Davies & Co. (Environmental) Ltd
*Emissions Monitoring Specialists*

# EMISSIONS MONITORING TEST REPORT

## CANLEY GARDEN CREMATORIUM
## Cannon Hill Road
## Coventry
## CV4 7DF

## 28th – 30th July 2014

Report Authorised by [redacted]

Date 22nd September 2014

Mr S P Atherton
Business Manager
EA MCertS Level 2 + TE1,2,3,4
MM 03 336

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Davies & Co. (Environmental) Ltd
Moor Road
Leeds, LS10 2DD, England
Tel: +44 (0) 113 270 4651
Fax: +44 (0) 113 276 5759
Email: info@davies-co-ltd.com

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## 1. INTRODUCTION

The four cremators and associated flue gas treatment systems at Canley Garden Crematorium were monitored between the 28th to 30th July 2014 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 Nos.1, 2 & 3 Cremators that are designated as the model FTII, and No.4 Cremator that is the model type FTIII. The two cremator types are similar other than the FTIII having a wider hearth capable of accepting larger coffin sizes. Each cremator is fitted with two nozzle mix burners utilising natural gas as the support fuel.

Cremators 1 & 2 share a combined flue gas treatment system designated as Stream 1, with an identical arrangement for Cremators 3 & 4 designated as Stream 2.

The waste gases from the two cremators 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 plant operates under full microprocessor based automatic control that requires little manual intervention.

The cremator 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 2010 – (EPR 2010) 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 cremator and associated flue gas treatment system with the requirements of the Guidance Note in terms of emission releases to air.

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 correct the sampling rate).

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.

Testing was conducted using centre point sampling given that the duct diameter is 350mm.

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

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.

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.

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 EN 15058.

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 calibrated using a certified reference gas prior to, and following each test.

zeroed with air passed through a catalytic converter and calibrated with a nominal 50 ppmv propane in balance air gas prior to, and following each test.

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 EN 14789.

The analyser was calibrated using a certified reference gas prior to, and following each test.

The output of the analyser was 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 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 & 3 are 60 minute mean results.

Total Particulate Matter, Hydrogen Chloride, Carbon Monoxide and Volatile Organic Compound determinations are given in Table 1.

Mercury determinations are given in Tables 2 & 4, and are single tests of extended duration.

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(2012) where required.

All data logs and calculations are given in Appendix 1.

All analysis reports are given in Appendix 2.

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

**TABLE 1**
**Canley Crematorium Stream 1 Abatement System Outlet**
**Emissions Monitoring 29th July 2014**
**Total Particulate Matter & Hydrogen Chloride Sampling**

| | | Test 1 | Test 2 | Test 3 | Average | Requirement to PG5/2 (2012) |
|---|---|---|---|---|---|---|
| Total Particulate Matter | - mg/Nm$^3$c. | 0.12 ± 3.11 | 0.06 ± 3.23 | 1.42 ± 3.62 | **0.53** | <20 |
| Hydrogen Chloride | - mg/Nm$^3$c. | 18.99 ± 0.95 | 21.10 ± 1.09 | 40.51 ± 2.15 | **26.87** | <30 |
| Carbon Monoxide | | | | | | |
| Test Average | - mg/Nm$^3$c. | 2.38 ± 0.12 | 4.73 ± 0.24 | 0.26 ± 0.01 | **2.46** | <100 |
| First 30 min Average | - mg/Nm$^3$c. | 2.62 ± 0.13 | 2.84 ± 0.14 | 0.52 ± 0.03 | **-** | |
| Second 30 min Average | - mg/Nm$^3$c. | 2.14 ± 0.11 | 6.69 ± 0.33 | 0.00 ± 0.00 | **-** | |
| First 60 min Average | - mg/Nm$^3$c. | 2.38 ± 0.12 | 4.73 ± 0.24 | 0.26 ± 0.01 | **-** | |
| Organic Compounds | - mg/Nm$^3$c. | 0.09 ± 0.00 | 0.07 ± 0.00 | 0.01 ± 0.00 | **0.06** | <20 |
| Flue Oxygen | - %v/v dry | 13.80 ± 0.10 | 14.67 ± 0.10 | 15.35 ± 0.10 | **14.61** | |
| Flue Moisture | - %v/v | 7.4 ± 0.7 | 7.4 ± 0.7 | 6.4 ± 0.6 | **7.1** | |
| | - %w/w | 4.7 ± 0.5 | 4.7 ± 0.5 | 4.1 ± 0.4 | **4.5** | |
| Flue Temperature | - Deg C | 129 ± 2 | 134 ± 2 | 132 ± 2 | **132** | |
| Volumetric Flow | - Nm$^3$/h dry | 3260 ± 65 | 3570 ± 71 | 3284 ± 66 | **3371** | |

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

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**TABLE 2**
**Canley Crematorium Stream 1 Abatement System Outlet**
**Emissions Monitoring 30th July 2014**
**Mercury Sampling**

| | | Test 4 | Requirement to PG5/2 (2012) |
|---|---|---|---|
| Mercury | - µg/Nm$^3$c. | 4.82 ± 4.48 | <50 |

| | | |
|---|---|---|
| Flue Oxygen | - %v/v dry | 15.00 ± 0.10 |
| Flue Moisture | - %v/v | 4.5 ± 0.4 |
| | - %w/w | 2.8 ± 0.3 |
| Flue Temperature | - Deg C | 118 ± 2 |
| Volumetric Flow | - Nm$^3$/h dry | 2593 ± 52 |

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**
**Canley Crematorium Stream 2 Abatement System Outlet**
**Emissions Monitoring 28th July 2014**
**Total Particulate Matter & Hydrogen Chloride Sampling**

| | | Test 1 | Test 2 | Test 3 | Average | Requirement to PG5/2 (2012) |
|---|---|---|---|---|---|---|
| Total Particulate Matter | - mg/Nm$^3$c. | 0.70 ± 3.76 | 0.53 ± 3.86 | 2.13 ± 6.26 | **1.12** | <20 |
| Hydrogen Chloride | - mg/Nm$^3$c. | 40.56 ± 2.55 | 38.88 ± 2.50 | 36.18 ± 2.55 | **38.54** | <30 |
| Carbon Monoxide | | | | | | |
| Test Average | - mg/Nm$^3$c. | 0.00 ± 0.00 | 0.08 ± 0.00 | 0.00 ± 0.00 | **0.03** | <100 |
| First 30 min Average | - mg/Nm$^3$c. | 0.00 ± 0.00 | 0.16 ± 0.01 | 0.00 ± 0.00 | **-** | |
| Second 30 min Average | - mg/Nm$^3$c. | 0.01 ± 0.00 | 0.00 ± 0.00 | 0.00 ± 0.00 | **-** | |
| First 60 min Average | - mg/Nm$^3$c. | 0.00 ± 0.00 | 0.08 ± 0.00 | 0.00 ± 0.00 | **-** | |
| Organic Compounds | - mg/Nm$^3$c. | 0.08 ± 0.00 | 0.00 ± 0.00 | 0.00 ± 0.00 | **0.03** | <20 |

| | | | | | |
|---|---|---|---|---|---|
| Flue Oxygen | - %v/v dry | 16.89 ± 0.10 | 17.04 ± 0.10 | 17.50 ± 0.10 | **17.15** |
| Flue Moisture | - %v/v | 6.8 ± 0.7 | 7.0 ± 0.7 | 9.4 ± 0.9 | **7.7** |
| | - %w/w | 4.3 ± 0.4 | 4.5 ± 0.4 | 6.1 ± 0.6 | **5.0** |
| Flue Temperature | - Deg C | 96 ± 2 | 96 ± 2 | 93 ± 2 | **95** |
| Volumetric Flow | - Nm$^3$/h dry | 4762 ± 95 | 4517 ± 90 | 3333 ± 67 | **4204** |

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

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**TABLE 4**
**Canley Crematorium Stream 2 Abatement System Outlet**
**Emissions Monitoring 29th July 2014**
**Mercury Sampling**

| | | Test 4 | Requirement to PG5/2 (2012) |
|---|---|---|---|
| Mercury | - µg/Nm$^3$c. | 5.64 ± 7.09 | <50 |

| | | |
|---|---|---|
| Flue Oxygen | - %v/v dry | 15.98 ± 0.10 |
| Flue Moisture | - %v/v | 8.2 ± 0.8 |
| | - %w/w | 5.3 ± 0.5 |
| Flue Temperature | - Deg C | 97 ± 2 |
| Volumetric Flow | - Nm$^3$/h dry | 4549 ± 91 |

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

## 4. COMMENTS

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

The average emissions of hydrogen chloride from Stream 1 were below the emission limit, but Stream 2 failed to meet the emission limit value.

The high HCl emissions could be due to unusually high levels of chlorides within the coffin, or coffin contents, or could be due to an insufficient feed of reagent to the system.

The cremators and flue gas treatment system operated satisfactorily during testing without any failure or alarm events.

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

## 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 use using suitable 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

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# Canley Crematorium Stream 1 Abatement System Outlet

## Data Log 29/07/14

**Test 1**

| Time _ | Flue Gas °C | Meter °C | Flue Oxygen %v/v dry | CO mg/Nm³ c. | VOC mg/Nm³ c. | Sample Point Pa |
|---|---|---|---|---|---|---|
| | | | | | | |
| 14:14 | 129 | 44.2 | 15.26 | 8.17 | 0.43 | 93.2 |
| 14:15 | 128 | 44.1 | 13.20 | 21.84 | 1.13 | 72.2 |
| 14:16 | 129 | 43.9 | 11.62 | 12.64 | 2.17 | 91.6 |
| 14:17 | 129 | 43.7 | 11.37 | 3.08 | 0.01 | 89.9 |
| 14:18 | 129 | 43.6 | 11.86 | 0.83 | 0.00 | 79.8 |
| 14:19 | 128 | 43.5 | 12.06 | 1.70 | 0.00 | 59.6 |
| 14:20 | 129 | 43.5 | 11.13 | 5.17 | 0.00 | 107.5 |
| 14:21 | 130 | 43.5 | 12.69 | 9.62 | 0.00 | 115.1 |
| 14:22 | 129 | 43.5 | 15.73 | 14.22 | 0.00 | 78.1 |
| 14:23 | 128 | 43.5 | 14.46 | 4.03 | 0.23 | 57.1 |
| 14:24 | 128 | 43.6 | 13.25 | 0.00 | 0.00 | 50.4 |
| 14:25 | 128 | 43.6 | 11.99 | 0.00 | 0.00 | 52.1 |
| 14:26 | 128 | 43.7 | 11.52 | 0.00 | 0.00 | 54.6 |
| 14:27 | 128 | 43.8 | 12.09 | 0.00 | 0.00 | 53.8 |
| 14:28 | 128 | 43.9 | 12.56 | 0.00 | 0.00 | 45.4 |
| 14:29 | 128 | 44.0 | 12.74 | 0.00 | 0.00 | 48.7 |
| 14:30 | 127 | 44.2 | 11.59 | 0.00 | 0.00 | 38.6 |
| 14:31 | 127 | 44.2 | 12.06 | 0.00 | 0.00 | 31.1 |
| 14:32 | 127 | 44.3 | 14.78 | 0.00 | 0.00 | 42.0 |
| 14:33 | 127 | 44.5 | 13.15 | 0.00 | 0.00 | 48.7 |
| 14:34 | 127 | 44.6 | 12.12 | 0.00 | 0.00 | 58.8 |
| 14:35 | 127 | 44.7 | 12.08 | 0.00 | 0.00 | 52.9 |
| 14:36 | 127 | 44.8 | 14.13 | 0.00 | 0.00 | 54.6 |
| 14:37 | 128 | 44.9 | 15.23 | 0.02 | 0.00 | 72.2 |
| 14:38 | 128 | 45.1 | 11.94 | 0.00 | 0.00 | 79.8 |
| 14:39 | 128 | 45.3 | 12.45 | 0.00 | 0.00 | 72.2 |
| 14:40 | 128 | 45.4 | 12.94 | 0.00 | 0.00 | 80.6 |
| 14:41 | 129 | 45.6 | 13.14 | 0.00 | 0.00 | 122.6 |
| 14:42 | 129 | 45.7 | 13.89 | 0.00 | 0.00 | 107.5 |
| 14:43 | 129 | 45.9 | 14.89 | 0.00 | 0.00 | 96.6 |
| 14:44 | 130 | 46.0 | 14.61 | 0.00 | 0.00 | 147.8 |
| 14:45 | 130 | 46.2 | 14.97 | 0.00 | 0.00 | 126.8 |
| 14:46 | 130 | 46.3 | 15.83 | 0.00 | 0.00 | 126.8 |
| 14:47 | 130 | 46.5 | 15.13 | 0.00 | 0.00 | 148.7 |
| 14:48 | 130 | 46.7 | 15.50 | 0.00 | 0.00 | 121.0 |
| 14:49 | 130 | 46.9 | 15.98 | 0.00 | 0.00 | 127.7 |
| 14:50 | 131 | 47.0 | 15.31 | 0.00 | 0.00 | 147.8 |
| 14:51 | 130 | 47.2 | 15.61 | 0.00 | 0.00 | 122.6 |
| 14:52 | 130 | 47.4 | 16.11 | 0.00 | 0.00 | 135.2 |
| 14:53 | 131 | 47.5 | 15.09 | 0.00 | 0.00 | 148.7 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 14:54 | 131 | 47.6 | 15.82 | 0.00 | 0.00 | 122.6 |
| 14:55 | 130 | 47.8 | 16.26 | 0.00 | 0.00 | 128.5 |
| 14:56 | 131 | 47.9 | 15.45 | 0.00 | 0.00 | 142.0 |
| 14:57 | 131 | 48.1 | 16.86 | 0.41 | 0.00 | 156.2 |
| 14:58 | 131 | 48.2 | 17.78 | 4.90 | 0.00 | 139.4 |
| 14:59 | 131 | 48.4 | 15.03 | 0.00 | 0.06 | 139.4 |
| 15:00 | 132 | 48.5 | 16.29 | 36.98 | 1.19 | 168.0 |
| 15:01 | 132 | 48.6 | 15.22 | 18.56 | 0.00 | 138.6 |
| 15:02 | 131 | 48.7 | 12.62 | 1.15 | 0.00 | 117.6 |
| 15:03 | 131 | 48.8 | 13.56 | 0.47 | 0.00 | 110.0 |
| 15:04 | 131 | 48.8 | 15.08 | 0.00 | 0.00 | 94.9 |
| 15:05 | 131 | 48.9 | 13.58 | 0.00 | 0.00 | 113.4 |
| 15:06 | 131 | 49.0 | 13.80 | 0.00 | 0.00 | 101.6 |
| 15:07 | 131 | 49.0 | 13.69 | 0.41 | 0.00 | 104.2 |
| 15:08 | 131 | 49.1 | 12.22 | 0.08 | 0.00 | 95.8 |
| 15:09 | 131 | 49.2 | 11.76 | 0.08 | 0.00 | 90.7 |
| 15:10 | 130 | 49.2 | 13.52 | 0.48 | 0.00 | 79.8 |
| 15:11 | 131 | 49.2 | 12.53 | 0.01 | 0.00 | 96.6 |
| 15:12 | 131 | 49.3 | 11.87 | 0.00 | 0.00 | 95.8 |
| 15:13 | 131 | 49.3 | 13.35 | 0.54 | 0.00 | 98.3 |
| 15:14 | 131 | 49.3 | 13.51 | 0.00 | 0.00 | 100.8 |
| | | | | | | |
| **Average** | **129** | **46.2** | **13.80** | **2.38** | **0.09** | **96.6** |

| | | |
|---|---|---|
| Average for first 30 mins of test | **2.62** | - |
| Average for second 30 mins of test | **2.14** | - |
| Average for first 60 mins of test | **2.38** | **0.09** |

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# Canley Crematorium Stream 1 Abatement System Outlet

## Data Log 29/07/14

**Test 2**

| Time _ | Flue Gas °C | Meter °C | Flue Oxygen %v/v dry | CO mg/Nm³ c. | VOC mg/Nm³ c. | Sample Point Pa |
|---|---|---|---|---|---|---|
| | | | | | | |
| 15:34 | 132 | 45.8 | 14.66 | 3.56 | 0.00 | 144.5 |
| 15:35 | 131 | 45.6 | 13.98 | 4.78 | 0.00 | 108.4 |
| 15:36 | 131 | 45.4 | 14.10 | 2.57 | 0.00 | 80.6 |
| 15:37 | 130 | 45.3 | 13.71 | 2.17 | 0.00 | 65.5 |
| 15:38 | 130 | 45.1 | 13.77 | 1.50 | 0.00 | 75.6 |
| 15:39 | 131 | 45.0 | 13.83 | 3.44 | 0.00 | 155.4 |
| 15:40 | 133 | 44.9 | 14.30 | 4.59 | 0.08 | 166.3 |
| 15:41 | 133 | 44.9 | 14.67 | 8.27 | 2.45 | 143.6 |
| 15:42 | 133 | 44.9 | 14.35 | 6.21 | 1.82 | 128.5 |
| 15:43 | 132 | 44.9 | 14.39 | 4.70 | 0.00 | 120.1 |
| 15:44 | 132 | 44.9 | 14.58 | 3.42 | 0.00 | 107.5 |
| 15:45 | 132 | 44.9 | 14.30 | 1.53 | 0.00 | 126.8 |
| 15:46 | 133 | 44.9 | 14.22 | 2.32 | 0.00 | 122.6 |
| 15:47 | 133 | 45.0 | 13.64 | 2.42 | 0.00 | 108.4 |
| 15:48 | 133 | 45.0 | 14.15 | 3.42 | 0.00 | 103.3 |
| 15:49 | 133 | 45.1 | 13.73 | 2.27 | 0.00 | 107.5 |
| 15:50 | 133 | 45.2 | 13.21 | 2.20 | 0.00 | 110.0 |
| 15:51 | 133 | 45.3 | 13.10 | 2.09 | 0.00 | 110.9 |
| 15:52 | 133 | 45.4 | 13.34 | 2.16 | 0.00 | 92.4 |
| 15:53 | 133 | 45.5 | 13.51 | 2.93 | 0.00 | 90.7 |
| 15:54 | 133 | 45.6 | 14.20 | 3.02 | 0.00 | 87.4 |
| 15:55 | 132 | 45.6 | 14.67 | 2.60 | 0.00 | 86.5 |
| 15:56 | 133 | 45.7 | 14.62 | 2.58 | 0.00 | 109.2 |
| 15:57 | 134 | 45.8 | 14.59 | 2.89 | 0.00 | 148.7 |
| 15:58 | 135 | 45.9 | 14.27 | 2.46 | 0.00 | 182.3 |
| 15:59 | 136 | 46.0 | 14.66 | 1.76 | 0.00 | 173.0 |
| 16:00 | 136 | 46.1 | 13.88 | 1.15 | 0.00 | 163.8 |
| 16:01 | 137 | 46.1 | 13.54 | 1.10 | 0.00 | 188.2 |
| 16:02 | 137 | 46.2 | 14.85 | 1.34 | 0.00 | 154.6 |
| 16:03 | 137 | 46.3 | 14.70 | 1.29 | 0.00 | 121.0 |
| 16:04 | 136 | 46.3 | 14.78 | 1.29 | 0.00 | 103.3 |
| 16:05 | 136 | 46.4 | 14.57 | 1.25 | 0.00 | 90.7 |
| 16:06 | 135 | 46.5 | 14.26 | 2.14 | 0.00 | 88.2 |
| 16:07 | 135 | 46.6 | 12.88 | 2.01 | 0.00 | 105.8 |
| 16:08 | 137 | 46.6 | 12.90 | 1.52 | 0.00 | 163.8 |
| 16:09 | 139 | 46.7 | 14.15 | 1.19 | 0.00 | 214.2 |
| 16:10 | 139 | 46.7 | 14.84 | 1.34 | 0.00 | 199.9 |
| 16:11 | 139 | 46.8 | 14.80 | 0.02 | 0.00 | 180.6 |
| 16:12 | 139 | 46.9 | 14.60 | 0.00 | 0.00 | 142.8 |
| 16:13 | 138 | 46.9 | 15.25 | 0.00 | 0.00 | 105.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 16:14 | 137 | 47.0 | 14.78 | 0.02 | 0.00 | 79.8 |
| 16:15 | 136 | 47.1 | 14.79 | 0.02 | 0.00 | 62.2 |
| 16:16 | 135 | 47.2 | 13.95 | 0.01 | 0.00 | 64.7 |
| 16:17 | 135 | 47.2 | 13.70 | 0.01 | 0.00 | 86.5 |
| 16:18 | 135 | 47.3 | 14.03 | 0.58 | 0.00 | 102.5 |
| 16:19 | 136 | 47.4 | 14.90 | 0.02 | 0.00 | 119.3 |
| 16:20 | 136 | 47.4 | 15.65 | 0.04 | 0.00 | 125.2 |
| 16:21 | 135 | 47.5 | 15.99 | 0.00 | 0.00 | 123.5 |
| 16:22 | 135 | 47.5 | 15.94 | 0.00 | 0.00 | 119.3 |
| 16:23 | 135 | 47.6 | 15.84 | 0.00 | 0.00 | 117.6 |
| 16:24 | 135 | 47.7 | 15.95 | 0.00 | 0.00 | 113.4 |
| 16:25 | 134 | 47.7 | 15.84 | 0.00 | 0.00 | 110.9 |
| 16:26 | 134 | 47.8 | 15.95 | 0.00 | 0.00 | 111.7 |
| 16:27 | 134 | 47.8 | 16.18 | 0.00 | 0.00 | 110.9 |
| 16:28 | 133 | 47.9 | 16.51 | 0.00 | 0.00 | 94.9 |
| 16:29 | 133 | 47.9 | 17.50 | 0.00 | 0.00 | 113.4 |
| 16:30 | 133 | 47.9 | 17.81 | 0.00 | 0.00 | 101.6 |
| 16:31 | 132 | 48.0 | 16.22 | 0.00 | 0.00 | 68.9 |
| 16:32 | 131 | 48.0 | 16.30 | 74.27 | 0.00 | 76.4 |
| 16:33 | 131 | 48.0 | 16.69 | 112.58 | 0.00 | 79.0 |
| 16:34 | 131 | 48.1 | 13.96 | 3.72 | 0.00 | 91.6 |
| | | | | | | |
| **Average** | **134** | **46.4** | **14.67** | **4.73** | **0.07** | **117.2** |

| | | |
|---|---|---|
| Average for first 30 mins of test | **2.84** | - |
| Average for second 30 mins of test | **6.69** | - |
| Average for first 60 mins of test | **4.73** | **0.07** |

# Canley Crematorium Stream 1 Abatement System Outlet

## Data Log 29/07/14

**Test 3**

| Time | Flue Gas °C | Meter °C | Flue Oxygen %v/v dry | CO mg/Nm³ c. | VOC mg/Nm³ c. | Sample Point Pa |
|---|---|---|---|---|---|---|
| | | | | | | |
| 17:06 | 130 | 43.5 | 13.31 | 1.28 | 0.28 | 92.4 |
| 17:07 | 130 | 43.3 | 13.94 | 1.16 | 0.00 | 74.8 |
| 17:08 | 130 | 43.1 | 14.01 | 0.00 | 0.00 | 65.5 |
| 17:09 | 129 | 43.0 | 13.78 | 0.00 | 0.00 | 63.8 |
| 17:10 | 129 | 42.9 | 13.81 | 0.00 | 0.00 | 68.9 |
| 17:11 | 130 | 42.8 | 13.83 | 0.00 | 0.00 | 88.2 |
| 17:12 | 130 | 42.7 | 14.28 | 0.00 | 0.00 | 114.2 |
| 17:13 | 131 | 42.7 | 14.99 | 0.97 | 0.00 | 110.0 |
| 17:14 | 130 | 42.7 | 15.49 | 0.02 | 0.00 | 79.8 |
| 17:15 | 130 | 42.7 | 15.94 | 0.00 | 0.00 | 67.2 |
| 17:16 | 129 | 42.7 | 16.38 | 1.20 | 0.00 | 79.8 |
| 17:17 | 130 | 42.8 | 15.20 | 3.58 | 0.26 | 106.7 |
| 17:18 | 130 | 42.9 | 14.13 | 0.61 | 0.15 | 95.8 |
| 17:19 | 130 | 43.0 | 15.81 | 4.12 | 0.00 | 103.3 |
| 17:20 | 131 | 43.1 | 14.88 | 3.15 | 0.00 | 101.6 |
| 17:21 | 131 | 43.2 | 14.21 | 0.00 | 0.00 | 103.3 |
| 17:22 | 132 | 43.3 | 16.35 | 0.00 | 0.00 | 129.4 |
| 17:23 | 132 | 43.5 | 17.11 | 0.00 | 0.00 | 129.4 |
| 17:24 | 132 | 43.6 | 17.17 | 0.00 | 0.00 | 128.5 |
| 17:25 | 132 | 43.7 | 17.32 | 0.00 | 0.00 | 126.8 |
| 17:26 | 132 | 43.8 | 17.46 | 0.00 | 0.00 | 123.5 |
| 17:27 | 132 | 44.0 | 16.70 | 0.00 | 0.00 | 117.6 |
| 17:28 | 131 | 44.1 | 15.08 | 0.00 | 0.00 | 111.7 |
| 17:29 | 131 | 44.2 | 15.20 | 0.03 | 0.00 | 115.9 |
| 17:30 | 132 | 44.3 | 16.28 | 0.00 | 0.00 | 135.2 |
| 17:31 | 132 | 44.4 | 15.03 | 0.00 | 0.00 | 126.8 |
| 17:32 | 132 | 44.6 | 15.65 | 0.00 | 0.00 | 125.2 |
| 17:33 | 132 | 44.7 | 16.20 | 0.00 | 0.00 | 113.4 |
| 17:34 | 132 | 44.8 | 15.04 | 0.00 | 0.00 | 115.1 |
| 17:35 | 132 | 45.0 | 14.37 | 0.00 | 0.00 | 110.0 |
| 17:36 | 133 | 45.1 | 14.42 | 0.00 | 0.00 | 108.4 |
| 17:37 | 133 | 45.2 | 14.55 | 0.00 | 0.00 | 107.5 |
| 17:38 | 133 | 45.4 | 14.71 | 0.00 | 0.00 | 107.5 |
| 17:39 | 133 | 45.5 | 14.84 | 0.00 | 0.00 | 106.7 |
| 17:40 | 133 | 45.6 | 14.96 | 0.00 | 0.00 | 105.8 |
| 17:41 | 133 | 45.7 | 15.07 | 0.00 | 0.00 | 106.7 |
| 17:42 | 133 | 45.8 | 15.22 | 0.00 | 0.00 | 84.0 |
| 17:43 | 133 | 45.9 | 14.37 | 0.00 | 0.00 | 66.4 |
| 17:44 | 132 | 45.9 | 13.68 | 0.00 | 0.00 | 59.6 |
| 17:45 | 132 | 46.0 | 13.29 | 0.00 | 0.00 | 61.3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 17:46 | 132 | 46.0 | 14.45 | 0.00 | 0.00 | 74.8 |
| 17:47 | 132 | 46.1 | 15.36 | 0.00 | 0.00 | 84.0 |
| 17:48 | 132 | 46.1 | 15.84 | 0.00 | 0.00 | 84.8 |
| 17:49 | 132 | 46.1 | 15.97 | 0.00 | 0.00 | 92.4 |
| 17:50 | 132 | 46.2 | 16.07 | 0.00 | 0.00 | 99.1 |
| 17:51 | 132 | 46.2 | 15.63 | 0.00 | 0.00 | 100.0 |
| 17:52 | 132 | 46.3 | 15.70 | 0.00 | 0.00 | 101.6 |
| 17:53 | 133 | 46.4 | 15.77 | 0.00 | 0.00 | 100.8 |
| 17:54 | 133 | 46.4 | 15.81 | 0.00 | 0.00 | 99.1 |
| 17:55 | 133 | 46.5 | 16.30 | 0.00 | 0.00 | 89.9 |
| 17:56 | 132 | 46.6 | 16.55 | 0.00 | 0.00 | 96.6 |
| 17:57 | 133 | 46.7 | 16.33 | 0.00 | 0.00 | 100.8 |
| 17:58 | 133 | 46.8 | 15.95 | 0.00 | 0.00 | 100.8 |
| 17:59 | 133 | 46.8 | 15.99 | 0.00 | 0.00 | 100.8 |
| 18:00 | 133 | 46.9 | 16.02 | 0.00 | 0.00 | 100.0 |
| 18:01 | 133 | 47.0 | 15.98 | 0.00 | 0.00 | 92.4 |
| 18:02 | 133 | 47.1 | 15.78 | 0.00 | 0.00 | 74.8 |
| 18:03 | 132 | 47.2 | 15.25 | 0.00 | 0.00 | 71.4 |
| 18:04 | 132 | 47.2 | 15.09 | 0.00 | 0.00 | 68.0 |
| 18:05 | 132 | 47.2 | 15.91 | 0.00 | 0.00 | 71.4 |
| 18:06 | 132 | 47.3 | 16.37 | 0.00 | 0.00 | 68.0 |
| | | | | | | |
| **Average** | **132** | **44.9** | **15.35** | **0.26** | **0.01** | **96.9** |

| | | |
|---|---|---|
| Average for first 30 mins of test | **0.52** | - |
| Average for second 30 mins of test | **0.00** | - |
| Average for first 60 mins of test | **0.26** | **0.01** |

Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

## Canley Crematorium Stream 1 Abatement System Outlet

## Total Particulate Matter and Hydrogen Chloride

| | |
|---|---|
| Contract | Canley Crematorium, DEM0744 |
| Date | 29th July 2014 |
| Location | Flue Gas Abatement System Outlet |
| Engineer(s) | JB & ST |
| Absorbent | $H_2O$ |

| **Test Log** | **Test 1** | **Test 2** | **Test 3** |
|---|---|---|---|
| Barometric Pressure(kPa) | 100.2 | 100.2 | 100.2 |
| Gas Meter Temperature(Deg C) | 46.2 | 46.4 | 44.9 |
| Oxygen Concentration(%v/v dry) | 13.80 | 14.67 | 15.35 |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 3260 | 3570 | 3284 |

| | Start | End | Start | End | Start | End |
|---|---|---|---|---|---|---|
| Time | 14:14 | 15:14 | 15:34 | 16:34 | 17:06 | 18:06 |
| Gas Meter Reading($Am^3$ dry) | 46.387 | 46.753 | 46.780 | 47.182 | 47.281 | 47.681 |
| Absorber Weight(g) | 3647.6 | 3667.5 | 3507.1 | 3528.9 | 3652.5 | 3671.3 |
| Filter Reference | CA290714F11 | | CA290714F21 | | CA290714F31 | |
| Filter Weight(g) | 0.54680 | 0.54682 | 0.54544 | 0.54545 | 0.55130 | 0.55151 |
| Probe Rinse Reference | CA290714R11 | | CA290714R21 | | CA290714R31 | |
| Probe Rinse Weight(g) | 79.4873 | 79.4873 | 79.4873 | 79.4873 | 79.4873 | 79.4874 |
| Sample Reference HCl | CA290714H11 | | CA290714H21 | | CA290714H31A&B | |
| Absorbent Volume(ml) | 500 | | 500 | | 250 | 250 |
| Absorbent(mg/l as HCl) | 8.5 | | 9.1 | | 31 | 0.05 |
| Blank(mg/l as HCl) | 0.05 | | 0.05 | | 0.05 | 0.05 |

**Calculation: General**

| | | | |
|---|---|---|---|
| Barometric Pressure(kPa) | 100.2 | 100.2 | 100.2 |
| Gas Meter temperature(Deg C) | 46.2 | 46.4 | 44.9 |
| Gas Volume Sampled($Am^3$ dry) | 0.366 | 0.402 | 0.400 |
| Gas Volume Sampled($Nm^3$ dry) | 0.3096 | 0.3399 | 0.3397 |
| Mass of Dry Gas(g @ 1292.8 g/$Nm^3$) | 400.26 | 439.42 | 439.23 |
| Change in Absorber Weight(g) | 19.9 | 21.8 | 18.8 |
| Water Vapour Volume($Nm^3$ @ 803.9 g/$Nm^3$) | 0.0248 | 0.0271 | 0.0234 |
| Gas Volume($Nm^3$ wet) | 0.3344 | 0.3670 | 0.3631 |
| Mass of Wet Gas(g) | 420.16 | 461.22 | 458.03 |
| **Moisture Concentration(%v/v)** | **7.4** | **7.4** | **6.4** |
| **Moisture Concentration(%w/w)** | **4.7** | **4.7** | **4.1** |

**Calculation: Particulate**

| | | | |
|---|---|---|---|
| Increase In Filter Weights(g) | 0.00003 | 0.00001 | 0.00027 |
| Particulate Emission(mg/$Nm^3$ dry) | 0.08 | 0.04 | 0.80 |
| Oxygen Concentration(%v/v dry) | 13.80 | 14.67 | 15.35 |
| **Particulate Emission** | **0.12** | **0.06** | **1.42** |
| **(mg/$Nm^3$ @ 11 %v/v Oxygen dry)** | | | |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 3260 | 3570 | 3284 |
| **Particulate Emission(g/h)** | **0.27** | **0.14** | **2.62** |
| | | | |
| Required Sample Velocity(Nm/s) | 9.41 | 10.31 | 9.48 |
| Nozzle Used(mm) | 3.5 | 3.5 | 3.5 |
| Area of Nozzle($m^2$) | 0.00000962 | 0.00000962 | 0.00000962 |
| Test Duration(mins) | 60 | 60 | 60 |
| Actual Sample Velocity(Nm/s) | 8.94 | 9.81 | 9.81 |
| Isokinetic Closure(%) | 95 | 95 | 103 |
| | | 98 | |

**Calculation: HCl**

| | | | |
|---|---|---|---|
| Absorbent(mg/l as HCl) | 8.50 | 9.10 | 31.05 |
| Blank(mg/l as HCl) | 0.05 | 0.05 | 0.05 |
| Chloride Absorbed(mg/l as HCl) | 8.45 | 9.05 | 31 |
| Chloride Absorbed(mg as HCl) | 4.23 | 4.53 | 7.75 |
| HCl(mg) | 4.23 | 4.53 | 7.75 |
| HCl Emission(mg/$Nm^3$ dry) | 13.65 | 13.31 | 22.81 |
| Oxygen Concentration(%v/v dry) | 13.80 | 14.67 | 15.35 |
| **HCl Emission** | **18.99** | **21.10** | **40.51** |
| **(mg/$Nm^3$ @ 11 %v/v Oxygen dry)** | | | |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 3260 | 3570 | 3284 |
| **HCl Emission(g/h)** | **44.48** | **47.52** | **74.91** |

Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

## Canley Crematorium Stream 1 Abatement System Outlet

## Flue Gas Volumetric Flow

| | |
|---|---|
| Contract | Canley Crematorium, DEM0744 |
| Date | 29th July 2014 |
| Location | Flue Gas Abatement System Outlet |
| Engineer(s) | JB & ST |

| **Test Log** | **Test 1** | **Test 2** | **Test 3** |
|---|---|---|---|
| Flue Gas Temperature(Deg C) | 129 | 134 | 132 |
| Flue Gas Pitot Head Sample Points(Pa) | 96.6 | 117.2 | 96.9 |
| Flue Gas Moisture(%v/v) | 7.4 | 7.4 | 6.4 |
| Flue Gas Moisture(%w/w) | 4.7 | 4.7 | 4.1 |
| Flue Gas Duct Dimensions(mm) | 350 mm Diameter Circular Stack | | |
| Flue Gas Duct Area($m^2$) | 0.0962 | | |
| **Calculation** | | | |
| Flue Gas Density($kg/m^3$) | 0.8615 | 0.8515 | 0.8586 |
| Sample Points | | | |
| Flue Gas Velocity(Am/s) | 14.98 | 16.59 | 15.02 |
| Flue Gas Volumetric Flowrate($Am^3/h$) | 5188 | 5747 | 5203 |
| Flue Gas Volumetric Flowrate($Am^3/h$ dry) | 4804 | 5323 | 4868 |
| Flue Gas Volumetric Flowrate($Nm^3/h$ dry) | 3260 | 3570 | 3284 |
| Duct Mean | | | |
| Flue Gas Velocity(Am/s) | 14.78 | 16.37 | 14.82 |
| Flue Gas Volumetric Flowrate($Am^3/h$) | 5118 | 5670 | 5133 |
| Flue Gas Volumetric Flowrate($Am^3/h$ dry) | 4740 | 5251 | 4803 |
| **Flue Gas Volumetric Flowrate($Nm^3/h$ dry)** | **3216** | **3522** | **3240** |

Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

# Canley Crematorium Stream 1 Abatement System Outlet

**Data Log** **30/07/14**

**Test 4**

| Time | Flue Gas °C | Meter °C | Flue $O_2$ %v/v dry | Sample Point Pa |
|---|---|---|---|---|
| | | | | |
| 11:18 | 95 | 26.2 | 15.28 | 50.4 |
| 11:19 | 95 | 26.2 | 15.99 | 35.3 |
| 11:20 | 96 | 26.3 | 15.20 | 49.6 |
| 11:21 | 97 | 26.5 | 14.13 | 53.8 |
| 11:22 | 98 | 26.6 | 14.92 | 40.3 |
| 11:23 | 99 | 26.9 | 15.89 | 61.3 |
| 11:24 | 101 | 27.1 | 13.24 | 68.9 |
| 11:25 | 100 | 27.4 | 15.79 | 26.0 |
| 11:26 | 100 | 27.8 | 15.58 | 24.4 |
| 11:27 | 101 | 28.1 | 15.03 | 46.2 |
| 11:28 | 101 | 28.5 | 14.80 | 37.8 |
| 11:29 | 101 | 28.9 | 15.82 | 30.2 |
| 11:30 | 102 | 29.3 | 14.62 | 47.9 |
| 11:31 | 103 | 29.7 | 14.51 | 45.4 |
| 11:32 | 104 | 30.1 | 14.57 | 47.9 |
| 11:33 | 104 | 30.6 | 15.51 | 31.9 |
| 11:34 | 105 | 31.0 | 15.29 | 42.8 |
| 11:35 | 105 | 31.4 | 14.02 | 53.8 |
| 11:36 | 105 | 31.8 | 14.59 | 41.2 |
| 11:37 | 105 | 32.2 | 15.39 | 27.7 |
| 11:38 | 106 | 32.6 | 15.42 | 40.3 |
| 11:39 | 107 | 33.1 | 14.16 | 48.7 |
| 11:40 | 107 | 33.5 | 14.72 | 33.6 |
| 11:41 | 107 | 33.9 | 16.42 | 32.8 |
| 11:42 | 107 | 34.3 | 15.09 | 42.0 |
| 11:43 | 108 | 34.7 | 14.28 | 40.3 |
| 11:44 | 107 | 35.1 | 16.04 | 25.2 |
| 11:45 | 107 | 35.5 | 16.83 | 36.1 |
| 11:46 | 108 | 35.8 | 15.04 | 37.0 |
| 11:47 | 108 | 36.2 | 15.27 | 28.6 |
| 11:48 | 108 | 36.6 | 17.28 | 37.0 |
| 11:49 | 109 | 36.9 | 15.88 | 41.2 |
| 11:50 | 109 | 37.3 | 15.20 | 31.1 |
| 11:51 | 109 | 37.6 | 17.71 | 38.6 |
| 11:52 | 109 | 38.0 | 13.94 | 32.8 |
| 11:53 | 108 | 38.3 | 14.95 | 21.8 |
| 11:54 | 109 | 38.6 | 14.76 | 29.4 |
| 11:55 | 108 | 38.9 | 14.94 | 12.6 |
| 11:56 | 109 | 39.2 | 17.26 | 30.2 |
| 11:57 | 109 | 39.5 | 13.19 | 20.2 |
| 11:58 | 108 | 39.8 | 16.05 | 16.8 |

| | | | | |
|---|---|---|---|---|
| 11:59 | 109 | 40.1 | 16.45 | 31.9 |
| 12:00 | 109 | 40.4 | 13.86 | 19.3 |
| 12:01 | 108 | 40.6 | 15.38 | 22.7 |
| 12:02 | 109 | 40.9 | 15.76 | 41.2 |
| 12:03 | 110 | 41.1 | 13.31 | 60.5 |
| 12:04 | 111 | 41.4 | 14.64 | 54.6 |
| 12:05 | 111 | 41.6 | 15.65 | 31.1 |
| 12:06 | 111 | 41.8 | 15.45 | 49.6 |
| 12:07 | 112 | 42.1 | 14.75 | 62.2 |
| 12:08 | 112 | 42.3 | 16.26 | 47.9 |
| 12:09 | 112 | 42.5 | 16.69 | 47.9 |
| 12:10 | 112 | 42.7 | 16.87 | 47.9 |
| 12:11 | 113 | 42.9 | 16.61 | 63.0 |
| 12:12 | 113 | 43.1 | 15.79 | 44.5 |
| 12:13 | 114 | 43.3 | 16.96 | 50.4 |
| 12:14 | 114 | 43.5 | 16.44 | 61.3 |
| 12:15 | 114 | 43.7 | 16.07 | 44.5 |
| 12:16 | 114 | 43.8 | 17.24 | 49.6 |
| 12:17 | 114 | 44.0 | 16.79 | 62.2 |
| 12:18 | 114 | 44.1 | 16.02 | 45.4 |
| 12:19 | 115 | 44.3 | 17.42 | 59.6 |
| 12:20 | 116 | 44.4 | 16.29 | 63.8 |
| 12:21 | 116 | 44.6 | 16.48 | 45.4 |
| 12:22 | 116 | 44.7 | 17.55 | 53.8 |
| 12:23 | 116 | 44.9 | 17.01 | 65.5 |
| 12:24 | 116 | 45.0 | 16.30 | 47.9 |
| 12:25 | 116 | 45.1 | 17.68 | 58.0 |
| 12:26 | 117 | 45.2 | 16.70 | 65.5 |
| 12:27 | 116 | 45.3 | 16.42 | 45.4 |
| 12:28 | 117 | 45.4 | 17.65 | 52.1 |
| 12:29 | 118 | 45.6 | 17.10 | 63.8 |
| 12:30 | 118 | 45.7 | 16.25 | 47.9 |
| 12:31 | 118 | 45.8 | 17.71 | 54.6 |
| 12:32 | 118 | 45.9 | 16.96 | 65.5 |
| 12:33 | 118 | 46.0 | 16.36 | 47.9 |
| 12:34 | 118 | 46.1 | 17.74 | 57.1 |
| 12:35 | 118 | 46.2 | 16.00 | 57.1 |
| 12:36 | 118 | 46.3 | 16.36 | 39.5 |
| 12:37 | 118 | 46.4 | 17.49 | 48.7 |
| 12:38 | 119 | 46.5 | 16.81 | 58.8 |
| 12:39 | 119 | 46.6 | 16.14 | 42.8 |
| 12:40 | 118 | 46.7 | 17.55 | 52.9 |
| 12:41 | 118 | 46.8 | 16.68 | 43.7 |
| 12:42 | 117 | 46.9 | 19.51 | 26.0 |
| 12:43 | 117 | 47.0 | 20.58 | 18.5 |
| 12:44 | 117 | 47.0 | 17.26 | 28.6 |
| 12:45 | 118 | 47.1 | 13.97 | 56.3 |
| 12:46 | 119 | 47.1 | 17.78 | 77.3 |
| 12:47 | 120 | 47.1 | 14.26 | 72.2 |

| | | | | |
|---|---|---|---|---|
| 12:48 | 120 | 47.2 | 15.58 | 44.5 |
| 12:49 | 119 | 47.2 | 15.83 | 39.5 |
| 12:50 | 119 | 47.2 | 15.83 | 41.2 |
| 12:51 | 119 | 47.2 | 16.14 | 55.4 |
| 12:52 | 120 | 47.2 | 15.15 | 63.8 |
| 12:53 | 120 | 47.2 | 14.84 | 52.1 |
| 12:54 | 120 | 47.2 | 14.50 | 46.2 |
| 12:55 | 120 | 47.2 | 14.97 | 43.7 |
| 12:56 | 120 | 47.2 | 15.09 | 43.7 |
| 12:57 | 120 | 47.2 | 15.18 | 45.4 |
| 12:58 | 120 | 47.2 | 14.99 | 50.4 |
| 12:59 | 119 | 47.2 | 14.77 | 47.0 |
| 13:00 | 119 | 47.2 | 15.39 | 44.5 |
| 13:01 | 119 | 47.2 | 15.51 | 42.8 |
| 13:02 | 119 | 47.2 | 15.14 | 40.3 |
| 13:03 | 120 | 47.2 | 14.52 | 40.3 |
| 13:04 | 120 | 47.2 | 14.58 | 42.0 |
| 13:05 | 120 | 47.2 | 14.74 | 41.2 |
| 13:06 | 119 | 47.2 | 14.90 | 40.3 |
| 13:07 | 119 | 47.2 | 14.91 | 36.1 |
| 13:08 | 118 | 47.2 | 14.60 | 36.1 |
| 13:09 | 119 | 47.2 | 14.71 | 37.0 |
| 13:10 | 119 | 47.2 | 14.62 | 53.8 |
| 13:11 | 120 | 47.2 | 14.84 | 61.3 |
| 13:12 | 120 | 47.2 | 14.92 | 53.8 |
| 13:13 | 120 | 47.3 | 14.78 | 47.0 |
| 13:14 | 120 | 47.3 | 14.53 | 53.8 |
| 13:15 | 120 | 47.3 | 14.73 | 58.0 |
| 13:16 | 120 | 47.3 | 14.64 | 58.0 |
| 13:17 | 120 | 47.4 | 14.55 | 58.0 |
| 13:18 | 120 | 47.4 | 14.52 | 57.1 |
| 13:19 | 120 | 47.4 | 14.81 | 52.1 |
| 13:20 | 120 | 47.5 | 14.84 | 38.6 |
| 13:21 | 120 | 47.5 | 14.80 | 36.1 |
| 13:22 | 120 | 47.5 | 15.10 | 32.8 |
| 13:23 | 119 | 47.5 | 15.30 | 31.1 |
| 13:24 | 119 | 47.6 | 15.68 | 30.2 |
| 13:25 | 119 | 47.6 | 16.15 | 29.4 |
| 13:26 | 118 | 47.6 | 16.40 | 29.4 |
| 13:27 | 118 | 47.7 | 16.43 | 29.4 |
| 13:28 | 118 | 47.7 | 16.69 | 28.6 |
| 13:29 | 118 | 47.7 | 16.96 | 27.7 |
| 13:30 | 118 | 47.7 | 17.21 | 27.7 |
| 13:31 | 118 | 47.8 | 17.43 | 39.5 |
| 13:32 | 118 | 47.8 | 16.55 | 37.8 |
| 13:33 | 118 | 47.8 | 17.15 | 26.9 |
| 13:34 | 118 | 47.9 | 17.80 | 31.9 |
| 13:35 | 118 | 47.9 | 17.93 | 53.8 |
| 13:36 | 119 | 47.9 | 15.72 | 40.3 |

| | | | | |
|---|---|---|---|---|
| 13:37 | 118 | 47.9 | 17.87 | 35.3 |
| 13:38 | 119 | 48.0 | 17.60 | 62.2 |
| 13:39 | 118 | 48.0 | 16.00 | 37.0 |
| 13:40 | 118 | 48.0 | 18.52 | 51.2 |
| 13:41 | 118 | 48.0 | 16.80 | 58.8 |
| 13:42 | 118 | 48.0 | 16.74 | 37.0 |
| 13:43 | 118 | 48.1 | 17.98 | 40.3 |
| 13:44 | 118 | 48.1 | 17.21 | 27.7 |
| 13:45 | 118 | 48.1 | 18.54 | 45.4 |
| 13:46 | 117 | 48.1 | 14.71 | 14.3 |
| 13:47 | 116 | 48.1 | 17.87 | 7.6 |
| 13:48 | 116 | 48.2 | 18.93 | 18.5 |
| 13:49 | 117 | 48.2 | 17.75 | 39.5 |
| 13:50 | 117 | 48.2 | 14.54 | 43.7 |
| 13:51 | 118 | 48.3 | 16.27 | 89.0 |
| 13:52 | 119 | 48.3 | 17.53 | 92.4 |
| 13:53 | 120 | 48.3 | 17.68 | 91.6 |
| 13:54 | 120 | 48.3 | 17.73 | 92.4 |
| 13:55 | 120 | 48.3 | 17.78 | 86.5 |
| 13:56 | 121 | 48.3 | 17.46 | 100.8 |
| 13:57 | 121 | 48.4 | 15.07 | 103.3 |
| 13:58 | 121 | 48.4 | 14.77 | 103.3 |
| 13:59 | 121 | 48.4 | 14.75 | 102.5 |
| 14:00 | 122 | 48.4 | 14.78 | 102.5 |
| 14:01 | 123 | 48.4 | 14.79 | 96.6 |
| 14:02 | 123 | 48.4 | 14.69 | 94.1 |
| 14:03 | 123 | 48.4 | 14.71 | 91.6 |
| 14:04 | 123 | 48.5 | 14.69 | 91.6 |
| 14:05 | 123 | 48.5 | 14.74 | 89.9 |
| 14:06 | 122 | 48.5 | 14.70 | 89.9 |
| 14:07 | 122 | 48.5 | 14.71 | 89.9 |
| 14:08 | 123 | 48.5 | 14.74 | 102.5 |
| 14:09 | 125 | 48.5 | 14.54 | 120.1 |
| 14:10 | 125 | 48.6 | 14.87 | 93.2 |
| 14:11 | 125 | 48.6 | 14.91 | 91.6 |
| 14:12 | 125 | 48.6 | 14.87 | 84.8 |
| 14:13 | 125 | 48.6 | 15.85 | 95.8 |
| 14:14 | 124 | 48.6 | 17.09 | 91.6 |
| 14:15 | 124 | 48.6 | 16.09 | 74.8 |
| 14:16 | 123 | 48.6 | 12.77 | 53.8 |
| 14:17 | 124 | 48.6 | 15.17 | 97.4 |
| 14:18 | 127 | 48.6 | 14.48 | 157.9 |
| 14:19 | 128 | 48.6 | 13.35 | 133.6 |
| 14:20 | 128 | 48.6 | 14.05 | 94.9 |
| 14:21 | 127 | 48.6 | 13.89 | 94.9 |
| 14:22 | 127 | 48.7 | 14.05 | 97.4 |
| 14:23 | 127 | 48.6 | 14.34 | 102.5 |
| 14:24 | 127 | 48.7 | 14.09 | 121.0 |
| 14:25 | 128 | 48.7 | 13.46 | 123.5 |

| | | | | |
|---|---|---|---|---|
| 14:26 | 128 | 48.7 | 13.41 | 128.5 |
| 14:27 | 128 | 48.7 | 13.95 | 109.2 |
| 14:28 | 129 | 48.7 | 13.64 | 108.4 |
| 14:29 | 129 | 48.7 | 13.45 | 110.9 |
| 14:30 | 129 | 48.7 | 13.24 | 124.3 |
| 14:31 | 129 | 48.7 | 13.43 | 116.8 |
| 14:32 | 129 | 48.7 | 13.46 | 115.9 |
| 14:33 | 129 | 48.7 | 13.53 | 119.3 |
| 14:34 | 129 | 48.7 | 13.50 | 121.8 |
| 14:35 | 129 | 48.7 | 13.54 | 115.1 |
| 14:36 | 129 | 48.7 | 13.52 | 110.0 |
| 14:37 | 128 | 48.7 | 13.57 | 92.4 |
| 14:38 | 128 | 48.8 | 13.27 | 75.6 |
| 14:39 | 128 | 48.8 | 12.87 | 68.0 |
| 14:40 | 127 | 48.8 | 12.51 | 57.1 |
| 14:41 | 127 | 48.8 | 11.95 | 57.1 |
| 14:42 | 128 | 48.8 | 12.02 | 72.2 |
| 14:43 | 128 | 48.8 | 12.49 | 80.6 |
| 14:44 | 128 | 48.8 | 12.96 | 76.4 |
| 14:45 | 128 | 48.8 | 12.97 | 66.4 |
| 14:46 | 127 | 48.8 | 12.56 | 55.4 |
| 14:47 | 127 | 48.8 | 12.06 | 47.9 |
| 14:48 | 127 | 48.8 | 11.51 | 44.5 |
| 14:49 | 126 | 48.8 | 11.33 | 40.3 |
| 14:50 | 126 | 48.8 | 11.10 | 35.3 |
| 14:51 | 126 | 48.8 | 10.21 | 45.4 |
| 14:52 | 126 | 48.8 | 11.53 | 39.5 |
| 14:53 | 126 | 48.9 | 10.91 | 32.8 |
| 14:54 | 125 | 48.9 | 10.23 | 30.2 |
| 14:55 | 125 | 48.8 | 9.74 | 28.6 |
| 14:56 | 125 | 48.9 | 9.62 | 26.9 |
| 14:57 | 124 | 48.9 | 9.66 | 25.2 |
| 14:58 | 124 | 48.9 | 9.60 | 23.5 |
| 14:59 | 124 | 48.9 | 9.63 | 23.5 |
| 15:00 | 124 | 48.9 | 9.78 | 24.4 |
| 15:01 | 123 | 48.9 | 10.02 | 26.0 |
| 15:02 | 123 | 48.9 | 10.67 | 31.1 |
| 15:03 | 123 | 48.9 | 11.21 | 43.7 |
| 15:04 | 123 | 48.9 | 12.61 | 45.4 |
| 15:05 | 123 | 48.9 | 13.09 | 49.6 |
| 15:06 | 124 | 49.0 | 13.77 | 59.6 |
| 15:07 | 125 | 49.0 | 14.64 | 59.6 |
| 15:08 | 125 | 49.0 | 14.81 | 55.4 |
| 15:09 | 125 | 48.9 | 15.83 | 65.5 |
| 15:10 | 125 | 48.9 | 16.16 | 80.6 |
| 15:11 | 126 | 48.9 | 13.14 | 113.4 |
| 15:12 | 126 | 48.9 | 12.07 | 93.2 |
| 15:13 | 126 | 48.8 | 13.30 | 89.9 |
| 15:14 | 126 | 48.8 | 12.68 | 80.6 |

| | | | | |
|---|---|---|---|---|
| 15:15 | 126 | 48.8 | 12.52 | 72.2 |
| 15:16 | 126 | 48.8 | 12.74 | 74.8 |
| 15:17 | 126 | 48.8 | 12.75 | 73.9 |
| 15:18 | 126 | 48.8 | 12.50 | 74.8 |
| 15:19 | 127 | 48.7 | 12.44 | 100.8 |
| 15:20 | 127 | 48.7 | 13.14 | 105.0 |
| 15:21 | 128 | 48.7 | 14.67 | 135.2 |
| 15:22 | 128 | 48.6 | 17.19 | 136.9 |
| **Average** | **118** | **44.9** | **15.00** | **57.8** |

Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

## Canley Crematorium Stream 1 Abatement System Outlet

## Mercury

| | |
|---|---|
| Contract | Canley Crematorium, DEM0744 |
| Date | 30th July 2014 |
| Location | Flue Gas Abatement System Outlet |
| Engineer(s) | JB & ST |
| Absorbent | 4% $K_2CR_2O_7$ / 20% $HNO_3$ in $H_2O$ |

| **Test Log** | **Test 4** | |
|---|---|---|
| Barometric Pressure(kPa) | 101.8 | |
| Gas Meter Temperature(Deg C) | 44.9 | |
| Oxygen Concentration(%v/v dry) | 15.00 | |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 2593 | |
| | Start | End |
| Time | 11:18 | 15:22 |
| Gas Meter Reading($Am^3$ dry) | 47.732 | 49.335 |
| Absorber Weight(g) | 3538.1 | 3590.2 |
| Filter Reference | CA300714HgF1 | |
| Filter Fraction Analysed | 1 | |
| Filter(µg as Hg) | 0.02 | |
| Filter Blank(µg as Hg) | 0.01 | |
| Probe Rinse Reference | Washed into Hg1A | |
| Probe Rinse Volume(ml) | 0 | |
| Probe Rinse(µg/l as Hg) | 0 | |
| Probe Rinse Blank(µg/l as Hg) | 0 | |
| Absorbent Reference | CA300714Hg1A&B | |
| Absorbent Volume(ml) | 250 | 250 |
| Absorbent(µg/l as Hg) | 21 | 1.3 |
| Absorbent Blank(µg/l as Hg) | 3.2 | 3.2 |

**Calculation: General**

| | |
|---|---|
| Barometric Pressure(kPa) | 101.8 |
| Gas Meter Temperature(Deg C) | 44.9 |
| Gas Volume Sampled($Am^3$ dry) | 1.603 |
| Gas Volume Sampled($Nm^3$ dry) | 1.3836 |
| Mass of Dry Gas(g @ 1292.8 g/$Nm^3$) | 1788.68 |
| Change in Absorber Weight(g) | 52.1 |
| Water Vapour Volume($Nm^3$ @ 803.9 g/$Nm^3$) | 0.0648 |
| Gas Volume($Nm^3$ wet) | 1.4484 |
| Mass of Wet Gas(g) | 1840.78 |
| **Moisture Concentration(%v/v)** | **4.5** |
| **Moisture Concentration(%w/w)** | **2.8** |

**Calculation: Mercury**

| | |
|---|---|
| Filter(µg as Hg) | 0.01 |
| Probe Rinse(µg as Hg) | 0.00 |
| Absorbent(µg as Hg) | 3.98 |
| Total Mercury Sampled(µg) | 3.99 |
| Mercury Emission(µg/$Nm^3$ dry) | 2.88 |
| Oxygen Concentration(%v/v dry) | 15.00 |
| **Mercury Emission (µg/$Nm^3$ @ 11 %v/v Oxygen dry)** | **4.82** |
| Flue Gas Volumetric Flowrate($Nm^3$/h dry) | 2593 |
| **Mercury Emission(g/h)** | **0.007** |

| | |
|---|---|
| Required Sample Velocity(Nm/s) | 7.59 |
| Nozzle Used(mm) | 4.0 |
| Area of Nozzle($m^2$) | 0.00001257 |
| Test Duration(mins) | 244 |
| Actual Sample Velocity(Nm/s) | 7.52 |
| Isokinetic Closure(%) | 99 |

Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

## Canley Crematorium Stream 1 Abatement System Outlet

## Flue Gas Volumetric Flow

| | |
|---|---|
| Contract | Canley Crematorium, DEM0744 |
| Date | 30th July 2014 |
| Location | Flue Gas Abatement System Outlet |
| Engineer(s) | JB & ST |

| **Test Log** | **Test 4** |
|---|---|
| Flue Gas Temperature(Deg C) | 118 |
| Flue Gas Pitot Head Sample Points(Pa) | 57.8 |
| Flue Gas Pitot Head Duct Mean(Pa) | 56.3 |
| Flue Gas Moisture(%v/v) | 4.5 |
| Flue Gas Moisture(%w/w) | 2.8 |
| Flue Gas Duct Dimensions(mm) | 350 mm Diameter |
| Flue Gas Duct Area($m^2$) | 0.0962 |
| **Calculation** | |
| Flue Gas Density($kg/m^3$) | 0.8928 |
| Sample Points | |
| Flue Gas Velocity(Am/s) | 11.38 |
| Flue Gas Volumetric Flowrate($Am^3/h$) | 3942 |
| Flue Gas Volumetric Flowrate($Am^3/h$ dry) | 3765 |
| Flue Gas Volumetric Flowrate($Nm^3/h$ dry) | 2628 |
| Duct Mean | |
| Flue Gas Velocity(Am/s) | 11.23 |
| Flue Gas Volumetric Flowrate($Am^3/h$) | 3889 |
| Flue Gas Volumetric Flowrate($Am^3/h$ dry) | 3715 |
| **Flue Gas Volumetric Flowrate($Nm^3/h$ dry)** | **2593** |

Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

# Canley Crematorium Stream 2 Abatement System Outlet

## Data Log 28/07/14

**Test 1**

| Time _ | Flue Gas °C | Meter °C | Flue Oxygen %v/v dry | CO mg/Nm³ c. | VOC mg/Nm³ c. | Sample Point Pa |
|---|---|---|---|---|---|---|
| | | | | | | |
| 13:05 | 97 | 26.3 | 17.89 | 0.00 | 0.38 | 285.6 |
| 13:06 | 96 | 26.4 | 17.49 | 0.00 | 4.55 | 236.0 |
| 13:07 | 97 | 26.5 | 16.56 | 0.00 | 0.00 | 248.6 |
| 13:08 | 96 | 26.7 | 17.13 | 0.00 | 0.00 | 226.8 |
| 13:09 | 96 | 26.9 | 17.17 | 0.00 | 0.00 | 198.2 |
| 13:10 | 97 | 27.2 | 15.74 | 0.00 | 0.00 | 265.4 |
| 13:11 | 97 | 27.6 | 15.11 | 0.00 | 0.00 | 252.0 |
| 13:12 | 97 | 27.9 | 15.57 | 0.00 | 0.00 | 247.0 |
| 13:13 | 97 | 28.3 | 16.12 | 0.00 | 0.00 | 221.8 |
| 13:14 | 98 | 28.7 | 15.72 | 0.00 | 0.00 | 245.3 |
| 13:15 | 97 | 29.1 | 16.21 | 0.00 | 0.00 | 220.1 |
| 13:16 | 97 | 29.5 | 15.85 | 0.00 | 0.00 | 215.9 |
| 13:17 | 97 | 30.0 | 15.96 | 0.00 | 0.00 | 241.9 |
| 13:18 | 98 | 30.4 | 16.08 | 0.00 | 0.00 | 240.2 |
| 13:19 | 97 | 30.9 | 16.49 | 0.00 | 0.03 | 201.6 |
| 13:20 | 97 | 31.3 | 16.18 | 0.00 | 0.00 | 184.0 |
| 13:21 | 97 | 31.8 | 15.63 | 0.00 | 0.00 | 210.0 |
| 13:22 | 96 | 32.2 | 16.35 | 0.00 | 0.00 | 187.3 |
| 13:23 | 96 | 32.7 | 16.33 | 0.00 | 0.00 | 183.1 |
| 13:24 | 96 | 33.2 | 16.30 | 0.00 | 0.00 | 200.8 |
| 13:25 | 95 | 33.6 | 16.32 | 0.00 | 0.00 | 168.8 |
| 13:26 | 95 | 34.1 | 16.56 | 0.00 | 0.00 | 157.9 |
| 13:27 | 95 | 34.5 | 16.61 | 0.00 | 0.00 | 168.0 |
| 13:28 | 96 | 34.9 | 16.15 | 0.00 | 0.00 | 179.8 |
| 13:29 | 96 | 35.4 | 16.86 | 0.00 | 0.00 | 166.3 |
| 13:30 | 95 | 35.8 | 17.05 | 0.00 | 0.00 | 175.6 |
| 13:31 | 96 | 36.2 | 16.60 | 0.00 | 0.00 | 205.8 |
| 13:32 | 95 | 36.6 | 17.02 | 0.00 | 0.00 | 179.8 |
| 13:33 | 95 | 37.0 | 17.17 | 0.00 | 0.00 | 172.2 |
| 13:34 | 95 | 37.3 | 16.97 | 0.00 | 0.00 | 189.8 |
| 13:35 | 96 | 37.7 | 16.97 | 0.00 | 0.00 | 170.5 |
| 13:36 | 96 | 38.1 | 17.37 | 0.00 | 0.00 | 177.2 |
| 13:37 | 96 | 38.4 | 17.47 | 0.00 | 0.00 | 194.0 |
| 13:38 | 96 | 38.8 | 17.14 | 0.00 | 0.00 | 183.1 |
| 13:39 | 95 | 39.1 | 17.79 | 0.00 | 0.00 | 177.2 |
| 13:40 | 95 | 39.4 | 17.93 | 0.00 | 0.00 | 184.0 |
| 13:41 | 95 | 39.8 | 17.52 | 0.00 | 0.00 | 186.5 |
| 13:42 | 95 | 40.1 | 17.72 | 0.00 | 0.00 | 171.4 |
| 13:43 | 96 | 40.4 | 16.74 | 0.00 | 0.00 | 157.1 |
| 13:44 | 96 | 40.7 | 17.06 | 0.00 | 0.00 | 173.9 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13:45 | 95 | 41.0 | 18.26 | 0.00 | 0.00 | 154.6 |
| 13:46 | 95 | 41.3 | 17.56 | 0.00 | 0.00 | 168.8 |
| 13:47 | 95 | 41.6 | 16.64 | 0.00 | 0.00 | 168.0 |
| 13:48 | 95 | 41.9 | 17.66 | 0.00 | 0.00 | 157.1 |
| 13:49 | 95 | 42.2 | 17.85 | 0.00 | 0.00 | 150.4 |
| 13:50 | 94 | 42.4 | 16.87 | 0.00 | 0.00 | 136.9 |
| 13:51 | 95 | 42.7 | 17.20 | 0.00 | 0.00 | 161.3 |
| 13:52 | 95 | 42.9 | 18.01 | 0.00 | 0.00 | 154.6 |
| 13:53 | 96 | 43.1 | 16.56 | 0.00 | 0.00 | 176.4 |
| 13:54 | 95 | 43.4 | 17.08 | 0.00 | 0.00 | 167.2 |
| 13:55 | 95 | 43.6 | 17.31 | 0.00 | 0.00 | 166.3 |
| 13:56 | 95 | 43.8 | 18.76 | 0.18 | 0.00 | 164.6 |
| 13:57 | 95 | 44.0 | 16.99 | 0.00 | 0.00 | 173.0 |
| 13:58 | 95 | 44.2 | 16.64 | 0.00 | 0.00 | 181.4 |
| 13:59 | 95 | 44.4 | 16.67 | 0.00 | 0.00 | 148.7 |
| 14:00 | 94 | 44.6 | 17.08 | 0.00 | 0.00 | 131.9 |
| 14:01 | 94 | 44.8 | 17.28 | 0.00 | 0.00 | 140.3 |
| 14:02 | 95 | 44.9 | 16.88 | 0.00 | 0.00 | 174.7 |
| 14:03 | 95 | 45.1 | 16.93 | 0.00 | 0.00 | 163.8 |
| 14:04 | 94 | 45.3 | 17.25 | 0.00 | 0.00 | 157.1 |
| 14:05 | 94 | 45.4 | 17.84 | 0.00 | 0.00 | 140.3 |
| | | | | | | |
| **Average** | **96** | **36.8** | **16.89** | **0.00** | **0.08** | **186.7** |

| | | |
|---|---|---|
| Average for first 30 mins of test | **0.00** | - |
| Average for second 30 mins of test | **0.01** | - |
| Average for first 60 mins of test | **0.00** | **0.08** |

Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

# Canley Crematorium Stream 2 Abatement System Outlet

## Data Log 28/07/14

**Test 2**

| Time _ | Flue Gas °C | Meter °C | Flue Oxygen %v/v dry | CO mg/Nm³ c. | VOC mg/Nm³ c. | Sample Point Pa |
|---|---|---|---|---|---|---|
| | | | | | | |
| 14:52 | 98 | 42.7 | 15.87 | 0.08 | 0.00 | 163.8 |
| 14:53 | 98 | 42.7 | 16.53 | 0.00 | 0.00 | 147.0 |
| 14:54 | 98 | 42.6 | 16.78 | 0.00 | 0.00 | 157.1 |
| 14:55 | 97 | 42.7 | 16.70 | 0.00 | 0.00 | 166.3 |
| 14:56 | 98 | 42.7 | 16.15 | 0.00 | 0.00 | 211.7 |
| 14:57 | 99 | 42.8 | 16.36 | 0.00 | 0.00 | 254.5 |
| 14:58 | 98 | 42.9 | 17.51 | 0.00 | 0.00 | 202.4 |
| 14:59 | 97 | 43.1 | 17.83 | 0.00 | 0.00 | 165.5 |
| 15:00 | 97 | 43.2 | 17.71 | 0.00 | 0.00 | 155.4 |
| 15:01 | 97 | 43.3 | 17.89 | 0.00 | 0.00 | 164.6 |
| 15:02 | 97 | 43.5 | 17.75 | 0.96 | 0.00 | 216.7 |
| 15:03 | 98 | 43.6 | 17.23 | 3.61 | 0.00 | 235.2 |
| 15:04 | 98 | 43.8 | 17.16 | 0.16 | 0.00 | 247.0 |
| 15:05 | 98 | 43.9 | 17.35 | 0.00 | 0.00 | 242.8 |
| 15:06 | 98 | 44.1 | 17.20 | 0.00 | 0.00 | 216.7 |
| 15:07 | 98 | 44.3 | 16.97 | 0.00 | 0.00 | 183.1 |
| 15:08 | 97 | 44.5 | 17.12 | 0.00 | 0.00 | 155.4 |
| 15:09 | 96 | 44.7 | 17.30 | 0.00 | 0.00 | 146.2 |
| 15:10 | 96 | 44.8 | 17.24 | 0.00 | 0.00 | 140.3 |
| 15:11 | 95 | 45.0 | 17.20 | 0.00 | 0.00 | 136.1 |
| 15:12 | 95 | 45.1 | 17.17 | 0.00 | 0.00 | 129.4 |
| 15:13 | 96 | 45.3 | 17.17 | 0.00 | 0.00 | 134.4 |
| 15:14 | 96 | 45.4 | 16.86 | 0.00 | 0.00 | 161.3 |
| 15:15 | 97 | 45.5 | 16.12 | 0.00 | 0.00 | 178.1 |
| 15:16 | 97 | 45.6 | 16.24 | 0.00 | 0.00 | 175.6 |
| 15:17 | 97 | 45.7 | 15.98 | 0.00 | 0.00 | 171.4 |
| 15:18 | 97 | 45.8 | 15.93 | 0.00 | 0.00 | 192.4 |
| 15:19 | 97 | 45.9 | 16.01 | 0.00 | 0.00 | 187.3 |
| 15:20 | 97 | 46.0 | 16.15 | 0.00 | 0.00 | 182.3 |
| 15:21 | 97 | 46.2 | 16.23 | 0.00 | 0.00 | 181.4 |
| 15:22 | 96 | 46.3 | 16.36 | 0.00 | 0.00 | 178.1 |
| 15:23 | 96 | 46.5 | 16.44 | 0.00 | 0.00 | 176.4 |
| 15:24 | 96 | 46.6 | 16.56 | 0.00 | 0.00 | 171.4 |
| 15:25 | 96 | 46.7 | 16.60 | 0.00 | 0.00 | 169.7 |
| 15:26 | 96 | 46.9 | 16.71 | 0.00 | 0.00 | 168.0 |
| 15:27 | 96 | 47.0 | 16.82 | 0.00 | 0.00 | 165.5 |
| 15:28 | 96 | 47.1 | 16.92 | 0.00 | 0.00 | 166.3 |
| 15:29 | 95 | 47.2 | 17.01 | 0.00 | 0.00 | 164.6 |
| 15:30 | 95 | 47.3 | 17.08 | 0.00 | 0.00 | 162.1 |
| 15:31 | 95 | 47.4 | 17.12 | 0.00 | 0.00 | 162.1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 15:32 | 95 | 47.5 | 17.19 | 0.00 | 0.00 | 161.3 |
| 15:33 | 95 | 47.6 | 17.23 | 0.00 | 0.00 | 160.4 |
| 15:34 | 95 | 47.7 | 17.27 | 0.00 | 0.00 | 158.8 |
| 15:35 | 95 | 47.8 | 17.31 | 0.00 | 0.00 | 156.2 |
| 15:36 | 95 | 47.9 | 17.30 | 0.00 | 0.00 | 152.0 |
| 15:37 | 94 | 48.0 | 17.30 | 0.00 | 0.00 | 152.9 |
| 15:38 | 95 | 48.1 | 17.36 | 0.00 | 0.00 | 163.0 |
| 15:39 | 95 | 48.2 | 17.47 | 0.00 | 0.00 | 161.3 |
| 15:40 | 95 | 48.2 | 17.49 | 0.00 | 0.00 | 163.8 |
| 15:41 | 95 | 48.3 | 17.53 | 0.00 | 0.00 | 163.8 |
| 15:42 | 95 | 48.4 | 17.52 | 0.00 | 0.00 | 162.1 |
| 15:43 | 95 | 48.5 | 17.55 | 0.00 | 0.00 | 162.1 |
| 15:44 | 95 | 48.6 | 17.58 | 0.00 | 0.00 | 163.0 |
| 15:45 | 95 | 48.6 | 17.60 | 0.00 | 0.00 | 160.4 |
| 15:46 | 95 | 48.7 | 17.57 | 0.00 | 0.00 | 144.5 |
| 15:47 | 95 | 48.8 | 17.39 | 0.00 | 0.00 | 142.0 |
| 15:48 | 95 | 48.8 | 17.37 | 0.00 | 0.00 | 142.8 |
| 15:49 | 95 | 48.9 | 17.41 | 0.00 | 0.00 | 140.3 |
| 15:50 | 95 | 49.0 | 17.35 | 0.00 | 0.00 | 136.9 |
| 15:51 | 95 | 49.0 | 17.33 | 0.00 | 0.00 | 135.2 |
| 15:52 | 94 | 49.1 | 18.23 | 0.15 | 0.00 | 137.8 |
| | | | | | | |
| **Average** | **96** | **46.1** | **17.04** | **0.08** | **0.00** | **169.0** |

| | | |
|---|---|---|
| Average for first 30 mins of test | **0.16** | - |
| Average for second 30 mins of test | **0.00** | - |
| Average for first 60 mins of test | **0.08** | **0.00** |

Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

# Canley Crematorium Stream 2 Abatement System Outlet

## Data Log 28/07/14

**Test 3**

| Time | Flue Gas °C | Meter °C | Flue Oxygen %v/v dry | CO mg/Nm³ c. | VOC mg/Nm³ c. | Sample Point Pa |
|---|---|---|---|---|---|---|
| | | | | | | |
| 16:03 | 97 | 48.9 | 16.78 | 0.00 | 0.00 | 213.4 |
| 16:04 | 97 | 48.8 | 17.43 | 0.00 | 0.00 | 200.8 |
| 16:05 | 97 | 48.7 | 17.57 | 0.00 | 0.00 | 177.2 |
| 16:06 | 96 | 48.7 | 17.49 | 0.00 | 0.00 | 151.2 |
| 16:07 | 96 | 48.6 | 17.35 | 0.00 | 0.00 | 150.4 |
| 16:08 | 96 | 48.6 | 17.14 | 0.00 | 0.00 | 159.6 |
| 16:09 | 96 | 48.6 | 16.75 | 0.00 | 0.00 | 194.9 |
| 16:10 | 97 | 48.6 | 16.33 | 0.00 | 0.00 | 225.1 |
| 16:11 | 98 | 48.6 | 16.89 | 0.00 | 0.00 | 223.4 |
| 16:12 | 98 | 48.6 | 16.85 | 0.00 | 0.00 | 219.2 |
| 16:13 | 98 | 48.6 | 16.96 | 0.00 | 0.00 | 221.8 |
| 16:14 | 98 | 48.7 | 16.64 | 0.00 | 0.00 | 215.9 |
| 16:15 | 98 | 48.7 | 16.46 | 0.00 | 0.00 | 177.2 |
| 16:16 | 97 | 48.7 | 16.75 | 0.00 | 0.00 | 159.6 |
| 16:17 | 97 | 48.8 | 16.60 | 0.00 | 0.00 | 173.9 |
| 16:18 | 97 | 48.8 | 16.63 | 0.00 | 0.00 | 197.4 |
| 16:19 | 97 | 48.9 | 16.88 | 0.00 | 0.00 | 190.7 |
| 16:20 | 97 | 48.9 | 16.78 | 0.00 | 0.00 | 189.8 |
| 16:21 | 97 | 48.9 | 16.84 | 0.00 | 0.00 | 175.6 |
| 16:22 | 96 | 49.0 | 17.44 | 0.00 | 0.00 | 173.9 |
| 16:23 | 96 | 49.0 | 18.25 | 0.15 | 0.00 | 162.1 |
| 16:24 | 95 | 49.1 | 17.84 | 0.00 | 0.00 | 100.8 |
| 16:25 | 94 | 49.1 | 17.18 | 0.00 | 0.00 | 53.8 |
| 16:26 | 94 | 49.2 | 16.89 | 0.00 | 0.00 | 58.0 |
| 16:27 | 94 | 49.2 | 16.83 | 0.00 | 0.00 | 55.4 |
| 16:28 | 93 | 49.3 | 16.25 | 0.00 | 0.00 | 64.7 |
| 16:29 | 94 | 49.3 | 16.16 | 0.00 | 0.00 | 91.6 |
| 16:30 | 94 | 49.3 | 16.53 | 0.00 | 0.00 | 89.0 |
| 16:31 | 93 | 49.3 | 16.42 | 0.00 | 0.00 | 79.8 |
| 16:32 | 92 | 49.3 | 16.64 | 0.00 | 0.00 | 63.8 |
| 16:33 | 92 | 49.3 | 16.42 | 0.00 | 0.00 | 57.1 |
| 16:34 | 92 | 49.2 | 16.35 | 0.00 | 0.00 | 55.4 |
| 16:35 | 92 | 49.2 | 16.57 | 0.00 | 0.00 | 47.0 |
| 16:36 | 91 | 49.1 | 16.80 | 0.00 | 0.00 | 40.3 |
| 16:37 | 91 | 49.1 | 16.57 | 0.00 | 0.00 | 41.2 |
| 16:38 | 91 | 49.1 | 16.55 | 0.00 | 0.00 | 41.2 |
| 16:39 | 91 | 49.0 | 16.63 | 0.00 | 0.00 | 40.3 |
| 16:40 | 90 | 49.0 | 16.64 | 0.00 | 0.00 | 38.6 |
| 16:41 | 90 | 49.0 | 16.74 | 0.00 | 0.00 | 36.1 |
| 16:42 | 90 | 48.9 | 16.86 | 0.00 | 0.00 | 35.3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 16:43 | 90 | 48.9 | 17.12 | 0.00 | 0.00 | 35.3 |
| 16:44 | 90 | 48.9 | 17.36 | 0.00 | 0.00 | 35.3 |
| 16:45 | 89 | 48.9 | 17.65 | 0.00 | 0.00 | 34.4 |
| 16:46 | 89 | 48.8 | 17.91 | 0.00 | 0.00 | 33.6 |
| 16:47 | 89 | 48.8 | 18.16 | 0.00 | 0.00 | 32.8 |
| 16:48 | 89 | 48.8 | 18.45 | 0.00 | 0.00 | 31.9 |
| 16:49 | 89 | 48.8 | 18.58 | 0.00 | 0.00 | 38.6 |
| 16:50 | 89 | 48.8 | 18.84 | 0.00 | 0.00 | 39.5 |
| 16:51 | 88 | 48.8 | 19.10 | 0.00 | 0.00 | 39.5 |
| 16:52 | 88 | 48.8 | 19.23 | 0.00 | 0.00 | 39.5 |
| 16:53 | 88 | 48.8 | 19.37 | 0.00 | 0.00 | 39.5 |
| 16:54 | 88 | 48.7 | 19.48 | 0.00 | 0.00 | 39.5 |
| 16:55 | 88 | 48.7 | 19.61 | 0.00 | 0.00 | 39.5 |
| 16:56 | 88 | 48.7 | 19.71 | 0.00 | 0.00 | 38.6 |
| 16:57 | 88 | 48.7 | 19.81 | 0.00 | 0.00 | 46.2 |
| 16:58 | 88 | 48.7 | 19.57 | 0.00 | 0.00 | 44.5 |
| 16:59 | 88 | 48.7 | 17.99 | 0.00 | 0.00 | 28.6 |
| 17:00 | 87 | 48.7 | 19.60 | 0.00 | 0.00 | 32.8 |
| 17:01 | 88 | 48.7 | 19.96 | 0.00 | 0.00 | 51.2 |
| 17:02 | 88 | 48.8 | 18.70 | 0.00 | 0.00 | 37.0 |
| 17:03 | 87 | 48.8 | 17.88 | 0.00 | 0.00 | 25.2 |
| | | | | | | |
| **Average** | **93** | **48.9** | **17.50** | **0.00** | **0.00** | **95.5** |

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

Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

## Canley Crematorium Stream 2 Abatement System Outlet

## Total Particulate Matter and Hydrogen Chloride

| | |
|---|---|
| Contract | Canley Crematorium, DEM0744 |
| Date | 28th July 2014 |
| Location | Flue Gas Abatement System Outlet |
| Engineer(s) | JB & ST |
| Absorbent | $H_2O$ |

| **Test Log** | **Test 1** | **Test 2** | **Test 3** |
|---|---|---|---|
| Barometric Pressure(kPa) | 100.2 | 100.2 | 100.2 |
| Gas Meter Temperature(Deg C) | 36.8 | 46.1 | 48.9 |
| Oxygen Concentration(%v/v dry) | 16.89 | 17.04 | 17.50 |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 4762 | 4517 | 3333 |

| | Start | End | Start | End | Start | End |
|---|---|---|---|---|---|---|
| Time | 13:05 | 14:05 | 14:52 | 15:52 | 16:03 | 17:03 |
| Gas Meter Reading($Am^3$ dry) | 43.398 | 43.916 | 44.106 | 44.646 | 44.717 | 45.098 |
| Absorber Weight(g) | 3483.7 | 3510.0 | 3636.9 | 3664.6 | 3483.2 | 3510.0 |
| Filter Reference | CA280714F12 | | CA280714F22 | | CA280714F32 | |
| Filter Weight(g) | 0.55219 | 0.55230 | 0.55003 | 0.55011 | 0.55287 | 0.55307 |
| Probe Rinse Reference | CA280714R12 | | CA280714R22 | | CA280714R32 | |
| Probe Rinse Weight(g) | 79.4873 | 79.4873 | 79.4873 | 79.4874 | 79.4874 | 79.4874 |
| Sample Reference HCl | CA280714H12 | | CA280714H22 | | CA280714H32 A&B | |
| Absorbent Volume(ml) | 500 | | 500 | | 250 | 250 |
| Absorbent(mg/l as HCl) | 15 | | 14 | | 16 | 0.07 |
| Blank(mg/l as HCl) | 0.05 | | 0.05 | | 0.05 | 0.05 |

**Calculation: General**

| | | | |
|---|---|---|---|
| Barometric Pressure(kPa) | 100.2 | 100.2 | 100.2 |
| Gas Meter temperature(Deg C) | 36.8 | 46.1 | 48.9 |
| Gas Volume Sampled($Am^3$ dry) | 0.518 | 0.540 | 0.381 |
| Gas Volume Sampled($Nm^3$ dry) | 0.4515 | 0.4570 | 0.3196 |
| Mass of Dry Gas(g @ 1292.8 g/$Nm^3$) | 583.74 | 590.77 | 413.22 |
| Change in Absorber Weight(g) | 26.3 | 27.7 | 26.8 |
| Water Vapour Volume($Nm^3$ @ 803.9 g/$Nm^3$) | 0.0327 | 0.0345 | 0.0333 |
| Gas Volume($Nm^3$ wet) | 0.4842 | 0.4914 | 0.3530 |
| Mass of Wet Gas(g) | 610.04 | 618.47 | 440.02 |
| **Moisture Concentration(%v/v)** | **6.8** | **7.0** | **9.4** |
| **Moisture Concentration(%w/w)** | **4.3** | **4.5** | **6.1** |

**Calculation: Particulate**

| | | | |
|---|---|---|---|
| Increase In Filter Weights(g) | 0.00013 | 0.00009 | 0.00024 |
| Particulate Emission(mg/$Nm^3$ dry) | 0.29 | 0.21 | 0.74 |
| Oxygen Concentration(%v/v dry) | 16.89 | 17.04 | 17.50 |
| **Particulate Emission** | **0.70** | **0.53** | **2.13** |
| **(mg/$Nm^3$ @ 11 %v/v Oxygen dry)** | | | |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 4762 | 4517 | 3333 |
| **Particulate Emission(g/h)** | **1.37** | **0.93** | **2.46** |
| | | | |
| Required Sample Velocity(Nm/s) | 13.75 | 13.04 | 9.62 |
| Nozzle Used(mm) | 3.5 | 3.5 | 3.5 |
| Area of Nozzle($m^2$) | 0.00000962 | 0.00000962 | 0.00000962 |
| Test Duration(mins) | 60 | 60 | 60 |
| Actual Sample Velocity(Nm/s) | 13.04 | 13.19 | 9.23 |
| Isokinetic Closure(%) | 95 | 101 | 96 |
| | | 97 | |

**Calculation: HCl**

| | | | |
|---|---|---|---|
| Absorbent(mg/l as HCl) | 15.00 | 14.00 | 16.07 |
| Blank(mg/l as HCl) | 0.05 | 0.05 | 0.05 |
| Chloride Absorbed(mg/l as HCl) | 14.95 | 13.95 | 16.02 |
| Chloride Absorbed(mg as HCl) | 7.48 | 6.98 | 4.01 |
| HCl(mg) | 7.48 | 6.98 | 4.01 |
| HCl Emission(mg/$Nm^3$ dry) | 16.55 | 15.26 | 12.53 |
| Oxygen Concentration(%v/v dry) | 16.89 | 17.04 | 17.50 |
| **HCl Emission** | **40.56** | **38.88** | **36.18** |
| **(mg/$Nm^3$ @ 11 %v/v Oxygen dry)** | | | |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 4762 | 4517 | 3333 |
| **HCl Emission(g/h)** | **78.84** | **68.94** | **41.77** |

Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

## Canley Crematorium Stream 2 Abatement System Outlet

## Flue Gas Volumetric Flow

| | |
|---|---|
| Contract | Canley Crematorium, DEM0744 |
| Date | 28th July 2014 |
| Location | Flue Gas Abatement System Outlet |
| Engineer(s) | JB & ST |

| **Test Log** | **Test 1** | **Test 2** | **Test 3** |
|---|---|---|---|
| Flue Gas Temperature(Deg C) | 96 | 96 | 93 |
| Flue Gas Pitot Head Sample Points(Pa) | 186.7 | 169.0 | 95.5 |
| Flue Gas Moisture(%v/v) | 6.8 | 7.0 | 9.4 |
| Flue Gas Moisture(%w/w) | 4.3 | 4.5 | 6.1 |
| Flue Gas Duct Dimensions(mm) | 350 mm Diameter Circular Stack | | |
| Flue Gas Duct Area($m^2$) | 0.0962 | | |
| **Calculation** | | | |
| Flue Gas Density($kg/m^3$) | 0.9418 | 0.9401 | 0.9434 |
| Sample Points | | | |
| Flue Gas Velocity(Am/s) | 19.91 | 18.96 | 14.23 |
| Flue Gas Volumetric Flowrate($Am^3/h$) | 6897 | 6567 | 4928 |
| Flue Gas Volumetric Flowrate($Am^3/h$ dry) | 6431 | 6106 | 4463 |
| Flue Gas Volumetric Flowrate($Nm^3/h$ dry) | 4762 | 4517 | 3333 |
| Duct Mean | | | |
| Flue Gas Velocity(Am/s) | 19.64 | 18.70 | 14.04 |
| Flue Gas Volumetric Flowrate($Am^3/h$) | 6804 | 6478 | 4862 |
| Flue Gas Volumetric Flowrate($Am^3/h$ dry) | 6344 | 6024 | 4403 |
| **Flue Gas Volumetric Flowrate($Nm^3/h$ dry)** | **4698** | **4456** | **3289** |

Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

# Canley Crematorium Stream 2 Abatement System Outlet

**Data Log** **29/07/14**

**Test 4**

| Time | Flue Gas °C | Meter °C | Flue $O_2$ %v/v dry | Sample Point Pa |
|---|---|---|---|---|
| | | | | |
| 11:17 | 93 | 27.4 | 15.32 | 183.1 |
| 11:18 | 93 | 27.5 | 15.97 | 131.0 |
| 11:19 | 93 | 27.6 | 15.56 | 94.1 |
| 11:20 | 93 | 27.7 | 15.62 | 127.7 |
| 11:21 | 93 | 27.9 | 15.52 | 139.4 |
| 11:22 | 93 | 28.2 | 15.01 | 156.2 |
| 11:23 | 95 | 28.4 | 14.80 | 259.6 |
| 11:24 | 97 | 28.7 | 15.72 | 221.8 |
| 11:25 | 96 | 29.1 | 16.79 | 163.0 |
| 11:26 | 96 | 29.5 | 15.06 | 170.5 |
| 11:27 | 96 | 29.8 | 15.16 | 162.1 |
| 11:28 | 96 | 30.2 | 16.12 | 185.6 |
| 11:29 | 96 | 30.6 | 15.73 | 231.8 |
| 11:30 | 97 | 31.0 | 16.62 | 214.2 |
| 11:31 | 97 | 31.5 | 14.90 | 220.9 |
| 11:32 | 98 | 31.9 | 14.59 | 256.2 |
| 11:33 | 98 | 32.3 | 15.33 | 262.1 |
| 11:34 | 98 | 32.7 | 15.99 | 250.3 |
| 11:35 | 98 | 33.1 | 15.80 | 224.3 |
| 11:36 | 98 | 33.5 | 15.77 | 227.6 |
| 11:37 | 98 | 33.9 | 15.68 | 230.2 |
| 11:38 | 99 | 34.4 | 15.70 | 271.3 |
| 11:39 | 99 | 34.8 | 15.99 | 258.7 |
| 11:40 | 99 | 35.2 | 15.63 | 252.0 |
| 11:41 | 99 | 35.6 | 15.14 | 231.8 |
| 11:42 | 100 | 36.0 | 15.18 | 249.5 |
| 11:43 | 100 | 36.4 | 15.70 | 269.6 |
| 11:44 | 100 | 36.7 | 16.10 | 272.2 |
| 11:45 | 101 | 37.1 | 15.94 | 289.0 |
| 11:46 | 100 | 37.5 | 15.91 | 265.4 |
| 11:47 | 100 | 37.8 | 16.07 | 257.9 |
| 11:48 | 101 | 38.1 | 16.03 | 273.8 |
| 11:49 | 100 | 38.5 | 15.74 | 234.4 |
| 11:50 | 99 | 38.8 | 16.16 | 202.4 |
| 11:51 | 98 | 39.1 | 16.17 | 178.1 |
| 11:52 | 98 | 39.4 | 16.15 | 160.4 |
| 11:53 | 97 | 39.7 | 15.32 | 125.2 |
| 11:54 | 96 | 40.0 | 15.62 | 100.0 |
| 11:55 | 96 | 40.3 | 15.31 | 81.5 |
| 11:56 | 95 | 40.6 | 15.16 | 79.0 |
| 11:57 | 96 | 40.8 | 15.10 | 94.9 |

| | | | | |
|---|---|---|---|---|
| 11:58 | 96 | 41.1 | 15.42 | 84.8 |
| 11:59 | 95 | 41.4 | 16.14 | 83.2 |
| 12:00 | 95 | 41.6 | 16.48 | 104.2 |
| 12:01 | 96 | 41.9 | 15.00 | 163.0 |
| 12:02 | 97 | 42.1 | 14.52 | 199.1 |
| 12:03 | 97 | 42.3 | 15.94 | 181.4 |
| 12:04 | 98 | 42.5 | 16.71 | 209.2 |
| 12:05 | 99 | 42.8 | 15.92 | 218.4 |
| 12:06 | 99 | 43.0 | 15.11 | 199.1 |
| 12:07 | 98 | 43.2 | 15.57 | 184.8 |
| 12:08 | 98 | 43.4 | 15.76 | 184.0 |
| 12:09 | 98 | 43.6 | 15.90 | 188.2 |
| 12:10 | 98 | 43.8 | 16.06 | 185.6 |
| 12:11 | 97 | 44.0 | 16.10 | 178.1 |
| 12:12 | 97 | 44.2 | 16.10 | 176.4 |
| 12:13 | 97 | 44.4 | 16.17 | 172.2 |
| 12:14 | 97 | 44.5 | 16.18 | 167.2 |
| 12:15 | 97 | 44.7 | 16.01 | 165.5 |
| 12:16 | 97 | 44.8 | 15.55 | 167.2 |
| 12:17 | 97 | 45.0 | 16.02 | 163.0 |
| 12:18 | 97 | 45.1 | 16.36 | 174.7 |
| 12:19 | 97 | 45.3 | 16.64 | 184.8 |
| 12:20 | 97 | 45.4 | 16.72 | 180.6 |
| 12:21 | 97 | 45.6 | 16.21 | 167.2 |
| 12:22 | 96 | 45.7 | 15.96 | 150.4 |
| 12:23 | 96 | 45.9 | 16.44 | 146.2 |
| 12:24 | 96 | 46.0 | 16.52 | 146.2 |
| 12:25 | 96 | 46.1 | 16.45 | 156.2 |
| 12:26 | 96 | 46.2 | 15.99 | 155.4 |
| 12:27 | 96 | 46.3 | 16.23 | 145.3 |
| 12:28 | 96 | 46.4 | 16.61 | 147.0 |
| 12:29 | 96 | 46.6 | 16.60 | 156.2 |
| 12:30 | 96 | 46.7 | 16.13 | 157.9 |
| 12:31 | 96 | 46.8 | 16.91 | 142.8 |
| 12:32 | 96 | 46.9 | 17.61 | 143.6 |
| 12:33 | 97 | 47.0 | 17.08 | 223.4 |
| 12:34 | 98 | 47.0 | 17.28 | 239.4 |
| 12:35 | 98 | 47.1 | 15.45 | 223.4 |
| 12:36 | 97 | 47.2 | 16.16 | 170.5 |
| 12:37 | 97 | 47.3 | 16.31 | 173.0 |
| 12:38 | 97 | 47.4 | 16.44 | 175.6 |
| 12:39 | 97 | 47.4 | 16.71 | 185.6 |
| 12:40 | 97 | 47.5 | 16.37 | 193.2 |
| 12:41 | 98 | 47.6 | 16.30 | 203.3 |
| 12:42 | 98 | 47.7 | 15.74 | 201.6 |
| 12:43 | 98 | 47.7 | 15.24 | 202.4 |
| 12:44 | 98 | 47.8 | 15.19 | 234.4 |
| 12:45 | 98 | 47.8 | 15.79 | 203.3 |
| 12:46 | 98 | 47.9 | 15.33 | 210.8 |

| | | | | |
|---|---|---|---|---|
| 12:47 | 99 | 48.0 | 15.31 | 257.0 |
| 12:48 | 99 | 48.0 | 15.93 | 250.3 |
| 12:49 | 100 | 48.1 | 16.21 | 281.4 |
| 12:50 | 100 | 48.1 | 16.13 | 260.4 |
| 12:51 | 101 | 48.2 | 15.48 | 287.3 |
| 12:52 | 102 | 48.2 | 16.17 | 294.0 |
| 12:53 | 102 | 48.3 | 15.23 | 282.2 |
| 12:54 | 102 | 48.3 | 15.33 | 243.6 |
| 12:55 | 100 | 48.3 | 15.65 | 188.2 |
| 12:56 | 100 | 48.4 | 15.61 | 171.4 |
| 12:57 | 99 | 48.4 | 15.74 | 156.2 |
| 12:58 | 99 | 48.5 | 15.76 | 168.8 |
| 12:59 | 99 | 48.5 | 15.44 | 186.5 |
| 13:00 | 99 | 48.5 | 15.34 | 212.5 |
| 13:01 | 99 | 48.6 | 15.33 | 201.6 |
| 13:02 | 99 | 48.6 | 15.52 | 189.0 |
| 13:03 | 99 | 48.6 | 15.43 | 181.4 |
| 13:04 | 98 | 48.7 | 15.76 | 179.8 |
| 13:05 | 98 | 48.7 | 16.07 | 184.0 |
| 13:06 | 98 | 48.8 | 16.22 | 175.6 |
| 13:07 | 98 | 48.9 | 16.15 | 170.5 |
| 13:08 | 98 | 48.9 | 15.95 | 152.9 |
| 13:09 | 98 | 49.0 | 15.42 | 149.5 |
| 13:10 | 98 | 49.0 | 15.40 | 157.1 |
| 13:11 | 98 | 49.1 | 15.59 | 149.5 |
| 13:12 | 97 | 49.1 | 15.76 | 144.5 |
| 13:13 | 97 | 49.1 | 15.90 | 138.6 |
| 13:14 | 96 | 49.1 | 15.95 | 132.7 |
| 13:15 | 97 | 49.2 | 16.09 | 155.4 |
| 13:16 | 97 | 49.2 | 16.50 | 167.2 |
| 13:17 | 98 | 49.2 | 16.53 | 193.2 |
| 13:18 | 99 | 49.3 | 15.92 | 205.0 |
| 13:19 | 98 | 49.3 | 16.66 | 189.8 |
| 13:20 | 98 | 49.4 | 16.83 | 191.5 |
| 13:21 | 99 | 49.4 | 16.18 | 231.8 |
| 13:22 | 98 | 49.5 | 16.54 | 180.6 |
| 13:23 | 97 | 49.5 | 16.30 | 168.8 |
| 13:24 | 97 | 49.5 | 15.70 | 163.8 |
| 13:25 | 97 | 49.6 | 15.82 | 155.4 |
| 13:26 | 97 | 49.6 | 15.93 | 148.7 |
| 13:27 | 97 | 49.7 | 16.02 | 141.1 |
| 13:28 | 96 | 49.7 | 16.16 | 140.3 |
| 13:29 | 96 | 49.8 | 16.37 | 139.4 |
| 13:30 | 96 | 49.8 | 16.50 | 128.5 |
| 13:31 | 96 | 49.9 | 16.42 | 121.8 |
| 13:32 | 96 | 49.9 | 16.47 | 121.0 |
| 13:33 | 96 | 50.0 | 16.55 | 118.4 |
| 13:34 | 96 | 50.0 | 16.59 | 115.1 |
| 13:35 | 96 | 50.1 | 16.61 | 114.2 |

| | | | | |
|---|---|---|---|---|
| 13:36 | 95 | 50.1 | 16.66 | 112.6 |
| 13:37 | 95 | 50.2 | 16.73 | 113.4 |
| 13:38 | 95 | 50.2 | 16.77 | 110.9 |
| 13:39 | 95 | 50.3 | 16.87 | 110.9 |
| 13:40 | 95 | 50.3 | 16.97 | 120.1 |
| 13:41 | 95 | 50.3 | 17.16 | 145.3 |
| 13:42 | 96 | 50.4 | 15.64 | 144.5 |
| 13:43 | 95 | 50.4 | 16.87 | 120.1 |
| 13:44 | 95 | 50.5 | 17.23 | 121.8 |
| 13:45 | 96 | 50.5 | 16.80 | 172.2 |
| 13:46 | 97 | 50.6 | 16.77 | 163.0 |
| **Average** | **97** | **43.8** | **15.98** | **180.7** |

Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

## Canley Crematorium Stream 2 Abatement System Outlet

## Mercury

| | |
|---|---|
| Contract | Canley Crematorium, DEM0744 |
| Date | 29th July 2014 |
| Location | Flue Gas Abatement System Outlet |
| Engineer(s) | JB & ST |
| Absorbent | 4% $K_2CR_2O_7$ / 20% $HNO_3$ in $H_2O$ |

| **Test Log** | **Test 4** |
|---|---|
| Barometric Pressure(kPa) | 101.8 |
| Gas Meter Temperature(Deg C) | 43.8 |
| Oxygen Concentration(%v/v dry) | 15.98 |
| Flue Gas Volumetric Flow($Nm^3$/h dry) | 4549 |

| | Start | End |
|---|---|---|
| Time | 11:17 | 13:46 |
| Gas Meter Reading($Am^3$ dry) | 45.171 | 46.378 |
| Absorber Weight(g) | 3514.4 | 3589.5 |
| Filter Reference | CA290714HgF2 | |
| Filter Fraction Analysed | 1 | |
| Filter(µg as Hg) | 0.78 | |
| Filter Blank(µg as Hg) | 0.01 | |
| Probe Rinse Reference | Washed into Hg2A | |
| Probe Rinse Volume(ml) | 0 | |
| Probe Rinse(µg/l as Hg) | 0 | |
| Probe Rinse Blank(µg/l as Hg) | 0 | |
| Absorbent Reference | CA290714Hg2A&B | |
| Absorbent Volume(ml) | 250 | 250 |
| Absorbent(µg/l as Hg) | 11 | 4.1 |
| Absorbent Blank(µg/l as Hg) | 3.2 | 3.2 |

**Calculation: General**

| | |
|---|---|
| Barometric Pressure(kPa) | 101.8 |
| Gas Meter Temperature(Deg C) | 43.8 |
| Gas Volume Sampled($Am^3$ dry) | 1.207 |
| Gas Volume Sampled($Nm^3$ dry) | 1.0454 |
| Mass of Dry Gas(g @ 1292.8 g/$Nm^3$) | 1351.47 |
| Change in Absorber Weight(g) | 75.1 |
| Water Vapour Volume($Nm^3$ @ 803.9 g/$Nm^3$) | 0.0934 |
| Gas Volume($Nm^3$ wet) | 1.1388 |
| Mass of Wet Gas(g) | 1426.57 |
| **Moisture Concentration(%v/v)** | **8.2** |
| **Moisture Concentration(%w/w)** | **5.3** |

| | |
|---|---|
| Filter(µg as Hg) | 0.77 |
| Probe Rinse(µg as Hg) | 0.00 |
| Absorbent(µg as Hg) | 2.18 |
| Total Mercury Sampled(µg) | 2.95 |
| Mercury Emission(µg/$Nm^3$ dry) | 2.82 |
| Oxygen Concentration(%v/v dry) | 15.98 |
| **Mercury Emission (µg/$Nm^3$ @ 11 %v/v Oxygen dry)** | **5.64** |
| Flue Gas Volumetric Flowrate($Nm^3$/h dry) | 4549 |
| **Mercury Emission(g/h)** | **0.013** |
| | |
| Required Sample Velocity(Nm/s) | 13.31 |
| Nozzle Used(mm) | 3.5 |
| Area of Nozzle($m^2$) | 0.00000962 |
| Test Duration(mins) | 149 |
| Actual Sample Velocity(Nm/s) | 12.15 |
| Isokinetic Closure(%) | 91 |

Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

## Canley Crematorium Stream 2 Abatement System Outlet

## Flue Gas Volumetric Flow

| | |
|---|---|
| Contract | Canley Crematorium, DEM0744 |
| Date | 29th July 2014 |
| Location | Flue Gas Abatement System Outlet |
| Engineer(s) | JB & ST |

| **Test Log** | **Test 4** |
|---|---|
| Flue Gas Temperature(Deg C) | 97 |
| Flue Gas Pitot Head Sample Points(Pa) | 180.7 |
| Flue Gas Pitot Head Duct Mean(Pa) | 175.9 |
| Flue Gas Moisture(%v/v) | 8.2 |
| Flue Gas Moisture(%w/w) | 5.3 |
| Flue Gas Duct Dimensions(mm) | 350 mm Diameter |
| Flue Gas Duct Area($m^2$) | 0.0962 |

**Calculation**

| | |
|---|---|
| Flue Gas Density($kg/m^3$) | 0.9342 |
| Sample Points | |
| Flue Gas Velocity(Am/s) | 19.67 |
| Flue Gas Volumetric Flowrate($Am^3/h$) | 6812 |
| Flue Gas Volumetric Flowrate($Am^3/h$ dry) | 6253 |
| Flue Gas Volumetric Flowrate($Nm^3/h$ dry) | 4610 |
| Duct Mean | |
| Flue Gas Velocity(Am/s) | 19.40 |
| Flue Gas Volumetric Flowrate($Am^3/h$) | 6720 |
| Flue Gas Volumetric Flowrate($Am^3/h$ dry) | 6169 |
| **Flue Gas Volumetric Flowrate($Nm^3/h$ dry)** | **4549** |

# APPENDIX 2

Analysis Reports

Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

SAL

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:** 413309-1

**Date of Report:** 13-Aug-2014

**Customer:** Davies & Co (Environmental)
Moor Road
Leeds
LS10 2DD

**Customer Contact:** Mr Steve Atherton

**Customer Job Reference:** DEM0744
**Customer Purchase Order:** 50000654
**Date Job Received at SAL:** 05-Aug-2014
**Date Analysis Started:** 05-Aug-2014
**Date Analysis Completed:** 13-Aug-2014

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 :
James Allan
Project Manager

Issued by :
James Allan
Project Manager

Signature valid
Digitally signed by James Allan
Date: 2014.08.13 17:12:41 BST
Reason: Issued
Location: SAL

**SAL Reference:** 413309
**Customer Reference:** DEM0744

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

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **SAL Reference** | **413309 001** | **413309 002** | **413309 003** | **413309 004** | **413309 005** |
| | | | | **Customer Sample Reference** | **CA280714 H12** | **CA280714 H22** | **CA280714 H32A** | **CA280714 H32B** | **CA280714 HOB** |
| | | | | **Test Sample** | **AR** | **AR** | **AR** | **AR** | **AR** |
| **Determinand** | **Method** | **LOD** | **Units** | **Symbol** | | | | | |
| Hydrogen Chloride | IC | 0.05 | mg/l | U | (13) **15** | (13) **14** | (13) **16** | (13) **0.07** | (13) **0.05** |

**SAL Reference:** 413309
**Customer Reference:** DEM0744

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

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | **SAL Reference** | **413309 006** | **413309 007** | **413309 008** | **413309 009** |
| | | | | **Customer Sample Reference** | **CA290714 H11** | **CA290714 H21** | **CA290714 H31A** | **CA290714 H31B** |
| | | | | **Test Sample** | **AR** | **AR** | **AR** | **AR** |
| **Determinand** | **Method** | **LOD** | **Units** | **Symbol** | | | | |
| Hydrogen Chloride | IC | 0.05 | mg/l | U | (13) **8.5** | (13) **9.1** | (195) **31** | (13) <0.05 |

**SAL Reference:** 413309
**Customer Reference:** DEM0744

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

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | **SAL Reference** | **413309 010** | **413309 011** | **413309 012** |
| | | | | **Customer Sample Reference** | **CA290714 HGF2** | **CA290714 HGFBLANK** | **CA300714 HGF1** |
| | | | | **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 | **0.02** |

**SAL Reference:** 413309
**Customer Reference:** DEM0744

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

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **SAL Reference** | **413309 013** | **413309 014** | **413309 015** | **413309 016** | **413309 017** |
| | | | | **Customer Sample Reference** | **CA290714 HGA2A** | **CA290714 HGA2B** | **CA290714 HGABLANK** | **CA300714 HGA1A** | **CA300714 HGA1B** |
| | | | | **Test Sample** | **AR** | **AR** | **AR** | **AR** | **AR** |
| **Determinand** | **Method** | **LOD** | **Units** | **Symbol** | | | | | |
| Mercury | CVAFS (BS EN 13211) | 0.5 | µg/l | U | **11** | **4.1** | **3.2** | (195) **21** | **1.3** |

## Index to symbols used in 413309-1

| Value | Description |
|---|---|
| AR | As Received |
| 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 |
| 13 | Results have been blank corrected. |
| U | Analysis is UKAS accredited |

**Particulate Weight Determination**

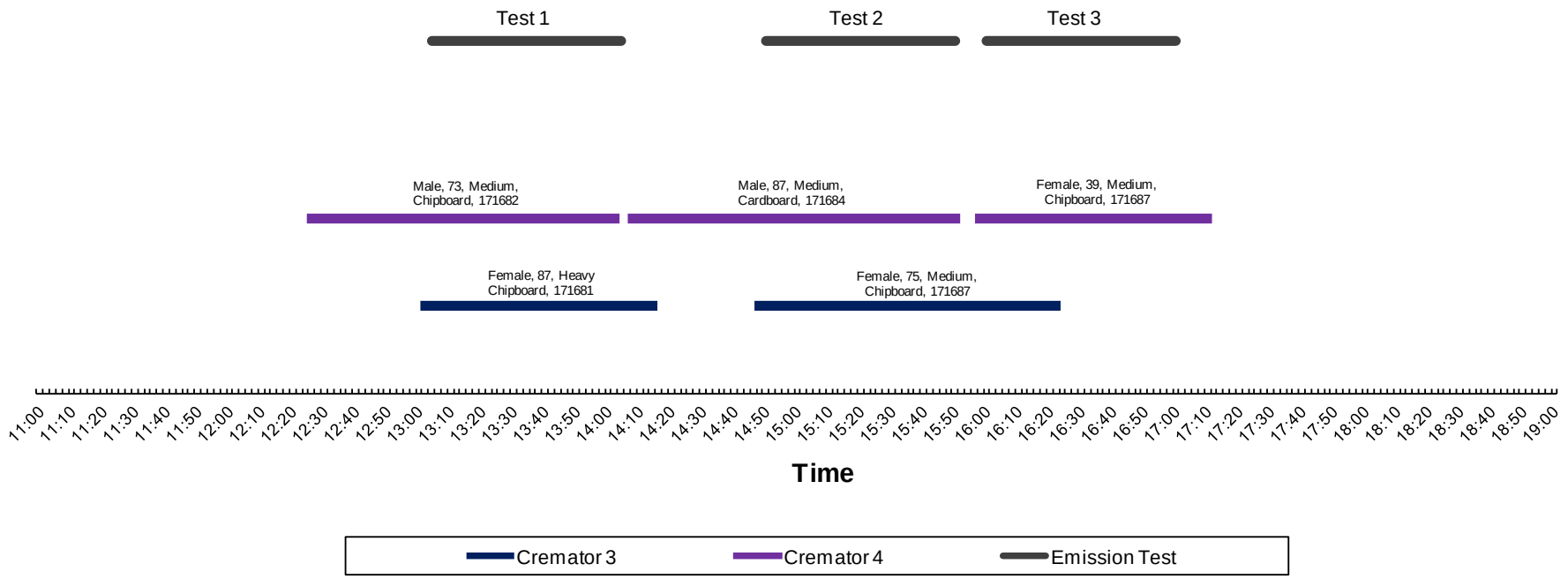
| Filter / Rinse Reference | | Clean Dry Weight g | Dirty Dry Weight g |
|---|---|---|---|
| CA290714F11 | F4 | 0.54680 | 0.54682 |
| CA290714F21 | F5 | 0.54544 | 0.54545 |
| CA290714F31 | F6 | 0.55130 | 0.55151 |
| CA290714R11 | 1 | 79.48733 | 79.48734 |
| CA290714R21 | 2 | 79.48734 | 79.48734 |
| CA290714R31 | 3 | 79.48734 | 79.48740 |
| CA280714F12 | F1 | 0.55219 | 0.55230 |
| CA280714F22 | F2 | 0.55003 | 0.55011 |
| CA280714F32 | F3 | 0.55287 | 0.55307 |
| CA280714R12 | 1 | 79.48733 | 79.48735 |
| CA280714R22 | 2 | 79.48735 | 79.48736 |
| CA280714R32 | 3 | 79.48736 | 79.48740 |

# APPENDIX 3

Details of Plant Operation During Testing

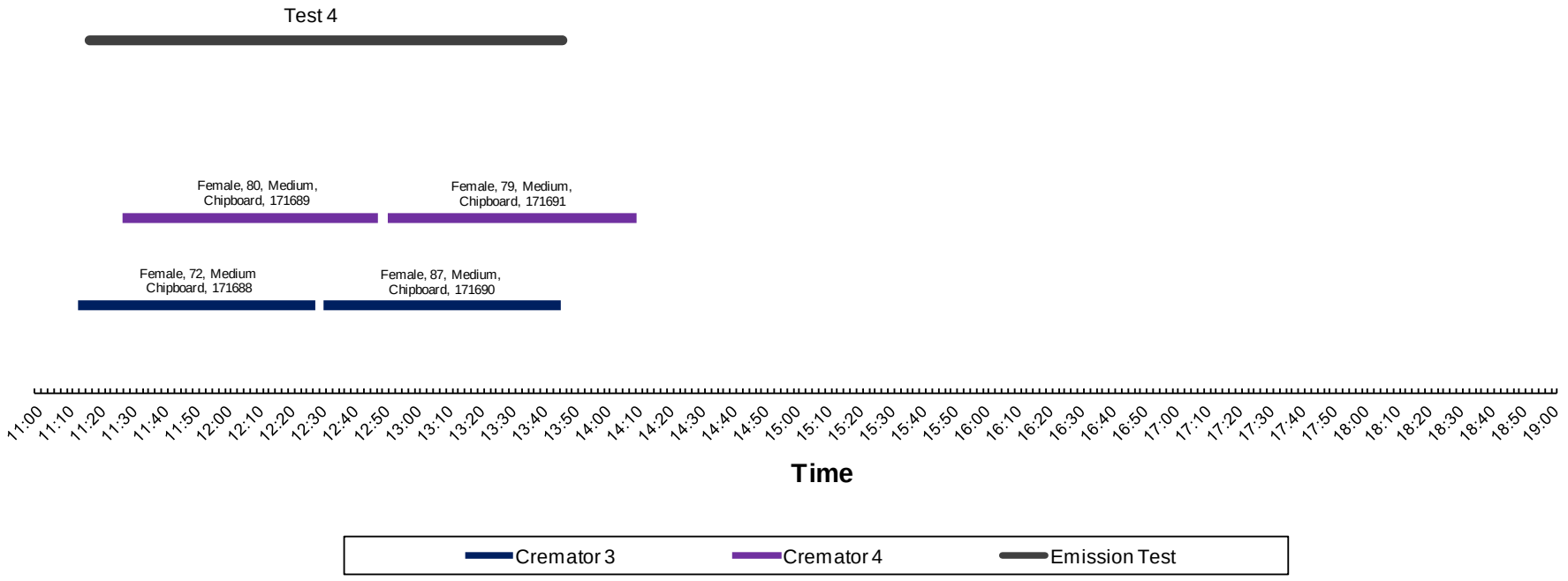
Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

# Canley Garden Crematorium Cremators 3 & 4 (Stream 2)
# Emission Tests 28/07/2014
# Plant Operation & Test Periods



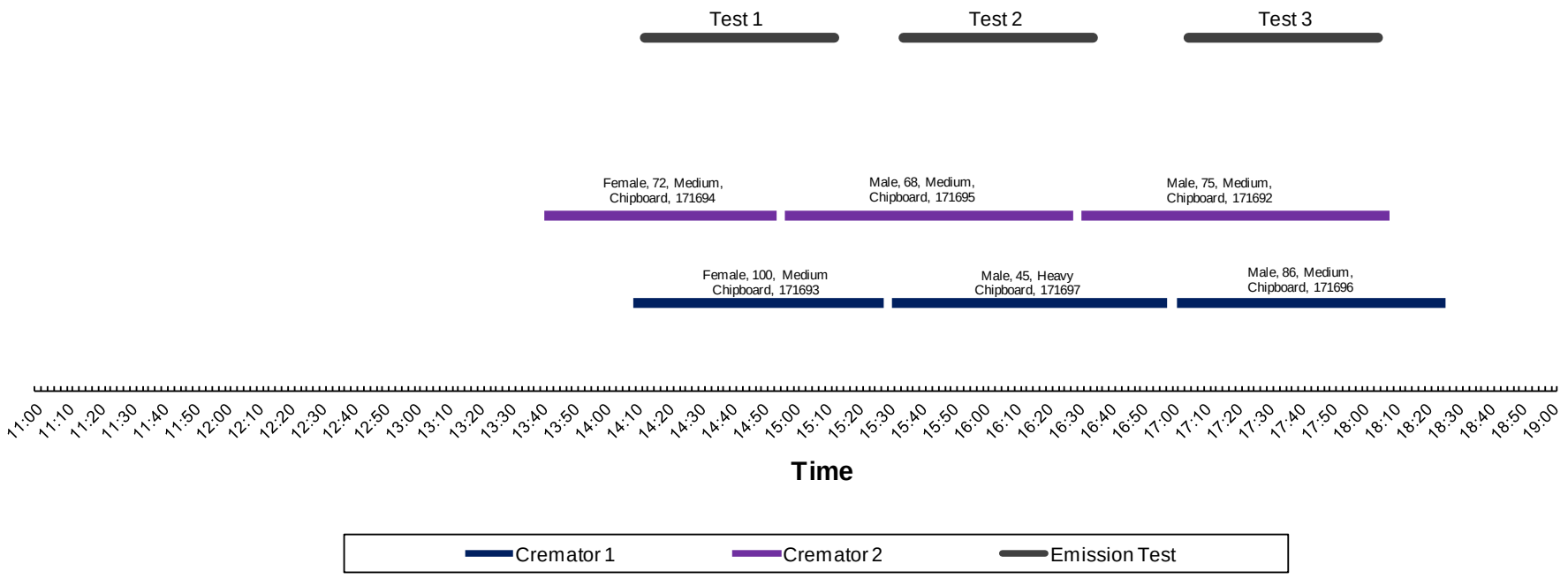
Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

# Canley Garden Crematorium Cremators 3 & 4 (Stream 2)
# Emission Tests 29/07/2014
# Plant Operation & Test Periods



Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

# Canley Garden Crematorium Cremators 1 & 2 (Stream 1)
# Emission Tests 29/07/2014
# Plant Operation & Test Periods



Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

# Canley Garden Crematorium Cremators 1 & 2 (Stream 1)
# Emission Tests 30/07/2014
# Plant Operation & Test Periods