

Aspen Environmental Ltd

## Particulate Emissions 12/09/2012

| Filter | Dry Gas Meter: | | | Temperature ° C | | | Time | | | Particulate | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ref | DGM Correction Factor = 1.03 | | | Stack | Gas Meter | Normal Sample Volume Litres | Initial | Final | Elapsed minutes | Filter mg | Acetone mg | Concentration mg/m3 |
| | Initial | Final | Elapsed | | | | | | | | | |
| **Wood Burning Boiler** | | | | | | | | | | | | |
| Barometric Pressure = | | 989 | mb | | | | | | | | | |
| 87894 | 495837.6 | 496983.8 | 146.2 | 166 | 16 | 130.9 | 14:36 | 15:06 | 30 | 13800 | 2.8 | 136.8 |
| | | | | | Dry Gas Volume | 130.9 | | | | | | 136.8 |
| | | | | | Wet Gas Volume | 140.3 | | | | | | 118.3 |
| 87892 | Field Blank | | | | | | | | | <3.04 | 1.5 | 0.01 |

## Percentage Isokinetic Sampling Efficiency

| Wood Burning Boiler | | Sample Volume in Litres | |
|---|---|---|---|
| Normal Duct Velocity | 5.91 Nm / s | Theoretical | 133.7 |
| Sampling Tip Diameter | 4 mm | Actual | 140.3 |
| Sampling Time | 30 minutes | **% Isokinetic** | **104.9** |

# A.Nuttall, Dudley

Aspen Environmental Ltd

## HCl & SO2 Emissions (12/09/2012)

| Filter Ref | Dry Gas Meter: DGM Correction Factor = 1.03 Initial | Final | Elapsed | Temperature °C Stack | Gas Meter | Normal Sample Volume Litres | Time Initial | Final | Elapsed minutes | Solution mg | Concentration mg/m3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bubbler Solutions:** | | | | | | | | | | | **Hydrogen chloride** |
| **Barometric Pressure =** | | | **989** | **mb** | | | | | | | |
| G9750 | 493765.4 | 493832.0 | 66.6 | 170 | 18 | 59.2 | 13:49 | 14:19 | 30 | 5.63 | |
| G9749 | | | | Dry Gas Volume | | 59.2 | | | | 0.23 | 99.1 |
| | | | | **Wet Gas Volume** | | **63.5** | | | | | **92.4** |
| G9748 | 493763.0 | 493763.0 | 0.0 | 170 | 18 | 0.0 | 13:12 | 13:27 | 15 | 0.01 | |
| **Bubbler Solutions:** | | | | | | | | | | | **Sulphur dioxide** |
| **Barometric Pressure =** | | | **989** | **mb** | | | | | | | |
| G9750 | 493765.4 | 493832.0 | 66.6 | 170 | 18 | 59.2 | 13:49 | 14:19 | 30 | 1.53 | |
| G9749 | | | | Dry Gas Volume | | 59.2 | | | | 0.06 | 26.9 |
| | | | | **Wet Gas Volume** | | **63.5** | | | | | **25.1** |
| G9748 | 493763.0 | 493763.0 | 0.0 | 170 | 18 | 0.0 | 13:12 | 13:27 | 15 | 0.01 | |



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# A.Nuttall Ltd, Dudley

Aspen Environmental Ltd

## Absorbtion Tubes

| Sample Ref | Pump Number | Volume Counter Initial | Volume Counter Final | Volume Counter Elapsed | Volume Counter Pump Factor | Temperature ° C Stack | Temperature ° C Ambient | Sample Volume Ambient Litres | Sample Volume Normal Litres | Sampling Time Initial | Sampling Time Final | Sampling Time Elapsed Minutes | Hydrogen Cyanide Sample micrograms | Hydrogen Cyanide Concentration mg/Nm3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Soda Lime Tubes for Analysis of Cyanide** | | | | | | | | | | | | | | |
| Barometric Pressure | | | 989 mb | | | | | | | | | | | |
| G9744 | 265 | 395453 | 412819 | 17366 | 0.60 | 166 | 16 | 10.42 | 9.61 | 11:38 | 12:50 | 82 | 1.0 | 0.104 |
| | | | | | | | Dry Gas Volume | | 9.61 | | | | | 0.104 |
| | | | | | | | Wet Gas Volume | | 10.30 | | | | | 0.097 |
| G9745 | Control | | | | | | | | | | | | <1 | |

| Sample Ref | Pump Number | Volume Counter Initial | Volume Counter Final | Volume Counter Elapsed | Volume Counter Pump Factor | Temperature ° C Stack | Temperature ° C Ambient | Sample Volume Ambient Litres | Sample Volume Normal Litres | Sampling Time Initial | Sampling Time Final | Sampling Time Elapsed Minutes | Formaldehyde Sample micrograms | Formaldehyde Concentration mg/Nm3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **XAD-2 Tubes for Analysis of Formaldehyde** | | | | | | | | | | | | | | |
| G9746 | 272 | 969964 | 986692 | 16728 | 0.75 | 166 | 16 | 12.55 | 11.57 | 11:38 | 12:50 | 82 | <0.5 | <0.05 |
| | | | | | | | Dry Gas Volume | | 11.57 | | | | | <0.05 |
| | | | | | | | Wet Gas Volume | | 12.40 | | | | | <0.04 |
| G9747 | Control | | | | | | | | | | | | <0.5 | |

## Pitot Flow Measurements Aspen Environmental Ltd

| | | | |
|---|---|---|---|
| **Client:** A.Nuttall Ltd | | **Time & Date:** | 12/09/2012: 14:30 |
| **Address:** Dudley | | **Operator:** | GB +JB |
| | | **Job Number:** | 1058 |
| | | **Location:** | Wood Burning Boiler |

| **Details of Duct** | | | **Absolute Atmospheric Pressure (millibars)** | | | |
|---|---|---|---|---|---|---|
| | | | | **Instrument** | **Correction** | **Corrected** |
| **Duct Shape:** | Vertical | Circular | **Initial:** | 991 | -2 | 989 |
| **Dimension / Diameter: (cm)** | | 29 | **Final:** | 991 | -2 | 989 |
| **Area: sq metres** | | 0.07 | **Mean:** | | | 989 |

| **Pitot Tube Position:** | **Distance into Duct % Diameter** | **cm** | **Axis 1: Velocity Pressure Pv Pascals** | **Static Pressure Ps Pascals** | **Duct Temp ° Celsius** | **Axis 2: Velocity Pressure Pv Pascals** | **Static Pressure Ps Pascals** | **Duct Temp ° Celsius** |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.9 | 0.6 | 52 | -27 | 166 | | | |
| 2 | 7.7 | 2.2 | 52 | -27 | 166 | | | |
| 3 | 15.3 | 4.4 | 63 | -33 | 166 | | | |
| 4 | 21.7 | 6.3 | 61 | -38 | 166 | | | |
| 5 | 36.1 | 10.5 | 58 | -38 | 166 | | | |
| 6 | 63.9 | 18.5 | 58 | -40 | 166 | | | |
| 7 | 78.3 | 22.7 | 62 | -39 | 166 | | | |
| 8 | 84.7 | 24.6 | 64 | -36 | 166 | | | |
| 9 | 92.3 | 26.8 | 61 | -33 | 166 | | | |
| 10 | 98.1 | 28.4 | 70 | -30 | 166 | | | |
| | **RMS & Means:** | | 60.32 | -34.1 | 166 | 60.32 | -34.1 | 166 |

| | | | | | |
|---|---|---|---|---|---|
| **Mean Pv (Pascals)** | 60.32 | **Mean T in K (°C + 273)** | | | 439 |
| **Static Pressure (Pa)** | -34.1 | **Pitot Tub** | 331 | **K Factor** | 0.785 |

| | |
|---|---|
| **Duct Velocity (V) @ Temperature (T) in metres per second** | **9.74** |
| **Duct Velocity (V) @ 273K, 1013mb, in metres per second** | **5.91** |
| **Duct Volume Flow @ T in cubic metres per second** | **0.64** |
| **Duct Volume Flow @ 273K, 1013mb, in cubic metres per second** | **0.39** |
| **Duct Volume Flow @ 273K, 1013mb, in cubic feet per minute** | **827** |
| **Duct Volume Flow @ Temperature (T) in cubic feet per minute** | **1363** |

RPS Laboratories

UKAS TESTING 0605

## Test Certificate

Date 26/09/2012

| | | | |
|---|---|---|---|
| Client | Aspen Environmental Ltd<br>25A Church Street<br>Uttoxeter<br>Staffordshire<br>ST14 8AG | Order No. | 1711 |
| | | Certificate No. | WK12-5932 |
| | | Issue No. | 1 |
| Contact | Dr Geoff Buck | Date Received | 17/09/2012 |
| Description | 2 filters & 2 solutions for TPM | Technique | Gravimetric Stack |

| Sample No. | 714059 | 87892 | Method |
|---|---|---|---|
| Total particulate matter | <0.04 mg | | D9(U) |
| Sample No. | 714060 | 87894 | Method |
| Total particulate matter | 13.80 mg | | D9(U) |
| Sample No. | 714061 | G9742 | Method |
| Total particulate matter | 1.3 mg | | D9(U) |
| Sample No. | 714062 | G9743 | Method |
| Total particulate matter | 2.8 mg | | D9(U) |



RPS Laboratories Ltd. Unit 12, Waters Edge Business Park, Modwen Road, Salford, M5 3EZ
Tel: (0161) 872 2443 Fax: (0161) 877 3959

0565

## Test Certificate

Date 26/09/2012

| | | | |
|---|---|---|---|
| Client | Aspen Environmental Ltd | Certificate No. | WK12-5932 |
| | | Issue No. | 1 |

Tested By Ceri Wanklyn Date 25/09/2012

Approved By Date 26/09/2012

Lora McKerracher
Chemist

For and on authority of RPS Laboratories Ltd.

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

Concentration values (mg/m3 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"





RPS Laboratories Ltd. Unit 12. Waters Edge Business Park. Modwen Road. Salford. M5 3EZ
Tel: (0161) 872 2443 Fax: (0161) 877 3959

RPS Laboratories

UKAS TESTING 0605

## Test Certificate

Date 21/09/2012

| | | | |
|---|---|---|---|
| Client | Aspen Environmental Ltd<br>25A Church Street<br>Uttoxeter<br>Staffordshire<br>ST14 8AG | Order No. | 1711 |
| | | Certificate No. | WK12-5933 |
| | | Issue No. | 1 |
| Contact | Dr Geoff Buck | Date Received | 17/09/2012 |
| Description | 3 solutions for chloride & sulphate | Technique | IC Stack |

| Sample No. | 714063 | G9748 | | Method |
|---|---|---|---|---|
| Chloride | 0.11 µg/ml | 130 ml | | C27(U) |
| Sulphate | 0.17 µg/ml | | | C27(U) |
| Sample No. | 714064 | G9749 | | Method |
| Chloride | 0.93 µg/ml | 250 ml | | C27(U) |
| Sulphate | 0.37 µg/ml | | | C27(U) |
| Sample No. | 714065 | G9750 | | Method |
| Chloride | 26.7 µg/ml | 211 ml | | C27(U) |
| Sulphate | 10.9 µg/ml | | | C27(U) |



RPS Laboratories Ltd. Unit 12, Waters Edge Business Park, Modwen Road, Salford, M5 3EZ
Tel: (0161) 872 2443 Fax: (0161) 877 3959

UKAS TESTING 0605

## Test Certificate

Date 21/09/2012

| | | | |
|---|---|---|---|
| Client | Aspen Environmental Ltd | Certificate No. | WK12-5933 |
| | | Issue No. | 1 |

| | | | |
|---|---|---|---|
| Tested By | Nicholas Lynch | Date | 20/09/2012 |
| Approved By | | Date | 21/09/2012 |

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/m3 and ppm) are provided to assist with interpretation only, they are not covered by the scope of UKAS accreditation.

Results stated as nil are refering to the sample volume.

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

Analysis carried out on sample as received.





RPS Laboratories Ltd. Unit 12, Waters Edge Business Park, Modwen Road, Salford, M5 3EZ
Tel: (0161) 872 2443 Fax: (0161) 877 3959

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## *CERTIFICATE OF ANALYSIS*

**ANALYSIS REQUESTED BY:** Geoff Buck
Aspen Environmental Ltd
25A Chruch Street
Utoxeter
Staffordshire
ST14 8AG

**CONTRACT NO:** 30945-1

**PROJECT NO:** 610

**DATE OF ISSUE:** 02/10/2012

**DATE SAMPLES RECEIVED:** 14/09/2012

**DATE SAMPLES ANALYSED:** 26/09/2012

**DESCRIPTION OF SAMPLES:** Two x SKC tubes (soda lime)

**ANALYSIS REQUESTED:** HCN analysis

**METHOD:** The samples were subcontracted for analysis using a colorimetric method.



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IOM CONSULTING LIMITED, Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Telephone: +44 (0)131 449 8000, Facsimile: +44 (0)131 449 6084, Email: iom@iom-world.org
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**CONRACT NO:** 30945-1

**PROJECT NO:** 610

**DATE OF ISSUE:** 02/10/2012

**RESULTS:**

| Sample | Hydrogen Cyanide Weight (µg) |
|---|---|
| G9744 | 1.0 |
| G9745 | <1.0 |

**COMMENTS:**

The limit of detection for this method is 0.1 µg.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched by external clients, this includes calculated results based on the clients sampling information.

**REPORTED BY:**

**David Todd**
*Chemist*

**AUTHORISED BY:**

Alison Searl

**Alison Searl**
*Director of Analytical Services*

WORKING FOR A HEALTHY FUTURE

## *CERTIFICATE OF ANALYSIS*

**ANALYSIS REQUESTED BY:** Geoff Buck
Aspen Environmental Ltd
25A Church Street
Uttoxeter
Staffordshire
ST14 8AG

**CONTRACT NO:** 30945-2
**PROJECT NO:** 610
**DATE OF ISSUE:** 21/09/2012

**DATE SAMPLE(S) RECEIVED:** 14 September 2012

**DATE SAMPLE(S) ANALYSED:** 20 September 2012

**DESCRIPTION OF SAMPLE(S):** Two SKC 226-118 Sorbent Tubes

**ANALYSIS REQUESTED:** Formaldehyde Analysis

**METHOD** The samples were prepared for analysis in accordance with IM 8 using a modification of **NIOSH 2541.**

The samples were desorbed in 1 mL of toluene using mesitylene as an internal standard. An aliquot of each sample was analysed by gas chromatography (GC) with a flame ionisation detector. The GC was fitted with a 30 metre ZB-WAX capillary column and programmed to heat from 60 to 240°C. Calibration standards were prepared from known weights of analytical grade chemicals in the desorption solution.



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UKAS TESTING 0374

Aspen Environmental Ltd

**CONTRACT NO:** 30945-2

**PROJECT NO:** 610

**DATE OF ISSUE:** 21/09/2012

**RESULTS:**

| Sample | Formaldehyde (µg *) |
|---|---|
| G9746 | <0.5 |
| G9747 | <0.5 |

* UKAS accreditation for this work is restricted to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are outside the scope of this accreditation

**COMMENTS:**

The limit of detection by this method is 0.5 µg.

IOM Consulting cannot accept responsibility for samples that have been incorrectly collected or despatched by external clients.

Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation.

**ANALYSED BY:**

**Jennifer Gray**
*Chemist*

**AUTHORISED BY:**

**Carolyn McGonagle**
*Senior Chemist*

Aspen Environmental Ltd

Sheet 1 of 4

# General Sampling Data Form

Location & Drawing Nuttalls

| | | | | | | |
|---|---|---|---|---|---|---|
| Location | | | | | | |
| Date 12/9/12. Time | 10.15 | | | | | |
| Barometric Pressure mb | 991 | | | | | |
| Temperature ° C Exhaust | | | | | | |
| Ambient | 16 | | | | | |
| Gas Meter | | | | | | |

Pitot Tube Traverses (Measurements in Pa) — Stack Dimensions (cm) & Aspect 29 circ vert 4 — Aspen Job Number 1058

| Position | Time | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Mean | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pv | | 52 | 58 | 63 | 61 | 54 | 58 | 62 | 64 | 61 | 70 | | |
| Ps | 14.30 | -27 | -27 | -33 | -38 | -38 | -40 | -39 | -36 | -33 | -50 | | |
| T | | 166 | — | — | — | — | — | — | — | — | → | | |
| Angle | | | | | | | | | | | | | |
| Pv | | | | | | | | | | | | | Is the SiGel >50 % Fresh ✓ |
| Ps | | | | | | | | | | | | | Stack Gas Homogeneity N/A |
| T | | | | | | | | | | | | | |
| Angle | | | | | | | | | | | | | |

Flow @ Ambient m / s — Sampling Flow L / min — Tip Diameter mm — Pitot Tube 331 — Equipment & Blank

| Sample Reference | Position | Time Initial | Time Final | Gas Meter / Counter Initial | Gas Meter / Counter Final | Vacuum % <2 | Sampling Points Centre. cm / Comments | | Equipment & Blank | |
|---|---|---|---|---|---|---|---|---|---|---|
| 265 ½ | Goon | 11.28 | 12.50 | 395453 | 412519 | ✓ | HCN | 10 L @ 1.0 | 129 | Pump |
| 272 ½ | Xan | 11.28 | 12.50 | 969964 | 98 1692 | ✓ | CHOH | 6.4 m/s | 80 | Flowmeter |
| | | | | | | | | ~~10 L/m @ 6~~ | 97 | Gasmeter |
| | | | | | | | | 4.2 L/m @ 4 | 83 | Gas Temp |
| | | | | | | | | | (1) | Silica Gel |
| | | 14.52 | 15.33 | 49 3326 | 4938376 | ✓✓ | | | 503. | Thermocouple |
| | | | | | | | | | | Field Blank |
| 87894 | | 14.36 | +30 | 4938376 | 4939838 | | Portico. | | | |
| | | | | | | | | | Operator SB & JB | |
| 87892 | | | | | | | | | Normal Flow 5.91 Nm/s 0.39 Nm³/s | |

Form 1 — © Aspen Environmental Ltd — Version 10 (Feb 2011)



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| Aspen Environmental Ltd | Sheet 2 of 4 | Impinger Line Sampling Data Form |
|---|---|---|

Location: Nuttalls Dudley

Notes:

| Analyte | Solution | Method |
|---|---|---|
| HCl | DI H2O | EN 1911 ✓ |
| SO2 | H2O2 | EN 14791 ✓ |
| H2S | ZnAc | EPA 11 |
| Other | | |

| | | | | | |
|---|---|---|---|---|---|
| Date 12/9/12 | Time | 1250. | | | |
| Barometric Pressure 991 mb | | | | | |
| Temperature °C | Exhaust | 170 | | | |
| | Ambient | | | | |
| Gas Meter | | 18 | | | |

To be used with Form 1 General Sampling Data — Aspen Job No 1058.

Equipment: Westech Line ✓; Other ?; Impingers 2; 3; 4 ✓; Pump No 110; DGM No

| Sample Ref | | Temperature °C Probe | Oven | Ice | Impinger Line Vacuum Checks DGM Initial | DGM Final | Difference | % | Readings DGM | DGM°C | Time | Flow Rate l/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HCl Line Conditioning | Initial | | | ✓ | | | | | | | | |
| | Final | | | | | | | | | | | |
| Field Blank 1 | Initial | 142 | 178 | ✓ | | 493763.0 | | | | | 13.12 | |
| | Final | 140 | 178 | ✓ | | 493763.0 | | | | 18.0 | 13.47 | |
| Sample | Initial | 137 | 178 | ✓ | 493745.2 | 493765.2 | 0.2 | 1.0 | 493785.4 | 18. | 13.49 | 2.0 |
| | Final | | | | 34.6 | 34.6 | 0.0 | ✓ | 493832 | 18.4 | +30 | 2.0 |
| Sample | Initial | | | | | | | | | | | |
| | Final | | | | WATER CONCENTRATION. | | | | | | | |
| Sample | Initial | | | | ~~IMP 1~~ | PRE WEIGHT | POST | WATER | | | | |
| | Final | | | | IMP 1 | 873.1 | 875.9 | 2.8 | | | | |
| Sample | Initial | | | | IMP 2 | 882.9 | 882.8 | -0.1 | | | | |
| | Final | | | | IMP 3 | 714.9 | 715.0 | 0.1 | | | | |
| Field Blank 2 | Initial | | | | IMP 4 | 1054.9 | 1055.5 | 0.9 | | | | |
| | Final | | | | | | | 3.79 = 4L | | | | |

Is the SiGel > 50 % Fresh ✓

Operator GB+JB

The Sampling Efficiency Sample should be collected every 10th sample

Aspen Environmental Ltd SHEET 3 OF 4 **Horiba PG-250 Calibration Form:**

| Location & Date: | | | | Calibration Time | Ambient Temperature °C | Line Pressure mb | Barometric Pressure mb |
|---|---|---|---|---|---|---|---|
| Nettles 12/9/12 | | | | 10.50 | | | 991 |
| Oxygen 1091 | | | Vacuum | Carbon monoxide ( ppm) | Nitric Oxide ( ppm) | Carbon dioxide ( %) | |
| 20.9 % | 11 % | 0 % | mb | 100.8. | 178.2 | 11.98 | |
| 20.94 | 11.1 | 0.2/0.18 | | -0.4 100.8 100.0 | 0.0 178.2 174.2 | -0.02 11.98 11.96/11.97 | |
| Time to Calibration (Minutes) | | | | Sub 60 secs | Sub 60 secs | Sub 60 secs | |

Comments Test: Start & Finish Times

11.25 INTO STACK. FID 4PPM 0

14.15 Change Co Scale to 500 - overlap. 0

14.20 Stop.

Instrumental Readings

| Time | °C | NO | SO2 | CO | CO2 | O2 |
|---|---|---|---|---|---|---|
| 11.29 | 167 | 395 | | 27 | 6.9 | 13.9 |
| 13.12 | 171 | 380 | | 56 | 6.6 | 14.2 |
| 14:15 | 155 | 294 | | 190 | 5.4 | 15.4 |
| 16.20 | 163 | | | | | |
| | | | | 500 @ 14.15 | | |
| Scale | | 500 | | 200 | 20 | 25 |
| Span Gas | | | | | | |
| T 90 | | | | | | |

| | Calibration Time | Ambient Temperature °C | Line Pressure mb | Barometric Pressure mb |
|---|---|---|---|---|
| | 15.08 | | | |
| Oxygen / Vacuum | Carbon monoxide ( ppm) | Nitric Oxide ( ppm) | Carbon dioxide ( %) | |
| 20.9 % / 11 % / 0 % / mb | -0.1 -96 - 0 | -0.1 - 177 - 0 | 0.02 -11.95 - 0 | |
| 02 / 0 | | | | |
| Time to Calibration (Minutes) | | | | |
| Operator PB + JB | | | | |
| Job Number 1058 | | | | |

Form 4 Aspen Environmental Ltd Calibration gas records on Aspen Environmental Ltd Form 33 Version 14 Apr 2012

Aspen Environmental Ltd

| Aspen Environmental Ltd | | SHEET 4 OF 4. | | | | | | Bernath Model 3006 Hydrocarbon Analyser | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location NUTTALL | | | | | | | | Date 12/9/12 | | Operator GB & JB | | |
| Start Up | | Calibration Parameters: Instrument Readings | | | | | | Job No. 1058 | | | | |
| Run No. | Time | Pump mb | Line Zero | | | Zero Gas $N_2$ | | | Calibration Gas 81.55ppm | | | | Configuration 3m |
| | | | Scale 1 | Scale 2 | Scale 3 | Scale 1 | Scale 2 | Scale 3 | Internal | External | Internal | External | |
| | 10.40 | 600 | | | | | | | | | | | Ambient Temp |
| | | milliAmps | | 0.2/0.2 | | | | | | 16.8 | | | |

| Data Logger: Fourier Systems | | | | Readings | |
|---|---|---|---|---|---|
| Time | Scale | Run No. | Notes | Time | mA |
| 10.48 | | | IND STACK SCALE TO 3. | | |
| 10.52 | | | SCALE 2. | See | Sheet 2 |
| | | | | | |
| 14.20 | | | OFF. | | |

| Recalibration | | Calibration Parameters: Instrument Readings | | | | | | | | Sampling Conditions | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Run No. | Time | Pump mb | Line Zero | | | Zero Gas | | | Calibration Gas | | | |
| | | | Scale 1 | Scale 2 | Scale 3 | Scale 1 | Scale 2 | Scale 3 | Internal | External | Internal | External |
| 1 | 15.00 | 600 | | $N_2$ | | | | | | | | |
| | | milliAmps | | 0.2 | | | | | | 10.36 | | |

## Uncertainty Calculations 21/07/2008

Aspen Environmental Ltd

**Horiba PG-250 Combustion Analyser**

| Carbon dioxide | | Oxygen | | | | |
|---|---|---|---|---|---|---|
| 0 | 12 | 0 | 20.9 | Xr | | |
| 0.03 | 12 | 0 | 20.9 | | | |
| 0.03 | 12 | 0 | 20.9 | | | |
| 0.03 | 12 | 0 | 20.9 | | | |
| 0.02 | 12.01 | 0 | 20.91 | | | |
| 0.03 | 12 | 0 | 20.9 | | | |
| 0.03 | 12.01 | 0 | 20.9 | | | |
| 0.03 | 12 | 0 | 20.9 | | | |
| 0.03 | 12.01 | -0.01 | 20.9 | | | |
| 0.03 | 12 | 0 | 20.9 | | | |
| 0.03 | 12.01 | 0 | 20.9 | | | |
| 0.03 | 12 | 0 | 20.91 | | | |
| 0.03 | 12.00 | 0.00 | 20.90 | Mean | x | |
| 0.00 | 0.00 | 0.00 | 0.00 | SD | S | |
| 0.04 | 0.00 | 0.00 | 0.00 | d = x - Xr | | |
| **0.35** | **0.10** | | **0.07** | **Uncertainty** | **ud = sqrt (3 x d)** | |
| | 12 | | 20.9 | Xr | Span Gases | |
| | 1.30 | | 1.30 | | Relative Uncertainty % | BOC |
| | 20.00 | | 25.00 | | Instrument Range | |
| | **0.26** | | **0.33** | | % / ppm Uncertainty | |
| | **0.40** | | **0.50** | | Linearity | Horiba |
| | **0.20** | | **0.25** | | Zero Drift | Horiba |
| | **0.20** | | **0.25** | | Span Drift | Horiba |
| | 0 | | 0 | | Interferents % & ppm | Aspen |
| | 0.022 | | 0.0275 | | Linearity % & ppm | Aspen |
| | 0.06 | | 0.075 | | Zero SD | Aspen |
| | 0.03 | | 0.0375 | | Span SD | Aspen |
| | 0.0012 | | 0.00209 | | Atmospheric Pressure | MCerts |
| | 0.02 | | 0.025 | | Voltage | ½ of EN |
| | 0.018 | | 0.0375 | | Ambient Temp | ½ of EN |
| | 0 | | 0 | | Losses & Leakage | Aspen |
| | 0.1 | | 0.1 | | Zero Drift % & ppm | Aspen |
| | 0.02 | | 0.02 | | Span Drift % & ppm | Aspen |

| Carbon dioxide | | Oxygen | |
|---|---|---|---|
| Sum Sqs | 0.0161094 | 0.0202231 | |
| SqRt | 0.126923 | 0.142208 | Combined Uncertainty of Range |
| | 0.248769 | 0.2787277 | Expanded Uncertainty |
| | **0.9951** | **1.1149** | **% Uncertainty** |

Aspen Environmental Ltd Horiba Uncertainty Calculations v3 Jul 2008

## Uncertainty Calculations on Bernath 3005 FID

Aspen Environmental Ltd

| 783.1 | | 82.3 | | 8.25 | | Certified Values of propane conc in ppm |
|---|---|---|---|---|---|---|
| Bernath FID actual mA readings (5/01/2007) | | | | | | |
| 800 (3) | 80 (3) | 80 (2) | 8 (2) | 8 (1) | Con (1) | |
| 17.17 | 1.77 | 17.43 | 1.52 | 15.48 | 2.69 | |
| 17.16 | 1.79 | 17.43 | 1.52 | 15.55 | 2.69 | |
| 17.18 | 1.79 | 17.46 | 1.52 | 15.62 | 2.61 | |
| 17.14 | 1.77 | 17.51 | 1.52 | 15.58 | 2.63 | |
| 17.16 | 1.76 | 17.47 | 1.54 | 15.54 | 2.63 | |
| 17.14 | 1.77 | 17.43 | 1.52 | 15.54 | 2.63 | |
| 17.19 | 1.77 | 17.45 | 1.5 | 15.56 | 2.65 | |
| 17.14 | 1.78 | 17.41 | 1.5 | 15.66 | 2.67 | |
| 17.12 | 1.77 | 17.47 | 1.52 | 15.52 | 2.67 | |
| 17.14 | 1.78 | 17.43 | 1.5 | 15.6 | 2.65 | |
| 17.15 | 1.75 | 17.37 | 1.52 | 15.5 | | |
| 17.15 | 1.77 | 17.44 | 1.52 | 15.56 | 2.65 | Mean |
| 0.02 | 0.01 | 0.03 | 0.01 | 0.05 | 0.03 | SD |
| 2.23 | 2.23 | 2.23 | 2.23 | 2.23 | 2.26 | students t p357 Stats Book |
| 0.04 | 0.03 | 0.08 | 0.03 | 0.11 | 0.06 | Repeatabil SD x t |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Bias = mean - true |
| 0.04 | 0.03 | 0.08 | 0.03 | 0.11 | 0.06 | Uncertaint bias = repeatability |
| **0.26** | **1.43** | **0.45** | **1.69** | **0.72** | **2.22** | **Instrument Percentage Uncertainty** |
| **1.00** | **1.00** | **1.00** | **1.00** | **1.00** | **1.00** | **Gas Percentage Uncertainty** |
| **1.03** | **1.74** | **1.09** | **1.96** | **1.23** | **2.43** | **Overall Calculated % Uncertainty** |
| **± 2 %** | **± 2 %** | **± 2 %** | **± 2 %** | **± 2 %** | **± 3 %** | **Working Figures % of Reading** |

**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 |
| | | | | **Expanded Result** | **6.1 %** |

**Uncertainty for HCl Sampling to EN 13649: 2002** Aspen Environmental Ltd

**Uncertainty for a series of duplicate measurements of HCl**

data from J.990 Thyssen Krupp Ltd

sd 0.141 mean 6.88 = ± 2.06 %
double to allow for less good data (& ? absolute accuracy & standards)
double to 95 % ± 8.24 **Expanded Result = ± 8.20%**

continuous process = no change in humidity
v little change in temperature
low flow pumps with counters, so not identical flows, but results divided by volumes (Aspen bubble flow meter cal)

Laboratories don't provide uncertainty estimates on analytical results