



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

# EMISSIONS MONITORING TEST REPORT

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

**28<sup>th</sup> – 29<sup>th</sup> July 2015**

Report Authorised by



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## 1. INTRODUCTION

The four cremators and associated flue gas treatment systems at Canley Garden Crematorium were monitored between the 28<sup>th</sup> to 29<sup>th</sup> July 2015 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<sub>2</sub> infrared analyser for the on-line measurement of carbon monoxide. The analyser has a fixed range of 0-1250 mg/Nm<sup>3</sup> 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<sup>3</sup>, 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<sub>2</sub> 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 Garden Crematorium Stream 1 Abatement System Outlet**  
**Emissions Monitoring 29th July 2015**  
**Total Particulate Matter & Hydrogen Chloride Sampling**

	Test 1	Test 2	Test 3	Average	Requirement to PG5/2 (2012)
Total Particulate Matter - mg/Nm <sup>3</sup> c.	0.32 ± 2.51	0.22 ± 3.41	0.62 ± 3.27	<b>0.39</b>	<20
Hydrogen Chloride - mg/Nm <sup>3</sup> c.	5.09 ± 0.50	13.80 ± 0.89	20.57 ± 1.10	<b>13.15</b>	<30
Carbon Monoxide					
Test Average - mg/Nm <sup>3</sup> c.	7.20 ± 0.36	3.04 ± 0.15	4.14 ± 0.21	<b>4.80</b>	<100
First 30 min Average - mg/Nm <sup>3</sup> c.	9.70 ± 0.48	5.27 ± 0.26	7.69 ± 0.38	-	
Second 30 min Average - mg/Nm <sup>3</sup> c.	4.63 ± 0.23	0.75 ± 0.04	0.48 ± 0.02	-	
First 60 min Average - mg/Nm <sup>3</sup> c.	7.20 ± 0.36	3.04 ± 0.15	4.14 ± 0.21	-	
Organic Compounds - mg/Nm <sup>3</sup> c.	0.08 ± 0.00	0.10 ± 0.00	0.15 ± 0.01	<b>0.11</b>	<20
Flue Oxygen - %v/v dry	13.41 ± 0.10	13.81 ± 0.10	14.83 ± 0.10	<b>14.02</b>	
Flue Moisture - %v/v	7.4 ± 0.7	7.0 ± 0.7	5.7 ± 0.6	<b>6.7</b>	
- %w/w	4.7 ± 0.5	4.5 ± 0.4	3.6 ± 0.4	<b>4.3</b>	
Flue Temperature - Deg C	133 ± 2	134 ± 2	134 ± 2	<b>134</b>	
Volumetric Flow - Nm <sup>3</sup> /h dry	3416 ± 68	2621 ± 52	3165 ± 63	<b>3068</b>	

Note 1: All emissions as concentration levels are given as mg/Nm<sup>3</sup> 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**  
**Canley Garden Crematorium Stream 1 Abatement System Outlet**  
**Emissions Monitoring 29th July 2015**  
**Mercury Sampling**

		Test 4	Requirement to PG5/2 (2012)
Mercury	- $\mu\text{g}/\text{Nm}^3\text{c}$ .	12.54 $\pm$ 1.95	<50
Flue Oxygen	- %v/v dry	14.99 $\pm$ 0.10	
Flue Moisture	- %v/v	5.8 $\pm$ 0.6	
	- %w/w	3.7 $\pm$ 0.4	
Flue Temperature	- Deg C	134 $\pm$ 2	
Volumetric Flow	- $\text{Nm}^3/\text{h}$ dry	2713 $\pm$ 54	

Note 1: All emissions as concentration levels are given as  $\mu\text{g}/\text{Nm}^3$  or  $\text{mg}/\text{Nm}^3$  corrected to 11%v/v oxygen and dry gas

Note 2: All uncertainties ( $\pm$ ) are calculated to a 95% confidence interval

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

**TABLE 3**  
**Canley Garden Crematorium Stream 2 Abatement System Outlet**  
**Emissions Monitoring 28th July 2015**  
**Total Particulate Matter & Hydrogen Chloride Sampling**

	Test 1	Test 2	Test 3	Average	Requirement to PG5/2 (2012)
Total Particulate Matter - mg/Nm <sup>3</sup> c.	0.69 ± 2.27	0.42 ± 2.76	1.02 ± 3.35	<b>0.71</b>	<20
Hydrogen Chloride - mg/Nm <sup>3</sup> c.	12.94 ± 0.81	21.52 ± 1.32	19.46 ± 1.26	<b>17.98</b>	<30
Carbon Monoxide Test Average - mg/Nm <sup>3</sup> c.	1.43 ± 0.07	3.67 ± 0.18	1.10 ± 0.06	<b>2.07</b>	<100
First 30 min Average - mg/Nm <sup>3</sup> c.	2.81 ± 0.14	7.23 ± 0.36	2.17 ± 0.11	-	
Second 30 min Average - mg/Nm <sup>3</sup> c.	0.01 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	-	
First 60 min Average - mg/Nm <sup>3</sup> c.	1.43 ± 0.07	3.67 ± 0.18	1.10 ± 0.06	-	
Organic Compounds - mg/Nm <sup>3</sup> c.	0.12 ± 0.01	0.26 ± 0.01	0.03 ± 0.00	<b>0.14</b>	<20
Flue Oxygen - %v/v dry	15.86 ± 0.10	16.26 ± 0.10	16.85 ± 0.10	<b>16.32</b>	
Flue Moisture - %v/v	6.0 ± 0.6	5.3 ± 0.5	4.8 ± 0.5	<b>5.4</b>	
- %w/w	3.8 ± 0.4	3.4 ± 0.3	3.1 ± 0.3	<b>3.4</b>	
Flue Temperature - Deg C	104 ± 2	104 ± 2	101 ± 2	<b>103</b>	
Volumetric Flow - Nm <sup>3</sup> /h dry	6070 ± 121	5534 ± 111	4896 ± 98	<b>5500</b>	

Note 1: All emissions as concentration levels are given as mg/Nm<sup>3</sup> 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 4**  
**Canley Garden Crematorium Stream 2 Abatement System Outlet**  
**Emissions Monitoring 28th July 2015**  
**Mercury Sampling**

		Test 4	Requirement to PG5/2 (2012)
Mercury	- $\mu\text{g}/\text{Nm}^3\text{c}$ .	4.60 $\pm$ 4.07	<50
Flue Oxygen	- %v/v dry	18.03 $\pm$ 0.10	
Flue Moisture	- %v/v	3.4 $\pm$ 0.3	
	- %w/w	2.1 $\pm$ 0.2	
Flue Temperature	- Deg C	97 $\pm$ 2	
Volumetric Flow	- $\text{Nm}^3/\text{h}$ dry	3503 $\pm$ 70	

Note 1: All emissions as concentration levels are given as  $\mu\text{g}/\text{Nm}^3$  or  $\text{mg}/\text{Nm}^3$  corrected to 11%v/v oxygen and dry gas

Note 2: All uncertainties ( $\pm$ ) 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, hydrogen chloride, mercury, carbon monoxide and volatile organic compounds.

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
		Mercury

## **APPENDIX 1**

### Data Logs and Calculations

## Canley Garden Crematorium Stream 1 Abatement System Outlet

### Data Log

29/07/15

#### Test 1

Time	Flue Gas °C	Meter °C	Flue Oxygen %v/v dry	CO mg/Nm <sup>3</sup> c.	VOC mg/Nm <sup>3</sup> c.	Sample Point Pa
10:43	125	23.2	13.88	42.76	2.23	114.2
10:44	125	23.3	14.72	38.54	2.01	110.9
10:45	125	23.4	13.69	13.13	0.03	122.6
10:46	125	23.6	13.91	3.82	0.00	102.5
10:47	126	23.8	13.66	0.31	0.00	93.2
10:48	126	24.1	13.56	0.00	0.00	83.2
10:49	127	24.3	12.97	0.41	0.00	105.8
10:50	129	24.6	13.36	11.04	0.00	123.5
10:51	128	24.9	14.56	27.50	0.00	93.2
10:52	128	25.2	14.05	15.33	0.00	91.6
10:53	128	25.5	13.20	4.43	0.00	113.4
10:54	129	25.9	13.40	4.74	0.00	121.8
10:55	130	26.2	13.81	11.19	0.00	105.0
10:56	130	26.6	13.59	11.00	0.00	99.1
10:57	132	27.0	12.89	11.06	0.00	133.6
10:58	132	27.4	13.72	13.58	0.00	120.1
10:59	131	27.7	13.64	14.73	0.34	119.3
11:00	131	28.1	13.72	14.23	0.00	112.6
11:01	131	28.6	13.53	10.18	0.00	105.0
11:02	132	29.0	13.43	11.31	0.00	141.1
11:03	134	29.4	13.68	8.68	0.00	143.6
11:04	135	29.8	14.05	12.23	0.00	142.8
11:05	136	30.1	13.49	1.75	0.00	154.6
11:06	136	30.5	14.28	6.38	0.00	130.2
11:07	135	30.9	13.62	7.78	0.00	137.8
11:08	136	31.3	13.86	0.39	0.00	148.7
11:09	135	31.6	13.93	0.00	0.00	126.8
11:10	135	32.0	13.68	0.08	0.00	115.9
11:11	135	32.3	14.71	2.85	0.00	87.4
11:12	136	32.7	12.75	1.21	0.00	111.7
11:13	136	33.1	13.63	0.00	0.00	118.4
11:14	135	33.4	14.96	0.10	0.00	86.5
11:15	134	33.7	15.08	0.00	0.00	77.3
11:16	133	34.0	12.79	0.00	0.00	74.8
11:17	133	34.3	13.70	0.00	0.00	56.3
11:18	133	34.5	13.72	0.07	0.00	74.8
11:19	135	34.8	13.28	0.00	0.00	121.0
11:20	137	35.1	15.04	8.62	0.00	140.3
11:21	137	35.3	13.87	12.18	0.00	115.9

11:22	135	35.6	13.20	10.41	0.00	87.4
11:23	135	35.9	13.38	8.32	0.00	78.1
11:24	134	36.1	13.37	5.59	0.00	62.2
11:25	133	36.4	15.17	2.10	0.00	54.6
11:26	133	36.6	11.94	1.92	0.00	52.1
11:27	133	36.8	10.07	10.22	0.00	65.5
11:28	135	37.0	12.18	6.00	0.00	107.5
11:29	135	37.2	13.13	5.78	0.00	98.3
11:30	135	37.4	12.69	5.07	0.00	90.7
11:31	136	37.6	11.07	3.03	0.00	118.4
11:32	136	37.9	11.71	4.14	0.00	104.2
11:33	135	38.0	12.53	3.82	0.00	100.0
11:34	135	38.2	13.18	3.33	0.00	105.8
11:35	135	38.4	11.82	2.77	0.00	99.1
11:36	136	38.6	12.73	6.50	0.00	114.2
11:37	138	38.8	12.96	6.85	0.00	139.4
11:38	139	39.0	12.50	4.93	0.00	146.2
11:39	139	39.2	14.68	6.65	0.00	135.2
11:40	139	39.3	13.33	5.20	0.00	112.6
11:41	138	39.5	12.25	4.79	0.00	98.3
11:42	138	39.7	13.78	5.73	0.00	98.3
11:43	137	39.9	12.75	4.66	0.00	89.0
<b>Average</b>	<b>133</b>	<b>32.2</b>	<b>13.41</b>	<b>7.20</b>	<b>0.08</b>	<b>107.1</b>

Average for first 30 mins of test	<b>9.70</b>	-
Average for second 30 mins of test	<b>4.63</b>	-
Average for first 60 mins of test	<b>7.20</b>	<b>0.08</b>



## Canley Garden Crematorium Stream 1 Abatement System Outlet

### Data Log

29/07/15

#### Test 2

Time	Flue Gas °C	Meter °C	Flue Oxygen %v/v dry	CO mg/Nm <sup>3</sup> c.	VOC mg/Nm <sup>3</sup> c.	Sample Point Pa
12:00	140	40.0	13.46	29.74	3.52	118.4
12:01	138	39.9	12.78	23.97	1.37	90.7
12:02	138	39.8	12.55	18.93	0.99	79.8
12:03	137	39.7	12.29	9.33	0.00	80.6
12:04	137	39.7	11.82	5.69	0.00	89.9
12:05	138	39.7	11.55	4.35	0.00	84.8
12:06	138	39.7	11.77	7.01	0.00	92.4
12:07	139	39.7	12.38	12.20	0.00	90.7
12:08	138	39.7	12.90	9.17	0.00	68.0
12:09	137	39.8	11.83	9.37	0.00	57.1
12:10	136	39.8	12.38	6.46	0.00	62.2
12:11	136	39.8	13.48	5.38	0.00	76.4
12:12	136	39.9	14.10	5.29	0.00	70.6
12:13	137	39.9	14.57	3.95	0.00	96.6
12:14	137	40.0	13.89	2.40	0.00	90.7
12:15	137	40.1	14.40	2.80	0.00	73.9
12:16	137	40.2	12.00	0.28	0.00	92.4
12:17	137	40.3	14.56	3.29	0.00	85.7
12:18	137	40.4	14.62	2.91	0.00	94.9
12:19	137	40.5	13.54	0.07	0.00	105.0
12:20	136	40.5	14.57	0.33	0.00	79.0
12:21	136	40.7	15.19	0.09	0.00	61.3
12:22	136	40.7	12.58	0.00	0.00	62.2
12:23	136	40.8	13.50	0.05	0.00	48.7
12:24	135	40.9	14.41	0.09	0.00	42.0
12:25	135	41.0	12.74	0.06	0.00	49.6
12:26	134	41.0	12.22	0.06	0.00	47.0
12:27	134	41.1	13.00	0.06	0.00	52.9
12:28	134	41.1	13.23	0.00	0.00	59.6
12:29	134	41.2	12.78	0.00	0.00	42.0
12:30	134	41.2	14.03	0.00	0.00	53.8
12:31	134	41.3	13.77	0.00	0.00	61.3
12:32	134	41.3	13.21	0.00	0.00	46.2
12:33	133	41.3	14.21	0.00	0.00	57.1
12:34	134	41.4	13.90	0.00	0.00	80.6
12:35	133	41.4	15.03	0.00	0.00	62.2
12:36	133	41.5	16.34	0.00	0.00	50.4
12:37	132	41.5	13.70	0.00	0.00	43.7
12:38	133	41.6	12.81	0.05	0.00	47.0

12:39	133	41.6	13.52	0.08	0.00	51.2
12:40	133	41.7	13.16	0.08	0.00	63.0
12:41	132	41.7	13.27	0.00	0.00	46.2
12:42	131	41.8	16.04	0.00	0.00	42.0
12:43	131	41.8	14.84	0.00	0.00	41.2
12:44	131	41.8	11.78	0.00	0.00	44.5
12:45	131	41.9	15.59	0.00	0.00	52.9
12:46	131	41.9	14.01	0.00	0.00	46.2
12:47	131	42.0	14.41	0.00	0.00	49.6
12:48	132	42.0	14.46	0.00	0.00	51.2
12:49	131	42.1	13.44	0.00	0.00	56.3
12:50	131	42.1	14.56	0.00	0.00	47.9
12:51	130	42.1	15.78	1.69	0.00	52.9
12:52	130	42.1	15.02	5.10	0.00	51.2
12:53	130	42.2	12.61	0.07	0.00	42.0
12:54	130	42.2	16.55	0.11	0.00	42.8
12:55	130	42.2	14.02	0.00	0.00	42.0
12:56	130	42.3	13.49	0.00	0.00	43.7
12:57	130	42.3	14.10	0.00	0.00	44.5
12:58	130	42.3	17.70	0.12	0.00	54.6
12:59	130	42.3	14.53	1.13	0.00	58.0
13:00	130	42.3	17.53	13.99	0.00	52.1
<b>Average</b>	<b>134</b>	<b>41.1</b>	<b>13.81</b>	<b>3.04</b>	<b>0.10</b>	<b>62.7</b>

Average for first 30 mins of test	<b>5.27</b>	-
Average for second 30 mins of test	<b>0.75</b>	-
Average for first 60 mins of test	<b>3.04</b>	<b>0.10</b>

## Canley Garden Crematorium Stream 1 Abatement System Outlet

### Data Log

29/07/15

#### Test 3

Time	Flue Gas °C	Meter °C	Flue Oxygen %v/v dry	CO mg/Nm <sup>3</sup> c.	VOC mg/Nm <sup>3</sup> c.	Sample Point Pa
13:13	130	42.1	16.43	5.06	0.05	74.8
13:14	129	42.1	13.10	2.42	0.01	51.2
13:15	130	42.0	16.15	2.38	0.00	56.3
13:16	130	41.9	12.95	0.32	0.00	61.3
13:17	131	41.9	13.99	0.07	0.00	68.9
13:18	131	41.9	13.70	0.00	0.00	84.0
13:19	131	41.8	15.01	4.86	0.00	83.2
13:20	131	41.8	14.34	7.35	0.00	66.4
13:21	130	41.8	13.01	0.06	0.00	53.8
13:22	131	41.8	13.66	0.07	0.00	71.4
13:23	132	41.8	12.62	0.43	0.00	87.4
13:24	133	41.8	13.90	0.00	0.00	80.6
13:25	133	41.9	14.26	0.00	0.00	79.8
13:26	133	41.8	14.35	0.00	0.00	77.3
13:27	133	41.8	15.37	2.32	0.00	105.8
13:28	133	41.9	16.12	9.97	0.00	103.3
13:29	133	41.9	16.88	14.28	0.00	81.5
13:30	132	41.9	13.71	0.08	0.00	57.1
13:31	132	41.9	16.36	0.15	0.00	57.1
13:32	132	41.9	14.97	0.00	0.40	48.7
13:33	132	41.9	12.67	81.14	2.64	73.1
13:34	135	41.9	14.04	78.92	5.44	131.0
13:35	135	42.0	14.47	12.25	0.62	108.4
13:36	134	42.0	15.19	4.91	0.00	79.8
13:37	133	42.0	13.85	0.55	0.00	66.4
13:38	132	42.0	13.62	0.07	0.00	58.8
13:39	132	42.0	13.32	0.07	0.00	56.3
13:40	132	42.1	14.68	0.84	0.00	63.8
13:41	133	42.1	14.23	0.06	0.00	66.4
13:42	134	42.1	13.01	1.62	0.00	91.6
13:43	135	42.1	13.62	8.20	0.00	110.9
13:44	135	42.1	14.80	5.99	0.00	93.2
13:45	134	42.1	14.52	0.62	0.00	75.6
13:46	134	42.2	13.60	2.78	0.00	73.1
13:47	133	42.3	12.52	1.85	0.00	63.8
13:48	133	42.3	13.92	1.25	0.00	62.2
13:49	134	42.4	13.10	0.16	0.00	65.5
13:50	134	42.4	13.94	0.97	0.00	52.9
13:51	134	42.5	13.37	0.08	0.00	67.2

13:52	134	42.5	13.15	0.00	0.00	64.7
13:53	134	42.5	14.73	0.00	0.00	75.6
13:54	134	42.5	14.34	0.00	0.00	100.8
13:55	134	42.5	15.30	0.00	0.00	100.8
13:56	136	42.5	15.56	0.00	0.00	122.6
13:57	137	42.5	15.29	0.00	0.00	115.1
13:58	137	42.5	14.56	0.00	0.00	110.0
13:59	138	42.5	15.61	0.00	0.00	113.4
14:00	138	42.5	16.64	0.00	0.00	128.5
14:01	138	42.6	16.73	0.00	0.00	139.4
14:02	138	42.6	16.72	0.00	0.00	142.0
14:03	138	42.6	16.90	0.00	0.00	142.8
14:04	138	42.6	17.06	0.00	0.00	134.4
14:05	139	42.7	15.73	0.00	0.00	124.3
14:06	140	42.7	16.92	0.00	0.00	136.1
14:07	140	42.7	17.27	0.00	0.00	137.8
14:08	140	42.8	16.46	0.00	0.00	126.0
14:09	140	42.8	16.78	0.00	0.00	130.2
14:10	140	42.8	17.54	0.00	0.00	133.6
14:11	139	42.9	16.49	0.00	0.00	100.8
14:12	138	42.9	15.38	0.57	0.00	79.8
14:13	137	42.9	16.25	0.00	0.00	79.0
<b>Average</b>	<b>134</b>	<b>42.2</b>	<b>14.83</b>	<b>4.14</b>	<b>0.15</b>	<b>89.3</b>

Average for first 30 mins of test	<b>7.69</b>	-
Average for second 30 mins of test	<b>0.48</b>	-
Average for first 60 mins of test	<b>4.14</b>	<b>0.15</b>

## Canley Garden Crematorium Stream 1 Abatement System Outlet

### Total Particulate Matter and Hydrogen Chloride

Contract Canley Garden Crematorium, DEM0818  
Date 29th July 2015  
Location Flue Gas Abatement System Outlet  
Engineer(s) JB & ST  
Absorbent H<sub>2</sub>O

Test Log	Test 1		Test 2		Test 3	
Barometric Pressure(kPa)	100.9		101.0		101.1	
Gas Meter Temperature(Deg C)	32.2		41.1		42.2	
Oxygen Concentration(%v/v dry)	13.41		13.81		14.83	
Flue Gas Volumetric Flow(Nm <sup>3</sup> /h dry)	3416		2621		3165	
Time	Start	End	Start	End	Start	End
	10:43	11:43	12:00	13:00	13:13	14:13
Gas Meter Reading(Am <sup>3</sup> dry)	195.088	195.497	195.563	195.890	195.937	196.336
Absorber Weight(g)	3552.6	3575.9	3719.2	3736.3	3573.0	3589.7
Filter Reference	CA290715F11		CA290715F12		CA290715F13	
Filter Weight(g)	0.50966	0.50968	0.54025	0.54026	0.53816	0.53819
Probe Rinse Reference	CA290715R11		CA290715R12		CA290715R13	
Probe Rinse Weight(g)	76.8480	76.8480	76.8480	76.8481	76.8481	76.8482
Sample Reference HCl	CA290715H11		CA290715H21		CA290715H31A&B	
Absorbent Volume(ml)	500		500		250	250
Absorbent(mg/l as HCl)	3		5.8		17	0.64
Blank(mg/l as HCl)	0.19		0.19		0.19	0.19

### Calculation: General

Barometric Pressure(kPa)	100.9	101.0	101.1
Gas Meter temperature(Deg C)	32.2	41.1	42.2
Gas Volume Sampled(Am <sup>3</sup> dry)	0.409	0.327	0.399
Gas Volume Sampled(Nm <sup>3</sup> dry)	0.3644	0.2834	0.3449
Mass of Dry Gas(g @ 1292.8 g/Nm <sup>3</sup> )	471.10	366.39	445.84
Change in Absorber Weight(g)	23.3	17.1	16.7
Water Vapour Volume(Nm <sup>3</sup> @ 803.9 g/Nm <sup>3</sup> )	0.0290	0.0213	0.0208
Gas Volume(Nm <sup>3</sup> wet)	0.3934	0.3047	0.3656
Mass of Wet Gas(g)	494.40	383.49	462.54
<b>Moisture Concentration(%v/v)</b>	<b>7.4</b>	<b>7.0</b>	<b>5.7</b>
<b>Moisture Concentration(%w/w)</b>	<b>4.7</b>	<b>4.5</b>	<b>3.6</b>

**Calculation: Particulate**

Increase In Filter Weights(g)	0.00009	0.00004	0.00013
Particulate Emission(mg/Nm <sup>3</sup> dry)	0.24	0.16	0.38
Oxygen Concentration(%v/v dry)	13.41	13.81	14.83
<b>Particulate Emission</b>	<b>0.32</b>	<b>0.22</b>	<b>0.62</b>
<b>(mg/Nm<sup>3</sup> @ 11 %v/v Oxygen dry)</b>			
Flue Gas Volumetric Flow(Nm <sup>3</sup> /h dry)	3416	2621	3165
<b>Particulate Emission(g/h)</b>	<b>0.83</b>	<b>0.41</b>	<b>1.22</b>
Required Sample Velocity(Nm/s)	9.86	7.57	9.14
Nozzle Used(mm)	3.5	3.5	3.5
Area of Nozzle(m <sup>2</sup> )	0.00000962	0.00000962	0.00000962
Test Duration(mins)	60	60	60
Actual Sample Velocity(Nm/s)	10.52	8.18	9.96
Isokinetic Closure(%)	107	108	109
		108	

**Calculation: HCl**

Absorbent(mg/l as HCl)	3.00	5.80	17.64
Blank(mg/l as HCl)	0.19	0.19	0.19
Chloride Absorbed(mg/l as HCl)	2.81	5.61	17.45
Chloride Absorbed(mg as HCl)	1.41	2.81	4.36
HCl(mg)	1.41	2.81	4.36
HCl Emission(mg/Nm <sup>3</sup> dry)	3.86	9.90	12.65
Oxygen Concentration(%v/v dry)	13.41	13.81	14.83
<b>HCl Emission</b>	<b>5.09</b>	<b>13.80</b>	<b>20.57</b>
<b>(mg/Nm<sup>3</sup> @ 11 %v/v Oxygen dry)</b>			
Flue Gas Volumetric Flow(Nm <sup>3</sup> /h dry)	3416	2621	3165
<b>HCl Emission(g/h)</b>	<b>13.17</b>	<b>25.94</b>	<b>40.04</b>

## Canley Garden Crematorium Stream 1 Abatement System Outlet

### Flue Gas Volumetric Flow

Contract Canley Garden Crematorium, DEM0818  
 Date 29th July 2015  
 Location Flue Gas Abatement System Outlet  
 Engineer(s) JB & ST

Test Log	Test 1	Test 2	Test 3
Flue Gas Temperature(Deg C)	133	134	134
Flue Gas Pitot Head Sample Points(Pa)	107.1	62.7	89.3
Flue Gas Moisture(%v/v)	7.4	7.0	5.7
Flue Gas Moisture(%w/w)	4.7	4.5	3.6
Flue Gas Duct Dimensions(mm)	350 mm Diameter Circular Stack		
Flue Gas Duct Area(m <sup>2</sup> )	0.0962		

### Calculation

Flue Gas Density(kg/m <sup>3</sup> )	0.8534	0.8527	0.8547
<u>Sample Points</u>			
Flue Gas Velocity(Am/s)	15.84	12.13	14.46
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h)	5487	4200	5007
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h dry)	5083	3907	4722
Flue Gas Volumetric Flowrate(Nm <sup>3</sup> /h dry)	3416	2621	3165
<u>Duct Mean</u>			
Flue Gas Velocity(Am/s)	15.63	11.96	14.26
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h)	5414	4143	4940
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h dry)	5015	3854	4659
<b>Flue Gas Volumetric Flowrate(Nm<sup>3</sup>/h dry)</b>	<b>3371</b>	<b>2586</b>	<b>3123</b>

## Canley Garden Crematorium Stream 1 Abatement System Outlet

Data Log

29/07/15

Test 4

Time	Flue Gas °C	Meter °C	Flue O <sub>2</sub> %v/v dry	Sample Point Pa
14:33	137	41.8	17.51	71.4
14:34	137	41.6	13.96	63.8
14:35	137	41.4	16.05	65.5
14:36	136	41.3	15.55	65.5
14:37	136	41.1	15.73	65.5
14:38	136	41.0	16.86	68.9
14:39	136	40.9	14.51	68.0
14:40	136	40.8	17.68	73.1
14:41	136	40.7	15.33	54.6
14:42	135	40.7	16.98	45.4
14:43	135	40.7	16.12	45.4
14:44	135	40.7	18.05	54.6
14:45	135	40.6	15.23	58.0
14:46	135	40.6	16.43	73.1
14:47	135	40.6	15.81	65.5
14:48	135	40.6	15.11	70.6
14:49	136	40.6	17.14	72.2
14:50	136	40.6	15.06	71.4
14:51	135	40.6	16.25	71.4
14:52	135	40.6	16.69	76.4
14:53	135	40.6	17.48	76.4
14:54	134	40.7	14.67	72.2
14:55	134	40.7	17.67	72.2
14:56	135	40.7	15.08	70.6
14:57	135	40.7	15.11	68.9
14:58	135	40.7	17.20	68.0
14:59	135	40.8	14.50	68.0
15:00	135	40.8	18.55	70.6
15:01	134	40.8	17.06	49.6
15:02	133	40.8	16.68	35.3
15:03	132	40.8	13.10	19.3
15:04	131	40.9	13.81	16.8
15:05	131	40.9	14.89	22.7
15:06	131	40.9	13.39	31.9
15:07	131	40.9	14.27	16.0
15:08	130	41.0	15.38	16.8
15:09	130	41.0	15.23	36.1
15:10	130	41.0	14.10	23.5
15:11	129	41.0	15.97	20.2
15:12	129	41.0	13.53	35.3



15:13	129	41.1	14.86	18.5
15:14	128	41.0	16.81	14.3
15:15	128	41.1	17.02	35.3
15:16	128	41.1	14.87	22.7
15:17	128	41.1	15.82	23.5
15:18	128	41.1	15.33	31.1
15:19	127	41.1	13.53	19.3
15:20	127	41.1	17.14	23.5
15:21	127	41.1	15.98	24.4
15:22	126	41.1	12.94	13.4
15:23	126	41.1	15.35	23.5
15:24	126	41.1	14.78	18.5
15:25	125	41.1	13.62	16.0
15:26	125	41.1	16.06	21.8
15:27	125	41.1	14.57	16.0
15:28	125	41.1	13.53	21.8
15:29	125	41.1	15.44	23.5
15:30	124	41.1	14.35	18.5
15:31	124	41.2	14.57	16.0
15:32	123	41.2	14.80	10.9
15:33	124	41.2	15.75	26.9
15:34	124	41.2	14.35	40.3
15:35	126	41.3	15.84	85.7
15:36	129	41.4	15.97	141.1
15:37	131	41.4	16.18	133.6
15:38	130	41.5	17.47	105.0
15:39	129	41.6	16.23	81.5
15:40	128	41.7	16.92	70.6
15:41	129	41.8	17.73	88.2
15:42	129	41.9	14.99	80.6
15:43	129	41.9	16.04	83.2
15:44	130	42.0	15.62	72.2
15:45	130	42.1	15.08	92.4
15:46	130	42.2	16.49	84.0
15:47	130	42.2	15.32	87.4
15:48	130	42.3	17.30	98.3
15:49	130	42.4	14.98	89.0
15:50	130	42.4	16.68	76.4
15:51	130	42.5	17.39	49.6
15:52	129	42.5	15.21	33.6
15:53	129	42.6	15.85	35.3
15:54	128	42.6	12.49	22.7
15:55	128	42.7	16.31	26.0
15:56	129	42.7	16.51	86.5
15:57	132	42.7	14.38	134.4
15:58	133	42.8	14.27	101.6
15:59	133	42.8	14.76	75.6
16:00	132	42.9	15.01	60.5
16:01	132	42.9	13.63	58.8

16:02	132	42.9	13.32	67.2
16:03	133	43.0	11.68	117.6
16:04	136	43.0	13.94	179.8
16:05	140	43.0	13.72	211.7
16:06	143	43.0	14.20	221.8
16:07	145	43.0	14.27	212.5
16:08	144	43.0	14.49	168.0
16:09	143	43.1	14.92	126.8
16:10	142	43.1	14.36	117.6
16:11	142	43.1	14.30	124.3
16:12	142	43.1	14.14	129.4
16:13	141	43.1	13.68	117.6
16:14	141	43.1	13.42	115.9
16:15	141	43.1	13.45	110.9
16:16	140	43.2	13.34	95.8
16:17	139	43.2	13.21	85.7
16:18	139	43.3	13.93	83.2
16:19	138	43.4	13.79	75.6
16:20	139	43.4	13.52	106.7
16:21	140	43.5	14.09	115.9
16:22	141	43.6	14.25	110.9
16:23	141	43.6	14.10	108.4
16:24	141	43.7	14.00	110.9
16:25	141	43.7	14.18	110.9
16:26	140	43.8	13.14	107.5
16:27	140	43.8	13.78	114.2
16:28	140	43.8	14.62	99.1
16:29	139	43.8	13.75	90.7
16:30	139	43.9	13.24	84.8
16:31	138	43.9	13.19	84.0
16:32	138	43.9	13.48	97.4
16:33	140	43.9	14.28	124.3
16:34	140	44.0	15.00	112.6
16:35	140	44.0	14.92	89.0
16:36	139	44.0	14.54	69.7
16:37	138	44.0	14.31	54.6
16:38	138	44.0	13.04	49.6
16:39	137	44.0	12.27	42.8
16:40	136	44.0	13.13	39.5
16:41	136	44.0	13.32	48.7
16:42	137	44.0	13.17	48.7
16:43	136	44.0	12.79	42.0
16:44	136	43.9	13.70	47.0
16:45	136	43.9	13.65	48.7
16:46	136	43.9	13.43	47.9
16:47	135	43.8	13.48	46.2
16:48	134	43.8	13.53	37.0
16:49	134	43.8	13.74	34.4
16:50	134	43.7	13.68	34.4

16:51	134	43.7	13.90	35.3
16:52	134	43.7	14.29	43.7
16:53	134	43.6	14.16	41.2
16:54	133	43.6	14.32	37.0
16:55	133	43.6	15.29	47.0
16:56	132	43.5	14.89	45.4
16:57	132	43.5	14.68	42.8
16:58	133	43.5	15.16	47.9
16:59	134	43.5	15.27	75.6
17:00	134	43.5	14.70	79.0
17:01	134	43.5	15.97	65.5
17:02	134	43.5	14.48	86.5
17:03	134	43.5	15.86	87.4
17:04	134	43.5	15.83	77.3
17:05	134	43.6	14.67	73.9
17:06	134	43.6	14.65	73.9
17:07	135	43.6	15.74	73.1
17:08	135	43.6	15.87	68.9
17:09	135	43.7	15.06	64.7
17:10	134	43.7	14.44	63.8
17:11	134	43.7	15.15	68.9
17:12	134	43.7	15.76	63.0
17:13	134	43.7	14.56	61.3
17:14	134	43.7	14.47	60.5
17:15	134	43.7	14.50	58.8
17:16	135	43.7	14.99	63.8
17:17	135	43.8	16.09	68.9
17:18	135	43.7	16.29	69.7
17:19	134	43.7	17.16	52.1
17:20	133	43.7	17.09	52.1
17:21	133	43.8	14.61	53.8
17:22	133	43.8	15.07	47.0
17:23	133	43.8	17.62	56.3
17:24	133	43.8	17.12	52.1
<b>Average</b>	<b>134</b>	<b>42.4</b>	<b>14.99</b>	<b>67.5</b>

## Canley Garden Crematorium Stream 1 Abatement System Outlet

### Mercury

Contract Canley Garden Crematorium, DEM0818  
 Date 29th July 2015  
 Location Flue Gas Abatement System Outlet  
 Engineer(s) JB & ST  
 Absorbent 4% K<sub>2</sub>CR<sub>2</sub>O<sub>7</sub> / 20% HNO<sub>3</sub> in H<sub>2</sub>O

#### Test Log

#### Test 4

Barometric Pressure(kPa) 101.1  
 Gas Meter Temperature(Deg C) 42.4  
 Oxygen Concentration(%v/v dry) 14.99  
 Flue Gas Volumetric Flow(Nm<sup>3</sup>/h dry) 2713

	Start	End
Time	14:33	17:24
Gas Meter Reading(Am <sup>3</sup> dry)	196.434	197.402
Absorber Weight(g)	3745.4	3786.9
Filter Reference	CA290715HgF1	
Filter Fraction Analysed	1	
Filter(µg as Hg)	0.01	
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	CA290715Hg1A&B	
Absorbent Volume(ml)	250	250
Absorbent(µg/l as Hg)	26	0.7
Absorbent Blank(µg/l as Hg)	0.8	0.8

#### Calculation: General

Barometric Pressure(kPa)	101.1
Gas Meter Temperature(Deg C)	42.4
Gas Volume Sampled(Am <sup>3</sup> dry)	0.968
Gas Volume Sampled(Nm <sup>3</sup> dry)	0.8361
Mass of Dry Gas(g @ 1292.8 g/Nm <sup>3</sup> )	1080.97
Change in Absorber Weight(g)	41.5
Water Vapour Volume(Nm <sup>3</sup> @ 803.9 g/Nm <sup>3</sup> )	0.0516
Gas Volume(Nm <sup>3</sup> wet)	0.8878
Mass of Wet Gas(g)	1122.47
<b>Moisture Concentration(%v/v)</b>	<b>5.8</b>
<b>Moisture Concentration(%w/w)</b>	<b>3.7</b>

**Calculation: Mercury**

Filter( $\mu\text{g}$ as Hg)	0.00
Probe Rinse( $\mu\text{g}$ as Hg)	0.00
Absorbent( $\mu\text{g}$ as Hg)	6.28
Total Mercury Sampled( $\mu\text{g}$ )	6.28
Mercury Emission( $\mu\text{g}/\text{Nm}^3$ dry)	7.50
Oxygen Concentration(%v/v dry)	14.99
<b>Mercury Emission</b>	<b>12.54</b>
<b>(<math>\mu\text{g}/\text{Nm}^3</math> @ 11 %v/v Oxygen dry)</b>	
Flue Gas Volumetric Flowrate( $\text{Nm}^3/\text{h}$ dry)	2713
<b>Mercury Emission(g/h)</b>	<b>0.020</b>
Required Sample Velocity( $\text{Nm}/\text{s}$ )	7.94
Nozzle Used(mm)	3.5
Area of Nozzle( $\text{m}^2$ )	0.00000962
Test Duration(mins)	171
Actual Sample Velocity( $\text{Nm}/\text{s}$ )	8.47
Isokinetic Closure(%)	107

## Canley Garden Crematorium Stream 1 Abatement System Outlet

### Flue Gas Volumetric Flow

Contract	Canley Garden Crematorium, DEM0818
Date	29th July 2015
Location	Flue Gas Abatement System Outlet
Engineer(s)	JB & ST

#### Test Log

#### Test 4

Flue Gas Temperature(Deg C)	134
Flue Gas Pitot Head Sample Points(Pa)	67.5
Flue Gas Pitot Head Duct Mean(Pa)	65.7
Flue Gas Moisture(%v/v)	5.8
Flue Gas Moisture(%w/w)	3.7
Flue Gas Duct Dimensions(mm)	350 mm Diameter
Flue Gas Duct Area(m <sup>2</sup> )	0.0962

#### Calculation

Flue Gas Density(kg/m <sup>3</sup> )	0.8559
<u>Sample Points</u>	
Flue Gas Velocity(Am/s)	12.55
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h)	4349
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h dry)	4096
Flue Gas Volumetric Flowrate(Nm <sup>3</sup> /h dry)	2750
<u>Duct Mean</u>	
Flue Gas Velocity(Am/s)	12.39
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h)	4290
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h dry)	4041
<b>Flue Gas Volumetric Flowrate(Nm<sup>3</sup>/h dry)</b>	<b>2713</b>

## Canley Garden Crematorium Stream 2 Abatement System Outlet

### Data Log

28/07/15

#### Test 1

Time	Flue Gas °C	Meter °C	Flue Oxygen %v/v dry	CO mg/Nm <sup>3</sup> c.	VOC mg/Nm <sup>3</sup> c.	Sample Point Pa
08:57	100	23.3	15.92	0.00	0.05	128.5
08:58	99	23.3	17.20	6.90	0.00	147.8
08:59	99	23.4	15.49	1.68	0.00	162.1
09:00	100	23.5	16.09	0.23	0.00	168.8
09:01	102	23.7	15.65	0.23	0.00	273.0
09:02	101	24.0	16.59	5.93	0.00	311.6
09:03	102	24.3	15.65	2.05	0.00	325.1
09:04	102	24.7	15.33	0.19	0.00	326.8
09:05	102	25.0	15.50	0.00	0.00	340.2
09:06	101	25.4	16.00	0.00	0.00	342.7
09:07	101	25.8	15.74	0.00	0.00	350.3
09:08	100	26.3	15.84	0.00	0.00	359.5
09:09	100	26.7	14.68	0.00	0.02	360.4
09:10	100	27.1	14.93	0.18	1.50	370.4
09:11	102	27.5	15.60	0.99	2.60	373.8
09:12	103	27.9	14.78	0.00	0.00	374.6
09:13	104	28.3	15.61	0.00	0.00	369.6
09:14	105	28.7	15.65	0.00	0.00	367.1
09:15	106	29.1	16.11	0.00	0.00	362.0
09:16	105	29.5	16.23	0.00	0.00	366.2
09:17	106	29.9	15.94	0.00	0.00	367.1
09:18	106	30.2	16.26	0.00	0.00	356.2
09:19	106	30.6	16.21	0.00	0.00	362.0
09:20	106	31.0	16.04	0.00	0.00	367.9
09:21	106	31.3	16.00	0.00	0.00	380.5
09:22	106	31.7	16.30	0.00	0.00	379.7
09:23	106	32.0	16.01	0.00	0.00	396.5
09:24	106	32.3	16.34	0.00	0.35	402.4
09:25	106	32.7	15.63	54.91	2.95	404.0
09:26	107	33.0	15.48	13.79	0.00	400.7
09:27	107	33.3	15.24	0.00	0.00	408.2
09:28	107	33.6	15.49	0.20	0.00	415.0
09:29	107	33.9	15.45	0.22	0.00	425.0
09:30	108	34.2	15.18	0.00	0.00	425.0
09:31	108	34.5	15.88	0.00	0.00	420.0
09:32	108	34.7	15.53	0.00	0.00	425.9
09:33	108	35.0	15.95	0.00	0.00	432.6
09:34	108	35.2	15.73	0.00	0.00	411.6
09:35	108	35.5	15.71	0.00	0.00	389.8

09:36	108	35.8	15.93	0.00	0.00	394.8
09:37	108	36.0	15.89	0.00	0.00	388.1
09:38	107	36.2	16.13	0.00	0.00	367.1
09:39	106	36.4	16.11	0.00	0.00	329.3
09:40	104	36.7	15.61	0.00	0.00	225.1
09:41	104	36.9	15.12	0.00	0.00	226.0
09:42	104	37.1	15.47	0.00	0.00	256.2
09:43	104	37.3	15.84	0.00	0.00	276.4
09:44	104	37.5	16.04	0.00	0.00	251.2
09:45	103	37.7	15.61	0.00	0.00	220.1
09:46	103	37.9	15.89	0.00	0.00	184.0
09:47	102	38.1	16.45	0.00	0.00	173.0
09:48	101	38.3	16.45	0.00	0.00	162.1
09:49	101	38.4	16.38	0.00	0.00	187.3
09:50	101	38.5	15.97	0.00	0.00	196.6
09:51	101	38.6	16.18	0.00	0.00	168.0
09:52	102	38.7	16.25	0.00	0.00	163.0
09:53	102	38.8	15.50	0.00	0.00	152.0
09:54	101	38.9	16.11	0.00	0.00	140.3
09:55	101	39.0	16.11	0.00	0.00	159.6
09:56	100	39.1	16.78	0.00	0.00	152.9
09:57	100	39.1	16.81	0.00	0.00	132.7
<b>Average</b>	<b>104</b>	<b>32.3</b>	<b>15.86</b>	<b>1.43</b>	<b>0.12</b>	<b>305.8</b>

Average for first 30 mins of test	<b>2.81</b>	-
Average for second 30 mins of test	<b>0.01</b>	-
Average for first 60 mins of test	<b>1.43</b>	<b>0.12</b>



## Canley Garden Crematorium Stream 2 Abatement System Outlet

### Data Log

28/07/15

#### Test 2

Time	Flue Gas °C	Meter °C	Flue Oxygen %v/v dry	CO mg/Nm <sup>3</sup> c.	VOC mg/Nm <sup>3</sup> c.	Sample Point Pa
10:35	103	35.5	17.77	43.46	3.19	285.6
10:36	102	35.4	17.16	0.00	0.53	214.2
10:37	103	35.3	17.18	34.97	4.08	311.6
10:38	103	35.3	17.87	145.47	7.72	338.5
10:39	104	35.3	15.50	0.22	0.10	346.9
10:40	105	35.3	16.89	0.00	0.00	329.3
10:41	104	35.5	16.67	0.00	0.00	278.0
10:42	104	35.6	16.87	0.00	0.00	276.4
10:43	104	35.7	16.05	0.00	0.00	308.3
10:44	104	35.9	16.84	0.00	0.00	283.9
10:45	105	36.1	15.70	0.00	0.00	359.5
10:46	106	36.2	15.58	0.00	0.00	370.4
10:47	105	36.4	15.93	0.00	0.00	331.0
10:48	105	36.7	15.25	0.00	0.00	315.0
10:49	106	36.9	15.15	0.00	0.00	359.5
10:50	106	37.1	15.18	0.00	0.00	373.8
10:51	107	37.3	15.22	0.00	0.00	378.8
10:52	107	37.5	15.24	0.00	0.00	341.0
10:53	107	37.7	15.23	0.00	0.00	330.1
10:54	107	37.8	14.98	0.00	0.00	336.0
10:55	107	38.0	15.00	0.00	0.00	334.3
10:56	107	38.2	15.24	0.00	0.00	341.0
10:57	108	38.4	15.09	0.00	0.00	357.8
10:58	108	38.6	15.43	0.00	0.00	381.4
10:59	109	38.7	15.65	0.00	0.00	367.1
11:00	108	38.9	15.68	0.00	0.00	344.4
11:01	109	39.1	15.51	0.00	0.00	363.7
11:02	109	39.2	15.71	0.00	0.00	370.4
11:03	108	39.4	15.24	0.00	0.00	315.0
11:04	107	39.5	15.09	0.00	0.00	285.6
11:05	107	39.6	15.21	0.00	0.00	257.0
11:06	106	39.7	15.44	0.00	0.00	246.1
11:07	105	39.9	15.54	0.00	0.00	220.1
11:08	105	40.0	15.81	0.00	0.00	232.7
11:09	104	40.1	16.05	0.00	0.00	209.2
11:10	103	40.2	15.94	0.00	0.00	190.7
11:11	102	40.3	15.99	0.00	0.00	176.4
11:12	102	40.4	16.01	0.00	0.00	155.4
11:13	102	40.4	15.89	0.00	0.00	140.3
11:14	102	40.5	15.99	0.00	0.00	142.8

11:15	102	40.5	16.26	0.00	0.00	142.0
11:16	101	40.6	16.52	0.00	0.00	143.6
11:17	101	40.7	16.65	0.00	0.00	138.6
11:18	100	40.7	16.67	0.00	0.00	137.8
11:19	100	40.8	16.56	0.00	0.00	129.4
11:20	100	40.8	16.12	0.00	0.00	117.6
11:21	100	40.9	16.17	0.00	0.00	128.5
11:22	100	40.9	16.65	0.00	0.00	120.1
11:23	100	41.0	16.85	0.00	0.00	134.4
11:24	100	41.0	17.19	0.00	0.00	149.5
11:25	101	41.1	17.04	0.00	0.00	202.4
11:26	100	41.1	17.93	0.00	0.00	158.8
11:27	100	41.2	17.92	0.00	0.00	181.4
11:28	101	41.2	17.24	0.00	0.00	218.4
11:29	100	41.2	18.51	0.00	0.00	165.5
11:30	101	41.3	18.07	0.00	0.00	192.4
11:31	101	41.3	17.75	0.00	0.00	185.6
11:32	101	41.4	18.69	0.00	0.00	157.1
11:33	101	41.5	17.14	0.00	0.00	196.6
11:34	101	41.5	16.06	0.00	0.00	194.9
11:35	101	41.6	16.05	0.00	0.00	188.2
<b>Average</b>	<b>104</b>	<b>38.9</b>	<b>16.26</b>	<b>3.67</b>	<b>0.26</b>	<b>250.5</b>

Average for first 30 mins of test	<b>7.23</b>	-
Average for second 30 mins of test	<b>0.00</b>	-
Average for first 60 mins of test	<b>3.67</b>	<b>0.26</b>

## Canley Garden Crematorium Stream 2 Abatement System Outlet

### Data Log

28/07/15

#### Test 3

Time	Flue Gas °C	Meter °C	Flue Oxygen %v/v dry	CO mg/Nm <sup>3</sup> c.	VOC mg/Nm <sup>3</sup> c.	Sample Point Pa
12:06	102	37.8	16.98	0.00	0.00	236.0
12:07	101	37.6	18.25	0.00	0.00	185.6
12:08	103	37.5	18.10	6.07	0.05	256.2
12:09	103	37.4	18.02	7.03	0.13	242.8
12:10	102	37.4	16.60	0.00	0.00	210.0
12:11	101	37.4	16.91	0.00	0.00	162.1
12:12	100	37.5	17.51	0.00	0.00	146.2
12:13	100	37.5	17.29	0.00	0.00	168.0
12:14	100	37.6	15.98	0.00	0.00	153.7
12:15	101	37.7	15.68	0.00	0.00	184.0
12:16	101	37.8	16.65	0.00	0.00	196.6
12:17	102	37.9	16.82	0.00	0.00	178.9
12:18	101	38.0	17.75	0.00	0.00	127.7
12:19	100	38.2	18.33	0.00	0.00	152.9
12:20	100	38.3	17.49	0.00	0.00	157.1
12:21	99	38.5	17.47	0.00	0.00	105.8
12:22	98	38.6	17.31	0.00	0.00	71.4
12:23	97	38.7	16.16	9.64	0.00	63.8
12:24	97	38.8	15.57	9.54	0.00	64.7
12:25	97	38.9	16.56	0.00	0.00	71.4
12:26	97	38.9	16.50	0.00	0.00	68.0
12:27	97	39.0	15.75	0.00	0.00	58.0
12:28	96	39.1	16.59	0.00	0.00	65.5
12:29	97	39.2	16.67	0.00	0.00	81.5
12:30	98	39.2	15.55	0.00	0.00	206.6
12:31	102	39.4	17.24	34.92	1.50	306.6
12:32	103	39.6	16.44	0.00	0.00	271.3
12:33	103	39.8	16.88	0.00	0.00	231.0
12:34	102	40.0	17.05	0.00	0.00	198.2
12:35	102	40.2	16.96	0.00	0.00	202.4
12:36	102	40.4	17.11	0.00	0.00	206.6
12:37	102	40.5	16.98	0.00	0.00	249.5
12:38	104	40.7	16.45	0.00	0.00	334.3
12:39	105	40.9	16.93	0.00	0.00	326.8
12:40	105	41.1	17.24	0.00	0.00	269.6
12:41	105	41.2	17.44	0.00	0.00	234.4
12:42	104	41.4	17.30	0.00	0.00	215.9
12:43	104	41.6	16.21	0.00	0.00	236.0
12:44	104	41.7	17.09	0.00	0.00	252.0

12:45	104	41.9	17.54	0.00	0.00	233.5
12:46	104	42.0	16.32	0.00	0.00	240.2
12:47	103	42.2	16.68	0.00	0.00	205.0
12:48	102	42.3	16.96	0.00	0.00	211.7
12:49	103	42.4	15.65	0.00	0.00	221.8
12:50	102	42.5	16.34	0.00	0.00	192.4
12:51	102	42.6	16.95	0.00	0.00	170.5
12:52	102	42.7	15.59	0.00	0.00	202.4
12:53	102	42.8	16.38	0.00	0.00	189.0
12:54	102	42.9	16.90	0.00	0.00	183.1
12:55	103	43.0	16.72	0.00	0.00	257.9
12:56	103	43.0	16.77	0.00	0.00	241.9
12:57	102	43.1	17.30	0.00	0.00	212.5
12:58	102	43.2	16.74	0.00	0.00	252.8
12:59	103	43.3	16.60	0.00	0.00	239.4
13:00	103	43.4	17.34	0.00	0.00	209.2
13:01	103	43.5	16.96	0.00	0.00	231.0
13:02	103	43.6	16.63	0.00	0.00	230.2
13:03	102	43.7	16.86	0.00	0.00	180.6
13:04	101	43.7	17.30	0.00	0.00	157.1
13:05	101	43.8	16.90	0.00	0.00	191.5
13:06	101	43.8	16.81	0.00	0.00	191.5
<b>Average</b>	<b>101</b>	<b>40.5</b>	<b>16.85</b>	<b>1.10</b>	<b>0.03</b>	<b>193.4</b>

Average for first 30 mins of test	<b>2.17</b>	-
Average for second 30 mins of test	<b>0.00</b>	-
Average for first 60 mins of test	<b>1.10</b>	<b>0.03</b>

## Canley Garden Crematorium Stream 2 Abatement System Outlet

### Total Particulate Matter and Hydrogen Chloride

Contract Canley Garden Crematorium, DEM0818  
Date 28th July 2015  
Location Flue Gas Abatement System Outlet  
Engineer(s) JB & ST  
Absorbent H<sub>2</sub>O

Test Log	Test 1		Test 2		Test 3	
Barometric Pressure(kPa)	100.3		100.1		100.4	
Gas Meter Temperature(Deg C)	32.3		38.9		40.5	
Oxygen Concentration(%v/v dry)	15.86		16.26		16.85	
Flue Gas Volumetric Flow(Nm <sup>3</sup> /h dry)	6070		5534		4896	
Time	Start	End	Start	End	Start	End
Gas Meter Reading(Am <sup>3</sup> dry)	08:57	09:57	10:35	11:35	12:06	13:06
Absorber Weight(g)	192.003	192.678	192.775	193.391	193.495	194.077
Filter Reference	3556.3	3587.2	3593.6	3617.5	3564.0	3584.5
Filter Weight(g)	CA280715F21		CA280715F22		CA280715F23	
Probe Rinse Reference	0.54086	0.54088	0.50953	0.50954	0.53603	0.53605
Probe Rinse Weight(g)	CA280715R21		CA280715R22		CA280715FR3	
Sample Reference HCl	75.5494	75.5496	75.5496	75.5497	75.5497	75.5498
Absorbent Volume(ml)	CA280715H12		CA280715H22		CA280715H32 A&B	
Absorbent(mg/l as HCl)	500		500		250	
Blank(mg/l as HCl)	8.1		11		16	
	0.19		0.19		0.19	

### Calculation: General

Barometric Pressure(kPa)	100.3	100.1	100.4
Gas Meter temperature(Deg C)	32.3	38.9	40.5
Gas Volume Sampled(Am <sup>3</sup> dry)	0.675	0.616	0.582
Gas Volume Sampled(Nm <sup>3</sup> dry)	0.5975	0.5327	0.5024
Mass of Dry Gas(g @ 1292.8 g/Nm <sup>3</sup> )	772.50	688.68	649.46
Change in Absorber Weight(g)	30.9	23.9	20.5
Water Vapour Volume(Nm <sup>3</sup> @ 803.9 g/Nm <sup>3</sup> )	0.0384	0.0297	0.0255
Gas Volume(Nm <sup>3</sup> wet)	0.6360	0.5624	0.5279
Mass of Wet Gas(g)	803.40	712.58	669.96
<b>Moisture Concentration(%v/v)</b>	<b>6.0</b>	<b>5.3</b>	<b>4.8</b>
<b>Moisture Concentration(%w/w)</b>	<b>3.8</b>	<b>3.4</b>	<b>3.1</b>

**Calculation: Particulate**

Increase In Filter Weights(g)	0.00021	0.00011	0.00021
Particulate Emission(mg/Nm <sup>3</sup> dry)	0.35	0.20	0.42
Oxygen Concentration(%v/v dry)	15.86	16.26	16.85
<b>Particulate Emission</b>	<b>0.69</b>	<b>0.42</b>	<b>1.02</b>
<b>(mg/Nm<sup>3</sup> @ 11 %v/v Oxygen dry)</b>			
Flue Gas Volumetric Flow(Nm <sup>3</sup> /h dry)	6070	5534	4896
<b>Particulate Emission(g/h)</b>	<b>2.13</b>	<b>1.09</b>	<b>2.05</b>
Required Sample Velocity(Nm/s)	17.53	15.98	14.14
Nozzle Used(mm)	3.5	3.5	3.5
Area of Nozzle(m <sup>2</sup> )	0.00000962	0.00000962	0.00000962
Test Duration(mins)	60	60	60
Actual Sample Velocity(Nm/s)	17.25	15.38	14.50
Isokinetic Closure(%)	98	96	103
		99	

**Calculation: HCl**

Absorbent(mg/l as HCl)	8.10	11.00	16.29
Blank(mg/l as HCl)	0.19	0.19	0.19
Chloride Absorbed(mg/l as HCl)	7.91	10.81	16.1
Chloride Absorbed(mg as HCl)	3.96	5.41	4.03
HCl(mg)	3.96	5.41	4.03
HCl Emission(mg/Nm <sup>3</sup> dry)	6.62	10.15	8.01
Oxygen Concentration(%v/v dry)	15.86	16.26	16.85
<b>HCl Emission</b>	<b>12.94</b>	<b>21.52</b>	<b>19.46</b>
<b>(mg/Nm<sup>3</sup> @ 11 %v/v Oxygen dry)</b>			
Flue Gas Volumetric Flow(Nm <sup>3</sup> /h dry)	6070	5534	4896
<b>HCl Emission(g/h)</b>	<b>40.18</b>	<b>56.15</b>	<b>39.23</b>

## Canley Garden Crematorium Stream 2 Abatement System Outlet

### Flue Gas Volumetric Flow

Contract Canley Garden Crematorium, DEM0818  
 Date 28th July 2015  
 Location Flue Gas Abatement System Outlet  
 Engineer(s) JB & ST

Test Log	Test 1	Test 2	Test 3
Flue Gas Temperature(Deg C)	104	104	101
Flue Gas Pitot Head Sample Points(Pa)	305.8	250.5	193.4
Flue Gas Moisture(%v/v)	6.0	5.3	4.8
Flue Gas Moisture(%w/w)	3.8	3.4	3.1
Flue Gas Duct Dimensions(mm)	350 mm Diameter Circular Stack		
Flue Gas Duct Area(m <sup>2</sup> )	0.0962		

### Calculation

Flue Gas Density(kg/m <sup>3</sup> )	0.9232	0.9252	0.9317
<u>Sample Points</u>			
Flue Gas Velocity(Am/s)	25.74	23.27	20.37
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h)	8915	8060	7056
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h dry)	8377	7634	6716
Flue Gas Volumetric Flowrate(Nm <sup>3</sup> /h dry)	6070	5534	4896
<u>Duct Mean</u>			
Flue Gas Velocity(Am/s)	25.39	22.96	20.10
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h)	8796	7952	6962
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h dry)	8264	7532	6625
<b>Flue Gas Volumetric Flowrate(Nm<sup>3</sup>/h dry)</b>	<b>5989</b>	<b>5459</b>	<b>4831</b>

## Canley Garden Crematorium Stream 2 Abatement System Outlet

Data Log

28/07/15

Test 4

Time	Flue Gas °C	Meter °C	Flue O <sub>2</sub> %v/v dry	Sample Point Pa
13:17	102	42.3	17.93	178.9
13:18	102	42.1	18.19	201.6
13:19	101	42.0	17.88	180.6
13:20	100	41.9	18.57	149.5
13:21	101	41.9	17.18	184.8
13:22	101	41.9	16.56	184.0
13:23	102	41.9	16.59	176.4
13:24	103	41.9	17.43	210.0
13:25	103	42.0	17.79	217.6
13:26	103	42.0	17.31	225.1
13:27	103	42.1	17.22	203.3
13:28	102	42.2	16.98	178.1
13:29	101	42.2	16.78	167.2
13:30	101	42.3	16.73	156.2
13:31	101	42.4	16.58	139.4
13:32	101	42.5	17.69	102.5
13:33	101	42.5	17.73	101.6
13:34	101	42.6	16.46	124.3
13:35	100	42.6	16.49	125.2
13:36	100	42.7	16.44	95.8
13:37	99	42.8	15.71	95.8
13:38	100	42.8	17.45	123.5
13:39	100	42.9	17.28	143.6
13:40	101	42.9	17.60	150.4
13:41	101	43.0	16.83	142.8
13:42	101	43.1	18.08	131.0
13:43	101	43.1	17.88	136.9
13:44	100	43.2	18.53	142.8
13:45	100	43.2	17.54	128.5
13:46	100	43.3	18.58	151.2
13:47	101	43.4	19.02	182.3
13:48	101	43.4	18.60	135.2
13:49	100	43.5	18.97	102.5
13:50	100	43.6	18.24	86.5
13:51	99	43.6	18.26	61.3
13:52	98	43.7	19.47	45.4
13:53	97	43.7	18.83	28.6
13:54	98	43.8	18.02	134.4
13:55	99	43.8	17.70	132.7
13:56	99	43.9	16.58	90.7



13:57	99	43.9	17.47	98.3
13:58	99	44.0	17.85	109.2
13:59	99	44.0	18.16	108.4
14:00	99	44.0	18.44	123.5
14:01	99	44.0	18.37	149.5
14:02	99	44.0	16.59	173.0
14:03	100	44.0	16.40	144.5
14:04	99	44.0	17.09	114.2
14:05	100	44.0	17.00	122.6
14:06	100	44.0	16.50	139.4
14:07	100	44.0	16.42	186.5
14:08	99	43.9	16.92	142.8
14:09	99	43.9	16.77	126.0
14:10	98	43.9	16.83	127.7
14:11	98	43.9	16.59	108.4
14:12	98	44.0	16.44	105.0
14:13	99	44.0	16.69	107.5
14:14	98	44.0	16.92	81.5
14:15	97	44.1	16.69	74.8
14:16	97	44.1	16.97	82.3
14:17	96	44.1	17.03	65.5
14:18	96	44.1	16.75	64.7
14:19	96	44.2	16.77	82.3
14:20	96	44.2	16.80	77.3
14:21	96	44.2	16.78	66.4
14:22	96	44.2	16.78	80.6
14:23	96	44.3	16.89	81.5
14:24	96	44.3	17.17	67.2
14:25	95	44.3	17.26	63.8
14:26	95	44.3	17.41	60.5
14:27	94	44.3	17.52	59.6
14:28	94	44.3	17.79	58.8
14:29	94	44.3	18.01	58.0
14:30	94	44.3	18.13	57.1
14:31	94	44.3	18.33	56.3
14:32	94	44.2	18.46	56.3
14:33	94	44.2	18.66	55.4
14:34	94	44.2	18.91	56.3
14:35	94	44.1	19.04	55.4
14:36	94	44.1	19.16	63.8
14:37	93	44.1	19.05	54.6
14:38	93	44.0	19.21	63.8
14:39	93	44.0	19.09	53.8
14:40	93	44.0	19.42	61.3
14:41	93	43.9	18.93	53.8
14:42	93	44.0	19.48	47.9
14:43	93	43.9	19.24	61.3
14:44	93	43.9	19.07	63.0
14:45	93	43.9	19.54	58.0

14:46	93	43.9	19.51	63.8
14:47	93	43.9	19.02	65.5
14:48	93	43.8	19.55	61.3
14:49	93	43.8	19.58	69.7
14:50	93	43.8	19.01	67.2
14:51	93	43.9	19.50	63.8
14:52	93	43.9	19.57	68.9
14:53	93	43.9	18.90	53.8
14:54	93	43.9	19.87	64.7
14:55	93	43.9	18.93	58.0
14:56	93	43.9	19.57	54.6
14:57	93	43.9	19.21	62.2
14:58	93	43.9	19.17	63.0
14:59	93	43.9	19.18	76.4
15:00	93	43.9	17.82	52.1
15:01	93	44.0	19.78	67.2
15:02	93	44.0	18.69	51.2
15:03	93	44.0	19.90	68.9
15:04	93	44.0	18.71	51.2
15:05	93	44.0	19.94	87.4
15:06	93	44.0	18.54	63.8
15:07	93	44.0	18.88	80.6
15:08	93	44.0	18.30	55.4
15:09	93	44.0	19.70	52.1
15:10	93	44.0	18.80	47.9
15:11	92	44.0	18.59	33.6
15:12	92	44.0	20.16	46.2
15:13	92	44.0	18.15	47.9
15:14	92	44.1	18.06	39.5
15:15	91	44.1	18.96	21.8
<b>Average</b>	<b>97</b>	<b>43.6</b>	<b>18.03</b>	<b>97.8</b>

## Canley Garden Crematorium Stream 2 Abatement System Outlet

### Mercury

Contract Canley Garden Crematorium, DEM0818  
 Date 28th July 2015  
 Location Flue Gas Abatement System Outlet  
 Engineer(s) JB & ST  
 Absorbent 4% K<sub>2</sub>CR<sub>2</sub>O<sub>7</sub> / 20% HNO<sub>3</sub> in H<sub>2</sub>O

#### Test Log

#### Test 4

Barometric Pressure(kPa) 100.5  
 Gas Meter Temperature(Deg C) 43.6  
 Oxygen Concentration(%v/v dry) 18.03  
 Flue Gas Volumetric Flow(Nm<sup>3</sup>/h dry) 3503

	Start	End
Time	13:17	15:15
Gas Meter Reading(Am <sup>3</sup> dry)	194.093	195.000
Absorber Weight(g)	3697.2	3719.1
Filter Reference	CA280715HgF2	
Filter Fraction Analysed	1	
Filter(µg as Hg)	0.16	
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	CA280715Hg2A&B	
Absorbent Volume(ml)	250	250
Absorbent(µg/l as Hg)	3	2.2
Absorbent Blank(µg/l as Hg)	0.8	0.8

#### Calculation: General

Barometric Pressure(kPa)	100.5
Gas Meter Temperature(Deg C)	43.6
Gas Volume Sampled(Am <sup>3</sup> dry)	0.907
Gas Volume Sampled(Nm <sup>3</sup> dry)	0.7759
Mass of Dry Gas(g @ 1292.8 g/Nm <sup>3</sup> )	1003.09
Change in Absorber Weight(g)	21.9
Water Vapour Volume(Nm <sup>3</sup> @ 803.9 g/Nm <sup>3</sup> )	0.0272
Gas Volume(Nm <sup>3</sup> wet)	0.8031
Mass of Wet Gas(g)	1024.99
<b>Moisture Concentration(%v/v)</b>	<b>3.4</b>
<b>Moisture Concentration(%w/w)</b>	<b>2.1</b>

**Calculation: Mercury**

Filter( $\mu\text{g}$ as Hg)	0.15
Probe Rinse( $\mu\text{g}$ as Hg)	0.00
Absorbent( $\mu\text{g}$ as Hg)	0.90
Total Mercury Sampled( $\mu\text{g}$ )	1.05
Mercury Emission( $\mu\text{g}/\text{Nm}^3$ dry)	1.35
Oxygen Concentration(%v/v dry)	18.03
<b>Mercury Emission</b>	<b>4.60</b>
<b>(<math>\mu\text{g}/\text{Nm}^3</math> @ 11 %v/v Oxygen dry)</b>	
Flue Gas Volumetric Flowrate( $\text{Nm}^3/\text{h}$ dry)	3503
<b>Mercury Emission(g/h)</b>	<b>0.005</b>
Required Sample Velocity( $\text{Nm}/\text{s}$ )	10.25
Nozzle Used(mm)	3.5
Area of Nozzle( $\text{m}^2$ )	0.00000962
Test Duration(mins)	118
Actual Sample Velocity( $\text{Nm}/\text{s}$ )	11.39
Isokinetic Closure(%)	111

## Canley Garden Crematorium Stream 2 Abatement System Outlet

### Flue Gas Volumetric Flow

Contract	Canley Garden Crematorium, DEM0818
Date	28th July 2015
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)	97.8
Flue Gas Pitot Head Duct Mean(Pa)	95.2
Flue Gas Moisture(%v/v)	3.4
Flue Gas Moisture(%w/w)	2.1
Flue Gas Duct Dimensions(mm)	350 mm Diameter
Flue Gas Duct Area(m <sup>2</sup> )	0.0962

#### Calculation

Flue Gas Density(kg/m <sup>3</sup> )	0.9467
<u>Sample Points</u>	
Flue Gas Velocity(Am/s)	14.37
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h)	4979
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h dry)	4810
Flue Gas Volumetric Flowrate(Nm <sup>3</sup> /h dry)	3551
<u>Duct Mean</u>	
Flue Gas Velocity(Am/s)	14.18
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h)	4912
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h dry)	4745
<b>Flue Gas Volumetric Flowrate(Nm<sup>3</sup>/h dry)</b>	<b>3503</b>

## **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:** 498849-1

**Date of Report:** 12-Aug-2015

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

**Customer Contact:** Mr Steve Atherton

**Customer Job Reference:** DEM0818  
**Customer Purchase Order:** 50001122  
**Date Job Received at SAL:** 05-Aug-2015  
**Date Analysis Started:** 05-Aug-2015  
**Date Analysis Completed:** 12-Aug-2015

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

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 Section 25 of the SAL Quality Manual



Report checked  
and authorised by :  
Kayleigh McCann  
Project Manager

Issued by :  
Kayleigh McCann  
Project Manager

**Signature valid**

Digitally signed by Kayleigh  
McCann  
Date: 2015.08.12 09:24:52 BST  
Reason: Issue  
Location: SAL

Page 1 of 2  
498849-1

SAL Reference: 498849 Customer Reference: DEM0818							
Filter Analysed as Filter							
Miscellaneous							
SAL Reference		498849 010	498849 011	498849 012			
Customer Sample Reference		CA280715 Hg2F	CA280715 HgFBLANK	CA290715 Hg1F			
Test Sample		AR	AR	AR			
Date Sampled		28-JUL-2015	28-JUL-2015	28-JUL-2015			
Determinand	Method	LOD	Units	Symbol			
Mercury	CVAFS (HF Digest BS EN 13211)	0.01	µg	U	(13) 0.16	(13) <0.01	(13) <0.01

SAL Reference: 498849 Customer Reference: DEM0818									
Impinger (4%K2Cr2O7/20%HNO3) Analysed as Impinger (4%K2Cr2O7/20%HNO3)									
Miscellaneous									
SAL Reference		498849 013	498849 014	498849 015	498849 016	498849 017			
Customer Sample Reference		CA280715 Hg2A	CA280715 Hg2B	CA280715 HgABLANK	CA290715 Hg1A	CA290715 Hg1B			
Test Sample		AR	AR	AR	AR	AR			
Date Sampled		28-JUL-2015	28-JUL-2015	28-JUL-2015	29-JUL-2015	29-JUL-2015			
Determinand	Method	LOD	Units	Symbol					
Mercury	CVAFS (BS EN 13211)	0.5	µg/l	U	3.0	2.2	0.8	(195) 26	0.7

SAL Reference: 498849 Customer Reference: DEM0818									
Impinger(DI water) Analysed as Impinger(DI water)									
Miscellaneous									
SAL Reference		498849 001	498849 002	498849 003	498849 004	498849 005			
Customer Sample Reference		CA280715 H12	CA280715 H22	CA280715 H32A	CA280715 H32B	CA280715 HOB			
Test Sample		AR	AR	AR	AR	AR			
Date Sampled		28-JUL-2015	28-JUL-2015	28-JUL-2015	28-JUL-2015	28-JUL-2015			
Determinand	Method	LOD	Units	Symbol					
Hydrogen Chloride	IC	0.05	mg/l	U	(13) 8.1	(13) 11	(13) 16	(13) 0.29	(13) 0.19

SAL Reference: 498849 Customer Reference: DEM0818									
Impinger(DI water) Analysed as Impinger(DI water)									
Miscellaneous									
SAL Reference		498849 006	498849 007	498849 008	498849 009				
Customer Sample Reference		CA290715 H11	CA290715 H21	CA290715 H31A	CA290715 H31B				
Test Sample		AR	AR	AR	AR				
Date Sampled		29-JUL-2015	29-JUL-2015	29-JUL-2015	29-JUL-2015				
Determinand	Method	LOD	Units	Symbol					
Hydrogen Chloride	IC	0.05	mg/l	U	(13) 3.0	(13) 5.8	(13) 17	(13) 0.64	

### Index to symbols used in 498849-1

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



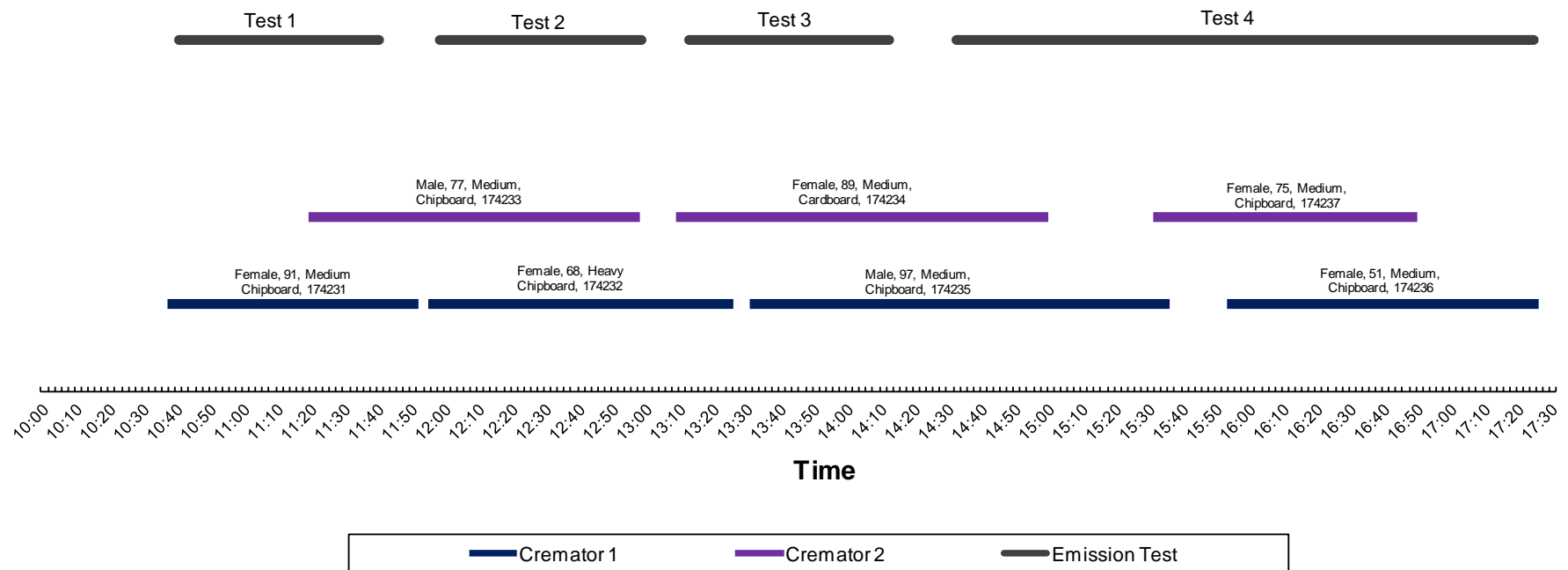
### Particulate Weight Determination

Filter / Rinse Reference		Clean Dry Weight g	Dirty Dry Weight g
CA280715F21	E8	0.54086	0.54088
CA280715F22	E9	0.50953	0.50954
CA280715F23	E10	0.53603	0.53605
CA280715R21	1	75.54937	75.54956
CA280715R22	2	75.54956	75.54966
CA280715FR3	3	75.54966	75.54985
CA290715F11	E11	0.50966	0.50968
CA290715F12	E12	0.54025	0.54026
CA290715F13	E13	0.53816	0.53819
CA290715R11	1	76.84795	76.84802
CA290715R12	2	76.84802	76.84805
CA290715R13	3	76.84805	76.84816

## **APPENDIX 3**

### Details of Plant Operation During Testing

## Canley Garden Crematorium Cremators 1 & 2 (Stream 1) Emission Tests 29/07/2015 Plant Operation & Test Periods



## Canley Garden Crematorium Cremators 3 & 4 (Stream 2) Emission Tests 28/07/2015 Plant Operation & Test Periods

