



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

# EMISSIONS MONITORING TEST REPORT

**PARNDON WOOD CREMATORIUM**  
**Parndon Wood Rd**  
**Harlow**  
**Essex**  
**CM19 4SF**

**16<sup>th</sup> January 2019**

Report Authorised by  Date 7<sup>th</sup> March 2019

Mr J L Boyce  
Emissions Monitoring Team Leader  
MCertS level 2 + TE1,2,3,4  
MM 06 707

JB/DEM1212/16.01.19



## CONTENTS

1. INTRODUCTION
  2. PROCEDURES
    - 2.1 Total Particulate Matter
    - 2.2 Hydrogen Chloride
    - 2.3 Mercury
    - 2.4 Carbon monoxide
    - 2.5 Total Organic Compounds
    - 2.6 Oxygen
    - 2.7 Moisture
    - 2.8 Temperature
    - 2.9 Velocity and Volumetric Flow
  3. RESULTS
    - TABLE 1 – Parndon Wood Cremators 1 & 2 & Abatement System – Emissions Monitoring January 2019 - Total Particulate Matter and Hydrogen Chloride Results
    - TABLE 2 – Parndon Wood Cremators 1 & 2 & Abatement System – Emissions Monitoring January 2019 - Mercury Results
    - TABLE 3 – Parndon Wood Cremators 1 & 2 & Abatement System – Emissions Monitoring January 2019 - Comparison of Test Results with Site Instrumentation
  4. COMMENTS
  5. QUALITY CONTROL
- APPENDIX 1            Data Logs and Calculations  
APPENDIX 2            Analysis Reports

## 1. INTRODUCTION

The two cremators and associated flue gas abatement system at Parndon Wood Crematorium, Parndon Wood Rd, Harlow, Essex, CM19 4SF were monitored on the 16<sup>th</sup> January 2019 to the requirements given in Process Guidance Note PG5/2 (2012) for emission releases to atmosphere.

The work was carried out on site by the following staff of Davies & Co (Engineering) Limited:

Mr J L Boyce  
EA MCertS Level 2 + TE1,2,3,4  
MM 06 707

Davies & Co does not hold company UKAS / MCertS accreditation at this time, as the company specialises in cremator and incinerator testing that are Part B processes. Air Quality Guidance Note AQ12 (04) states that UKAS / MCertS accreditation is not a mandatory requirement for the testing of Part B processes. Davies & Co are members of the Source Testing Association, and have extensive knowledge of crematoria testing. All analysis was conducted using UKAS approved laboratories, methods and calibrated equipment.

The work on site involved monitoring the flue gas components after the flue gas abatement system fitted to the cremators with the plant operating normally.

The plant being tested comprises two cremators, No1 of model type FTIII and No2 of model type FTII. The difference being the FTIII model having a wider hearth enabling larger coffin sizes to be charged. The cremators are fitted with two nozzle mix burners utilising natural gas as the support fuel.

The waste gases from both cremators combine and are ducted to a flue gas treatment plant. The treatment plant comprises of 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 boilers 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 cremators and flue gas abatement system were manufactured, installed and commissioned by Facultatieve Technologies Limited to meet the requirements of the Environmental Permitting (England & Wales) Regulations 2016 (EPR 2016) as relevant to new crematoria installations, summarised in Process Guidance Note PG5/2 (2012).

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

Measurements were undertaken to enable comparisons to be made of the operation of the cremators and associated abatement 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 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 method employed was 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 frit containing quartz microfibre filter (all heaters set to 160°C), PTFE sample line, dreschel absorption bottles, gas dryer (silica gel), sample line to pump, pump, gas meter, rotameter, pitot and impulse lines, electronic manometer, type K thermocouple, balance (for gravimetric moisture) and datalogger. Settings tables were pre-prepared to enable isokinetic flow to be maintained (based on online measurements of flue gas velocity and temperature to set nozzle flow / pump rate (l/min)).

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

Standard BS EN 13284 Part 1 was deviated from only in so far as a consequence of conducting tests in accordance with the requirements of PG5/2(12) that requires total particulate matter to be sampled for one hour of cremation. This therefore implies that only one sampling line can be used for each test run as sampling on 2 lines would require a stop half way through the test to move the probe out of one port and into another thus losing a period within the allotted one hour needed to obtain an hourly average as required by PG5/2(12). This is contrary to BS EN 13284 Part 1 that requires 2 sample lines to be used during an isokinetic test i.e. four point sampling (2 points x 2 lines) for a duct of this diameter.

The effect on uncertainty of using only one sample line is not considered to be significant and assumed to be within the calculated uncertainties stated in this report. These assumptions are on the basis that the preliminary pitot traverses confirmed the gas velocity profiles were well within required limits, and the duct dimensions were relatively small (350 mm diameter) considering the scope of BS EN 13284 Part 1. The duct was compliant with the requirements of the Standard in terms of duct dimensions and length measurements as well as meeting all requirements of Environment Agency Technical Guidance Note M1. In accordance with the Standard flue gas was sampled at 2 representative points along the sample line and as such there is no reason to suspect that the gas sampled from only one sampling line is not representative of the duct as a whole.

This recommended deviation is a reflection that cremation is a batch process, and that changing sampling ports part-way through a cremation could introduce more errors due to fact that a period of each cremation would not be sampled during the changeover process.

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

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

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 Cold Vapour Atomic Fluorescence Spectroscopy (CVAFS).

## 2.4 Carbon Monoxide

A flue gas sample was continuously extracted, filtered and dried before being passed through a pre-calibrated Siemens Ultramat 23 infrared analyser for the on-line measurement of carbon monoxide.

The method employed was BS EN 15058.

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 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, for example, a mean one minute emission of CO was say 100 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 Total Organic Compounds

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

with air passed through a catalytic converter and calibrated with a nominal 50 ppmv propane in balance air gas.

The method employed was BS EN 12619.

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

Similar comments apply to TOC'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 hydrogen chloride extraction, filtered and dried before being passed through a pre-calibrated Siemens Ultramat 23 electrochemical cell analyser for the on-line measurement of flue oxygen.

The method employed was BS EN 14789.

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

The 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.

## 2.8 Temperature

Flue gas temperature was measured by the use of a calibrated Type K thermocouple.

The method employed was BS EN 13284 Part 1.

The flue gas temperature was 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, 2 & 3.

Total Particulate Matter and Hydrogen Chloride determinations are given in Table 1.

Mercury determination is given in Table 2.

Comparison of Test Results with Site Instrumentation is given in table 3.

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

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

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

**TABLE 1**  
**Parndon Wood Cremators 1 & 2 & Abatement System**  
**Emissions Monitoring January 2019**  
**Total Particulate Matter & Hydrogen Chloride Sampling**

	Test H1	Test H2	Test H3	Average	Requirement to Site Permit & PG5/2 (2012)
	16 January 2019 08:22-09:22	16 January 2019 10:14-11:14	16 January 2019 12:09-13:09		
Total Particulate Matter - mg/Nm <sup>3</sup> c.	0.23 ± 1.36	1.22 ± 2.00	1.61 ± 2.41	<b>1.02</b>	<20
Hydrogen Chloride - mg/Nm <sup>3</sup> c.	6.94 ± 0.33	8.49 ± 0.47	21.17 ± 1.09	<b>12.20</b>	<30
Carbon Monoxide - mg/Nm <sup>3</sup> c.	6.03 ± 0.30	1.45 ± 0.01	0.47 ± 0.01	<b>2.65</b>	<100
Carbon Monoxide First 30 mins - mg/Nm <sup>3</sup> c.	2.19 ± 0.11	1.48 ± 0.01	0.86 ± 0.01	<b>1.51</b>	<100
Carbon Monoxide Second 30 mins - mg/Nm <sup>3</sup> c.	9.74 ± 0.01	1.42 ± 0.01	0.09 ± 0.01	<b>3.75</b>	<100
Organic Compounds - mg/Nm <sup>3</sup> c.	0.00 ± 0.01	0.00 ± 0.01	0.00 ± 0.01	<b>0.00</b>	<20
Flue Oxygen - %v/v dry	12.11 ± 0.10	15.05 ± 0.10	14.72 ± 0.10	<b>13.96</b>	
Flue Moisture - %v/v	5.7 ± 0.6	6.5 ± 0.6	9.2 ± 0.9	<b>7.1</b>	
- %w/w	3.6 ± 0.4	4.1 ± 0.4	5.9 ± 0.6	<b>4.5</b>	
Flue Temperature - Deg C	131 ± 2	135 ± 2	129 ± 2	<b>131</b>	
Volumetric Flow - Nm <sup>3</sup> /h dry	3046 ± 61	2806 ± 56	2277 ± 46	<b>2710</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**  
**Parndon Wood Cremators 1 & 2 & Abatement System Outlet**  
**Emissions Monitoring January 2019**  
**Mercury Sampling**

		Hg Test	Requirement to Site Permit & PG5/2 (2012)
		16 January 2019 13:45-16:57	
Mercury	- $\mu\text{g}/\text{Nm}^3_{\text{c}}$	24.54 $\pm$ 6.10	<50
Flue Oxygen	- %v/v dry	13.36 $\pm$ 0.10	
Flue Moisture	- %v/v	6.7 $\pm$ 0.7	
	- %w/w	4.3 $\pm$ 0.4	
Flue Temperature	- Deg C	143 $\pm$ 2	
Volumetric Flow	- $\text{Nm}^3/\text{h dry}$	2320 $\pm$ 46	

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**  
**Parndon Wood Cremators 1 & 2 & Abatement System**  
**Emissions Monitoring January 2019**  
**Comparison of Test Results with Site Instrumentation**

Cremator Plant	Test	Date	Comparison Cycle	Averaging Period (mins)	Carbon Monoxide mg/Nm <sup>3</sup>	
					Davies & Co	Site
Cremators 1&2 FGT Outlet	1	16 January 2019	Cremator 2	2 - 32	2	3
				32 - 62	10	11
Cremators 1&2 FGT Outlet	2	16 January 2019	Cremator 2	2 - 62	1	5
				32 - 62	1	2
Cremators 1&2 FGT Outlet	3	16 January 2019	Cremator 2	0 - 30	1	2
				30 - 60	0	0

Note 1: All emission concentration levels are given as mg/Nm<sup>3</sup> corrected to 11% oxygen, 273K & dry gas

Note 2: Results as emitted from Flue Gas Treatment (FGT) Plant with 2 cremators abated by 1 FGT

Note 3: The comparison cycle column shows which cremator's cycle is used for data comparison.

#### **4. COMMENTS**

The results obtained from this monitoring test work show compliance with the requirements given in Process Guidance Note PG5/2 (2012) for the cremators and abatement system.

All pollutant emission species monitored were below the limits given for concentration releases to atmosphere.

The results are expressed in the summary tables as concentration levels as this is understood to be the basis of the permit issued by the regulator

The cremator and flue gas clean up system operated satisfactorily during testing without any failure or alarm events.

No unusual charges were cremated during these tests. They were all of were of standard materials.

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

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

The CEM's on site are regularly maintained, checked and calibrated in accordance with the manufacturer's recommendations, and were functional at the time of the tests.

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

Comparisons of carbon monoxide monitoring given in table 3 show good evidence of correlation.

#### **5. QUALITY CONTROL**

All the tests performed were carried out to the methods given in the appropriate listed Standards using calibrated equipment. The gas analyser was calibrated prior to use using suitable calibration gases.

Analysis of the absorber solutions was carried out at an external UKAS laboratory following UKAS approved analysis methods.

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

Concept Life Sciences (CLS)	}	Hydrogen Chloride
		Mercury

## **APPENDIX 1**

Data Logs and Calculations

**Parndon Wood Cremators 1 & 2 & Abatement System**

**Data Log 16 January 2019**

Test H1

Time	Flue Gas °C	Meter °C	Flue O <sub>2</sub> %v/v dry	CO mg/Nm <sup>3</sup> c.	VOC mg/Nm <sup>3</sup> c.	Sample Point Pa
08:22	113	16.7	13.61	10.48	0.00	67.7
08:23	113	16.7	10.88	10.05	0.00	51.7
08:24	114	16.9	10.45	10.24	0.00	60.7
08:25	115	17.2	10.28	3.25	0.00	60.8
08:26	115	17.4	10.39	0.00	0.00	58.7
08:27	115	17.6	12.02	0.00	0.00	60.8
08:28	116	17.8	11.35	5.33	0.00	66.1
08:29	116	18.0	10.56	9.18	0.00	50.2
08:30	116	18.3	12.12	2.75	0.00	56.2
08:31	117	18.7	11.04	1.12	0.00	50.8
08:32	117	19.1	10.77	0.00	0.00	34.7
08:33	116	19.4	11.54	0.00	0.00	33.9
08:34	116	19.8	11.17	0.00	0.00	50.6
08:35	117	20.0	11.41	0.00	0.00	53.0
08:36	118	20.3	10.71	0.00	0.00	79.4
08:37	119	20.7	12.16	0.34	0.00	82.6
08:38	120	21.1	11.46	0.52	0.00	96.4
08:39	121	21.4	11.38	1.63	0.00	95.2
08:40	123	21.7	11.97	1.86	0.00	105.1
08:41	124	21.8	11.91	3.73	0.00	111.1
08:42	126	22.0	11.61	3.63	0.00	127.2
08:43	127	22.2	12.39	1.55	0.00	117.8
08:44	129	22.6	12.20	0.00	0.00	114.9
08:45	129	22.9	12.36	0.00	0.00	100.6
08:46	130	23.1	12.80	0.00	0.00	96.3
08:47	131	23.4	12.21	0.00	0.00	120.9
08:48	133	23.6	11.70	0.00	0.00	130.6
08:49	134	23.7	12.61	0.00	0.00	119.9
08:50	135	24.0	12.79	0.00	0.00	123.8
08:51	136	24.3	12.22	0.00	0.00	122.2
08:52	137	24.6	12.49	0.00	0.00	123.9
08:53	138	24.9	12.87	0.00	0.00	120.5
08:54	139	25.1	12.79	0.00	0.00	108.5
08:55	138	25.3	12.32	0.00	0.00	104.9
08:56	139	25.5	12.34	0.00	0.00	119.4
08:57	140	25.8	12.64	0.00	0.00	118.0
08:58	141	26.1	12.73	0.00	0.00	107.9
08:59	141	26.4	12.14	0.00	0.00	133.5
09:00	143	26.6	13.84	13.28	0.00	134.5
09:01	144	26.8	11.22	23.35	0.00	120.2
09:02	143	26.9	11.75	24.82	0.00	102.7
09:03	142	27.1	12.93	27.83	0.00	103.6
09:04	142	27.4	12.71	22.15	0.00	87.9
09:05	142	27.7	12.04	10.85	0.00	77.0
09:06	141	28.0	12.89	11.22	0.00	74.7
09:07	141	28.3	13.36	12.47	0.00	75.9
09:08	141	28.4	12.74	11.68	0.00	65.1
09:09	140	28.5	12.86	12.08	0.00	62.9
09:10	139	28.7	12.40	13.20	0.00	59.0
09:11	139	28.9	11.71	14.60	0.00	58.8
09:12	139	29.2	12.20	14.71	0.00	57.1
09:13	139	29.4	11.81	13.23	0.00	69.2
09:14	139	29.5	12.12	10.86	0.00	59.1
09:15	138	29.6	12.97	11.68	0.00	54.7
09:16	137	29.8	12.90	11.74	0.00	50.5
09:17	136	29.9	12.87	9.91	0.00	47.0
09:18	136	30.2	12.79	8.12	0.00	40.6
09:19	135	30.4	12.61	6.62	0.00	41.0
09:20	135	30.6	12.56	6.26	0.00	41.1
09:21	134	30.8	12.52	6.15	0.00	38.4
09:22	134	30.8	12.61	5.26	0.00	39.1
<b>Average</b>	<b>131</b>	<b>24.3</b>	<b>12.11</b>	<b>6.03</b>	<b>0.00</b>	<b>81.9</b>

Carbon Monoxide First 30 mins	2.19
Carbon Monoxide Second 30 mins	9.74

**Parndon Wood Cremators 1 & 2 & Abatement System**

**Data Log 16 January 2019**

Test H2

Time	Flue Gas °C	Meter °C	Flue O <sub>2</sub> %v/v dry	CO mg/Nm <sup>3</sup> c.	VOC mg/Nm <sup>3</sup> c.	Sample Point Pa
10:14	133	35.5	14.28	22.44	0.00	56.4
10:15	133	35.5	13.97	8.13	0.00	70.5
10:16	133	35.6	13.37	3.10	0.00	67.5
10:17	133	35.6	12.61	0.33	0.00	61.1
10:18	133	35.6	12.69	0.51	0.00	61.5
10:19	133	35.6	13.51	2.05	0.00	51.2
10:20	133	35.6	14.28	2.24	0.00	58.5
10:21	133	35.6	14.26	1.46	0.00	65.9
10:22	133	35.5	13.37	0.00	0.00	63.3
10:23	133	35.4	14.23	0.00	0.00	70.0
10:24	134	35.4	14.67	0.71	0.00	63.4
10:25	134	35.4	14.63	0.00	0.00	61.2
10:26	134	35.4	14.82	0.00	0.00	90.1
10:27	135	35.5	13.80	0.00	0.00	62.5
10:28	134	35.4	14.26	0.00	0.00	45.7
10:29	133	35.4	15.68	0.00	0.00	45.8
10:30	133	35.3	15.40	0.00	0.00	41.3
10:31	132	35.3	14.90	0.00	0.00	33.8
10:32	132	35.4	15.87	0.00	0.00	37.5
10:33	131	35.4	15.90	0.00	0.00	40.0
10:34	131	35.3	15.05	0.00	0.00	34.7
10:35	131	35.3	16.00	0.00	0.00	44.4
10:36	131	35.3	15.88	0.00	0.00	46.9
10:37	131	35.3	15.25	0.00	0.00	43.9
10:38	130	35.3	16.03	0.00	0.00	44.5
10:39	131	35.3	16.15	0.00	0.00	73.7
10:40	131	35.4	14.17	0.00	0.00	56.1
10:41	130	35.3	15.88	0.00	0.00	47.2
10:42	130	35.3	17.05	1.35	0.00	51.0
10:43	130	35.3	16.32	2.11	0.00	72.5
10:44	132	35.4	14.29	0.00	0.00	83.6
10:45	132	35.4	14.59	0.00	0.00	53.7
10:46	131	35.4	16.26	0.00	0.00	75.6
10:47	132	35.4	15.22	0.00	0.00	79.3
10:48	133	35.4	15.46	0.53	0.00	82.6
10:49	133	35.4	15.80	14.01	0.00	83.2
10:50	134	35.3	14.10	1.61	0.00	86.3
10:51	134	35.3	14.95	0.00	0.00	64.2
10:52	133	35.3	16.48	8.66	0.00	63.4
10:53	134	35.3	15.70	10.44	0.00	85.3
10:54	135	35.4	14.84	0.00	0.00	77.7
10:55	134	35.4	15.58	0.00	0.00	83.3
10:56	136	35.4	15.68	0.55	0.00	101.0
10:57	137	35.4	14.18	0.00	0.00	81.9
10:58	136	35.4	15.21	0.00	0.00	90.4
10:59	138	35.5	15.39	0.00	0.00	102.9
11:00	138	35.5	15.37	0.00	0.00	104.2
11:01	139	35.5	14.96	0.00	0.00	107.5
11:02	140	35.5	14.57	0.00	0.00	101.2
11:03	140	35.5	15.26	0.00	0.00	88.7
11:04	141	35.5	15.91	0.00	0.00	101.2
11:05	141	35.6	15.51	0.00	0.00	101.5
11:06	142	35.6	15.61	0.00	0.00	99.3
11:07	142	35.6	15.45	0.00	0.00	100.9
11:08	143	35.7	14.92	0.00	0.00	98.2
11:09	142	35.5	14.98	0.00	0.00	79.9
11:10	142	34.9	16.47	0.00	0.00	88.1
11:11	142	35.0	16.63	3.89	0.00	87.1
11:12	142	35.1	16.31	4.35	0.00	80.8
11:13	142	35.2	14.30	0.00	0.00	79.0
11:14	143	35.3	13.91	0.00	0.00	77.6
<b>Average</b>	<b>135</b>	<b>35.4</b>	<b>15.05</b>	<b>1.45</b>	<b>0.00</b>	<b>71.3</b>

Carbon Monoxide First 30 mins	1.48
Carbon Monoxide Second 30 mins	1.42



**Parndon Wood Cremators 1 & 2 & Abatement System**

**Data Log 16 January 2019**

Test H3

Time	Flue Gas °C	Meter °C	Flue O <sub>2</sub> %v/v dry	CO mg/Nm <sup>3</sup> c.	VOC mg/Nm <sup>3</sup> c.	Sample Point Pa
12:09	131	36.4	13.86	8.22	0.00	62.4
12:10	131	36.4	13.83	5.38	0.00	43.7
12:11	130	36.4	13.78	0.92	0.00	42.3
12:12	130	36.3	14.30	1.47	0.00	48.4
12:13	131	36.3	13.80	2.09	0.00	70.5
12:14	131	36.2	12.89	5.57	0.00	59.4
12:15	131	36.2	13.68	1.86	0.00	50.9
12:16	131	36.2	13.49	0.39	0.00	51.1
12:17	131	36.2	13.76	0.00	0.00	48.6
12:18	131	36.1	14.07	0.00	0.00	54.1
12:19	131	36.1	14.42	0.00	0.00	50.1
12:20	131	36.0	14.63	0.00	0.00	45.9
12:21	130	36.0	14.98	0.00	0.00	45.3
12:22	130	36.0	15.21	0.00	0.00	53.2
12:23	131	35.9	13.10	0.00	0.00	40.5
12:24	130	35.9	12.22	0.00	0.00	28.4
12:25	129	35.9	12.35	0.00	0.00	25.9
12:26	129	35.9	13.54	0.00	0.00	24.0
12:27	128	35.9	13.35	0.00	0.00	22.2
12:28	128	35.9	12.96	0.00	0.00	22.7
12:29	127	35.8	13.06	0.00	0.00	23.3
12:30	127	35.8	12.99	0.00	0.00	36.8
12:31	128	35.8	12.64	0.00	0.00	37.4
12:32	127	35.8	12.63	0.00	0.00	35.6
12:33	127	35.9	12.97	0.00	0.00	34.8
12:34	127	35.8	13.48	0.00	0.00	36.9
12:35	127	35.9	13.87	0.00	0.00	39.3
12:36	127	35.9	14.25	0.00	0.00	37.9
12:37	127	35.9	14.66	0.00	0.00	38.2
12:38	126	35.9	14.95	0.00	0.00	38.4
12:39	126	35.9	15.18	0.00	0.00	37.7
12:40	126	35.9	15.49	0.00	0.00	38.5
12:41	126	35.8	15.70	0.00	0.00	40.4
12:42	126	35.9	15.13	0.00	0.00	37.5
12:43	126	35.9	15.62	0.00	0.00	36.6
12:44	125	35.8	16.29	0.00	0.00	43.7
12:45	126	35.8	15.22	0.00	0.00	44.0
12:46	126	35.8	16.11	0.00	0.00	47.9
12:47	126	35.9	16.37	0.00	0.00	61.7
12:48	127	35.8	13.89	0.00	0.00	52.9
12:49	127	35.8	15.41	0.00	0.00	45.6
12:50	126	35.8	16.62	0.00	0.00	65.8
12:51	128	35.8	14.87	0.00	0.00	73.3
12:52	128	35.9	15.58	0.00	0.00	53.9
12:53	128	35.8	15.94	0.00	0.00	41.2
12:54	128	35.8	16.23	0.00	0.00	73.3
12:55	129	35.9	13.98	0.00	0.00	69.0
12:56	129	35.9	15.88	0.00	0.00	41.7
12:57	128	35.9	18.04	1.68	0.00	54.2
12:58	130	35.9	16.45	1.08	0.00	87.3
12:59	131	35.9	15.20	0.00	0.00	80.7
13:00	132	35.9	15.42	0.00	0.00	80.8
13:01	132	35.9	15.46	0.00	0.00	80.6
13:02	133	35.9	15.53	0.00	0.00	73.7
13:03	133	35.8	15.41	0.00	0.00	53.6
13:04	132	35.8	16.14	0.00	0.00	51.1
13:05	132	35.8	16.48	0.00	0.00	52.7
13:06	132	35.8	15.61	0.00	0.00	48.8
13:07	132	35.8	16.56	0.00	0.00	47.0
13:08	132	35.8	16.56	0.00	0.00	51.5
13:09	132	35.8	15.70	0.00	0.00	58.5
<b>Average</b>	<b>129</b>	<b>35.9</b>	<b>14.72</b>	<b>0.47</b>	<b>0.00</b>	<b>48.7</b>

Carbon Monoxide First 30 mins	0.86
Carbon Monoxide Second 30 mins	0.09

## Parndon Wood Cremators 1 & 2 & Abatement System

### Total Particulate Matter and Hydrogen Chloride

Contract            Parndon Wood Crematorium DEM1212  
Date                16th January 2019  
Location            2 x Cremator Abatement System Outlet (Flue To Stack)  
Engineer(s)        JB  
Absorbent          H<sub>2</sub>O

Test Log	Test H1		Test H2		Test H3	
Barometric Pressure(kPa)	99.8		99.8		99.8	
Gas Meter Temperature(Deg C)	24.3		35.4		35.9	
Oxygen Concentration(%v/v dry)	12.11		15.05		14.72	
Flue Gas Volumetric Flow(Nm <sup>3</sup> /h dry)	3046		2806		2277	
	Start	End	Start	End	Start	End
Time	08:22	09:22	10:14	11:14	12:09	13:09
Gas Meter Reading(Am <sup>3</sup> dry)	133.835	134.382	134.901	135.482	135.250	135.706
Absorber Weight(g)	3512.8	3536.7	3452.1	3480.2	3306.2	3338.4
Filter Reference	PW160119F1		PW160119F2		PW160119F3	
Filter Weight(g)	0.53337	0.53340	0.52223	0.52234	0.52355	0.52367
Probe Rinse Reference	PW160119R		PW160119R		PW160119R	
Probe Rinse Weight(g)	75.78316	75.78323	75.78323	75.78349	75.78349	75.78377
Sample Reference HCl	PW160119 H1		PW160119 H2		PW160119 H3A+B	
Absorbent Volume(ml)	500		500		250	250
Absorbent(mg/l as HCl)	6.1		5.1		21	0.06
Blank(mg/l as HCl)	0		0		0	0

#### Calculation: General

Barometric Pressure(kPa)	99.8	99.8	99.8
Gas Meter temperature(Deg C)	24.3	35.4	35.9
Gas Volume Sampled(Am <sup>3</sup> dry)	0.547	0.581	0.456
Gas Volume Sampled(Nm <sup>3</sup> dry)	0.4949	0.5067	0.3970
Mass of Dry Gas(g @ 1292.8 g/Nm <sup>3</sup> )	639.84	655.05	513.23
Change in Absorber Weight(g)	23.9	28.1	32.2
Water Vapour Volume(Nm <sup>3</sup> @ 803.9 g/Nm <sup>3</sup> )	0.0297	0.0350	0.0401
Gas Volume(Nm <sup>3</sup> wet)	0.5247	0.5416	0.4370
Mass of Wet Gas(g)	663.74	683.15	545.43
<b>Moisture Concentration(%v/v)</b>	<b>5.7</b>	<b>6.5</b>	<b>9.2</b>
<b>Moisture Concentration(%w/w)</b>	<b>3.6</b>	<b>4.1</b>	<b>5.9</b>

### Calculation: Particulate

Increase In Filter Weights(g)	0.00010	0.00037	0.00040
Particulate Emission(mg/Nm <sup>3</sup> dry)	0.20	0.72	1.01
Oxygen Concentration(%v/v dry)	12.11	15.05	14.72
<b>Particulate Emission</b>	<b>0.23</b>	<b>1.22</b>	<b>1.61</b>
(mg/Nm <sup>3</sup> @ 11 %v/v Oxygen dry)			
Flue Gas Volumetric Flow(Nm <sup>3</sup> /h dry)	3046	2806	2277
<b>Particulate Emission(g/h)</b>	<b>0.62</b>	<b>2.03</b>	<b>2.29</b>
Required Sample Velocity(Nm/s)	8.79	8.10	6.57
Nozzle Used(mm)	4.5	4.5	4.5
Area of Nozzle(m <sup>2</sup> )	0.00001590	0.00001590	0.00001590
Test Duration(mins)	60	60	60
Actual Sample Velocity(Nm/s)	8.64	8.85	6.93
Isokinetic Closure(%)	98	109	105
Start Leak Check(%)	1.2	1.2	1.2
	@10 l/min	@10 l/min	@10 l/min
End Leak Check(%)	1.2	1.2	1.2
	@10 l/min	@10 l/min	@10 l/min

### Calculation: HCl

Absorbent(mg/l as HCl)	6.1	5.1	21	0.06
Blank(mg/l as HCl)	0	0	0	0
Chloride Absorbed(mg/l as HCl)	6.1	5.1	21	0.06
Chloride Absorbed(mg as HCl)	3.05	2.55	5.25	0.02
HCl(mg)	3.05	2.55	5.27	
HCl Emission(mg/Nm <sup>3</sup> dry)	6.16	5.03	13.26	
Oxygen Concentration(%v/v dry)	12.11	15.05	14.72	
<b>HCl Emission</b>	<b>6.94</b>	<b>8.49</b>	<b>21.17</b>	
(mg/Nm <sup>3</sup> @ 11 %v/v Oxygen dry)				
Flue Gas Volumetric Flow(Nm <sup>3</sup> /h dry)	3046	2806	2277	
<b>HCl Emission(g/h)</b>	<b>18.77</b>	<b>14.12</b>	<b>30.20</b>	

## Parndon Wood Cremators 1 & 2 & Abatement System

### Flue Gas Volumetric Flow

Contract Parndon Wood Crematorium DEM1212  
 Date 16th January 2019  
 Location 2 x Cremator Abatement System Outlet (Flue To Stack)  
 Engineer(s) JB

Test Log	Test H1	Test H2	Test H3
Flue Gas Temperature(Deg C)	131	135	129
Flue Gas Pitot Head Sample Points(Pa)	81.9	71.3	48.7
Flue Gas Moisture(%v/v)	5.7	6.5	9.2
Flue Gas Moisture(%w/w)	3.6	4.1	5.9
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> )	0.8627	0.8517	0.8583
Flue Gas Velocity(Am/s)	13.78	12.94	10.66
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h)	4773	4483	3691
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h dry)	4503	4194	3353
<b>Flue Gas Volumetric Flowrate(Nm<sup>3</sup>/h dry)</b>	<b>3046</b>	<b>2806</b>	<b>2277</b>

## Parndon Wood Cremators 1 & 2 & Abatement System Outlet

Data Log

16/01/19

Hg Test

Time	Flue Gas °C	Meter °C	Flue O <sub>2</sub> %v/v dry	Pitot Head Pa
13:45	136	36.3	14.03	85.6
13:46	137	36.2	13.36	54.6
13:47	136	36.1	15.69	50.6
13:48	136	36.1	16.09	67.8
13:49	136	36.0	13.81	66.1
13:50	136	36.0	14.02	51.5
13:51	136	35.9	15.45	56.5
13:52	137	35.9	14.46	63.5
13:53	137	35.9	15.25	65.2
13:54	137	35.8	14.70	65.3
13:55	137	19.5	14.02	56.9
13:56	136	19.4	13.32	69.3
13:57	138	35.7	17.22	117.9
13:58	140	35.7	13.50	106.8
13:59	140	35.7	11.41	97.2
14:00	140	35.7	12.60	73.1
14:01	140	35.7	12.75	75.0
14:02	141	35.6	13.02	68.8
14:03	140	35.6	11.95	80.7
14:04	142	35.6	12.11	89.0
14:05	142	35.6	13.70	76.5
14:06	142	35.6	13.52	75.3
14:07	142	35.5	13.77	71.7
14:08	142	35.6	13.84	76.4
14:09	142	35.6	13.93	62.0
14:10	141	35.5	14.42	56.8
14:11	141	35.5	13.43	53.9
14:12	140	35.5	14.08	53.1
14:13	140	35.5	14.49	34.4
14:14	139	35.4	12.49	31.9
14:15	138	35.5	13.23	24.2
14:16	138	35.5	13.31	20.9
14:17	137	35.5	13.05	18.1
14:18	136	35.5	12.87	16.8
14:19	135	35.5	12.88	17.3
14:20	135	35.4	13.04	16.3
14:21	135	35.5	13.10	20.5
14:22	134	35.5	13.25	24.9
14:23	134	35.5	13.76	22.8
14:24	133	35.5	15.81	23.6
14:25	133	35.5	16.15	29.0
14:26	133	35.5	15.98	32.1
14:27	133	35.5	14.85	31.7
14:28	132	35.5	15.06	31.8
14:29	132	35.5	15.17	41.4
14:30	132	35.6	15.77	41.0
14:31	132	35.7	15.65	44.5
14:32	132	35.7	12.55	52.5
14:33	132	35.6	11.86	45.8
14:34	133	35.6	17.22	81.9
14:35	134	35.6	13.22	107.6
14:36	135	35.6	10.51	71.6
14:37	134	35.6	13.49	56.0
14:38	134	35.6	13.26	80.7
14:39	135	35.7	12.01	60.0
14:40	134	35.7	14.29	66.5
14:41	135	35.7	11.52	87.6
14:42	137	35.7	10.69	138.9
14:43	140	35.7	11.60	111.4
14:44	140	35.7	11.16	87.1
14:45	140	35.7	12.30	95.4
14:46	141	35.7	13.16	119.0
14:47	142	35.7	11.91	107.7
14:48	142	35.7	12.27	83.9
14:49	142	35.6	11.99	80.9



14:50	142	35.6	12.12	82.1
14:51	143	35.6	12.17	82.2
14:52	143	35.6	12.55	96.5
14:53	144	35.5	12.02	73.8
14:54	143	35.5	12.26	67.9
14:55	143	35.5	12.34	63.2
14:56	143	35.5	12.56	63.8
14:57	143	35.5	12.91	71.7
14:58	143	35.6	12.79	60.7
14:59	143	35.6	13.27	58.2
15:00	143	35.6	13.36	74.4
15:01	143	35.5	13.30	71.8
15:02	143	35.5	13.55	57.9
15:03	143	35.6	13.72	73.5
15:04	143	35.6	13.66	71.6
15:05	143	35.6	13.59	59.3
15:06	143	35.6	14.40	59.4
15:07	143	35.6	14.37	73.1
15:08	143	35.5	14.07	72.8
15:09	143	35.5	14.19	58.3
15:10	143	35.5	14.55	72.2
15:11	143	35.5	14.07	72.3
15:12	143	35.5	14.12	54.1
15:13	142	35.5	14.65	54.0
15:14	142	35.5	14.77	64.8
15:15	142	35.5	14.49	66.7
15:16	142	35.5	14.82	54.7
15:17	141	35.5	13.99	56.3
15:18	141	35.5	13.76	56.6
15:19	141	35.5	14.66	67.0
15:20	142	35.5	13.51	75.1
15:21	142	35.5	12.95	70.1
15:22	142	35.5	13.90	67.1
15:23	142	35.5	14.45	60.9
15:24	142	35.6	15.49	85.6
15:25	143	35.6	14.10	80.0
15:26	143	35.7	14.29	63.1
15:27	142	35.7	14.89	44.8
15:28	141	35.7	15.36	48.7
15:29	141	35.6	15.71	42.2
15:30	140	35.7	14.76	49.8
15:31	140	35.8	14.01	61.5
15:32	143	35.8	15.91	147.3
15:33	145	35.8	12.41	105.6
15:34	144	35.8	11.81	65.6
15:35	143	35.7	13.16	58.0
15:36	143	35.7	13.89	60.5
15:37	143	35.7	14.60	78.9
15:38	143	35.7	13.58	78.4
15:39	144	35.7	12.68	79.8
15:40	144	35.7	12.90	63.4
15:41	143	35.7	13.12	62.4
15:42	143	35.7	13.17	59.9
15:43	143	35.6	13.73	58.9
15:44	143	35.6	14.29	59.6
15:45	143	35.5	14.17	69.5
15:46	144	35.5	13.83	107.3
15:47	145	19.3	12.80	82.7
15:48	145	19.2	13.17	79.8
15:49	144	35.6	13.03	61.0
15:50	143	35.5	12.96	49.8
15:51	143	35.5	13.29	47.6
15:52	142	35.6	13.48	48.3
15:53	142	35.6	13.72	47.0
15:54	142	35.6	13.97	52.2
15:55	142	35.6	14.11	55.9
15:56	142	35.5	13.59	56.7
15:57	142	35.4	13.72	56.1
15:58	141	35.4	14.61	53.9
15:59	141	35.5	14.80	65.4
16:00	142	35.5	14.40	70.6
16:01	142	35.5	13.72	67.7
16:02	142	35.5	14.18	70.8
16:03	142	35.5	14.65	62.2



16:04	141	35.5	15.28	48.8
16:05	140	35.4	16.00	45.2
16:06	140	35.4	15.97	52.7
16:07	141	35.4	14.30	75.4
16:08	141	35.5	14.07	49.4
16:09	140	35.5	14.13	45.7
16:10	141	35.5	13.98	119.2
16:11	144	35.4	12.50	103.3
16:12	144	35.4	10.96	75.2
16:13	143	35.4	13.52	84.9
16:14	144	35.4	12.79	97.9
16:15	144	35.3	12.45	76.9
16:16	144	35.2	14.73	64.9
16:17	144	35.2	15.17	86.0
16:18	145	35.2	12.41	88.0
16:19	146	35.0	12.15	85.4
16:20	146	34.9	12.04	87.7
16:21	147	34.8	12.07	90.0
16:22	147	34.8	11.99	103.6
16:23	149	34.9	11.80	115.9
16:24	150	34.8	12.01	111.6
16:25	151	34.8	11.97	119.9
16:26	152	34.8	11.81	127.2
16:27	153	34.9	11.89	124.7
16:28	154	35.0	11.46	110.3
16:29	154	35.1	11.64	110.2
16:30	155	35.2	11.64	106.7
16:31	155	35.3	11.88	104.5
16:32	156	35.4	11.85	98.9
16:33	156	35.5	11.83	99.1
16:34	156	35.6	12.03	96.0
16:35	156	35.6	11.98	92.9
16:36	156	35.7	11.92	87.9
16:37	156	35.8	11.91	81.3
16:38	156	35.9	11.87	82.0
16:39	156	35.9	12.04	81.0
16:40	156	36.0	12.29	89.2
16:41	156	36.0	11.54	77.2
16:42	156	36.1	11.97	86.4
16:43	156	36.1	11.81	84.7
16:44	156	36.2	11.40	81.8
16:45	156	36.2	11.99	74.2
16:46	156	36.2	12.62	66.9
16:47	155	36.2	12.35	71.1
16:48	156	36.3	12.41	76.2
16:49	156	36.4	11.70	71.3
16:50	155	36.4	12.68	72.8
16:51	155	36.5	12.54	80.7
16:52	156	36.5	11.75	72.4
16:53	155	36.5	12.30	74.6
16:54	155	36.6	12.57	75.0
16:55	155	36.7	11.78	74.0
16:56	155	36.8	12.22	66.2
16:57	155	36.8	12.72	72.7
<b>Average</b>	<b>143</b>	<b>35.3</b>	<b>13.36</b>	<b>50.0</b>

## Parndon Wood Cremators 1 & 2 & Abatement System Outlet

### Mercury

Contract Parndon Wood Crematorium, DEM1212  
 Date 16th January 2019  
 Location Cremators 1 & 2 Flue Gas Abatement System Outlet  
 Engineer(s) JB  
 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

#### Hg Test

Barometric Pressure(kPa)	101.3	
Gas Meter Temperature(Deg C)	35.3	
Oxygen Concentration(%v/v dry)	13.36	
Flue Gas Volumetric Flow(Nm <sup>3</sup> /h dry)	2320	
	Start	End
Time	13:45	16:57
Gas Meter Reading(Am <sup>3</sup> dry)	137.250	139.106
Absorber Weight(g)	3502.6	3598.1
Filter Reference	PW160119 HgF	
Filter Fraction Analysed	1	
Filter(µg as Hg)	0.01	
Filter Blank(µg as Hg)	0	
Probe Rinse Reference	Washed into HgA	
Probe Rinse Volume(ml)	0	
Probe Rinse(µg/l as Hg)	0	
Probe Rinse Blank(µg/l as Hg)	0	
Absorbent Reference	PW160119 Hg A+B	
Absorbent Volume(ml)	250	290
Absorbent(µg/l as Hg)	120	16
Absorbent Blank(µg/l as Hg)	13.0	13.0

#### Calculation: General

Barometric Pressure(kPa)	101.3
Gas Meter Temperature(Deg C)	35.3
Gas Volume Sampled(Am <sup>3</sup> dry)	1.856
Gas Volume Sampled(Nm <sup>3</sup> dry)	1.6436
Mass of Dry Gas(g @ 1292.8 g/Nm <sup>3</sup> )	2124.80
Change in Absorber Weight(g)	95.5
Water Vapour Volume(Nm <sup>3</sup> @ 803.9 g/Nm <sup>3</sup> )	0.1188
Gas Volume(Nm <sup>3</sup> wet)	1.7624
Mass of Wet Gas(g)	2220.30
<b>Moisture Concentration(%v/v)</b>	<b>6.7</b>
<b>Moisture Concentration(%w/w)</b>	<b>4.3</b>



**Calculation: Mercury**

Filter( $\mu\text{g}$ as Hg)	0.01
Probe Rinse( $\mu\text{g}$ as Hg)	0.00
Absorbent( $\mu\text{g}$ as Hg)	30.75
Total Mercury Sampled( $\mu\text{g}$ )	30.76
Mercury Emission( $\mu\text{g}/\text{Nm}^3$ dry)	18.72
Oxygen Concentration(%v/v dry)	13.36
<b>Mercury Emission</b>	<b>24.54</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)	2320
<b>Mercury Emission(g/h)</b>	<b>0.043</b>
Required Sample Velocity( $\text{Nm}/\text{s}$ )	6.70
Nozzle Used(mm)	5.0
Area of Nozzle( $\text{m}^2$ )	0.00001963
Test Duration(mins)	192
Actual Sample Velocity( $\text{Nm}/\text{s}$ )	7.27
Isokinetic Closure(%)	108

## Parndon Wood Cremators 1 & 2 & Abatement System Outlet

### Flue Gas Volumetric Flow

Contract Parndon Wood Crematorium, DEM1212  
 Date 16th January 2019  
 Location Cremators 1 & 2 Flue Gas Abatement System Outlet  
 Engineer(s) JB

#### Test Log

#### Hg Test

Flue Gas Temperature(Deg C)	143
Flue Gas Pitot Head Sample Points(Pa)	50.0
Flue Gas Moisture(%v/v)	6.7
Flue Gas Moisture(%w/w)	4.3
Flue Gas Duct Dimensions(mm)	350 mm Diameter Circular Flue
Flue Gas Duct Area(m <sup>2</sup> )	0.0962

#### Calculation

Flue Gas Density(kg/m <sup>3</sup> )	0.8345
Flue Gas Velocity(Am/s)	10.95
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h)	3791
Flue Gas Volumetric Flowrate(Am <sup>3</sup> /h dry)	3536
<b>Flue Gas Volumetric Flowrate(Nm<sup>3</sup>/h dry)</b>	<b>2320</b>

**Parndon Wood Cremators 1 & 2 & Abatement System**

**Emissions Monitoring January 2019**

**Test Instrumentation Calibration Data**

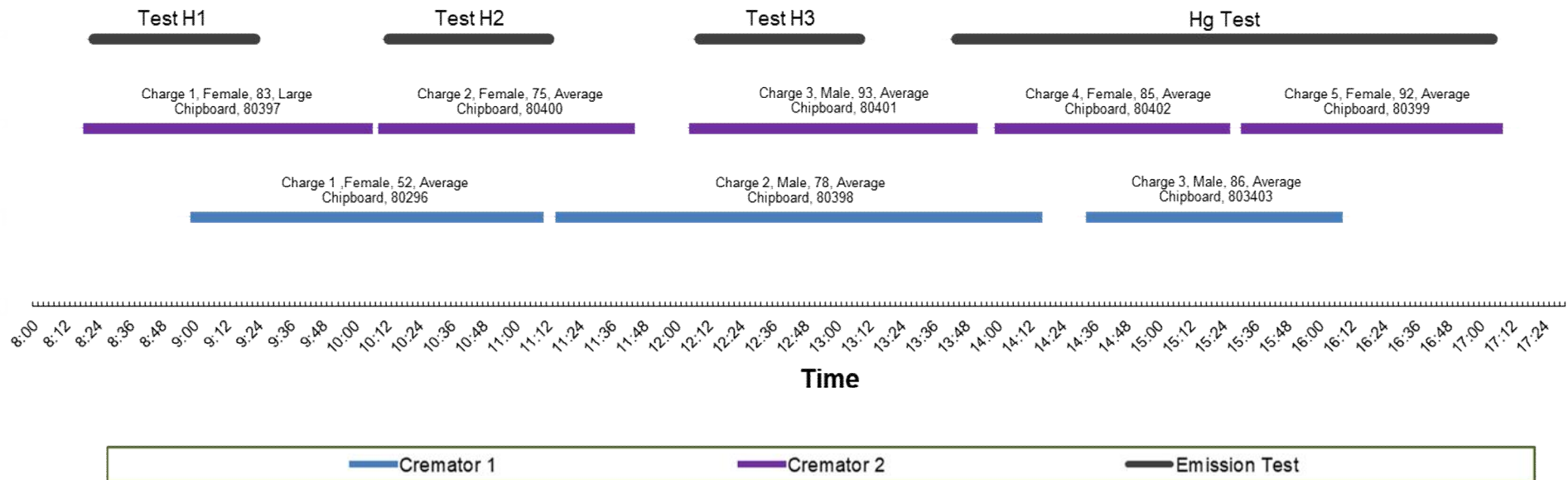
	Siemens Ultramat 23		Signal 3030PM
	CO	O <sub>2</sub>	VOC
Date of Check	16/01/2019	16/01/2019	16/01/2019
Time of Check	08:00	08:00	08:10
Test Reference	H1,H2&H3	H1,H2,H3&Hg	H1,H2&H3
Zero reading at analyser	0 mg/m <sup>3</sup>	20.95%	0.0 ppm
Span reading at analyser	498 mg/m <sup>3</sup>	0.01%	50.5 ppm
Zero check down line	0 mg/m <sup>3</sup>	20.95%	0.0 ppm
Span check down line	496 mg/m <sup>3</sup>	0.03%	50.5 ppm
Zero reading post test at analyser	0 mg/m <sup>3</sup>	20.95%	0.1 ppm
Date of Check	16/01/2019	16/01/2019	16/01/2019
Time of Check	14:00	17:20	17:20
Test Reference	H1,H2&H3	H1,H2,H3&Hg	H1,H2&H3
Zero reading at analyser	0 mg/m <sup>3</sup>	21.01%	-0.1 ppm
Span reading at analyser	496 mg/m <sup>3</sup>	0.01%	50.3 ppm
Zero check down line	0 mg/m <sup>3</sup>	21.01%	-0.1 ppm
Span check down line	494 mg/m <sup>3</sup>	0.01%	50.3 ppm
Zero in air post test at analyser	0 mg/m <sup>3</sup>	21.01%	-0.1 ppm

**Calibration Gases**

Gas	Supplier	Cylinder No.	Certified Conc.	Analytical Tolerance ± %
Carbon monoxide in Nitrogen	DRM	AGG2010-1-2	397 ppm 496 mg/m <sup>3</sup>	2
Propane in synthetic air	DRM	AGG2010-2-2	50.3 ppm	2
Oxygen		-	-	-



## Parndon Wood Cremators 1 & 2 & Abatement System Emission Tests 16/01/2019 Plant Operation & Test Periods





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

## **APPENDIX 2**

Analysis Reports

## Particulate Weight Determination

Reference			Clean Dry Weight g	Dirty Dry Weight g
Filters	PW160119FOB	17	0.55448	0.55449
	PW160119F1	Z11	0.53337	0.5334
	PW160119F2	Z12	0.52223	0.52234
	PW160119F3	Z13	0.52355	0.52367
Rinses	PW160119ROB		77.98413	77.98422
	PW160119R		75.78316	75.78377

## Concept Life Sciences Certificate of Analysis

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

**Report Number:** 796718-1 interim

**Date of Report:** 12-Feb-2019

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

**Customer Contact:** . Reports

**Customer Job Reference:** DEM1212  
**Customer Purchase Order:** 50001757  
**Date Job Received at Concept:** 21-Jan-2019  
**Date Analysis Started:** 22-Jan-2019  
**Date Analysis Completed:** 12-Feb-2019

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 Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual



Report checked  
and authorised by :  
David Plachcinski  
Customer Service Advisor

Issued by :  
David Plachcinski  
Customer Service Advisor

Validity unknown  
Digitally signed by David Plachcinski  
Date: 2019.02.17 14:05 GMT  
Reason: Issued  
Location: Concept

Concept Reference: 796718 Customer Reference: DEM1212									
Impinger(DI water)      Analysed as Impinger(DI water)									
Hydrogen Chloride									
Concept Reference		796718 001	796718 002	796718 003	796718 004	796718 005			
Customer Sample Reference		PW160119 H1	PW160119 H2	PW160119 H3A	PW160119 H3B	PW160119 HBLANK			
Test Sample		AR	AR	AR	AR	AR			
Date Sampled		16-JAN-2019	16-JAN-2019	16-JAN-2019	16-JAN-2019	16-JAN-2019			
Determinand	Method	LOD	Units	Symbol					
Hydrogen Chloride	IC	0.05	mg/l	U	6.1 <sup>(13)</sup>	5.1 <sup>(13)</sup>	21 <sup>(13)</sup>	0.06 <sup>(13)</sup>	<0.05 <sup>(13)</sup>

Concept Reference: 796718 Customer Reference: DEM1212						
Filter      Analysed as Filter						
Mercury						
Concept Reference		796718 006	796718 007			
Customer Sample Reference		PW160119 HgF	PW160119 HgFBLANK			
Test Sample		AR	AR			
Date Sampled		16-JAN-2019	16-JAN-2019			
Determinand	Method	LOD	Units	Symbol		
Mercury	CVAFS (HF Digest BS EN 13211)	0.01	µg	U	0.01 <sup>(13)</sup>	<0.01 <sup>(13)</sup>

Concept Reference: 796718 Customer Reference: DEM1212						
Impinger (4%K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> /20%HNO <sub>3</sub> )      Analysed as Impinger (4%K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> /20%HNO <sub>3</sub> )						
Mercury						
Concept Reference		796718 008	796718 009	796718 010		
Customer Sample Reference		PW160119 HgA	PW160119 HgB	PW160119 HgBLANK		
Test Sample		AR	AR	AR		
Date Sampled		16-JAN-2019	16-JAN-2019	16-JAN-2019		
Determinand	Method	LOD	Units	Symbol		
Mercury	CVAFS (BS EN 13211)	0.5	µg/l	U	120 <sup>(195)</sup>	16 <sup>(195)</sup> 13 <sup>(195)</sup>

### Index to symbols used in 796718-1 interim

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

### Notes

Interim report with all available results. Full report to follow.