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# EMISSIONS MONITORING TEST REPORT

## Canley Crematorium
## Cannon Hill Road
## Coventry
## CV4 7DF

## 23rd – 25th July 2013

Report Prepared by [redacted] Date 2nd September 2013

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**CONTENTS**

## 1. INTRODUCTION

The four cremators and associated flue gas treatment systems at Canley Crematorium, Coventry, were monitored between the 23rd and 25th July 2013 to the requirements given in Process Guidance Note PG5/2 (2012) for emission releases to atmosphere for abated plant.

The work involved monitoring a range of flue gas components with the plant operating normally.

The plant comprises four Cremators designated as the Evans Universal series 300/2 model. The cremators are fitted with three nozzle mix burners utilising gas as the support fuel.

The waste gases from cremators 1 and 2 combine, and are ducted to a common flue gas treatment plant. The treatment plant comprises a shell and tube boiler to cool the flue gases, a reagent feeder station that introduces a blend of activated carbon/sodium bicarbonate to react with the cooled gases, and a bag filter to clean the treated gases. The waste heat from the boiler in the form of warm water is dissipated to atmosphere via a finned tube air blast cooler situated outside the crematory.

The waste Gases from cremators 3 and 4 also combine and are ducted into a 2nd flue gas treatment plant operating in the same manner as with the plant attached to cremators 1 and 2.

Both plants operate under full microprocessor based automatic control that requires little manual intervention.

The cremators and flue gas clean up system were manufactured, installed and commissioned by Facultatieve Technologies Limited to meet the requirements of the Environmental Permitting (England and Wales) Regulations 2007 – (EPR 2007) as relevant to cremators, summarised in the Secretary of State's Process Guidance Note PG 5/2 (2012).

The flue ducting and test points were in accordance with the requirements of EA TGN M1.

Measurements were undertaken to enable comparisons to be made of the operation of the cremators and associated flue gas treatment system with the requirements of the Guidance Note in terms of emission releases to air.

The two plants were tested in normal operation, and "as found". The operating patterns of the cremators are dictated by the number of cremations to be completed during the working day, and the times the Funeral services take place. It follows that either one or both cremators can be operational at any one time during the working day, and these are served by the common abatement plant being tested.

This report details the monitoring procedures used and the results obtained from this test work along with comparisons with the Guidance Note requirements and comments where appropriate.

Relevant procedures were followed to enable quality control to be maintained throughout the test preparation, site test work, laboratory analysis, calculations and reporting.

## 2. PROCEDURES

### 2.1 Total Particulate Matter

A flue gas sample was extracted and filtered to collect total particulate matter. A Whatman QM-A filter paper was used with a particle retention of not less than 99.5% at a particle size of 0.3 micron. The flue gas extraction employed techniques given in BS EN 13284 Part 1.

The sampling was conducted using apparatus in accordance with the requirements of BS EN 13284 Part 1.

This consisted of a heated known dimension Pyrex glass nozzle, heated Pyrex glass probe liner, heated Pyrex glass filter housing with Titanium filter support containing quartz microfibre filter (all heaters set to 160°C), PTFE sample line, dreschel absorption bottles, gas dryer (silica gel), sample line to pump, pump, gas meter, rotameter, pitot and impulse lines, electronic manometer, type K thermocouple, balance (for gravimetric moisture) and datalogger. Settings tables were pre-prepared to enable isokinetic flow to be maintained (based on online measurements of flue gas velocity and temperature to set nozzle flow / pump rate (l/min)).

Particulate matter analysis was carried out by weighing the filter and probe rinse collection on a calibrated balance, with the media being dried and weighed prior to and following the test.

The tests reported herein were conducted to prove the performance of the cremators relative to PG5/2(2012).

### 2.2 Hydrogen Chloride

A flue gas sample was extracted and filtered.

A Whatman QM-A filter paper was used with a particle retention of not less than 99.5% at a particle size of 0.3 micron. The flue gas extraction employed techniques given in BS EN 13284 Part 1, incorporating the modifications given in Clause 2.1 above, to reflect the variable, batch nature of the process.

The gas sample was then passed through an absorption medium of de-ionised water to collect hydrogen chloride.

The method employed was BS EN 1911 Parts 1-3.

Laboratory analysis for hydrogen chloride was carried out on the absorption medium using Ion Chromatography (IC).

### 2.3 Mercury

A flue gas sample was extracted and filtered to collect solid phase mercury.

A Whatman QM-A filter paper was used with a particle retention of not less than 99.5% at a particle size

of 0.3 micron. The flue gas extraction employed techniques given in BS EN 13284 Part 1, incorporating the modifications given in Clause 2.1 above, to reflect the variable, batch nature of the process.

The gas sample was then passed through an absorption medium of acidified potassium dichromate to collect vapour phase mercury.

The method employed was BS EN 13211.

The Environment Agency Note Monitoring Guidance Note M2 recommends that a suitable sample averaging period is used to ensure an adequate limit of detection (LOD). As plant operation is variable in terms of the number of cremators in use at any one time, the nature of the charges being introduced to the cremators is unknown, and the expected pollutant concentrations will be low given that the plant is abated, sample durations were adjusted for each test according to circumstances at that time.

Laboratory analysis for solid and vapour phase mercury was carried out on the filter and absorption medium using Inductively Coupled Plasma (ICP-OES) Spectrophotometry.

## 2.4 Carbon Monoxide

A flue gas sample was continuously extracted, filtered and dried before being passed through a pre-calibrated Siemens Ultramat 23/$O_2$ infrared analyser for the on-line measurement of carbon monoxide. The analyser has a fixed range of 0-1250 mg/$Nm^3$ and was zeroed with air and calibrated with a nominal 800 ppmv carbon monoxide in balance nitrogen gas.

The method employed was BS ISO 12039.

The analyser output was continuously recorded using a Grant 'Squirrel' data logger.

For these tests a relatively high range analyser was used due to the typical pattern of carbon monoxide concentration emissions from cremators being very low (often indicated as zero) for most of the cycle, but with occasional, high, short duration spikes of CO being emitted. The convention since non-continuous emissions monitoring became a mandatory requirement for cremators during 1990, has been to attempt to monitor the magnitude of spikes, as these are often the main contributor to total CO emissions. If the mean one minute emission of CO was say 200 mg/$Nm^3$, it would be expected that the peak concentration during that one minute averaging period would be considerably higher than this. It follows that utilising a lower range analyser would frequently understate CO emissions, despite increasing sensitivity at low CO concentrations.

## 2.5 Volatile Organic Compounds

A flue gas sample was continuously extracted and filtered before being passed via a heated line through a pre-calibrated Signal 3030PM Flame Ionisation Detection (FID) analyser for the on-line measurement of volatile organic compounds. The analyser was ranged 0-100 ppmv total hydrocarbons and was zeroed with air passed through a catalytic converter and calibrated with a nominal 50 ppmv propane in

balance air gas.

The method employed was BS EN 12619.

The analyser output was continuously recorded using a Grant 'Squirrel' data logger.

Similar comments apply to VOC's as CO, in that the analyser scaling is set to quantify the peaks that are the nature of the emission.

## 2.6 Oxygen

A flue gas sample was continuously extracted from the same position in the flue as the other pollutants extraction, filtered and dried before being passed through a pre-calibrated Siemens Ultramat 23/$O_2$ electrochemical cell analyser for the on-line measurement of flue oxygen.

The method employed was BS ISO 12039.

The analyser was calibrated using a standard reference gas in the laboratory before and after the site visit, and with nitrogen "zero" gas and air at the start and end of each day's testing on site. It was assumed that calibration linearity was maintained during sampling, and the post checks indicated that this was the case.

The outputs of the analysers were continuously recorded using a Grant 'Squirrel' data logger.

## 2.7 Moisture

A flue gas sample was extracted and filtered. The gas sample was then passed through an absorption medium to collect any water vapour.

The method employed was BS EN 14790.

Flue gas moisture was determined gravimetrically by weighing the absorption medium and final gas drier prior to and following the test.

This was carried out alongside testing for hydrogen chloride and mercury.

## 2.8 Temperature

The cremator secondary chamber exit and flue (filter outlet) temperatures were measured by the use of calibrated Type K thermocouples.

The method employed was BS EN 13284 Part 1.

The gas temperatures were continuously recorded using a Grant 'Squirrel' data logger.

## 2.9 Velocity and Volumetric Flow

Flue gas velocity was found from inserting a calibrated s-type pitot tube into the flue. The pitot head pressure was then measured using a calibrated electronic manometer.

The method employed was BS EN 13284 Part 1.

The electronic manometer output was continuously recorded using a Grant 'Squirrel' data logger.

Flue gas velocity was then calculated from Bernoulli's equation as the density of the flue gas was known (from measurements of flue gas moisture and temperature).

Flue gas volumetric flow rate was found from the measurement of the flue duct size and hence its area and corrected to normalised conditions (again from measurements of flue gas moisture and temperature).

## 3. RESULTS

The results are summarised in Tables 1 to 6.

Total Particulate Matter, Hydrogen Chloride, Carbon Monoxide and Volatile Organic Compound determinations are given in Table 1(Cremators 1&2) & Table 4(Cremators 3&4).

Mercury determinations are given in Table 2(Cremators 1&2) & Table 5(Cremators 3&4).

A comparison of test results with site instrumentation is given in table 3(Cremators 1&2) & Table 6 (Cremators 3&4).

Moisture determinations were made on all tests.

Carbon Monoxide, Volatile Organic Compounds, Oxygen, Temperature and Velocity and Volumetric Flow were continuously monitored.

All values in the tables are corrected to the reference conditions of 273K, 101.3kPa, 11%v/v oxygen and dry gas as given in PG5/2(12) where required.

All the data logs and calculations can be seen in Appendix 1.

All the analysis reports can be seen in Appendix 2.

Appendix 3 gives details of plant operation during the various tests.

**TABLE 1**
**Coventry Cremators 1 & 2 Abatement System Outlet**
**Emissions Monitoring 24 -25th July 2013**
**Total Particulate Matter & Hydrogen Chloride Sampling**

| | | Test 12 - 2 | Test 12 - 3 | Test 12 - 4 | Average | Requirement to PG5/2 (2012) |
|---|---|---|---|---|---|---|
| Total Particulate Matter | - mg/Nm$^3$c. | 0.56 ± 1.84 | 0.00 ± ##### | 0.04 ± 1.55 | **0.20** | <20 |
| Hydrogen Chloride | - mg/Nm$^3$c. | 15.65 ± 2.00 | 30.40 ± 3.49 | 7.20 ± 0.85 | **17.75** | <30 |
| Carbon Monoxide | | | | | | |
| Test Average | - mg/Nm$^3$c. | 0.12 ± 0.01 | 7.59 ± 0.38 | 2.53 ± 0.13 | **3.41** | <100 |
| First 30 min Average | - mg/Nm$^3$c. | 0.00 ± 0.00 | 0.56 ± 0.03 | 0.24 ± 0.01 | - | |
| Second 30 min Average | - mg/Nm$^3$c. | 0.25 ± 0.01 | 14.85 ± 0.74 | 4.90 ± 0.24 | - | |
| First 60 min Average | - mg/Nm$^3$c. | 0.12 ± 0.01 | 7.59 ± 0.38 | 2.53 ± 0.13 | - | |
| Organic Compounds | - mg/Nm$^3$c. | 0.01 ± 0.00 | 0.69 ± 0.03 | 0.12 ± 0.01 | **0.27** | <20 |

| | | | | | |
|---|---|---|---|---|---|
| Flue Oxygen | - %v/v dry | 14.34 ± 0.10 | 15.95 ± 0.10 | 12.52 ± 0.10 | **14.27** |
| Flue Moisture | - %v/v | 8.1 ± 0.8 | 8.2 ± 0.8 | 7.8 ± 0.8 | **8.0** |
| | - %w/w | 5.2 ± 0.5 | 5.3 ± 0.5 | 5.0 ± 0.5 | **5.1** |
| Flue Temperature | - Deg C | 138 ± 2 | 127 ± 2 | 120 ± 2 | **128** |
| Volumetric Flow | - Nm$^3$/h dry | 2698 ± 54 | 1986 ± 40 | 2698 ± 54 | **2461** |

Note 1: All emissions as concentration levels are given as mg/Nm$^3$ corrected to 11%v/v oxygen and dry gas

Note 2: All uncertainties (±) are calculated to a 95% confidence interval

Uncertainties estimated using the procedure suggested in the STA Quality Guidance Note QGN001-01

**TABLE 2**
**Coventry Cremators 1 & 2 Abatement System Outlet**
**Emissions Monitoring 24th July 2013**
**Mercury Sampling**

| | | Test 12 - 1 | Requirement to PG5/2 (2012) |
|---|---|---|---|
| Mercury | - µg/Nm$^3$c. | 6.10 ± 0.37 | <50 |

| | | |
|---|---|---|
| Flue Oxygen | - %v/v dry | 13.53 ± 0.10 |
| Flue Moisture | - %v/v | 10.5 ± 1.1 |
| | - %w/w | 6.8 ± 0.7 |
| Flue Temperature | - Deg C | 129 ± 2 |
| Volumetric Flow | - Nm$^3$/h dry | 2542 ± 51 |

Note 1: All emissions as concentration levels are given as µg/Nm$^3$ or mg/Nm$^3$ corrected to 11%v/v oxygen and dry gas

Note 2: All uncertainties (±) are calculated to a 95% confidence interval
Uncertainties estimated using the procedure suggested in the STA Quality Guidance Note QGN001-01

**TABLE 3**

**Comparison of Test Results with Site Instrumentation - Cremators 1 & 2**

| Cremator | Test | Date | Cremation | Averaging Period (mins) | Carbon Monoxide mg/Nm³ | |
|---|---|---|---|---|---|---|
| | | | | | Davies & Co | Site |
| Number 1 | 12 - 2 | July 24, 2013 | 3 | 0 - 30 | 0 | 0 |
| Number 1 | 12 - 3 | July 24, 2013 | 3 | 30 - 60 | 0 | 0 |
| Number 1 | 12 - 4 | July 25, 2013 | 1 | 0 - 30 | 0 | 0 |

Note 1: All emission concentration levels are given as mg/Nm3 corrected to 11% oxygen, 273K & dry gas

Note 2: The results are taken as an average from either the 1st or 2nd 30 minute section of the cremation cycle

**TABLE 4**
**Coventry Cremators 3 & 4 Abatement System Outlet**
**Emissions Monitoring 23rd July 2013**
**Total Particulate Matter & Hydrogen Chloride Sampling**

| | | Test 34 - 1 | Test 34 - 2 | Test 34 - 3 | Average | Requirement to PG5/2 (2012) |
|---|---|---|---|---|---|---|
| Total Particulate Matter | - mg/Nm$^3$c. | 0.05 ± 2.21 | 0.00 ± #### | 1.05 ± 3.10 | **0.37** | <20 |
| Hydrogen Chloride | - mg/Nm$^3$c. | 8.59 ± 2.26 | 75.48 ± 5.46 | 43.47 ± 3.44 | **42.51** | <30 |
| Carbon Monoxide | | | | | | |
| Test Average | - mg/Nm$^3$c. | 2.20 ± 0.11 | 42.68 ± 2.13 | 5.24 ± 0.26 | **16.71** | <100 |
| First 30 min Average | - mg/Nm$^3$c. | 4.20 ± 0.21 | 39.85 ± 1.99 | 10.31 ± 0.52 | - | |
| Second 30 min Average | - mg/Nm$^3$c. | 0.13 ± 0.01 | 45.62 ± 2.28 | 0.00 ± 0.00 | - | |
| First 60 min Average | - mg/Nm$^3$c. | 2.20 ± 0.11 | 42.68 ± 2.13 | 5.24 ± 0.26 | - | |
| Organic Compounds | - mg/Nm$^3$c. | 0.00 ± 0.00 | 2.47 ± 0.12 | 0.06 ± 0.00 | **0.84** | <20 |

| | | | | | |
|---|---|---|---|---|---|
| Flue Oxygen | - %v/v dry | 15.53 ± 0.10 | 17.03 ± 0.10 | 17.60 ± 0.10 | **16.72** |
| Flue Moisture | - %v/v | 8.0 ± 0.8 | 5.7 ± 0.6 | 2.9 ± 0.3 | **5.5** |
| | - %w/w | 5.1 ± 0.5 | 3.6 ± 0.4 | 1.8 ± 0.2 | **3.5** |
| Flue Temperature | - Deg C | 92 ± 2 | 97 ± 2 | 96 ± 2 | **95** |
| Volumetric Flow | - Nm$^3$/h dry | 4562 ± 91 | 4676 ± 94 | 4419 ± 88 | **4552** |

Note 1: All emissions as concentration levels are given as mg/Nm$^3$ corrected to 11%v/v oxygen and dry gas

Note 2: All uncertainties (±) are calculated to a 95% confidence interval
Uncertainties estimated using the procedure suggested in the STA Quality Guidance Note QGN001-01

**TABLE 5**
**Coventry Cremators 3 & 4 Abatement System Outlet**
**Emissions Monitoring 23rd July 2013**
**Mercury Sampling**

| | | Test 34-4 | Requirement to PG5/2 (2012) |
|---|---|---|---|
| Mercury | - µg/Nm$^3$c. | 3.79 ± 0.41 | <50 |

| | | |
|---|---|---|
| Flue Oxygen | - %v/v dry | 17.10 ± 0.10 |
| Flue Moisture | - %v/v | 8.6 ± 0.9 |
| | - %w/w | 5.5 ± 0.6 |
| Flue Temperature | - Deg C | 98 ± 2 |
| Volumetric Flow | - Nm$^3$/h dry | 3983 ± 80 |

Note 1: All emissions as concentration levels are given as µg/Nm$^3$ or mg/Nm$^3$ corrected to 11%v/v oxygen and dry gas

Note 2: All uncertainties (±) are calculated to a 95% confidence interval
Uncertainties estimated using the procedure suggested in the STA Quality Guidance Note QGN001-01

**TABLE 6**

**Comparison of Test Results with Site Instrumentation - Cremators 3 & 4**

| Cremator | Test | Date | Cremation | Averaging Period (mins) | Carbon Monoxide mg/Nm³ | |
|---|---|---|---|---|---|---|
| | | | | | Davies & Co | Site |
| Number 3 | 34 - 1 | July 23, 2013 | 1 | 0 - 30 | 0 | 4 |
| Number 3 | 34 - 1 | July 23, 2013 | 1 | 30 - 60 | 0 | 0 |
| Number 4 | 34 - 2 | July 23, 2013 | 2 | 0 - 30 | 40 | 5 |

Note 1: All emission concentration levels are given as mg/Nm3 corrected to 11% oxygen, 273K & dry gas
Note 2: The results are taken as an average from either the 1st or 2nd 30 minute section of the cremation cycle

## 4. COMMENTS

The results from these series of tests demonstrate that both plants satisfy the requirements of PG5/2(2012) for the release to air of particulate matter, mercury, carbon monoxide and volatile organic compounds.

The emission to air of HCl from the Cremator 1 & 2 abatement plant was above the limit.

Combustion within the cremator secondary combustion chambers was good as is indicated by the low emissions of CO and VOC's.

No visible chimney emissions were observed throughout the test work other than the expected steam plume during preheat.

PG5/2 (2012) states that the continuous emission monitors (CEMs) should be periodically checked (calibrated) to ensure that the readings being reported are correct.

The PCME particulate monitor primarily functions as a filter leak detector rather than being calibrated to give qualitative results. This instrument is more than capable of satisfying this function.

## 5. QUALITY CONTROL

All the tests performed were carried out to the methods given in the appropriate listed Standards using calibrated equipment. The gas analysers were calibrated prior to, and during use using suitable, certified calibration gases.

Analysis of the filters and absorbers was carried out in-house and at an external laboratory.

For this test work the following external laboratory was used for the given determinations:

| | | |
|---|---|---|
| Scientific Analysis Laboratories (SAL) | } | Hydrogen Chloride<br>Mercury |

**APPENDIX 1**

Data Logs and Calculations

## Explanation of Data Logs

Data is taken from a Grant Squirrel data logger.

Time is from logger clock.
Flue Gas Temp is direct from test flue thermocouple.
Meter Temp is direct from gas meter.
(The stated meter temperature is that of the sampled gas at the meter, and is not the room ambient temperature. The temperature always increases during a test due to the heat gain from the sample pump that is contained in an enclosed box along with the gas meter, and this is quite normal).
Flue O2 is from the Siemens Ultramat U23/O2 analyser.
CO is from the Siemens Ultramat U23/O2 analyser.
VOC is from the Signal 3030PM FID analyser expressed as carbon equivalent.
Sample Point Pa is from the pitot tube to an Furness Controls electronic manometer.

The room temperature was typically 20°C, and there were no issues with the analysers overheating. Functional and calibration checks at the start and end of each test confirmed correct operation of the analysers.

All values in the tables are corrected to the reference conditions of 273K, 101.3kPa, 11%v/v oxygen and dry gas as given in PG5/2(12) where required.

**Site Instrumentation Calibration Data**

| | Siemens Ultramat 23 | | Signal 3030PM |
|---|---|---|---|
| | CO | $O_2$ | VOC |
| Type of Check | Pre-testing calibration | | |
| Date of Check | 23/07/2013 | 23/07/2013 | 23/07/2013 |
| Time of Check | 08:15 | 08:15 | 08:25 |
| Test Reference | Tests 34-1,2,3&4 | Tests 34-1,2,3&4 | Tests 34-1,2,&3 |
| Zero reading at analyser | 0 mg/m³ | 0.00% | 0.0 ppm |
| Span reading at analyser | 1024 mg/m³ | 20.95% | 53.4 ppm |
| Zero check down line | 0 mg/m³ | 0.10% | 0.0 ppm |
| Span check down line | 1021 mg/m³ | 20.95% | 53.7 ppm |
| Type of Check | Post-testing calibration | | |
| Date of Check | 23/07/2013 | 23/07/2013 | 23/07/2013 |
| Time of Check | 17:00 | 17:00 | 12:30 |
| Test Reference | Tests 34-1,2,3&4 | Tests 34-1,2,3&4 | Tests 34-1,2,&3 |
| Zero in air at analyser | 0 mg/m³ | 0.00% | 0.3 ppm |
| Span in air at analyser | 1026 mg/m³ | 21.03% | 54.0 ppm |
| Type of Check | Pre-testing calibration | | |
| Date of Check | 24/07/2013 | 24/07/2013 | 24/07/2013 |
| Time of Check | 10:20 | 10:20 | 14:15 |
| Test Reference | Tests 12-1,2&3 | Tests 12-1,2&3 | Tests 12-2&3 |
| Zero reading at analyser | 0 mg/m³ | 0.00% | 0.0 ppm |
| Span reading at analyser | 1026 mg/m³ | 20.95% | 53.5 ppm |
| Zero check down line | 0 mg/m³ | 0.20% | 0.0 ppm |
| Span check down line | 1021 mg/m³ | 20.95% | 53.2 ppm |
| Type of Check | Post-testing calibration | | |
| Date of Check | 24/07/2013 | 24/07/2013 | 24/07/2013 |
| Time of Check | 16:50 | 16:50 | 17:00 |
| Test Reference | Tests 12-1,2&3 | Tests 12-1,2&3 | Tests 12-2&3 |
| Zero in air at analyser | 0 mg/m³ | 0.00% | 0.3 ppm |
| Span in air at analyser | 1028 mg/m³ | 21.01% | 53.9 ppm |
| Type of Check | Pre-testing calibration | | |
| Date of Check | 25/07/2013 | 25/07/2013 | 25/07/2013 |
| Time of Check | 09:40 | 09:40 | 09:40 |
| Test Reference | Tests 12-4 | Tests 12-4 | Tests 12-4 |
| Zero reading at analyser | 0 mg/m³ | 0.00% | 0.0 ppm |
| Span reading at analyser | 1026 mg/m³ | 20.96% | 53.5 ppm |
| Zero check down line | 0 mg/m³ | 0.20% | 0.0 ppm |
| Span check down line | 1021 mg/m³ | 20.96% | 53.2 ppm |
| Type of Check | Post-testing calibration | | |
| Date of Check | 25/07/2013 | 25/07/2013 | 25/07/2013 |
| Time of Check | 11:10 | 11:10 | 11:10 |
| Test Reference | Tests 12-4 | Tests 12-4 | Tests 12-4 |
| Zero in air at analyser | 0 mg/m³ | 0.00% | 0.3 ppm |
| Span in air at analyser | 1027 mg/m³ | 21.02% | 54.1 ppm |

**Calibration Gases**

| Gas | Supplier | Cylinder No. | Nominal Conc. | Certified Conc. | Analytical Tolerance ± % |
|---|---|---|---|---|---|
| Carbon monoxide in Nitrogen | BOC | 147389 | 800 ppm | 817 ppm | 2 |
| Propane in synthetic air | BOC | 137127 | 50 ppm | 53.6 ppm | 2 |
| Oxygen | Fresh air | - | 20.9% | - | - |

## Coventry Cremators 1 & 2 Abatement System Outlet

## Data Log 24/07/13

**Test 12 - 2**

| Time | Flue Gas °C | Meter °C | Flue Oxygen %v/v dry | CO mg/Nm³ c. | VOC mg/Nm³ c. | Pitot Head Pa |
|---|---|---|---|---|---|---|
| | | | | | | |
| 14:27 | 133 | 52.6 | 14.95 | 0.00 | 0.00 | 71.0 |
| 14:28 | 133 | 52.4 | 15.50 | 0.00 | 0.00 | 82.3 |
| 14:29 | 134 | 52.3 | 15.65 | 0.00 | 0.00 | 83.2 |
| 14:30 | 134 | 52.0 | 14.40 | 0.00 | 0.00 | 81.9 |
| 14:31 | 135 | 52.0 | 13.65 | 0.00 | 0.00 | 91.6 |
| 14:32 | 135 | 51.7 | 14.10 | 0.00 | 0.00 | 85.7 |
| 14:33 | 135 | 51.6 | 14.00 | 0.00 | 0.00 | 73.1 |
| 14:34 | 135 | 51.6 | 13.85 | 0.00 | 0.00 | 74.3 |
| 14:35 | 136 | 51.7 | 13.85 | 0.00 | 0.00 | 75.2 |
| 14:36 | 136 | 51.6 | 13.95 | 0.00 | 0.00 | 78.5 |
| 14:37 | 136 | 51.4 | 14.00 | 0.00 | 0.00 | 73.1 |
| 14:38 | 136 | 51.3 | 13.85 | 0.00 | 0.00 | 72.7 |
| 14:39 | 137 | 51.2 | 13.85 | 0.00 | 0.01 | 79.0 |
| 14:40 | 137 | 51.0 | 13.90 | 0.00 | 0.00 | 78.1 |
| 14:41 | 137 | 50.9 | 13.80 | 0.00 | 0.00 | 77.3 |
| 14:42 | 138 | 50.8 | 13.95 | 0.00 | 0.00 | 95.3 |
| 14:43 | 139 | 50.6 | 14.30 | 0.00 | 0.00 | 105.8 |
| 14:44 | 140 | 50.6 | 14.35 | 0.00 | 0.00 | 107.9 |
| 14:45 | 141 | 50.6 | 14.40 | 0.00 | 0.00 | 111.3 |
| 14:46 | 142 | 50.5 | 14.50 | 0.00 | 0.00 | 113.8 |
| 14:47 | 143 | 50.4 | 14.50 | 0.00 | 0.00 | 131.5 |
| 14:48 | 146 | 50.2 | 14.75 | 0.00 | 0.00 | 161.7 |
| 14:49 | 147 | 50.2 | 15.05 | 0.00 | 0.00 | 151.6 |
| 14:50 | 147 | 50.2 | 15.05 | 0.00 | 0.00 | 146.2 |
| 14:51 | 148 | 50.1 | 14.70 | 0.00 | 0.00 | 152.5 |
| 14:52 | 149 | 50.2 | 14.45 | 0.00 | 0.00 | 137.3 |
| 14:53 | 149 | 50.2 | 14.60 | 0.00 | 0.00 | 136.1 |
| 14:54 | 149 | 50.1 | 14.60 | 0.00 | 0.00 | 130.6 |
| 14:55 | 149 | 50.0 | 14.55 | 0.00 | 0.00 | 124.7 |
| 14:56 | 149 | 50.0 | 14.55 | 0.00 | 0.00 | 112.6 |
| 14:57 | 148 | 50.0 | 14.65 | 0.00 | 0.00 | 108.4 |
| 14:58 | 148 | 50.0 | 14.75 | 0.00 | 0.00 | 94.5 |
| 14:59 | 147 | 50.0 | 14.65 | 0.00 | 0.00 | 80.2 |
| 15:00 | 146 | 50.1 | 14.80 | 0.00 | 0.00 | 74.8 |
| 15:01 | 144 | 50.0 | 14.70 | 0.00 | 0.00 | 58.8 |
| 15:02 | 143 | 50.0 | 14.00 | 0.00 | 0.00 | 47.9 |
| 15:03 | 142 | 50.1 | 13.55 | 0.00 | 0.00 | 46.2 |
| 15:04 | 141 | 50.1 | 13.95 | 0.00 | 0.00 | 51.2 |
| 15:05 | 141 | 50.1 | 15.55 | 0.00 | 0.00 | 74.8 |
| 15:06 | 140 | 50.2 | 16.15 | 7.49 | 0.55 | 65.1 |
| 15:07 | 139 | 50.2 | 15.70 | 0.00 | 0.00 | 51.7 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 15:08 | 138 | 50.2 | 15.00 | 0.00 | 0.00 | 36.5 |
| 15:09 | 137 | 50.3 | 13.65 | 0.00 | 0.00 | 24.4 |
| 15:10 | 136 | 50.4 | 13.75 | 0.00 | 0.00 | 20.2 |
| 15:11 | 135 | 50.4 | 14.50 | 0.00 | 0.00 | 22.7 |
| 15:12 | 135 | 50.5 | 15.00 | 0.00 | 0.00 | 27.7 |
| 15:13 | 135 | 50.5 | 15.50 | 0.00 | 0.00 | 23.9 |
| 15:14 | 134 | 50.5 | 14.35 | 0.00 | 0.00 | 17.2 |
| 15:15 | 133 | 50.7 | 12.35 | 0.00 | 0.00 | 11.3 |
| 15:16 | 132 | 50.7 | 12.45 | 0.00 | 0.00 | 10.9 |
| 15:17 | 132 | 50.7 | 14.05 | 0.00 | 0.00 | 16.8 |
| 15:18 | 131 | 50.9 | 14.85 | 0.00 | 0.00 | 16.8 |
| 15:19 | 131 | 50.9 | 14.30 | 0.00 | 0.00 | 14.7 |
| 15:20 | 130 | 51.0 | 12.80 | 0.00 | 0.00 | 11.3 |
| 15:21 | 130 | 51.0 | 12.60 | 0.00 | 0.00 | 9.2 |
| 15:22 | 130 | 51.0 | 13.90 | 0.00 | 0.00 | 9.7 |
| 15:23 | 129 | 51.1 | 14.65 | 0.00 | 0.00 | 10.1 |
| 15:24 | 129 | 51.1 | 14.55 | 0.00 | 0.00 | 11.8 |
| 15:25 | 128 | 51.2 | 13.65 | 0.00 | 0.00 | 13.0 |
| 15:26 | 128 | 51.2 | 13.70 | 0.00 | 0.00 | 10.5 |
| 15:27 | 127 | 51.2 | 15.35 | 0.00 | 0.00 | 11.8 |
| | | | | | | |
| **Average** | **138** | **50.8** | **14.34** | **0.12** | **0.01** | **68.5** |

| | | |
|---|---|---|
| Average for first 30 mins of test | **0.00** | - |
| Average for second 30 mins of test | **0.25** | - |
| Average for first 60 mins of test | **0.12** | **0.01** |

## Coventry Cremators 1 & 2 Abatement System Outlet

## Data Log 24/07/13

**Test 12 - 3**

| Time | Flue Gas °C | Meter °C | Flue Oxygen %v/v dry | CO mg/Nm³ c. | VOC mg/Nm³ c. | Sample Point Pa |
|---|---|---|---|---|---|---|
| | | | | | | |
| 15:40 | 129 | 52.7 | 15.70 | 0.00 | 0.00 | 71.4 |
| 15:41 | 129 | 52.7 | 15.60 | 0.00 | 0.00 | 63.8 |
| 15:42 | 128 | 52.7 | 15.60 | 0.00 | 0.00 | 60.9 |
| 15:43 | 128 | 52.7 | 15.60 | 0.00 | 0.00 | 59.2 |
| 15:44 | 129 | 52.7 | 15.60 | 0.00 | 0.00 | 65.5 |
| 15:45 | 130 | 52.7 | 14.80 | 0.00 | 0.00 | 70.1 |
| 15:46 | 131 | 52.8 | 15.40 | 0.00 | 0.00 | 71.0 |
| 15:47 | 131 | 52.8 | 15.80 | 0.00 | 0.00 | 56.7 |
| 15:48 | 130 | 52.8 | 15.20 | 0.00 | 0.00 | 47.9 |
| 15:49 | 130 | 52.9 | 13.60 | 0.00 | 0.00 | 42.0 |
| 15:50 | 129 | 52.9 | 15.60 | 0.00 | 0.00 | 43.3 |
| 15:51 | 129 | 52.9 | 14.50 | 0.00 | 0.00 | 60.5 |
| 15:52 | 129 | 52.9 | 14.20 | 0.00 | 0.00 | 44.5 |
| 15:53 | 128 | 52.9 | 12.70 | 0.00 | 0.00 | 33.2 |
| 15:54 | 128 | 52.9 | 15.70 | 0.00 | 0.00 | 32.8 |
| 15:55 | 128 | 53.0 | 14.20 | 0.00 | 0.00 | 32.8 |
| 15:56 | 128 | 53.0 | 14.10 | 0.00 | 0.00 | 26.5 |
| 15:57 | 128 | 53.0 | 14.30 | 0.29 | 0.00 | 25.6 |
| 15:58 | 127 | 53.0 | 12.90 | 6.88 | 0.63 | 24.4 |
| 15:59 | 127 | 53.1 | 14.60 | 0.00 | 0.00 | 24.8 |
| 16:00 | 127 | 53.1 | 14.00 | 0.63 | 0.12 | 35.7 |
| 16:01 | 127 | 53.1 | 13.70 | 0.00 | 0.00 | 29.4 |
| 16:02 | 127 | 53.1 | 13.30 | 0.00 | 0.00 | 23.9 |
| 16:03 | 127 | 53.1 | 14.90 | 3.38 | 0.30 | 19.3 |
| 16:04 | 126 | 53.1 | 13.50 | 1.81 | 0.00 | 16.4 |
| 16:05 | 126 | 53.1 | 16.00 | 0.00 | 0.00 | 18.5 |
| 16:06 | 126 | 53.2 | 16.60 | 0.00 | 0.00 | 21.8 |
| 16:07 | 126 | 53.2 | 16.80 | 0.00 | 0.00 | 20.6 |
| 16:08 | 125 | 53.2 | 14.90 | 0.00 | 0.00 | 21.0 |
| 16:09 | 125 | 53.2 | 14.30 | 4.28 | 0.12 | 20.2 |
| 16:10 | 125 | 53.3 | 15.40 | 0.00 | 0.00 | 15.1 |
| 16:11 | 125 | 53.3 | 17.30 | 0.00 | 0.00 | 16.4 |
| 16:12 | 125 | 53.3 | 17.30 | 0.00 | 0.00 | 20.6 |
| 16:13 | 125 | 53.2 | 15.00 | 0.00 | 0.00 | 28.6 |
| 16:14 | 125 | 53.3 | 17.60 | 0.00 | 0.00 | 25.2 |
| 16:15 | 125 | 53.3 | 18.60 | 0.00 | 0.00 | 29.4 |
| 16:16 | 124 | 53.3 | 18.90 | 0.00 | 0.00 | 36.5 |
| 16:17 | 125 | 53.3 | 18.10 | 56.30 | 4.86 | 52.9 |
| 16:18 | 126 | 53.3 | 17.40 | 378.10 | 34.45 | 50.8 |
| 16:19 | 126 | 53.4 | 16.60 | 11.21 | 1.53 | 32.8 |
| 16:20 | 126 | 53.4 | 16.80 | 0.00 | 0.00 | 30.7 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 16:21 | 126 | 53.4 | 17.10 | 0.00 | 0.00 | 31.9 |
| 16:22 | 125 | 53.4 | 17.30 | 0.00 | 0.00 | 30.2 |
| 16:23 | 125 | 53.4 | 17.40 | 0.00 | 0.00 | 30.7 |
| 16:24 | 125 | 53.4 | 17.60 | 0.00 | 0.00 | 31.1 |
| 16:25 | 125 | 53.4 | 17.70 | 0.00 | 0.00 | 33.6 |
| 16:26 | 125 | 53.5 | 15.90 | 0.00 | 0.00 | 37.4 |
| 16:27 | 125 | 53.5 | 17.40 | 0.00 | 0.00 | 36.5 |
| 16:28 | 126 | 53.5 | 17.40 | 0.00 | 0.00 | 35.7 |
| 16:29 | 126 | 53.5 | 17.50 | 0.00 | 0.00 | 36.1 |
| 16:30 | 126 | 53.6 | 17.60 | 0.00 | 0.00 | 37.4 |
| 16:31 | 126 | 53.6 | 17.60 | 0.00 | 0.00 | 36.5 |
| 16:32 | 126 | 53.6 | 17.60 | 0.00 | 0.00 | 35.7 |
| 16:33 | 126 | 53.6 | 16.20 | 0.00 | 0.00 | 34.4 |
| 16:34 | 126 | 53.6 | 17.60 | 0.00 | 0.00 | 34.0 |
| 16:35 | 125 | 53.6 | 17.70 | 0.00 | 0.00 | 34.0 |
| 16:36 | 126 | 53.6 | 16.60 | 0.00 | 0.00 | 34.0 |
| 16:37 | 126 | 53.6 | 16.20 | 0.00 | 0.00 | 33.6 |
| 16:38 | 126 | 53.7 | 17.70 | 0.00 | 0.00 | 33.6 |
| 16:39 | 126 | 53.7 | 17.70 | 0.00 | 0.00 | 33.2 |
| 16:40 | 126 | 53.6 | 12.44 | 0.00 | 0.00 | 34.9 |
| | | | | | | |
| **Average** | **127** | **53.2** | **15.95** | **7.59** | **0.69** | **36.2** |

| | | |
|---|---|---|
| Average for first 30 mins of test | **0.56** | - |
| Average for second 30 mins of test | **14.85** | - |
| Average for first 60 mins of test | **7.59** | **0.69** |

## Coventry Cremators 1 & 2 Abatement System Outlet

## Data Log 25/07/13

**Test 12 - 4**

z

| Time | Flue Gas °C | Meter °C | Flue Oxygen %v/v dry | CO mg/Nm³ c. | VOC mg/Nm³ c. | Sample Point Pa |
|---|---|---|---|---|---|---|
| | | | | | | |
| 09:56 | 101 | 26.1 | 13.35 | 1.32 | 0.00 | 70.6 |
| 09:57 | 102 | 26.3 | 12.65 | 0.12 | 0.00 | 65.1 |
| 09:58 | 102 | 26.6 | 12.35 | 0.00 | 0.00 | 60.1 |
| 09:59 | 103 | 26.9 | 12.35 | 0.00 | 0.00 | 63.4 |
| 10:00 | 104 | 27.2 | 12.65 | 0.00 | 0.00 | 69.7 |
| 10:01 | 106 | 27.6 | 12.55 | 0.00 | 0.00 | 69.3 |
| 10:02 | 108 | 28.0 | 12.25 | 0.00 | 0.00 | 74.3 |
| 10:03 | 110 | 28.4 | 12.75 | 0.00 | 0.00 | 91.6 |
| 10:04 | 113 | 28.9 | 12.85 | 0.49 | 0.00 | 94.5 |
| 10:05 | 113 | 29.3 | 13.45 | 1.34 | 0.00 | 78.5 |
| 10:06 | 114 | 29.8 | 12.95 | 0.13 | 0.00 | 79.4 |
| 10:07 | 114 | 30.2 | 12.85 | 0.00 | 0.00 | 75.6 |
| 10:08 | 114 | 30.6 | 12.65 | 0.00 | 0.00 | 73.1 |
| 10:09 | 115 | 31.1 | 12.65 | 0.00 | 0.00 | 84.0 |
| 10:10 | 116 | 31.6 | 12.75 | 0.61 | 0.00 | 93.2 |
| 10:11 | 118 | 32.0 | 13.15 | 1.54 | 0.00 | 88.6 |
| 10:12 | 119 | 32.5 | 13.05 | 1.27 | 0.00 | 81.9 |
| 10:13 | 120 | 32.9 | 12.85 | 0.37 | 0.00 | 78.5 |
| 10:14 | 121 | 33.3 | 12.95 | 0.38 | 0.00 | 93.2 |
| 10:15 | 121 | 33.8 | 13.05 | 0.00 | 0.00 | 85.7 |
| 10:16 | 121 | 34.2 | 13.05 | 0.00 | 0.00 | 79.8 |
| 10:17 | 121 | 34.7 | 12.85 | 0.00 | 0.00 | 80.2 |
| 10:18 | 121 | 35.1 | 14.15 | 0.00 | 0.00 | 72.2 |
| 10:19 | 121 | 35.6 | 13.25 | 0.00 | 0.00 | 77.7 |
| 10:20 | 122 | 36.0 | 12.85 | 0.00 | 0.00 | 78.1 |
| 10:21 | 123 | 36.4 | 13.15 | 0.00 | 0.00 | 68.9 |
| 10:22 | 123 | 36.7 | 12.75 | 0.00 | 0.00 | 53.3 |
| 10:23 | 122 | 37.1 | 12.45 | 0.00 | 0.00 | 44.9 |
| 10:24 | 122 | 37.5 | 13.75 | 0.00 | 0.00 | 48.7 |
| 10:25 | 122 | 37.9 | 12.95 | 0.00 | 0.00 | 48.3 |
| 10:26 | 122 | 38.2 | 13.25 | 0.00 | 0.00 | 68.5 |
| 10:27 | 123 | 38.6 | 12.95 | 10.01 | 0.36 | 66.4 |
| 10:28 | 123 | 39.0 | 13.05 | 39.67 | 2.79 | 52.5 |
| 10:29 | 123 | 39.3 | 11.05 | 12.83 | 0.63 | 53.3 |
| 10:30 | 124 | 39.6 | 12.15 | 5.12 | 0.11 | 51.2 |
| 10:31 | 125 | 40.0 | 11.35 | 5.31 | 0.00 | 79.4 |
| 10:32 | 127 | 40.3 | 12.55 | 18.83 | 0.91 | 94.5 |
| 10:33 | 127 | 40.7 | 12.75 | 14.16 | 1.01 | 92.4 |
| 10:34 | 127 | 41.0 | 13.15 | 3.98 | 0.00 | 79.0 |
| 10:35 | 126 | 41.2 | 13.35 | 2.77 | 0.00 | 60.9 |
| 10:36 | 126 | 41.5 | 12.05 | 0.67 | 0.00 | 44.5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 10:37 | 125 | 41.8 | 11.55 | 0.11 | 0.00 | 43.3 |
| 10:38 | 125 | 42.0 | 10.85 | 0.00 | 0.00 | 44.1 |
| 10:39 | 125 | 42.3 | 10.65 | 0.00 | 0.00 | 47.5 |
| 10:40 | 125 | 42.6 | 10.65 | 0.00 | 0.00 | 47.9 |
| 10:41 | 125 | 42.8 | 11.95 | 3.34 | 0.00 | 49.1 |
| 10:42 | 125 | 43.1 | 10.75 | 2.35 | 0.00 | 55.4 |
| 10:43 | 126 | 43.3 | 11.25 | 0.00 | 0.00 | 60.5 |
| 10:44 | 126 | 43.5 | 11.65 | 0.00 | 0.00 | 61.3 |
| 10:45 | 127 | 43.7 | 11.75 | 0.00 | 0.00 | 58.8 |
| 10:46 | 127 | 43.9 | 12.05 | 0.00 | 0.00 | 59.2 |
| 10:47 | 127 | 44.2 | 11.85 | 0.00 | 0.00 | 51.7 |
| 10:48 | 126 | 44.4 | 13.15 | 15.79 | 1.32 | 50.0 |
| 10:49 | 127 | 44.6 | 11.75 | 1.30 | 0.00 | 57.5 |
| 10:50 | 126 | 44.8 | 11.95 | 0.00 | 0.00 | 48.3 |
| 10:51 | 126 | 44.9 | 13.15 | 4.62 | 0.11 | 47.5 |
| 10:52 | 126 | 45.0 | 11.85 | 0.00 | 0.00 | 60.9 |
| 10:53 | 126 | 45.2 | 12.45 | 0.00 | 0.00 | 50.4 |
| 10:54 | 126 | 45.4 | 13.85 | 2.96 | 0.00 | 37.4 |
| 10:55 | 125 | 45.5 | 13.35 | 3.03 | 0.00 | 44.9 |
| 10:56 | 125 | 45.6 | 12.45 | 0.00 | 0.00 | 37.0 |
| | | | | | | |
| **Average** | **120** | **37.3** | **12.52** | **2.53** | **0.12** | **65.2** |

| | | |
|---|---|---|
| Average for first 30 mins of test | **0.24** | - |
| Average for second 30 mins of test | **4.90** | - |
| Average for first 60 mins of test | **2.53** | **0.12** |

## Coventry Cremators 1 & 2 Abatement System Outlet

## Total Particulate Matter and Hydrogen Chloride

| | |
|---|---|
| Contract | Coventry Crematorium, DEM0657 |
| Date | 24-25th July 2013 |
| Location | Cremators 1&2 Flue Gas Abatement System Outlet |
| Engineer(s) | JB |
| Absorbent | $H_2O$ |

| **Test Log** | **Test 12 - 2** | | **Test 12 - 3** | | **Test 12 - 4** | |
|---|---|---|---|---|---|---|
| Barometric Pressure(kPa) | 101.8 | | 101.8 | | 101.8 | |
| Gas Meter Temperature(Deg C) | 50.8 | | 53.2 | | 37.3 | |
| Oxygen Concentration(%v/v dry) | 14.34 | | 15.95 | | 12.52 | |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 2698 | | 1986 | | 2698 | |
| | Start | End | Start | End | Start | End |
| Time | 14:27 | 15:27 | 15:40 | 16:40 | 09:56 | 10:56 |
| Gas Meter Reading($Am^3$ dry) | 376.954 | 377.624 | 377.644 | 378.181 | 378.259 | 378.856 |
| Absorber Weight(g) | 3254.1 | 3294.2 | 3215.4 | 3247.8 | 3219.2 | 3255.1 |
| Filter Reference | CO240713F1,2-2 | | CO240713F1,2-3 | | CO250713F1,2-4 | |
| Filter Weight(g) | 0.53915 | 0.53927 | 0.53355 | 0.53355 | 0.53818 | 0.53819 |
| Probe Rinse Reference | CO240713R1&2 | | CO240713R1&2 | | CO250713R1&2 | |
| Probe Rinse Weight(g) | 77.6598 | 77.6599 | 77.6599 | 77.6599 | 77.6599 | 77.6599 |
| Sample Reference HCl | CO240713H12-2 | | CO240713H12-3 | | CO250713H12-4 A&B | |
| Absorbent Volume(ml) | 500 | | 500 | | 250 | 250 |
| Absorbent(mg/l as HCl) | 13 | | 15 | | 14 | 0.08 |
| Blank(mg/l as HCl) | 1.20 | | 1.20 | | 1.2 | 1.2 |

**Calculation: General**

| | | | |
|---|---|---|---|
| Barometric Pressure(kPa) | 101.8 | 101.8 | 101.8 |
| Gas Meter temperature(Deg C) | 50.8 | 53.2 | 37.3 |
| Gas Volume Sampled($Am^3$ dry) | 0.670 | 0.537 | 0.597 |
| Gas Volume Sampled($Nm^3$ dry) | 0.5677 | 0.4516 | 0.5279 |
| Mass of Dry Gas(g @ 1292.8 g/$Nm^3$) | 733.98 | 583.86 | 682.49 |
| Change in Absorber Weight(g) | 40.1 | 32.4 | 35.9 |
| Water Vapour Volume($Nm^3$ @ 803.9 g/$Nm^3$) | 0.0499 | 0.0403 | 0.0447 |
| Gas Volume($Nm^3$ wet) | 0.6176 | 0.4919 | 0.5726 |
| Mass of Wet Gas(g) | 774.08 | 616.26 | 718.39 |
| **Moisture Concentration(%v/v)** | **8.1** | **8.2** | **7.8** |
| **Moisture Concentration(%w/w)** | **5.2** | **5.3** | **5.0** |

**Calculation: Particulate**

| | | | |
|---|---|---|---|
| Increase In Filter Weights(g) | 0.00021 | 0.00000 | 0.00002 |
| Particulate Emission(mg/$Nm^3$ dry) | 0.37 | 0.00 | 0.03 |
| Oxygen Concentration(%v/v dry) | 14.34 | 15.95 | 12.52 |
| **Particulate Emission** | **0.56** | **0.00** | **0.04** |
| **(mg/$Nm^3$ @ 11 %v/v Oxygen dry)** | | | |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 2698 | 1986 | 2698 |
| **Particulate Emission(g/h)** | **1.01** | **0.00** | **0.09** |
| | | | |
| Required Sample Velocity(Nm/s) | 7.79 | 5.73 | 7.79 |
| Nozzle Used(mm) | 5.0 | 5.0 | 5.0 |
| Area of Nozzle($m^2$) | 0.00001963 | 0.00001963 | 0.00001963 |
| Test Duration(mins) | 60 | 60 | 60 |
| Actual Sample Velocity(Nm/s) | 8.03 | 6.39 | 7.47 |
| Isokinetic Closure(%) | 103 | 111 | 96 |
| | | 103 | |

**Calculation: HCl**

| | | | |
|---|---|---|---|
| Absorbent(mg/l as HCl) | 13.00 | 15.00 | 14.08 |
| Blank(mg/l as HCl) | 1.2 | 1.2 | 1.2 |
| Chloride Absorbed(mg/l as HCl) | 11.8 | 13.8 | 12.88 |
| Chloride Absorbed(mg as HCl) | 5.90 | 6.90 | 3.22 |
| HCl(mg) | 5.90 | 6.90 | 3.22 |
| HCl Emission(mg/$Nm^3$ dry) | 10.39 | 15.28 | 6.10 |
| Oxygen Concentration(%v/v dry) | 14.34 | 15.95 | 12.52 |
| **HCl Emission** | **15.65** | **30.40** | **7.20** |
| **(mg/$Nm^3$ @ 11 %v/v Oxygen dry)** | | | |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 2698 | 1986 | 2698 |
| **HCl Emission(g/h)** | **28.04** | **30.35** | **16.46** |

## Coventry Cremators 1 & 2 Abatement System Outlet

## Flue Gas Volumetric Flow

| | |
|---|---|
| Contract | Coventry Crematorium, DEM0657 |
| Date | 24-25th July 2013 |
| Location | Cremators 1&2 Flue Gas Abatement System Outlet |
| Engineer(s) | JB |

| **Test Log** | **Test 12 - 2** | **Test 12 - 3** | **Test 12 - 4** |
|---|---|---|---|
| Flue Gas Temperature(Deg C) | 138 | 127 | 120 |
| Flue Gas Pitot Head Sample Points(Pa) | 68.5 | 36.2 | 65.2 |
| Flue Gas Pitot Head Duct Mean(Pa) | 68.5 | 36.2 | 65.2 |
| Flue Gas Moisture(%v/v) | 8.1 | 8.2 | 7.8 |
| Flue Gas Moisture(%w/w) | 5.2 | 5.3 | 5.0 |
| Flue Gas Duct Dimensions(mm) | 350 mm Diameter Circular Stack | | |
| Flue Gas Duct Area($m^2$) | 0.0962 | | |
| **Calculation** | | | |
| Flue Gas Density($kg/m^3$) | 0.8417 | 0.8657 | 0.8805 |
| Flue Gas Velocity(Am/s) | 12.76 | 9.14 | 12.17 |
| Flue Gas Volumetric Flowrate($Am^3/h$) | 4419 | 3167 | 4215 |
| Flue Gas Volumetric Flowrate($Am^3/h$ dry) | 4063 | 2907 | 3887 |
| **Flue Gas Volumetric Flowrate($Nm^3/h$ dry)** | **2698** | **1986** | **2698** |

## Coventry Cremators 1 & 2 Abatement System Outlet

**Data Log** **24/07/13**

**Test 12 - 1**

| Time | Flue Gas °C | Meter °C | Flue $O_2$ %v/v dry | Pitot Head Pa |
|---|---|---|---|---|
| | | | | |
| 10:46 | 118 | 26.6 | 10.20 | 37.4 |
| 10:47 | 118 | 26.8 | 10.60 | 37.0 |
| 10:48 | 118 | 27.0 | 10.00 | 44.1 |
| 10:49 | 119 | 27.4 | 8.20 | 50.0 |
| 10:50 | 120 | 27.9 | 11.30 | 55.9 |
| 10:51 | 121 | 28.4 | 12.70 | 62.2 |
| 10:52 | 122 | 29.0 | 14.60 | 82.7 |
| 10:53 | 123 | 29.5 | 12.70 | 81.1 |
| 10:54 | 123 | 30.0 | 11.90 | 69.7 |
| 10:55 | 123 | 30.5 | 15.30 | 71.8 |
| 10:56 | 123 | 31.1 | 13.80 | 76.0 |
| 10:57 | 123 | 31.6 | 12.30 | 76.4 |
| 10:58 | 123 | 32.1 | 12.40 | 73.9 |
| 10:59 | 124 | 32.6 | 14.30 | 86.9 |
| 11:00 | 126 | 33.1 | 13.70 | 100.0 |
| 11:01 | 127 | 33.6 | 13.00 | 99.5 |
| 11:02 | 128 | 34.0 | 13.90 | 99.5 |
| 11:03 | 128 | 34.4 | 14.40 | 88.6 |
| 11:04 | 128 | 34.9 | 13.30 | 101.6 |
| 11:05 | 128 | 35.4 | 13.10 | 98.7 |
| 11:06 | 128 | 35.8 | 14.60 | 93.7 |
| 11:07 | 128 | 36.3 | 12.70 | 104.6 |
| 11:08 | 128 | 36.7 | 11.00 | 96.6 |
| 11:09 | 129 | 37.1 | 11.60 | 83.6 |
| 11:10 | 128 | 37.5 | 12.10 | 70.6 |
| 11:11 | 128 | 37.8 | 11.90 | 70.1 |
| 11:12 | 128 | 38.2 | 10.50 | 61.3 |
| 11:13 | 128 | 38.6 | 11.50 | 65.5 |
| 11:14 | 128 | 38.9 | 10.80 | 73.5 |
| 11:15 | 129 | 39.3 | 13.00 | 101.6 |
| 11:16 | 129 | 39.6 | 11.80 | 74.8 |
| 11:17 | 128 | 39.9 | 11.20 | 55.0 |
| 11:18 | 128 | 40.2 | 10.90 | 48.7 |
| 11:19 | 128 | 40.5 | 10.70 | 47.5 |
| 11:20 | 128 | 40.8 | 11.00 | 53.8 |
| 11:21 | 128 | 41.1 | 11.80 | 54.6 |
| 11:22 | 128 | 41.3 | 12.20 | 57.5 |
| 11:23 | 128 | 41.6 | 13.30 | 60.5 |
| 11:24 | 129 | 41.9 | 14.80 | 92.4 |
| 11:25 | 129 | 42.1 | 12.90 | 70.1 |
| 11:26 | 128 | 42.4 | 11.50 | 65.5 |

| | | | | |
|---|---|---|---|---|
| 11:27 | 129 | 42.7 | 13.10 | 78.1 |
| 11:28 | 129 | 43.0 | 11.50 | 73.1 |
| 11:29 | 130 | 43.2 | 13.10 | 84.8 |
| 11:30 | 130 | 43.4 | 11.70 | 76.0 |
| 11:31 | 130 | 43.7 | 12.30 | 79.0 |
| 11:32 | 131 | 43.9 | 12.90 | 97.0 |
| 11:33 | 132 | 44.1 | 13.60 | 102.5 |
| 11:34 | 131 | 44.2 | 12.30 | 83.2 |
| 11:35 | 131 | 44.4 | 12.50 | 81.9 |
| 11:36 | 131 | 44.6 | 13.50 | 91.6 |
| 11:37 | 131 | 44.8 | 13.80 | 75.6 |
| 11:38 | 130 | 45.0 | 12.50 | 53.8 |
| 11:39 | 129 | 45.2 | 11.90 | 44.5 |
| 11:40 | 129 | 45.4 | 12.00 | 52.9 |
| 11:41 | 129 | 45.5 | 11.30 | 50.8 |
| 11:42 | 129 | 45.6 | 12.90 | 50.0 |
| 11:43 | 128 | 45.7 | 12.30 | 39.1 |
| 11:44 | 129 | 45.9 | 12.70 | 48.7 |
| 11:45 | 129 | 46.0 | 12.30 | 49.1 |
| 11:46 | 129 | 46.2 | 12.70 | 56.7 |
| 11:47 | 129 | 46.3 | 13.30 | 63.8 |
| 11:48 | 129 | 46.5 | 13.50 | 64.7 |
| 11:49 | 129 | 46.6 | 13.70 | 62.6 |
| 11:50 | 129 | 46.7 | 14.00 | 64.7 |
| 11:51 | 129 | 46.8 | 15.90 | 71.8 |
| 11:52 | 128 | 46.9 | 16.90 | 53.3 |
| 11:53 | 128 | 47.0 | 16.00 | 40.7 |
| 11:54 | 127 | 47.2 | 12.40 | 32.3 |
| 11:55 | 127 | 47.3 | 11.20 | 37.0 |
| 11:56 | 127 | 47.5 | 12.50 | 31.5 |
| 11:57 | 127 | 47.5 | 12.50 | 31.5 |
| 11:58 | 127 | 47.6 | 11.70 | 37.8 |
| 11:59 | 127 | 47.7 | 15.00 | 38.2 |
| 12:00 | 127 | 47.6 | 12.60 | 36.5 |
| 12:01 | 127 | 47.7 | 14.00 | 38.2 |
| 12:02 | 126 | 47.8 | 14.60 | 31.1 |
| 12:03 | 126 | 47.7 | 11.70 | 42.0 |
| 12:04 | 126 | 47.7 | 12.80 | 39.1 |
| 12:05 | 127 | 47.7 | 12.20 | 45.8 |
| 12:06 | 128 | 47.7 | 13.60 | 55.4 |
| 12:07 | 129 | 47.7 | 14.00 | 77.3 |
| 12:08 | 129 | 47.7 | 15.20 | 77.7 |
| 12:09 | 128 | 47.6 | 14.40 | 57.5 |
| 12:10 | 128 | 47.5 | 13.90 | 47.0 |
| 12:11 | 127 | 47.5 | 13.80 | 44.5 |
| 12:12 | 128 | 47.6 | 15.00 | 80.2 |
| 12:13 | 130 | 47.6 | 16.20 | 119.3 |
| 12:14 | 131 | 47.7 | 15.40 | 96.6 |
| 12:15 | 131 | 47.7 | 15.60 | 81.5 |
| 12:16 | 132 | 47.7 | 12.20 | 81.1 |

| | | | | |
|---|---|---|---|---|
| 12:17 | 131 | 47.6 | 12.80 | 60.5 |
| 12:18 | 130 | 47.7 | 11.50 | 47.0 |
| 12:19 | 129 | 47.7 | 12.00 | 41.6 |
| 12:20 | 129 | 47.8 | 11.10 | 42.0 |
| 12:21 | 129 | 47.8 | 12.40 | 53.8 |
| 12:22 | 129 | 47.8 | 10.80 | 54.6 |
| 12:23 | 129 | 47.8 | 12.10 | 55.9 |
| 12:24 | 130 | 47.8 | 11.90 | 56.3 |
| 12:25 | 131 | 47.8 | 11.50 | 71.4 |
| 12:26 | 132 | 47.7 | 14.00 | 107.9 |
| 12:27 | 133 | 47.7 | 12.80 | 105.8 |
| 12:28 | 132 | 47.8 | 12.40 | 80.6 |
| 12:29 | 132 | 47.8 | 11.50 | 71.8 |
| 12:30 | 132 | 47.9 | 13.70 | 82.3 |
| 12:31 | 132 | 47.9 | 14.10 | 86.5 |
| 12:32 | 132 | 48.0 | 12.70 | 84.4 |
| 12:33 | 132 | 48.0 | 13.00 | 68.0 |
| 12:34 | 131 | 48.0 | 13.00 | 65.1 |
| 12:35 | 131 | 48.0 | 12.00 | 59.6 |
| 12:36 | 130 | 48.0 | 12.50 | 48.7 |
| 12:37 | 130 | 48.0 | 11.10 | 47.5 |
| 12:38 | 129 | 48.0 | 12.10 | 37.0 |
| 12:39 | 129 | 48.0 | 10.40 | 43.3 |
| 12:40 | 129 | 48.0 | 12.00 | 37.8 |
| 12:41 | 129 | 48.0 | 11.20 | 45.8 |
| 12:42 | 129 | 48.1 | 11.80 | 44.5 |
| 12:43 | 130 | 48.1 | 13.50 | 63.0 |
| 12:44 | 130 | 48.0 | 13.10 | 75.2 |
| 12:45 | 130 | 48.0 | 13.10 | 57.5 |
| 12:46 | 129 | 48.0 | 13.50 | 42.8 |
| 12:47 | 129 | 48.0 | 14.90 | 53.3 |
| 12:48 | 129 | 48.0 | 15.40 | 65.9 |
| 12:49 | 128 | 48.1 | 16.30 | 52.9 |
| 12:50 | 128 | 48.1 | 14.60 | 49.6 |
| 12:51 | 130 | 48.2 | 14.20 | 89.9 |
| 12:52 | 132 | 48.2 | 14.90 | 81.9 |
| 12:53 | 131 | 48.3 | 14.90 | 55.4 |
| 12:54 | 130 | 48.4 | 14.50 | 42.8 |
| 12:55 | 130 | 48.4 | 14.50 | 40.3 |
| 12:56 | 129 | 48.4 | 13.90 | 42.0 |
| 12:57 | 129 | 48.5 | 13.50 | 47.5 |
| 12:58 | 129 | 48.6 | 14.20 | 49.6 |
| 12:59 | 129 | 48.5 | 14.10 | 47.5 |
| 13:00 | 130 | 48.6 | 13.90 | 66.8 |
| 13:01 | 131 | 48.6 | 14.60 | 77.7 |
| 13:02 | 132 | 48.6 | 14.90 | 77.7 |
| 13:03 | 132 | 48.6 | 14.10 | 79.0 |
| 13:04 | 133 | 48.7 | 14.40 | 82.7 |
| 13:05 | 133 | 48.7 | 14.60 | 84.4 |
| 13:06 | 133 | 48.7 | 14.80 | 86.1 |

| | | | | |
|---|---|---|---|---|
| 13:07 | 133 | 48.7 | 14.50 | 86.1 |
| 13:08 | 134 | 48.7 | 15.90 | 87.4 |
| 13:09 | 134 | 48.8 | 16.30 | 99.5 |
| 13:10 | 134 | 48.8 | 16.50 | 105.4 |
| 13:11 | 134 | 48.9 | 16.60 | 101.2 |
| 13:12 | 134 | 48.9 | 16.60 | 97.9 |
| 13:13 | 134 | 48.9 | 16.20 | 97.4 |
| 13:14 | 134 | 48.9 | 16.40 | 101.6 |
| 13:15 | 133 | 49.0 | 15.40 | 96.2 |
| 13:16 | 133 | 49.0 | 16.50 | 86.9 |
| 13:17 | 133 | 49.0 | 16.80 | 91.6 |
| 13:18 | 133 | 49.0 | 16.90 | 92.8 |
| 13:19 | 132 | 49.0 | 15.80 | 88.6 |
| 13:20 | 132 | 49.1 | 16.10 | 77.7 |
| 13:21 | 131 | 49.1 | 16.00 | 74.3 |
| 13:22 | 131 | 49.0 | 17.10 | 81.9 |
| 13:23 | 132 | 49.0 | 17.40 | 90.7 |
| 13:24 | 132 | 49.0 | 16.20 | 83.6 |
| 13:25 | 131 | 49.0 | 16.10 | 62.6 |
| 13:26 | 130 | 49.0 | 14.00 | 52.9 |
| 13:27 | 129 | 49.1 | 14.90 | 34.0 |
| 13:28 | 128 | 49.1 | 12.50 | 23.9 |
| 13:29 | 128 | 49.1 | 15.40 | 18.5 |
| 13:30 | 127 | 49.0 | 19.90 | 22.3 |
| 13:31 | 128 | 49.1 | 13.70 | 22.3 |
| 13:32 | 127 | 49.0 | 13.20 | 17.2 |
| 13:33 | 127 | 49.0 | 13.40 | 22.3 |
| 13:34 | 127 | 49.0 | 14.00 | 24.4 |
| 13:35 | 126 | 49.0 | 15.80 | 37.4 |
| 13:36 | 126 | 49.0 | 17.00 | 47.5 |
| 13:37 | 127 | 49.1 | 15.70 | 56.7 |
| 13:38 | 127 | 49.1 | 16.20 | 41.6 |
| 13:39 | 127 | 49.2 | 16.50 | 51.7 |
| 13:40 | 128 | 49.3 | 14.00 | 59.6 |
| 13:41 | 128 | 49.3 | 12.80 | 46.6 |
| 13:42 | 127 | 49.4 | 14.00 | 32.3 |
| 13:43 | 127 | 49.4 | 13.90 | 42.8 |
| 13:44 | 126 | 49.5 | 15.50 | 33.6 |
| 13:45 | 126 | 49.6 | 16.10 | 34.9 |
| 13:46 | 126 | 49.7 | 13.40 | 50.4 |
| 13:47 | 127 | 49.8 | 12.50 | 50.0 |
| 13:48 | 127 | 49.8 | 13.60 | 40.3 |
| 13:49 | 127 | 49.9 | 10.40 | 39.5 |
| 13:50 | 127 | 50.0 | 12.90 | 32.3 |
| 13:51 | 127 | 50.0 | 12.70 | 49.6 |
| 13:52 | 128 | 50.1 | 13.30 | 67.6 |
| 13:53 | 127 | 50.1 | 12.70 | 58.4 |
| 13:54 | 127 | 50.2 | 12.80 | 57.5 |
| 13:55 | 127 | 50.3 | 12.20 | 44.5 |
| 13:56 | 127 | 50.4 | 11.90 | 54.6 |

| | | | | |
|---|---|---|---|---|
| 13:57 | 127 | 50.4 | 12.10 | 48.3 |
| 13:58 | 128 | 50.5 | 13.00 | 58.0 |
| 13:59 | 128 | 50.6 | 13.10 | 47.5 |
| 14:00 | 128 | 50.6 | 12.90 | 39.9 |
| 14:01 | 128 | 50.7 | 13.20 | 54.6 |
| 14:02 | 129 | 50.7 | 14.00 | 60.5 |
| 14:03 | 129 | 50.8 | 14.30 | 69.7 |
| 14:04 | 128 | 50.9 | 14.60 | 58.0 |
| 14:05 | 128 | 51.0 | 14.20 | 47.0 |
| 14:06 | 127 | 51.0 | 13.60 | 38.2 |
| 14:07 | 127 | 51.1 | 13.80 | 35.7 |
| 14:08 | 127 | 51.1 | 13.80 | 46.6 |
| 14:09 | 128 | 51.2 | 14.90 | 45.4 |
| 14:10 | 128 | 51.3 | 14.30 | 40.7 |
| 14:11 | 129 | 51.4 | 15.10 | 53.3 |
| 14:12 | 128 | 51.4 | 15.30 | 41.6 |
| 14:13 | 128 | 51.5 | 15.30 | 53.3 |
| | | | | |
| **Average** | **129** | **45.6** | **13.53** | **62.3** |

## Coventry Cremators 1 & 2 Abatement System Outlet

## Mercury

| | |
|---|---|
| Contract | Coventry Crematorium, DEM0657 |
| Date | 24th July 2013 |
| Location | Cremators 1&2 Flue Gas Abatement System Outlet |
| Engineer(s) | JB |
| Absorbent | 4% $K_2CR_2O_7$ / 20% $HNO_3$ in $H_2O$ |

| **Test Log** | **Test 12 - 1** | |
|---|---|---|
| Barometric Pressure(kPa) | 101.8 | |
| Gas Meter Temperature(Deg C) | 45.6 | |
| Oxygen Concentration(%v/v dry) | 13.53 | |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 2542 | |
| | Start | End |
| Time | 10:46 | 14:13 |
| Gas Meter Reading($Am^3$ dry) | 374.572 | 376.804 |
| Absorber Weight(g) | 3205.8 | 3387.4 |
| Filter Reference | CO240713HgF12-1 | |
| Filter Fraction Analysed | 1 | |
| Filter(µg as Hg) | 0.05 | |
| Filter Blank(µg as Hg) | 0.01 | |
| Probe Rinse Reference | Washed into Hg12-1A | |
| Probe Rinse Volume(ml) | 0 | |
| Probe Rinse(µg/l as Hg) | 0 | |
| Probe Rinse Blank(µg/l as Hg) | 0 | |
| Absorbent Reference | CO240713Hg12-1 A+B | |
| Absorbent Volume(ml) | 300 | 250 |
| Absorbent(µg/l as Hg) | 29 | 0.5 |
| Absorbent Blank(µg/l as Hg) | 0.5 | 0.5 |

**Calculation: General**

| | |
|---|---|
| Barometric Pressure(kPa) | 101.8 |
| Gas Meter Temperature(Deg C) | 45.6 |
| Gas Volume Sampled($Am^3$ dry) | 2.232 |
| Gas Volume Sampled($Nm^3$ dry) | 1.9218 |
| Mass of Dry Gas(g @ 1292.8 g/$Nm^3$) | 2484.45 |
| Change in Absorber Weight(g) | 181.6 |
| Water Vapour Volume($Nm^3$ @ 803.9 g/$Nm^3$) | 0.2259 |
| Gas Volume($Nm^3$ wet) | 2.1477 |
| Mass of Wet Gas(g) | 2666.05 |
| **Moisture Concentration(%v/v)** | **10.5** |
| **Moisture Concentration(%w/w)** | **6.8** |

**Calculation: Mercury**

| | |
|---|---|
| Filter(µg as Hg) | 0.04 |
| Probe Rinse(µg as Hg) | 0.00 |
| Absorbent(µg as Hg) | 8.70 |
| Total Mercury Sampled(µg) | 8.74 |
| Mercury Emission(µg/$Nm^3$ dry) | 4.55 |
| Oxygen Concentration(%v/v dry) | 13.53 |
| **Mercury Emission (µg/$Nm^3$ @ 11 %v/v Oxygen dry)** | **6.10** |
| Flue Gas Volumetric Flowrate($Nm^3$/h dry) | 2542 |
| **Mercury Emission(g/h)** | **0.012** |

| | |
|---|---|
| Required Sample Velocity(Nm/s) | 7.34 |
| Nozzle Used(mm) | 5.0 |
| Area of Nozzle($m^2$) | 0.00001963 |
| Test Duration(mins) | 207 |
| Actual Sample Velocity(Nm/s) | 7.88 |
| Isokinetic Closure(%) | 107 |

## Coventry Cremators 1 & 2 Abatement System Outlet

## Flue Gas Volumetric Flow

| | |
|---|---|
| Contract | Coventry Crematorium, DEM0657 |
| Date | 24th July 2013 |
| Location | Cremators 1&2 Flue Gas Abatement System Outlet |
| Engineer(s) | JB |

| **Test Log** | **Test 12 - 1** |
|---|---|
| Flue Gas Temperature(Deg C) | 129 |
| Flue Gas Pitot Head Sample Points(Pa) | 62.3 |
| Flue Gas Moisture(%v/v) | 10.5 |
| Flue Gas Moisture(%w/w) | 6.8 |
| Flue Gas Duct Dimensions(mm) | 350 mm Diameter Circular Stack |
| Flue Gas Duct Area($m^2$) | 0.0962 |

**Calculation**

| | |
|---|---|
| Flue Gas Density($kg/m^3$) | 0.8562 |
| Flue Gas Velocity(Am/s) | 12.07 |
| Flue Gas Volumetric Flowrate($Am^3/h$) | 4179 |
| Flue Gas Volumetric Flowrate($Am^3/h$ dry) | 3740 |
| **Flue Gas Volumetric Flowrate($Nm^3/h$ dry)** | **2542** |

## Coventry Cremators 3 & 4 Abatement System Outlet

## Data Log 23/07/13

**Test 34 - 1**

| Time | Flue Gas °C | Meter °C | Flue Oxygen %v/v dry | CO mg/Nm³ c. | VOC mg/Nm³ c. | Pitot Head Pa |
|---|---|---|---|---|---|---|
| | | | | | | |
| 08:37 | 80 | 25.3 | 18.25 | 12.49 | 0.00 | 122.2 |
| 08:38 | 81 | 25.5 | 17.10 | 5.24 | 0.00 | 118.4 |
| 08:39 | 82 | 25.8 | 15.65 | 16.21 | 0.00 | 119.7 |
| 08:40 | 82 | 26.1 | 14.95 | 2.60 | 0.00 | 102.9 |
| 08:41 | 83 | 26.5 | 14.55 | 0.64 | 0.00 | 100.8 |
| 08:42 | 85 | 26.9 | 14.80 | 7.60 | 0.00 | 154.1 |
| 08:43 | 87 | 27.3 | 15.60 | 12.81 | 0.00 | 197.4 |
| 08:44 | 88 | 27.8 | 15.90 | 10.85 | 0.00 | 168.0 |
| 08:45 | 88 | 28.3 | 15.75 | 6.38 | 0.00 | 173.0 |
| 08:46 | 88 | 28.8 | 15.65 | 6.06 | 0.00 | 175.6 |
| 08:47 | 88 | 29.3 | 15.50 | 5.95 | 0.00 | 187.7 |
| 08:48 | 89 | 29.9 | 15.45 | 4.66 | 0.00 | 198.7 |
| 08:49 | 91 | 30.4 | 15.45 | 4.38 | 0.00 | 225.1 |
| 08:50 | 93 | 30.9 | 15.45 | 3.59 | 0.00 | 257.0 |
| 08:51 | 95 | 31.4 | 15.60 | 2.92 | 0.00 | 310.4 |
| 08:52 | 96 | 31.9 | 15.75 | 3.98 | 0.00 | 306.6 |
| 08:53 | 96 | 32.3 | 15.85 | 2.51 | 0.00 | 246.5 |
| 08:54 | 96 | 32.8 | 15.85 | 1.38 | 0.00 | 256.2 |
| 08:55 | 96 | 33.2 | 15.80 | 1.35 | 0.00 | 289.8 |
| 08:56 | 96 | 33.7 | 15.80 | 2.51 | 0.00 | 257.0 |
| 08:57 | 96 | 34.1 | 16.20 | 1.74 | 0.00 | 237.7 |
| 08:58 | 95 | 34.6 | 16.20 | 3.43 | 0.00 | 177.2 |
| 08:59 | 95 | 35.0 | 15.70 | 1.74 | 0.00 | 186.5 |
| 09:00 | 96 | 35.5 | 16.00 | 1.12 | 0.00 | 248.2 |
| 09:01 | 96 | 35.8 | 16.50 | 1.97 | 0.00 | 201.6 |
| 09:02 | 95 | 36.3 | 16.10 | 3.43 | 0.00 | 149.5 |
| 09:03 | 94 | 36.6 | 15.55 | 1.12 | 0.00 | 177.2 |
| 09:04 | 95 | 37.0 | 15.75 | 0.00 | 0.00 | 216.7 |
| 09:05 | 95 | 37.4 | 16.05 | 0.60 | 0.00 | 192.4 |
| 09:06 | 94 | 37.8 | 15.75 | 1.03 | 0.00 | 150.8 |
| 09:07 | 94 | 38.1 | 15.50 | 0.00 | 0.00 | 196.6 |
| 09:08 | 96 | 38.5 | 15.65 | 0.00 | 0.00 | 260.0 |
| 09:09 | 97 | 38.8 | 15.80 | 0.00 | 0.00 | 260.0 |
| 09:10 | 97 | 39.1 | 15.90 | 0.00 | 0.00 | 239.0 |
| 09:11 | 97 | 39.4 | 16.00 | 0.00 | 0.00 | 254.9 |
| 09:12 | 97 | 39.8 | 16.05 | 0.00 | 0.00 | 232.7 |
| 09:13 | 97 | 40.1 | 16.35 | 0.00 | 0.00 | 211.3 |
| 09:14 | 95 | 40.4 | 16.35 | 0.00 | 0.00 | 160.4 |
| 09:15 | 93 | 40.7 | 14.90 | 0.00 | 0.00 | 137.3 |
| 09:16 | 93 | 41.0 | 14.50 | 0.00 | 0.00 | 158.3 |
| 09:17 | 94 | 41.2 | 15.75 | 0.00 | 0.00 | 189.8 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 09:18 | 95 | 41.6 | 16.25 | 0.00 | 0.00 | 153.3 |
| 09:19 | 94 | 41.9 | 15.70 | 0.21 | 0.00 | 105.8 |
| 09:20 | 93 | 42.1 | 14.80 | 0.17 | 0.00 | 93.7 |
| 09:21 | 93 | 42.3 | 14.50 | 0.00 | 0.00 | 129.8 |
| 09:22 | 94 | 42.6 | 14.95 | 0.00 | 0.00 | 187.7 |
| 09:23 | 94 | 42.8 | 15.45 | 0.00 | 0.00 | 202.0 |
| 09:24 | 94 | 43.1 | 15.55 | 0.00 | 0.00 | 176.4 |
| 09:25 | 95 | 43.3 | 15.35 | 0.00 | 0.00 | 163.4 |
| 09:26 | 94 | 43.5 | 15.10 | 0.00 | 0.00 | 144.9 |
| 09:27 | 94 | 43.8 | 14.95 | 0.00 | 0.00 | 136.1 |
| 09:28 | 94 | 44.0 | 14.90 | 0.00 | 0.00 | 128.9 |
| 09:29 | 93 | 44.2 | 15.10 | 0.00 | 0.00 | 113.0 |
| 09:30 | 92 | 44.5 | 15.05 | 0.00 | 0.00 | 111.7 |
| 09:31 | 91 | 44.6 | 14.45 | 0.00 | 0.00 | 100.8 |
| 09:32 | 92 | 44.8 | 14.10 | 0.00 | 0.00 | 76.0 |
| 09:33 | 92 | 45.1 | 14.30 | 0.00 | 0.00 | 84.0 |
| 09:34 | 92 | 45.3 | 14.70 | 0.31 | 0.00 | 72.2 |
| 09:35 | 92 | 45.4 | 14.95 | 1.15 | 0.00 | 70.6 |
| 09:36 | 92 | 45.6 | 14.70 | 1.17 | 0.00 | 77.3 |
| 09:37 | 91 | 45.8 | 15.35 | 0.76 | 0.00 | 67.2 |
| | | | | | | |
| **Average** | **92** | **37.0** | **15.53** | **2.20** | **0.00** | **173.8** |

| | | |
|---|---|---|
| Average for first 30 mins of test | **4.20** | - |
| Average for second 30 mins of test | **0.13** | - |
| Average for first 60 mins of test | **2.20** | **0.00** |

## Coventry Cremators 3 & 4 Abatement System Outlet

## Data Log 23/07/13

**Test 34 - 2**

| Time | Flue Gas °C | Meter °C | Flue Oxygen %v/v dry | CO mg/Nm³ c. | VOC mg/Nm³ c. | Sample Point Pa |
|---|---|---|---|---|---|---|
| | | | | | | |
| 09:53 | 96 | 48.8 | 16.50 | 7.16 | 0.00 | 164.2 |
| 09:54 | 96 | 48.9 | 16.80 | 4.02 | 0.00 | 144.1 |
| 09:55 | 95 | 49.0 | 16.81 | 5.27 | 0.00 | 104.6 |
| 09:56 | 96 | 49.1 | 17.10 | 33.24 | 1.53 | 143.6 |
| 09:57 | 96 | 49.2 | 16.60 | 61.51 | 2.63 | 152.9 |
| 09:58 | 96 | 49.2 | 17.00 | 68.85 | 3.47 | 142.0 |
| 09:59 | 95 | 49.3 | 17.40 | 59.45 | 4.21 | 138.6 |
| 10:00 | 95 | 49.4 | 16.20 | 42.04 | 1.93 | 157.9 |
| 10:01 | 96 | 49.5 | 17.00 | 35.61 | 2.18 | 174.3 |
| 10:02 | 96 | 49.6 | 17.20 | 50.63 | 2.04 | 192.8 |
| 10:03 | 98 | 49.7 | 17.30 | 80.93 | 4.90 | 210.4 |
| 10:04 | 99 | 49.8 | 17.70 | 65.70 | 4.41 | 226.0 |
| 10:05 | 99 | 49.9 | 18.30 | 71.95 | 4.08 | 209.6 |
| 10:06 | 97 | 50.0 | 17.50 | 68.71 | 4.43 | 151.6 |
| 10:07 | 97 | 50.1 | 17.20 | 37.78 | 0.57 | 168.8 |
| 10:08 | 97 | 50.2 | 17.90 | 36.62 | 1.75 | 219.7 |
| 10:09 | 96 | 50.3 | 18.00 | 59.05 | 2.85 | 173.0 |
| 10:10 | 96 | 50.5 | 17.10 | 52.95 | 1.93 | 128.5 |
| 10:11 | 96 | 50.7 | 16.60 | 22.48 | 0.00 | 151.6 |
| 10:12 | 98 | 50.7 | 17.40 | 21.73 | 0.00 | 208.7 |
| 10:13 | 98 | 50.8 | 18.60 | 28.03 | 0.37 | 228.9 |
| 10:14 | 97 | 50.9 | 18.10 | 37.26 | 0.00 | 159.2 |
| 10:15 | 95 | 51.0 | 16.80 | 31.77 | 0.00 | 117.2 |
| 10:16 | 96 | 51.1 | 16.70 | 18.22 | 0.00 | 175.6 |
| 10:17 | 97 | 51.1 | 16.90 | 17.79 | 0.00 | 198.2 |
| 10:18 | 98 | 51.2 | 17.50 | 61.91 | 4.00 | 246.1 |
| 10:19 | 100 | 51.2 | 18.50 | 51.05 | 2.42 | 254.5 |
| 10:20 | 99 | 51.3 | 16.80 | 45.89 | 0.99 | 184.4 |
| 10:21 | 98 | 51.4 | 17.80 | 22.30 | 0.27 | 152.9 |
| 10:22 | 98 | 51.5 | 17.30 | 11.06 | 0.00 | 168.0 |
| 10:23 | 98 | 51.5 | 16.90 | 24.26 | 0.00 | 225.5 |
| 10:24 | 99 | 51.6 | 16.60 | 40.29 | 1.16 | 276.4 |
| 10:25 | 99 | 51.6 | 17.30 | 24.93 | 0.31 | 236.5 |
| 10:26 | 99 | 51.7 | 17.40 | 13.90 | 0.00 | 218.0 |
| 10:27 | 100 | 51.7 | 17.00 | 8.97 | 0.00 | 236.0 |
| 10:28 | 100 | 51.8 | 16.80 | 5.54 | 0.00 | 252.8 |
| 10:29 | 99 | 51.9 | 17.50 | 4.08 | 0.00 | 217.1 |
| 10:30 | 98 | 52.0 | 17.50 | 2.88 | 0.00 | 179.3 |
| 10:31 | 97 | 52.1 | 16.60 | 1.73 | 0.00 | 160.9 |
| 10:32 | 97 | 52.2 | 16.90 | 0.46 | 0.00 | 176.0 |
| 10:33 | 97 | 52.2 | 17.50 | 0.49 | 0.00 | 136.9 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 10:34 | 97 | 52.2 | 17.60 | 0.58 | 0.00 | 131.9 |
| 10:35 | 97 | 52.2 | 16.70 | 1.19 | 0.00 | 149.1 |
| 10:36 | 97 | 52.3 | 17.20 | 0.47 | 0.00 | 146.6 |
| 10:37 | 96 | 52.3 | 18.00 | 0.53 | 0.00 | 117.6 |
| 10:38 | 95 | 52.4 | 17.70 | 1.01 | 0.00 | 111.7 |
| 10:39 | 95 | 52.4 | 18.70 | 0.61 | 0.00 | 124.7 |
| 10:40 | 95 | 52.4 | 16.10 | 80.04 | 2.52 | 127.3 |
| 10:41 | 96 | 52.5 | 17.90 | 10.05 | 0.00 | 188.2 |
| 10:42 | 99 | 52.5 | 17.80 | 556.55 | 53.28 | 262.1 |
| 10:43 | 98 | 52.5 | 15.40 | 544.57 | 42.34 | 189.8 |
| 10:44 | 98 | 52.5 | 16.80 | 11.29 | 0.00 | 155.0 |
| 10:45 | 97 | 52.6 | 15.90 | 12.95 | 0.00 | 132.7 |
| 10:46 | 97 | 52.6 | 16.40 | 8.87 | 0.00 | 168.8 |
| 10:47 | 97 | 52.6 | 17.10 | 4.15 | 0.00 | 163.4 |
| 10:48 | 96 | 52.6 | 17.10 | 3.62 | 0.00 | 159.6 |
| 10:49 | 97 | 52.6 | 16.60 | 5.94 | 0.00 | 144.5 |
| 10:50 | 98 | 52.7 | 14.90 | 6.18 | 0.00 | 186.1 |
| 10:51 | 99 | 52.7 | 15.90 | 5.76 | 0.00 | 217.1 |
| 10:52 | 99 | 52.6 | 16.00 | 7.68 | 0.00 | 191.9 |
| 10:53 | 98 | 52.6 | 12.44 | 3.22 | 0.00 | 171.8 |
| | | | | | | |
| **Average** | **97** | **51.2** | **17.03** | **42.68** | **2.47** | **177.1** |

| | | |
|---|---|---|
| Average for first 30 mins of test | **39.85** | - |
| Average for second 30 mins of test | **45.62** | - |
| Average for first 60 mins of test | **42.68** | **2.47** |

## Coventry Cremators 3 & 4 Abatement System Outlet

## Data Log 23/07/13

**Test 34 - 3**

z

| Time | Flue Gas °C | Meter °C | Flue Oxygen %v/v dry | CO mg/Nm³ c. | VOC mg/Nm³ c. | Sample Point Pa |
|---|---|---|---|---|---|---|
| | | | | | | |
| 11:24 | 97 | 52.6 | 16.75 | 20.14 | 0.32 | 164.6 |
| 11:25 | 97 | 52.4 | 16.55 | 8.23 | 0.00 | 157.9 |
| 11:26 | 97 | 52.3 | 16.75 | 5.03 | 0.00 | 160.4 |
| 11:27 | 96 | 52.2 | 17.05 | 5.43 | 0.00 | 160.9 |
| 11:28 | 97 | 52.0 | 16.55 | 4.57 | 0.00 | 176.0 |
| 11:29 | 97 | 51.9 | 16.85 | 3.44 | 0.00 | 154.1 |
| 11:30 | 98 | 51.9 | 16.45 | 20.57 | 0.32 | 198.7 |
| 11:31 | 99 | 51.8 | 16.05 | 39.39 | 2.47 | 197.4 |
| 11:32 | 98 | 51.7 | 17.05 | 25.33 | 0.33 | 189.8 |
| 11:33 | 98 | 51.7 | 17.55 | 15.74 | 0.00 | 177.7 |
| 11:34 | 97 | 51.8 | 17.35 | 6.73 | 0.00 | 164.2 |
| 11:35 | 97 | 51.7 | 17.55 | 5.94 | 0.00 | 150.4 |
| 11:36 | 96 | 51.6 | 17.35 | 5.61 | 0.00 | 135.2 |
| 11:37 | 97 | 51.6 | 17.25 | 9.00 | 0.00 | 160.9 |
| 11:38 | 98 | 51.4 | 17.55 | 14.55 | 0.00 | 176.0 |
| 11:39 | 99 | 51.3 | 17.45 | 10.38 | 0.00 | 202.4 |
| 11:40 | 98 | 51.4 | 16.85 | 12.53 | 0.00 | 160.4 |
| 11:41 | 97 | 51.3 | 17.55 | 19.90 | 0.00 | 154.1 |
| 11:42 | 96 | 51.3 | 17.75 | 18.95 | 0.00 | 139.0 |
| 11:43 | 96 | 51.3 | 17.65 | 18.37 | 0.00 | 135.7 |
| 11:44 | 96 | 51.3 | 16.45 | 11.40 | 0.00 | 121.8 |
| 11:45 | 96 | 51.4 | 17.35 | 11.77 | 0.00 | 131.0 |
| 11:46 | 97 | 51.4 | 17.35 | 10.37 | 0.00 | 157.1 |
| 11:47 | 98 | 51.3 | 17.35 | 9.25 | 0.00 | 197.4 |
| 11:48 | 98 | 51.3 | 16.95 | 4.53 | 0.00 | 166.3 |
| 11:49 | 97 | 51.2 | 17.55 | 1.19 | 0.00 | 171.4 |
| 11:50 | 97 | 51.2 | 17.65 | 1.22 | 0.00 | 205.8 |
| 11:51 | 97 | 51.2 | 17.05 | 0.00 | 0.00 | 206.6 |
| 11:52 | 97 | 51.1 | 17.15 | 0.00 | 0.00 | 159.6 |
| 11:53 | 97 | 51.1 | 17.55 | 0.00 | 0.00 | 149.5 |
| 11:54 | 98 | 51.1 | 17.45 | 0.00 | 0.00 | 174.3 |
| 11:55 | 97 | 51.1 | 16.85 | 0.00 | 0.00 | 149.5 |
| 11:56 | 96 | 51.1 | 17.85 | 0.00 | 0.00 | 115.1 |
| 11:57 | 95 | 51.2 | 17.95 | 0.00 | 0.00 | 125.2 |
| 11:58 | 95 | 51.3 | 16.95 | 0.00 | 0.00 | 118.9 |
| 11:59 | 95 | 51.4 | 17.65 | 0.00 | 0.00 | 92.0 |
| 12:00 | 94 | 51.4 | 18.35 | 0.00 | 0.00 | 94.5 |
| 12:01 | 95 | 51.4 | 17.75 | 0.00 | 0.00 | 103.3 |
| 12:02 | 95 | 51.5 | 17.75 | 0.00 | 0.00 | 90.3 |
| 12:03 | 95 | 51.5 | 19.05 | 0.00 | 0.00 | 94.1 |
| 12:04 | 94 | 51.6 | 18.75 | 0.00 | 0.00 | 100.8 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 12:05 | 94 | 51.6 | 17.85 | 0.00 | 0.00 | 106.7 |
| 12:06 | 93 | 51.6 | 19.25 | 0.00 | 0.00 | 94.5 |
| 12:07 | 94 | 51.7 | 18.85 | 0.00 | 0.00 | 146.2 |
| 12:08 | 96 | 51.7 | 16.85 | 0.00 | 0.00 | 155.8 |
| 12:09 | 95 | 51.8 | 18.25 | 0.00 | 0.00 | 110.9 |
| 12:10 | 95 | 51.9 | 19.25 | 0.00 | 0.00 | 125.6 |
| 12:11 | 96 | 52.0 | 17.95 | 0.00 | 0.00 | 178.9 |
| 12:12 | 96 | 52.0 | 18.35 | 0.00 | 0.00 | 162.1 |
| 12:13 | 95 | 52.0 | 18.65 | 0.00 | 0.00 | 135.2 |
| 12:14 | 95 | 52.2 | 18.75 | 0.00 | 0.00 | 152.0 |
| 12:15 | 95 | 52.2 | 18.15 | 0.00 | 0.00 | 148.3 |
| 12:16 | 96 | 52.3 | 18.75 | 0.00 | 0.00 | 152.5 |
| 12:17 | 96 | 52.3 | 18.45 | 0.00 | 0.00 | 150.8 |
| 12:18 | 97 | 52.4 | 17.65 | 0.00 | 0.00 | 146.2 |
| 12:19 | 96 | 52.4 | 18.75 | 0.00 | 0.00 | 118.4 |
| 12:20 | 96 | 52.4 | 18.05 | 0.00 | 0.00 | 177.2 |
| 12:21 | 96 | 52.5 | 17.45 | 0.00 | 0.00 | 171.4 |
| 12:22 | 96 | 52.5 | 17.35 | 0.00 | 0.00 | 158.3 |
| 12:23 | 96 | 52.5 | 17.25 | 0.00 | 0.00 | 156.2 |
| 12:24 | 97 | 52.6 | 17.25 | 0.00 | 0.00 | 156.2 |
| | | | | | | |
| **Average** | **96** | **51.7** | **17.60** | **5.24** | **0.06** | **149.9** |

| | | |
|---|---|---|
| Average for first 30 mins of test | **10.31** | - |
| Average for second 30 mins of test | **0.00** | - |
| Average for first 60 mins of test | **5.24** | **0.06** |

## Coventry Cremators 3 & 4 Abatement System Outlet

## Total Particulate Matter and Hydrogen Chloride

| | |
|---|---|
| Contract | Coventry Crematorium, DEM0657 |
| Date | 23rd July 2013 |
| Location | Cremators 3&4 Flue Gas Abatement System Outlet |
| Engineer(s) | JB |
| Absorbent | $H_2O$ |

| **Test Log** | **Test 34 - 1** | **Test 34 - 2** | **Test 34 - 3** |
|---|---|---|---|
| Barometric Pressure(kPa) | 101.8 | 101.8 | 101.8 |
| Gas Meter Temperature(Deg C) | 37.0 | 51.2 | 51.7 |
| Oxygen Concentration(%v/v dry) | 15.53 | 17.03 | 17.60 |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 4562 | 4676 | 4419 |

| | Start | End | Start | End | Start | End |
|---|---|---|---|---|---|---|
| Time | 08:37 | 09:37 | 09:53 | 10:53 | 11:24 | 12:24 |
| Gas Meter Reading($Am^3$ dry) | 367.994 | 368.646 | 368.823 | 369.614 | 370.200 | 370.986 |
| Absorber Weight(g) | 3254.1 | 3294.2 | 3215.4 | 3247.8 | 3219.2 | 3235.1 |
| Filter Reference | CO230713F3,4-1 | | CO230713F3,4-2 | | CO230713F3,4-3 | |
| Filter Weight(g) | 0.53702 | 0.53703 | 0.53545 | 0.53545 | 0.53691 | 0.53706 |
| Probe Rinse Reference | CO230713R3&4 | | CO230713R3&4 | | CO230713R3&4 | |
| Probe Rinse Weight(g) | 76.2315 | 76.2315 | 76.2315 | 76.2315 | 76.2315 | 76.2315 |
| Sample Reference HCl | CO230713H34-1 | | CO230713H34-2 | | CO230713H34-3 A&B | |
| Absorbent Volume(ml) | 500 | | 500 | | 250 | 250 |
| Absorbent(mg/l as HCl) | 6.6 | | 41 | | 40 | 0.05 |
| Blank(mg/l as HCl) | 1.2 | | 1.2 | | 1.2 | 1.2 |

**Calculation: General**

| | | | |
|---|---|---|---|
| Barometric Pressure(kPa) | 101.8 | 101.8 | 101.8 |
| Gas Meter temperature(Deg C) | 37.0 | 51.2 | 51.7 |
| Gas Volume Sampled($Am^3$ dry) | 0.652 | 0.791 | 0.786 |
| Gas Volume Sampled($Nm^3$ dry) | 0.5770 | 0.6693 | 0.6641 |
| Mass of Dry Gas(g @ 1292.8 g/$Nm^3$) | 745.94 | 865.26 | 858.51 |
| Change in Absorber Weight(g) | 40.1 | 32.4 | 15.9 |
| Water Vapour Volume($Nm^3$ @ 803.9 g/$Nm^3$) | 0.0499 | 0.0403 | 0.0198 |
| Gas Volume($Nm^3$ wet) | 0.6269 | 0.7096 | 0.6839 |
| Mass of Wet Gas(g) | 786.04 | 897.66 | 874.41 |
| **Moisture Concentration(%v/v)** | **8.0** | **5.7** | **2.9** |
| **Moisture Concentration(%w/w)** | **5.1** | **3.6** | **1.8** |

**Calculation: Particulate**

| | | | |
|---|---|---|---|
| Increase In Filter Weights(g) | 0.00002 | 0.00000 | 0.00023 |
| Particulate Emission(mg/$Nm^3$ dry) | 0.03 | 0.00 | 0.35 |
| Oxygen Concentration(%v/v dry) | 15.53 | 17.03 | 17.60 |
| **Particulate Emission** | **0.05** | **0.00** | **1.05** |
| **(mg/$Nm^3$ @ 11 %v/v Oxygen dry)** | | | |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 4562 | 4676 | 4419 |
| **Particulate Emission(g/h)** | **0.12** | **0.00** | **1.56** |
| | | | |
| Required Sample Velocity(Nm/s) | 13.17 | 13.50 | 12.76 |
| Nozzle Used(mm) | 4.0 | 4.0 | 4.0 |
| Area of Nozzle($m^2$) | 0.00001257 | 0.00001257 | 0.00001257 |
| Test Duration(mins) | 60 | 60 | 60 |
| Actual Sample Velocity(Nm/s) | 12.75 | 14.79 | 14.68 |
| Isokinetic Closure(%) | 97 | 110 | 115 |
| | | 107 | |

**Calculation: HCl**

| | | | |
|---|---|---|---|
| Absorbent(mg/l as HCl) | 6.60 | 41.00 | 40.05 |
| Blank(mg/l as HCl) | 1.2 | 1.2 | 1.2 |
| Chloride Absorbed(mg/l as HCl) | 5.4 | 39.8 | 38.85 |
| Chloride Absorbed(mg as HCl) | 2.70 | 19.90 | 9.71 |
| HCl(mg) | 2.70 | 19.90 | 9.71 |
| HCl Emission(mg/$Nm^3$ dry) | 4.68 | 29.73 | 14.63 |
| Oxygen Concentration(%v/v dry) | 15.53 | 17.03 | 17.60 |
| **HCl Emission** | **8.59** | **75.48** | **43.47** |
| **(mg/$Nm^3$ @ 11 %v/v Oxygen dry)** | | | |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 4562 | 4676 | 4419 |
| **HCl Emission(g/h)** | **21.35** | **139.03** | **64.63** |

## Coventry Cremators 3 & 4 Abatement System Outlet

## Flue Gas Volumetric Flow

| | |
|---|---|
| Contract | Coventry Crematorium, DEM0657 |
| Date | 23rd July 2013 |
| Location | Cremators 3&4 Flue Gas Abatement System Outlet |
| Engineer(s) | JB |

| **Test Log** | **Test 34 - 1** | **Test 34 - 2** | **Test 34 - 3** |
|---|---|---|---|
| Flue Gas Temperature(Deg C) | 92 | 97 | 96 |
| Flue Gas Pitot Head Sample Points(Pa) | 173.8 | 177.1 | 149.9 |
| Flue Gas Pitot Head Duct Mean(Pa) | 173.8 | 177.1 | 149.9 |
| Flue Gas Moisture(%v/v) | 8.0 | 5.7 | 2.9 |
| Flue Gas Moisture(%w/w) | 5.1 | 3.6 | 1.8 |
| Flue Gas Duct Dimensions(mm) | 350 mm Diameter Circular Stack | | |
| Flue Gas Duct Area($m^2$) | 0.0962 | | |
| **Calculation** | | | |
| Flue Gas Density($kg/m^3$) | 0.9471 | 0.9404 | 0.9492 |
| Flue Gas Velocity(Am/s) | 19.16 | 19.41 | 17.77 |
| Flue Gas Volumetric Flowrate($Am^3/h$) | 6635 | 6722 | 6156 |
| Flue Gas Volumetric Flowrate($Am^3/h$ dry) | 6107 | 6340 | 5978 |
| **Flue Gas Volumetric Flowrate($Nm^3/h$ dry)** | **4562** | **4676** | **4419** |

## Coventry Cremators 3 & 4 Abatement System Outlet

**Data Log** **23/07/13**

**Test 34-4**

| Time | Flue Gas °C | Meter °C | Flue $O_2$ %v/v dry | Pitot Head Pa |
|---|---|---|---|---|
| | | | | |
| 12:39 | 97 | 54.0 | 17.80 | 136.9 |
| 12:40 | 98 | 53.9 | 17.90 | 149.1 |
| 12:41 | 98 | 53.9 | 18.10 | 147.8 |
| 12:42 | 98 | 53.7 | 17.80 | 152.0 |
| 12:43 | 97 | 53.7 | 18.10 | 156.7 |
| 12:44 | 97 | 53.6 | 17.90 | 134.8 |
| 12:45 | 96 | 53.6 | 18.10 | 129.8 |
| 12:46 | 97 | 53.7 | 17.60 | 130.6 |
| 12:47 | 97 | 53.7 | 16.20 | 99.1 |
| 12:48 | 97 | 53.7 | 17.10 | 71.8 |
| 12:49 | 96 | 53.6 | 16.90 | 60.1 |
| 12:50 | 96 | 53.6 | 17.40 | 63.4 |
| 12:51 | 95 | 53.5 | 17.90 | 57.1 |
| 12:52 | 94 | 53.4 | 16.90 | 60.1 |
| 12:53 | 94 | 53.3 | 17.00 | 56.3 |
| 12:54 | 94 | 53.3 | 16.10 | 50.8 |
| 12:55 | 94 | 53.2 | 16.90 | 53.8 |
| 12:56 | 95 | 53.2 | 17.50 | 116.3 |
| 12:57 | 97 | 53.1 | 17.60 | 206.2 |
| 12:58 | 99 | 53.1 | 17.60 | 248.2 |
| 12:59 | 98 | 53.1 | 17.70 | 149.5 |
| 13:00 | 97 | 53.1 | 17.80 | 119.3 |
| 13:01 | 95 | 53.1 | 17.90 | 85.7 |
| 13:02 | 95 | 53.1 | 17.80 | 83.6 |
| 13:03 | 95 | 53.1 | 17.20 | 92.0 |
| 13:04 | 95 | 53.1 | 16.00 | 98.3 |
| 13:05 | 95 | 53.1 | 16.50 | 104.2 |
| 13:06 | 96 | 53.2 | 16.80 | 126.8 |
| 13:07 | 97 | 53.2 | 16.90 | 163.4 |
| 13:08 | 97 | 53.2 | 17.10 | 173.5 |
| 13:09 | 97 | 53.3 | 16.20 | 167.6 |
| 13:10 | 97 | 53.3 | 16.80 | 196.6 |
| 13:11 | 97 | 53.3 | 17.20 | 155.8 |
| 13:12 | 97 | 53.3 | 17.60 | 134.4 |
| 13:13 | 97 | 53.4 | 17.60 | 132.3 |
| 13:14 | 97 | 53.4 | 17.40 | 113.8 |
| 13:15 | 96 | 53.4 | 17.80 | 126.8 |
| 13:16 | 98 | 53.4 | 16.50 | 254.1 |
| 13:17 | 98 | 53.4 | 15.50 | 203.7 |
| 13:18 | 98 | 53.4 | 15.80 | 153.7 |
| 13:19 | 98 | 53.4 | 16.20 | 138.2 |

| | | | | |
|---|---|---|---|---|
| 13:20 | 98 | 53.4 | 16.40 | 134.4 |
| 13:21 | 97 | 53.4 | 16.50 | 133.1 |
| 13:22 | 98 | 53.4 | 16.90 | 162.1 |
| 13:23 | 98 | 53.3 | 17.10 | 184.4 |
| 13:24 | 98 | 53.3 | 16.10 | 164.2 |
| 13:25 | 97 | 53.2 | 14.80 | 149.5 |
| 13:26 | 98 | 53.2 | 15.40 | 173.0 |
| 13:27 | 99 | 53.1 | 15.60 | 185.2 |
| 13:28 | 99 | 53.0 | 15.60 | 166.7 |
| 13:29 | 99 | 53.1 | 15.60 | 153.3 |
| 13:30 | 98 | 53.0 | 15.90 | 127.7 |
| 13:31 | 98 | 53.0 | 16.20 | 125.2 |
| 13:32 | 97 | 53.0 | 15.90 | 117.6 |
| 13:33 | 97 | 52.9 | 16.00 | 108.4 |
| 13:34 | 97 | 52.8 | 16.10 | 104.6 |
| 13:35 | 97 | 52.8 | 16.20 | 107.9 |
| 13:36 | 97 | 52.8 | 16.40 | 111.7 |
| 13:37 | 97 | 52.7 | 16.30 | 108.4 |
| 13:38 | 97 | 52.6 | 16.50 | 107.5 |
| 13:39 | 96 | 52.6 | 16.40 | 105.4 |
| 13:40 | 96 | 52.6 | 16.00 | 96.6 |
| 13:41 | 96 | 52.7 | 16.00 | 94.9 |
| 13:42 | 96 | 52.7 | 15.90 | 104.2 |
| 13:43 | 97 | 52.7 | 16.30 | 104.2 |
| 13:44 | 97 | 52.8 | 16.20 | 104.2 |
| 13:45 | 97 | 52.8 | 16.40 | 119.7 |
| 13:46 | 97 | 52.9 | 16.60 | 133.6 |
| 13:47 | 97 | 53.0 | 16.80 | 115.9 |
| 13:48 | 96 | 53.0 | 16.50 | 115.1 |
| 13:49 | 97 | 53.0 | 16.40 | 147.8 |
| 13:50 | 97 | 53.0 | 17.10 | 126.4 |
| 13:51 | 97 | 53.1 | 17.00 | 111.7 |
| 13:52 | 97 | 53.1 | 16.50 | 111.7 |
| 13:53 | 98 | 53.1 | 16.40 | 166.7 |
| 13:54 | 98 | 53.2 | 17.30 | 157.1 |
| 13:55 | 97 | 53.2 | 17.50 | 110.9 |
| 13:56 | 96 | 53.2 | 16.60 | 102.5 |
| 13:57 | 97 | 53.2 | 16.40 | 127.3 |
| 13:58 | 97 | 53.2 | 17.50 | 97.9 |
| 13:59 | 96 | 53.2 | 17.40 | 72.2 |
| 14:00 | 96 | 53.2 | 16.30 | 88.2 |
| 14:01 | 97 | 53.3 | 16.90 | 131.9 |
| 14:02 | 96 | 53.3 | 18.00 | 98.7 |
| 14:03 | 95 | 53.3 | 17.50 | 73.5 |
| 14:04 | 95 | 53.4 | 16.70 | 101.2 |
| 14:05 | 96 | 53.4 | 17.00 | 125.6 |
| 14:06 | 97 | 53.4 | 17.60 | 92.4 |
| 14:07 | 96 | 53.4 | 17.70 | 77.3 |
| 14:08 | 96 | 53.3 | 17.30 | 91.1 |
| 14:09 | 97 | 53.3 | 17.50 | 138.2 |

| | | | | |
|---|---|---|---|---|
| 14:10 | 97 | 53.4 | 18.10 | 128.9 |
| 14:11 | 96 | 53.4 | 18.40 | 95.3 |
| 14:12 | 96 | 53.4 | 17.90 | 86.9 |
| 14:13 | 96 | 53.4 | 17.80 | 109.6 |
| 14:14 | 97 | 53.4 | 17.90 | 108.8 |
| 14:15 | 97 | 53.4 | 17.90 | 90.3 |
| 14:16 | 96 | 53.4 | 16.80 | 81.1 |
| 14:17 | 97 | 53.4 | 16.60 | 115.5 |
| 14:18 | 97 | 53.4 | 16.80 | 127.7 |
| 14:19 | 97 | 53.4 | 16.80 | 127.7 |
| 14:20 | 97 | 53.4 | 17.50 | 114.2 |
| 14:21 | 96 | 53.4 | 18.60 | 76.0 |
| 14:22 | 96 | 53.5 | 16.70 | 67.6 |
| 14:23 | 97 | 53.4 | 16.80 | 98.3 |
| 14:24 | 97 | 53.4 | 17.00 | 110.5 |
| 14:25 | 97 | 53.4 | 17.10 | 118.9 |
| 14:26 | 97 | 53.4 | 17.10 | 118.0 |
| 14:27 | 96 | 53.5 | 17.10 | 108.8 |
| 14:28 | 97 | 53.5 | 17.30 | 124.7 |
| 14:29 | 97 | 53.5 | 17.90 | 97.9 |
| 14:30 | 96 | 53.4 | 18.20 | 96.2 |
| 14:31 | 97 | 53.4 | 17.10 | 124.3 |
| 14:32 | 98 | 53.4 | 17.90 | 154.1 |
| 14:33 | 97 | 53.4 | 18.30 | 137.3 |
| 14:34 | 97 | 53.4 | 18.20 | 115.5 |
| 14:35 | 96 | 53.4 | 18.40 | 98.3 |
| 14:36 | 96 | 53.4 | 18.00 | 94.5 |
| 14:37 | 97 | 53.5 | 18.10 | 128.9 |
| 14:38 | 97 | 53.4 | 18.10 | 121.8 |
| 14:39 | 98 | 53.4 | 17.70 | 124.3 |
| 14:40 | 98 | 53.4 | 16.90 | 153.3 |
| 14:41 | 99 | 53.4 | 17.30 | 184.4 |
| 14:42 | 98 | 53.3 | 16.80 | 156.2 |
| 14:43 | 98 | 53.4 | 16.50 | 170.1 |
| 14:44 | 98 | 53.4 | 16.60 | 160.4 |
| 14:45 | 99 | 53.5 | 16.70 | 156.2 |
| 14:46 | 99 | 53.5 | 16.70 | 169.3 |
| 14:47 | 100 | 53.5 | 16.90 | 179.8 |
| 14:48 | 100 | 53.4 | 18.40 | 197.8 |
| 14:49 | 100 | 53.5 | 18.30 | 209.2 |
| 14:50 | 99 | 53.4 | 16.80 | 149.9 |
| 14:51 | 98 | 53.5 | 17.30 | 138.2 |
| 14:52 | 100 | 53.6 | 16.40 | 237.7 |
| 14:53 | 101 | 53.6 | 15.10 | 208.7 |
| 14:54 | 101 | 53.7 | 15.40 | 181.0 |
| 14:55 | 101 | 53.7 | 16.00 | 188.2 |
| 14:56 | 102 | 53.7 | 16.10 | 204.5 |
| 14:57 | 102 | 53.7 | 15.90 | 203.7 |
| 14:58 | 102 | 53.7 | 15.30 | 184.8 |
| 14:59 | 102 | 53.7 | 15.40 | 235.2 |

| | | | | |
|---|---|---|---|---|
| 15:00 | 104 | 53.7 | 15.30 | 273.4 |
| 15:01 | 104 | 53.8 | 15.50 | 275.1 |
| 15:02 | 105 | 53.9 | 15.90 | 263.8 |
| 15:03 | 104 | 53.8 | 16.00 | 230.6 |
| 15:04 | 105 | 53.8 | 16.00 | 262.9 |
| 15:05 | 105 | 53.8 | 16.20 | 246.5 |
| 15:06 | 105 | 53.8 | 16.10 | 209.6 |
| 15:07 | 104 | 53.8 | 15.90 | 178.5 |
| 15:08 | 103 | 53.8 | 15.70 | 147.4 |
| 15:09 | 102 | 53.8 | 15.80 | 139.9 |
| 15:10 | 102 | 53.8 | 15.90 | 140.3 |
| 15:11 | 102 | 53.8 | 16.20 | 140.3 |
| 15:12 | 101 | 53.8 | 16.40 | 137.8 |
| 15:13 | 101 | 53.9 | 16.50 | 124.7 |
| 15:14 | 100 | 53.9 | 16.70 | 121.4 |
| 15:15 | 100 | 53.8 | 16.70 | 113.0 |
| 15:16 | 99 | 53.9 | 16.70 | 102.5 |
| 15:17 | 99 | 53.9 | 16.60 | 105.4 |
| 15:18 | 99 | 53.9 | 16.60 | 108.8 |
| 15:19 | 99 | 53.9 | 15.90 | 130.6 |
| 15:20 | 101 | 53.9 | 16.50 | 187.3 |
| 15:21 | 102 | 53.9 | 16.70 | 212.9 |
| 15:22 | 102 | 53.9 | 16.80 | 205.8 |
| 15:23 | 102 | 53.9 | 17.00 | 202.4 |
| 15:24 | 102 | 54.0 | 17.00 | 198.7 |
| 15:25 | 102 | 54.0 | 17.10 | 191.1 |
| 15:26 | 102 | 54.0 | 17.00 | 176.4 |
| 15:27 | 101 | 54.1 | 17.10 | 149.1 |
| 15:28 | 100 | 54.1 | 17.10 | 145.7 |
| 15:29 | 100 | 54.1 | 17.20 | 142.0 |
| 15:30 | 99 | 54.1 | 17.30 | 119.3 |
| 15:31 | 99 | 54.1 | 17.10 | 105.0 |
| 15:32 | 99 | 54.1 | 17.30 | 95.8 |
| 15:33 | 99 | 54.1 | 17.30 | 102.9 |
| 15:34 | 99 | 54.1 | 17.40 | 108.8 |
| 15:35 | 99 | 54.2 | 17.40 | 111.3 |
| 15:36 | 98 | 54.1 | 17.40 | 105.8 |
| 15:37 | 98 | 54.1 | 17.40 | 106.3 |
| 15:38 | 98 | 54.1 | 17.40 | 92.8 |
| 15:39 | 98 | 54.1 | 17.90 | 90.3 |
| 15:40 | 97 | 54.1 | 17.60 | 60.5 |
| 15:41 | 97 | 54.1 | 17.20 | 34.0 |
| 15:42 | 97 | 54.2 | 18.10 | 52.1 |
| 15:43 | 96 | 54.2 | 16.20 | 40.3 |
| 15:44 | 96 | 54.2 | 17.20 | 21.8 |
| 15:45 | 95 | 54.2 | 17.00 | 9.2 |
| 15:46 | 95 | 54.2 | 16.90 | 4.2 |
| 15:47 | 94 | 54.2 | 17.10 | 4.2 |
| 15:48 | 94 | 54.1 | 17.30 | 6.3 |
| 15:49 | 94 | 54.1 | 17.70 | 9.2 |

| | | | | |
|---|---|---|---|---|
| 15:50 | 94 | 54.1 | 18.10 | 14.3 |
| 15:51 | 94 | 54.1 | 16.70 | 63.0 |
| 15:52 | 96 | 54.1 | 16.00 | 106.7 |
| 15:53 | 97 | 54.2 | 17.00 | 128.1 |
| 15:54 | 98 | 54.1 | 17.60 | 135.2 |
| 15:55 | 97 | 54.1 | 17.60 | 121.8 |
| 15:56 | 97 | 54.0 | 17.60 | 118.9 |
| 15:57 | 97 | 54.0 | 17.60 | 110.0 |
| 15:58 | 96 | 54.0 | 17.10 | 118.4 |
| 15:59 | 97 | 54.0 | 17.00 | 154.6 |
| 16:00 | 99 | 54.0 | 16.90 | 198.7 |
| 16:01 | 101 | 54.0 | 17.50 | 203.3 |
| 16:02 | 101 | 53.9 | 17.40 | 184.4 |
| 16:03 | 101 | 53.9 | 17.50 | 183.5 |
| 16:04 | 101 | 53.9 | 17.50 | 181.9 |
| 16:05 | 101 | 53.9 | 17.60 | 192.8 |
| 16:06 | 101 | 53.8 | 17.60 | 192.4 |
| 16:07 | 101 | 53.8 | 17.00 | 206.2 |
| 16:08 | 102 | 53.8 | 17.20 | 248.6 |
| 16:09 | 103 | 53.9 | 17.40 | 256.2 |
| 16:10 | 103 | 53.9 | 17.50 | 255.4 |
| 16:11 | 103 | 53.9 | 16.90 | 258.7 |
| 16:12 | 104 | 53.9 | 17.20 | 257.9 |
| 16:13 | 104 | 53.9 | 17.40 | 250.7 |
| 16:14 | 104 | 53.9 | 17.50 | 246.5 |
| 16:15 | 104 | 53.8 | 16.70 | 227.6 |
| 16:16 | 104 | 53.8 | 17.40 | 249.9 |
| 16:17 | 104 | 53.8 | 17.90 | 244.9 |
| 16:18 | 104 | 53.8 | 17.10 | 208.7 |
| 16:19 | 104 | 53.8 | 17.80 | 245.3 |
| 16:20 | 104 | 53.8 | 18.90 | 206.2 |
| 16:21 | 102 | 53.8 | 18.10 | 134.8 |
| 16:22 | 101 | 53.7 | 17.50 | 132.7 |
| 16:23 | 102 | 53.7 | 18.00 | 186.5 |
| 16:24 | 102 | 53.8 | 19.00 | 178.1 |
| 16:25 | 100 | 53.8 | 18.40 | 115.9 |
| 16:26 | 99 | 53.8 | 17.80 | 77.7 |
| 16:27 | 99 | 53.7 | 17.50 | 109.2 |
| 16:28 | 100 | 53.7 | 17.40 | 158.3 |
| 16:29 | 102 | 53.7 | 18.20 | 193.6 |
| 16:30 | 102 | 53.7 | 18.40 | 138.6 |
| 16:31 | 100 | 53.7 | 17.80 | 84.0 |
| 16:32 | 100 | 53.7 | 17.70 | 112.1 |
| 16:33 | 101 | 53.7 | 17.70 | 171.8 |
| 16:34 | 102 | 53.7 | 17.10 | 209.6 |
| 16:35 | 102 | 53.7 | 17.50 | 228.9 |
| 16:36 | 101 | 53.7 | 18.00 | 160.9 |
| 16:37 | 100 | 53.7 | 18.00 | 120.5 |
| 16:38 | 99 | 53.7 | 17.80 | 118.0 |
| 16:39 | 99 | 53.7 | 16.90 | 139.4 |

| | | | | |
|---|---|---|---|---|
| 16:40 | 99 | 53.8 | 17.90 | 103.7 |
| 16:41 | 98 | 53.9 | 18.30 | 86.1 |
| 16:42 | 98 | 54.0 | 18.60 | 89.0 |
| 16:43 | 98 | 53.9 | 17.60 | 105.0 |
| 16:44 | 98 | 53.9 | 18.40 | 105.8 |
| 16:45 | 98 | 53.9 | 19.00 | 93.2 |
| 16:46 | 97 | 54.0 | 18.90 | 76.0 |
| 16:47 | 97 | 54.0 | 18.80 | 71.0 |
| 16:48 | 98 | 54.0 | 19.20 | 118.0 |
| 16:49 | 98 | 54.0 | 17.50 | 86.1 |
| 16:50 | 98 | 54.0 | 17.60 | 84.8 |
| 16:51 | 98 | 53.9 | 17.20 | 71.4 |
| | | | | |
| **Average** | **98** | **53.6** | **17.10** | **136.2** |

## Coventry Cremators 3 & 4 Abatement System Outlet

## Mercury

| | |
|---|---|
| Contract | Coventry Crematorium, DEM0657 |
| Date | 23rd July 2013 |
| Location | Cremators 3&4 Flue Gas Abatement System Outlet |
| Engineer(s) | JB |
| Absorbent | 4% $K_2CR_2O_7$ / 20% $HNO_3$ in $H_2O$ |

| **Test Log** | **Test 34-4** | |
|---|---|---|
| Barometric Pressure(kPa) | 101.8 | |
| Gas Meter Temperature(Deg C) | 53.6 | |
| Oxygen Concentration(%v/v dry) | 17.10 | |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 3983 | |
| | Start | End |
| Time | 12:39 | 16:51 |
| Gas Meter Reading($Am^3$ dry) | 371.224 | 374.424 |
| Absorber Weight(g) | 3254.8 | 3457.5 |
| Filter Reference | CO230713HgF34-4 | |
| Filter Fraction Analysed | 1 | |
| Filter(µg as Hg) | 0.78 | |
| Filter Blank(µg as Hg) | 0.01 | |
| Probe Rinse Reference | Washed into Hg4A | |
| Probe Rinse Volume(ml) | 0 | |
| Probe Rinse(µg/l as Hg) | 0 | |
| Probe Rinse Blank(µg/l as Hg) | 0 | |
| Absorbent Reference | CO230713Hg34-4 A+B | |
| Absorbent Volume(ml) | 300 | 250 |
| Absorbent(µg/l as Hg) | 10 | 1.1 |
| Absorbent Blank(µg/l as Hg) | 0.5 | 0.5 |

**Calculation: General**

| | |
|---|---|
| Barometric Pressure(kPa) | 101.8 |
| Gas Meter Temperature(Deg C) | 53.6 |
| Gas Volume Sampled($Am^3$ dry) | 3.200 |
| Gas Volume Sampled($Nm^3$ dry) | 2.6882 |
| Mass of Dry Gas(g @ 1292.8 g/$Nm^3$) | 3475.34 |
| Change in Absorber Weight(g) | 202.7 |
| Water Vapour Volume($Nm^3$ @ 803.9 g/$Nm^3$) | 0.2521 |
| Gas Volume($Nm^3$ wet) | 2.9404 |
| Mass of Wet Gas(g) | 3678.04 |
| **Moisture Concentration(%v/v)** | **8.6** |
| **Moisture Concentration(%w/w)** | **5.5** |

**Calculation: Mercury**

| | |
|---|---|
| Filter(µg as Hg) | 0.77 |
| Probe Rinse(µg as Hg) | 0.00 |
| Absorbent(µg as Hg) | 3.18 |
| Total Mercury Sampled(µg) | 3.95 |
| Mercury Emission(µg/$Nm^3$ dry) | 1.47 |
| Oxygen Concentration(%v/v dry) | 17.10 |
| **Mercury Emission (µg/$Nm^3$ @ 11 %v/v Oxygen dry)** | **3.79** |
| Flue Gas Volumetric Flowrate($Nm^3$/h dry) | 3983 |
| **Mercury Emission(g/h)** | **0.006** |
| | |
| Required Sample Velocity(Nm/s) | 11.50 |
| Nozzle Used(mm) | 4.5 |
| Area of Nozzle($m^2$) | 0.00001590 |
| Test Duration(mins) | 252 |
| Actual Sample Velocity(Nm/s) | 11.18 |
| Isokinetic Closure(%) | 97 |

## Coventry Cremators 3 & 4 Abatement System Outlet

## Flue Gas Volumetric Flow

| | |
|---|---|
| Contract | Coventry Crematorium, DEM0657 |
| Date | 23rd July 2013 |
| Location | Cremators 3&4 Flue Gas Abatement System Outlet |
| Engineer(s) | JB |

| **Test Log** | **Test 34-4** |
|---|---|
| Flue Gas Temperature(Deg C) | 98 |
| Flue Gas Pitot Head Sample Points(Pa) | 136.2 |
| Flue Gas Moisture(%v/v) | 8.6 |
| Flue Gas Moisture(%w/w) | 5.5 |
| Flue Gas Duct Dimensions(mm) | 350 mm Diameter Circular Stack |
| Flue Gas Duct Area($m^2$) | 0.0962 |

**Calculation**

| | |
|---|---|
| Flue Gas Density($kg/m^3$) | 0.9305 |
| Flue Gas Velocity(Am/s) | 17.11 |
| Flue Gas Volumetric Flowrate($Am^3/h$) | 5927 |
| Flue Gas Volumetric Flowrate($Am^3/h$ dry) | 5419 |
| **Flue Gas Volumetric Flowrate($Nm^3/h$ dry)** | **3983** |

**APPENDIX 2**

Analysis Reports

Scientific Analysis Laboratories is a limited company registered in England and Wales (No 2514788) whose address is at Hadfield House, Hadfield Street, Manchester M16 9FE

# Scientific Analysis Laboratories Ltd

## Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2404

**Report Number:** 342734-1

**Date of Report:** 07-Aug-2013

**Customer:** Davies & Co (Engineering)
PO Box 11
Moor Road
Leeds
LS10 2DD

**Customer Contact:** Mr Steve Atherton

**Customer Job Reference:** DEM0657
**Customer Purchase Order:** 50000780
**Date Job Received at SAL:** 30-Jul-2013
**Date Analysis Started:** 31-Jul-2013
**Date Analysis Completed:** 07-Aug-2013

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22

UKAS TESTING
1549

Report checked and authorised by :
Kayleigh McCann
Project Manager

Issued by :
Kayleigh McCann
Project Manager

Validity unknown
Digitally signed by Kayleigh McCann
Date: 2013.08.07 17:02:51 BST
Reason: Issued
Location: SAL





Davies & Co (Engineering) Ltd

**SAL Reference:** 342734
**Customer Reference:** DEM0657

**Filter** Analysed as Filter
**Miscellaneous**

| | SAL Reference | 342734 010 | 342734 011 | 342734 012 |
|---|---|---|---|---|
| | Customer Sample Reference | CO230713 HgF34-4 | CO230713 HgFBLANK | CO240713 HgF12-1 |
| | Test Sample | AR | AR | AR |

| Determinand | Method | LOD | Units | Symbol | | | |
|---|---|---|---|---|---|---|---|
| Mercury | CVAFS (HF Digest BS EN 13211) | 0.01 | µg | U | (195) 0.78 | <0.01 | 0.05 |

**SAL Reference:** 342734
**Customer Reference:** DEM0657

**Impinger (4%K2Cr2O7/20%HNO3)** Analysed as Impinger (4%K2Cr2O7/20%HNO3)
**Miscellaneous**

| | SAL Reference | 342734 013 | 342734 014 | 342734 015 | 342734 016 | 342734 017 |
|---|---|---|---|---|---|---|
| | Customer Sample Reference | CO230713 Hg34-4A | CO230713 Hg34-4B | CO230713 HgBLANK | CO240713 Hg12-1A | CO240713 Hg12-1B |
| | Test Sample | AR | AR | AR | AR | AR |

| Determinand | Method | LOD | Units | Symbol | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Mercury | CVAFS (BS EN 13211) | 0.5 | µg/l | U | (195) 10 | 1.1 | <0.5 | (195) 29 | <0.5 |

**SAL Reference:** 342734
**Customer Reference:** DEM0657

**Impinger(DI water)** Analysed as Impinger(DI water)
**Miscellaneous**

| | SAL Reference | 342734 001 | 342734 002 | 342734 003 | 342734 004 | 342734 005 |
|---|---|---|---|---|---|---|
| | Customer Sample Reference | CO230713 H34-1 | CO230713 H34-2 | CO230713 H34-3A | CO230713 H34-3B | CO230713 HOB |
| | Test Sample | AR | AR | AR | AR | AR |

| Determinand | Method | LOD | Units | Symbol | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Hydrogen Chloride | IC | 0.05 | mg/l | U | (13) 6.6 | (13) 41 | (13) 40 | (13) <0.05 | (13) 1.2 |

**SAL Reference:** 342734
**Customer Reference:** DEM0657

**Impinger(DI water)** Analysed as Impinger(DI water)
**Miscellaneous**

| | SAL Reference | 342734 006 | 342734 007 | 342734 008 | 342734 009 |
|---|---|---|---|---|---|
| | Customer Sample Reference | CO240713 H12-2 | CO240713 H21-3 | CO250713 H12-4A | CO250713 H12-4B |
| | Test Sample | AR | AR | AR | AR |

| Determinand | Method | LOD | Units | Symbol | | | | |
|---|---|---|---|---|---|---|---|---|
| Hydrogen Chloride | IC | 0.05 | mg/l | U | (13) 13 | (13) 15 | (13) 14 | (13) 0.08 |

## Index to symbols used in 342734-1

| Value | Description |
|---|---|
| AR | As Received |
| 13 | Results have been blank corrected. |
| 195 | Due to levels found in the sample that are outside of the normal calibration range of the instrument, analysis was conducted on a diluted sample |
| U | Analysis is UKAS accredited |

## Particulate Weight Determination - Cremator 1&2 Abatement System

| Filter / Rinse Reference | | Clean Dry Weight g | Dirty Dry Weight g |
|---|---|---|---|
| CO240713FOB | 3 | 0.5378 | 0.5378 |
| CO240713F1,2-2 | H4 | 0.53915 | 0.53927 |
| CO240713F1,2-3 | H5 | 0.53355 | 0.53355 |
| CO250713F1,2-4 | H6 | 0.53818 | 0.53819 |
| CO240713ROB | | 77.36582 | 77.36482 |
| CO240713R1&2 | 1 | 77.65984 | 77.65993 |
| CO240713R1&2 | 2 | 77.65993 | 77.65993 |
| CO250713R1&2 | 3 | 77.65993 | 77.65994 |

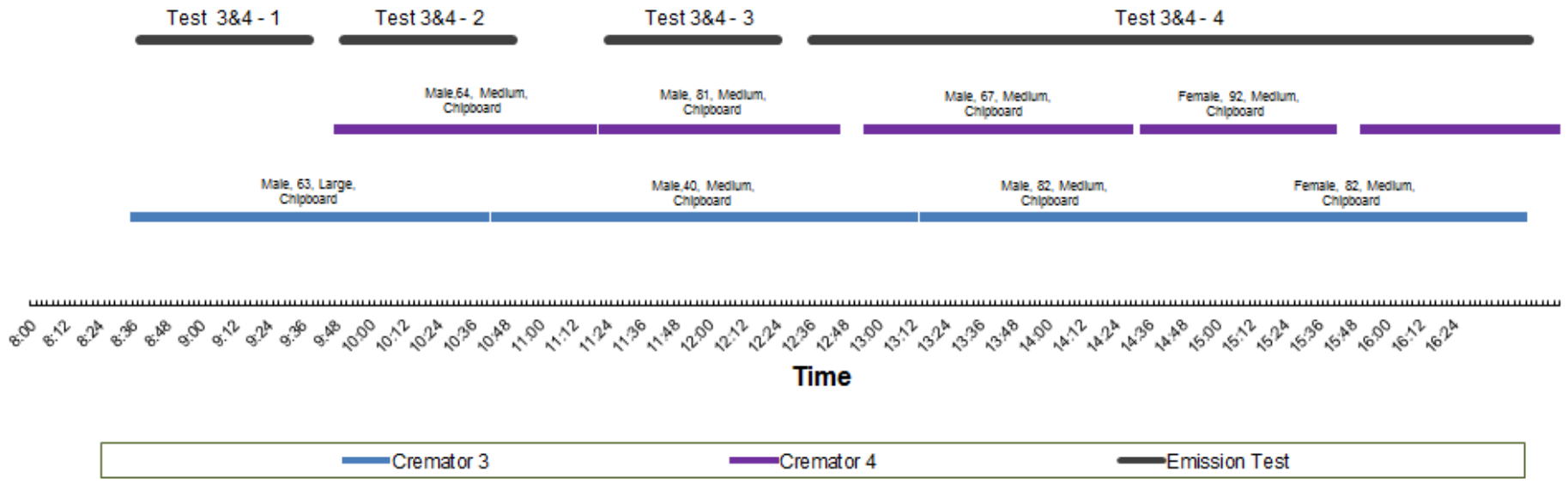
## Particulate Weight Determination

| Filter / Rinse Reference | | Clean Dry Weight g | Dirty Dry Weight g |
|---|---|---|---|
| CO230713FOB | 5 | 0.5416 | 0.5416 |
| CO230713F3,4-1 | H1 | 0.53702 | 0.53703 |
| CO230713F3,4-2 | H2 | 0.53545 | 0.53545 |
| CO230713F3,4-3 | H3 | 0.53691 | 0.53706 |
| CO230713ROB | | 77.25641 | 77.25641 |
| CO230713R3&4 | 1 | 76.23145 | 76.23146 |
| CO230713R3&4 | 2 | 76.23146 | 76.23146 |
| CO230713R3&4 | 3 | 76.23146 | 76.23154 |

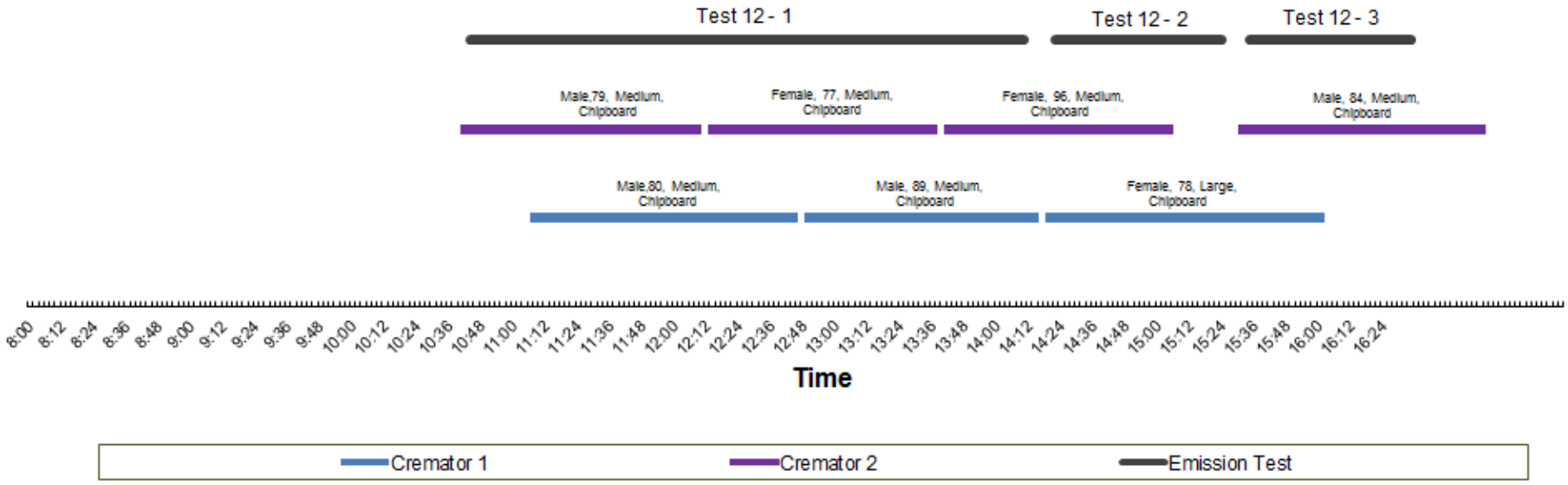
**APPENDIX 3**

Details of Plant Operation During Testing

# Coventry Crematorium Cremators 3 & 4
# Emission Tests 23/07/2013
# Plant Operation & Test Periods



# Coventry Crematorium Cremators 1 & 2
# Emission Tests 24/07/2013
# Plant Operation & Test Periods



# Coventry Crematorium Cremators 1 & 2
# Emission Tests 25/07/2013
# Plant Operation & Test Periods