



Davies & Co. (Environmental) Ltd
Emissions Monitoring Specialists

EMISSIONS MONITORING TEST REPORT

CANLEY CREMATORIUM
Cannon Hill Road
Coventry
CV4 7DF

30st July - 1st August 2019

Report Authorised by _____ Date 24th September 2018

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1. INTRODUCTION

The four cremators and associated flue gas treatment systems at Canley Crematorium, Cannon Hill Road, Coventry, CV4 7DF were monitored between the 30th July & 1st August 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
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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 cremator with the plant operating normally.

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

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

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

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

The cremators and flue gas abatement system were manufactured, installed and commissioned by Facultative 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.

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

This report details the monitoring procedures used and the results obtained from this test work along with comparisons with the 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/Nm³ 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/Nm³, 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
Coventry Cremators 1 & 2 & Abatement System
Emissions Monitoring July 2019
Total Particulate Matter & Hydrogen Chloride Sampling

	Test H1	Test H2	Test H3	Average	Requirement to Site Permit & PG5/2 (2012)
	30 July 2019 13:44-14:44	30 July 2019 14:56-15:56	31 July 2019 08:19-09:19		
Total Particulate Matter - mg/Nm ³ c.	3.58 ± 3.75	4.06 ± 4.26	3.17 ± 3.78	3.60	<20
Hydrogen Chloride - mg/Nm ³ c.	46.49 ± 2.84	52.74 ± 3.34	30.11 ± 1.82	43.11	<30
Carbon Monoxide - mg/Nm ³ c.	4.00 ± 0.20	3.26 ± 0.01	3.80 ± 0.01	3.69	<100
Carbon Monoxide First 30 mins - mg/Nm ³ c.	8.14 ± 0.41	6.63 ± 0.01	6.32 ± 0.01	7.03	<100
Carbon Monoxide Second 30 mins - mg/Nm ³ c.	0.00 ± 0.01	0.00 ± 0.01	1.36 ± 0.01	0.45	<100
Organic Compounds - mg/Nm ³ c.	0.08 ± 0.01	0.00 ± 0.01	0.00 ± 0.01	0.03	<20
Flue Oxygen - %v/v dry	16.65 ± 0.10	16.89 ± 0.10	16.34 ± 0.10	16.63	
Flue Moisture - %v/v	7.1 ± 0.7	7.4 ± 0.7	6.6 ± 0.7	7.0	
- %w/w	4.5 ± 0.5	4.7 ± 0.5	4.2 ± 0.4	4.5	
Flue Temperature - Deg C	142 ± 2	136 ± 2	128 ± 2	135	
Volumetric Flow - Nm ³ /h dry	2995 ± 60	2533 ± 51	2732 ± 55	2753	

Note 1: All emissions as concentration levels are given as mg/Nm³ corrected to 11%v/v oxygen and dry gas

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

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

TABLE 2
Coventry Sream 1 - Cremators 1 & 2 & Abatement System Outlet
Emissions Monitoring July 2019
Mercury Sampling

		Hg Test	Requirement to Site Permit & PG5/2 (2012)
		30 July 2019 10:02-13:32	
Mercury	- $\mu\text{g}/\text{Nm}^3$	171.49 \pm 8.58	<50
Flue Oxygen	- %v/v dry	13.72 \pm 0.10	
Flue Moisture	- %v/v	8.8 \pm 0.9	
	- %w/w	5.6 \pm 0.6	
Flue Temperature	- Deg C	145 \pm 2	
Volumetric Flow	- $\text{Nm}^3/\text{h dry}$	3505 \pm 70	

Note 1: All emissions as concentration levels are given as $\mu\text{g}/\text{Nm}^3$ or mg/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
Coventry Cremators 1 & 2 & Abatement System
Emissions Monitoring July 2019
Comparison of Test Results with Site Instrumentation

Cremator Plant	Test	Date	Averaging Period (mins)	Particulate mg/Nm ³		Carbon Monoxide mg/Nm ³	
				Davies & Co	Site	Davies & Co	Site
Cremators 1&2 FGT Outlet	1	30 July 2019	2 - 32	3.58	0	8	11
			32 - 62			0	0
Cremators 1&2 FGT Outlet	2	30 July 2019	2 - 62	4.06	0	0	0
			32 - 62			0	0

Note 1: All emission concentration levels are given as mg/Nm³ 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

TABLE 4
Coventry Cremators 3 & 4 & Abatement System
Emissions Monitoring July & August 2019
Total Particulate Matter & Hydrogen Chloride Sampling

	Test H1	Test H2	Test H3	Average	Requirement to Site Permit & PG5/2 (2012)
	31 July 2019 10:13-11:13	31 July 2019 15:00-16:00	01 August 2019 07:56-08:56		
Total Particulate Matter - mg/Nm ³ c.	1.77 ± 2.13	2.33 ± 3.22	1.56 ± 1.80	1.88	<20
Hydrogen Chloride - mg/Nm ³ c.	3.18 ± 0.34	9.90 ± 0.76	2.34 ± 0.27	5.14	<30
Carbon Monoxide - mg/Nm ³ c.	0.25 ± 0.01	0.32 ± 0.01	2.34 ± 0.01	0.97	<100
Carbon Monoxide First 30 mins - mg/Nm ³ c.	0.52 ± 0.03	0.66 ± 0.01	3.13 ± 0.01	1.44	<100
Carbon Monoxide Second 30 mins - mg/Nm ³ c.	0.00 ± 0.01	0.00 ± 0.01	1.57 ± 0.01	0.52	<100
Organic Compounds - mg/Nm ³ c.	0.00 ± 0.01	0.00 ± 0.01	0.00 ± 0.01	0.00	<20
Flue Oxygen - %v/v dry	16.33 ± 0.10	17.02 ± 0.10	15.53 ± 0.10	16.29	
Flue Moisture - %v/v	9.7 ± 1.0	8.9 ± 0.9	8.1 ± 0.8	8.9	
- %w/w	6.3 ± 0.6	5.7 ± 0.6	5.2 ± 0.5	5.7	
Flue Temperature - Deg C	100 ± 2	100 ± 2	103 ± 2	101	
Volumetric Flow - Nm ³ /h dry	4779 ± 96	3587 ± 72	4939 ± 99	4435	

Note 1: All emissions as concentration levels are given as mg/Nm³ corrected to 11%v/v oxygen and dry gas

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

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



TABLE 5
Coventry Stream 2 - Cremators 3 & 4 & Abatement System Outlet
Emissions Monitoring July 2019
Mercury Sampling

		Hg Test	Requirement to Site Permit & PG5/2 (2012)
		31 July 2019 11:34-14:42	
Mercury	- $\mu\text{g}/\text{Nm}^3$	20.53 \pm 3.74	<50
Flue Oxygen	- %v/v dry	15.02 \pm 0.10	
Flue Moisture	- %v/v	8.0 \pm 0.8	
	- %w/w	5.2 \pm 0.5	
Flue Temperature	- Deg C	105 \pm 2	
Volumetric Flow	- $\text{Nm}^3/\text{h dry}$	3490 \pm 70	

Note 1: All emissions as concentration levels are given as $\mu\text{g}/\text{Nm}^3$ or mg/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 6
Coventry Cremators 3 & 4 & Abatement System
Emissions Monitoring July & August 2019
Comparison of Test Results with Site Instrumentation

Cremator Plant	Test	Date	Averaging Period (mins)	Particulate mg/Nm ³		Carbon Monoxide mg/Nm ³	
				Davies & Co	Site	Davies & Co	Site
Cremators 1&2 FGT Outlet	1	31 July 2019	2 - 32	1.77	0	1	12
			32 - 62			0	9
Cremators 1&2 FGT Outlet	2	31 July 2019	2 - 62	2.33	0	1	11
			32 - 62			0	10

Note 1: All emission concentration levels are given as mg/Nm³ 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

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 stream 2, cremators 3 and 4 and their abatement system.

Stream 1, cremators 1 and 2, was compliant for the release of total particulate matter, carbon monoxide and volatile organic compounds and non-compliant for the release to atmosphere of hydrogen chloride and mercury.

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 cremators and flue gas clean up systems operated satisfactorily during testing without any failure or alarm events.

No unusual charges were cremated during these tests. They were all 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 show a good similarity between the two sets of results for stream 1 and a positive offset from the onsite instrumentation on stream 2. Emission levels were low throughout these tests however, supplying a reduced spread of data for thorough comparison.

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



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Emissions Monitoring Specialists

APPENDIX 1

Data Logs and Calculations

Coventry Cremators 1 & 2 & Abatement System

Data Log

30 July 2019

Test H1

Time	Flue Gas °C	Meter °C	Flue O ₂ %v/v dry	CO mg/Nm ³ c.	VOC mg/Nm ³ c.	Sample Point Pa
13:44	140	53.2	16.71	0.00	0.00	70.2
13:45	141	53.1	16.05	0.00	0.00	124.1
13:46	144	53.0	16.63	0.00	0.00	132.1
13:47	143	53.0	17.30	0.00	0.00	97.9
13:48	143	53.0	17.17	0.00	0.00	79.3
13:49	142	53.1	17.10	0.00	0.00	69.7
13:50	141	53.2	17.02	0.00	0.00	66.5
13:51	141	53.3	17.27	0.00	0.00	65.8
13:52	141	53.4	17.52	0.00	0.00	65.0
13:53	140	53.5	17.64	0.00	0.00	55.1
13:54	139	53.6	18.06	0.00	0.00	43.9
13:55	139	53.6	18.03	0.00	0.00	59.6
13:56	139	53.7	17.70	0.00	0.00	64.8
13:57	140	53.8	17.88	0.00	0.00	66.7
13:58	140	53.8	18.00	0.00	0.00	68.9
13:59	140	53.8	18.07	0.00	0.00	61.0
14:00	139	53.9	18.59	0.00	0.00	57.0
14:01	139	53.9	17.75	0.00	0.00	65.3
14:02	138	54.0	17.76	30.32	0.00	68.1
14:03	138	54.1	18.24	30.33	0.00	56.4
14:04	138	54.2	17.32	11.87	0.00	61.9
14:05	140	54.2	16.86	162.61	5.08	131.9
14:06	143	54.2	15.41	7.36	0.00	141.0
14:07	144	54.2	15.61	0.60	0.00	147.4
14:08	144	54.2	16.95	0.00	0.00	126.8
14:09	143	54.3	17.21	0.00	0.00	92.1
14:10	142	54.3	16.60	0.00	0.00	81.5
14:11	142	54.4	15.75	0.00	0.00	90.2
14:12	143	54.5	14.97	0.42	0.00	123.1
14:13	145	54.4	15.71	0.70	0.00	159.8
14:14	145	54.4	16.56	0.00	0.00	128.3
14:15	144	54.3	16.02	0.00	0.00	104.5
14:16	144	54.3	15.65	0.00	0.00	95.9
14:17	144	54.2	15.49	0.00	0.00	113.1
14:18	145	54.3	15.95	0.00	0.00	109.9
14:19	144	54.4	15.95	0.00	0.00	103.7
14:20	144	54.5	16.18	0.00	0.00	87.7
14:21	143	54.5	16.01	0.00	0.00	71.9
14:22	143	54.6	15.76	0.00	0.00	75.6
14:23	143	54.6	15.76	0.00	0.00	74.0
14:24	143	54.6	15.72	0.00	0.00	84.5
14:25	143	54.6	16.33	0.00	0.00	103.1
14:26	144	54.7	16.94	0.00	0.00	124.2
14:27	144	54.8	17.08	0.00	0.00	123.0
14:28	144	54.8	17.25	0.00	0.00	125.0
14:29	144	54.9	17.40	0.00	0.00	128.5
14:30	145	55.0	17.44	0.00	0.00	125.7
14:31	144	55.0	17.62	0.00	0.00	97.1
14:32	143	55.1	17.04	0.00	0.00	74.2
14:33	142	55.2	15.82	0.00	0.00	62.2
14:34	141	55.1	15.83	0.00	0.00	55.7
14:35	140	55.1	15.83	0.00	0.00	53.0
14:36	140	54.9	15.66	0.00	0.00	48.2
14:37	139	54.8	15.66	0.00	0.00	46.9
14:38	139	54.8	15.76	0.00	0.00	46.3
14:39	139	54.8	15.92	0.00	0.00	44.7
14:40	139	54.7	15.84	0.00	0.00	43.4
14:41	138	54.5	15.93	0.00	0.00	40.0
14:42	138	54.4	16.01	0.00	0.00	37.5
14:43	137	54.3	16.03	0.00	0.00	39.2
14:44	137	54.1	16.11	0.00	0.00	39.5
Average	142	54.2	16.65	4.00	0.08	83.6

Carbon Monoxide First 30 mins	8.14
Carbon Monoxide Second 30 mins	0.00

Coventry Cremators 1 & 2 & Abatement System

Data Log

30 July 2019

Test H2

Time	Flue Gas °C	Meter °C	Flue O ₂ %v/v dry	CO mg/Nm ³ c.	VOC mg/Nm ³ c.	Sample Point Pa
14:56	141	54.3	17.66	0.00	0.00	131.4
14:57	142	54.3	16.05	0.00	0.00	140.2
14:58	142	54.4	16.35	0.00	0.00	129.6
14:59	142	54.4	16.39	0.00	0.00	111.7
15:00	142	54.5	15.79	0.00	0.00	103.1
15:01	142	54.6	14.52	0.00	0.00	89.1
15:02	141	54.6	14.03	0.00	0.00	76.0
15:03	141	54.5	14.03	0.00	0.00	70.7
15:04	140	54.6	14.67	0.00	0.00	70.6
15:05	140	54.6	15.03	0.00	0.00	72.8
15:06	140	54.6	15.02	0.00	0.00	74.4
15:07	140	54.6	15.22	0.00	0.00	73.2
15:08	140	54.7	15.42	0.00	0.00	73.8
15:09	139	54.7	15.58	0.00	0.00	70.0
15:10	139	54.8	15.30	0.00	0.00	66.2
15:11	139	54.9	15.79	0.00	0.00	73.3
15:12	138	55.0	17.02	0.00	0.00	58.1
15:13	138	55.0	15.29	0.00	0.00	61.7
15:14	138	55.1	17.30	33.91	0.00	75.3
15:15	139	55.1	17.99	149.12	0.00	66.7
15:16	138	55.2	17.82	15.86	0.00	36.6
15:17	137	55.2	16.30	0.00	0.00	25.8
15:18	136	55.3	15.85	0.00	0.00	28.1
15:19	135	55.3	15.84	0.00	0.00	25.6
15:20	135	55.3	15.67	0.00	0.00	30.3
15:21	135	55.3	15.89	0.00	0.00	29.8
15:22	134	55.3	16.30	0.00	0.00	27.2
15:23	134	55.3	16.30	0.00	0.00	27.0
15:24	134	55.2	16.23	0.00	0.00	27.2
15:25	134	55.2	16.37	0.00	0.00	26.2
15:26	133	55.3	16.50	0.00	0.00	26.1
15:27	133	55.3	16.86	0.00	0.00	25.9
15:28	132	55.3	17.01	0.00	0.00	25.4
15:29	132	55.2	17.36	0.00	0.00	27.8
15:30	132	55.2	17.79	0.00	0.00	50.9
15:31	133	55.2	16.59	0.00	0.00	57.2
15:32	133	55.2	16.54	0.00	0.00	58.6
15:33	134	55.2	16.84	0.00	0.00	62.5
15:34	135	55.2	17.11	0.00	0.00	67.1
15:35	135	55.2	17.31	0.00	0.00	70.3
15:36	135	55.2	17.45	0.00	0.00	68.8
15:37	134	55.3	17.60	0.00	0.00	67.5
15:38	134	55.2	17.71	0.00	0.00	68.5
15:39	134	55.1	17.89	0.00	0.00	67.6
15:40	134	55.1	18.03	0.00	0.00	64.9
15:41	135	55.1	18.13	0.00	0.00	72.0
15:42	135	55.1	18.32	0.00	0.00	74.3
15:43	136	55.1	18.48	0.00	0.00	75.2
15:44	136	55.2	18.62	0.00	0.00	73.9
15:45	136	55.2	18.72	0.00	0.00	75.3
15:46	136	55.1	18.79	0.00	0.00	72.8
15:47	135	55.1	18.86	0.00	0.00	72.9
15:48	135	55.2	18.94	0.00	0.00	54.5
15:49	134	55.2	18.65	0.00	0.00	35.8
15:50	133	55.1	18.16	0.00	0.00	35.1
15:51	133	55.1	18.14	0.00	0.00	35.9
15:52	133	55.1	18.16	0.00	0.00	33.0
15:53	132	55.0	18.12	0.00	0.00	31.6
15:54	132	55.1	18.09	0.00	0.00	32.1
15:55	132	55.1	18.12	0.00	0.00	31.1
15:56	131	55.1	18.65	0.00	0.00	32.6
Average	136	55.0	16.89	3.26	0.00	59.3

Carbon Monoxide First 30 mins	6.63
Carbon Monoxide Second 30 mins	0.00

Coventry Cremators 1 & 2 & Abatement System

Data Log

31 July 2019

Test H3

Time	Flue Gas °C	Meter °C	Flue O ₂ %v/v dry	CO mg/Nm ³ c.	VOC mg/Nm ³ c.	Sample Point Pa
08:19	113	34.7	16.43	10.06	0.00	36.7
08:20	113	34.7	16.27	8.55	0.00	42.3
08:21	114	34.7	16.65	7.68	0.00	41.1
08:22	114	34.7	16.50	5.66	0.00	49.8
08:23	114	34.8	16.55	5.02	0.00	44.1
08:24	115	34.9	16.25	4.34	0.00	47.5
08:25	116	34.9	16.10	3.71	0.00	68.4
08:26	118	35.0	15.82	5.31	0.00	87.3
08:27	120	35.1	16.07	9.97	0.00	81.6
08:28	120	35.2	16.09	9.72	0.00	66.5
08:29	121	35.4	15.78	7.41	0.00	74.1
08:30	121	35.5	15.72	6.68	0.00	69.6
08:31	121	35.7	16.06	6.86	0.00	64.3
08:32	122	35.8	15.95	6.85	0.00	76.2
08:33	123	35.9	15.71	5.92	0.00	84.5
08:34	124	36.1	15.71	5.41	0.00	85.2
08:35	125	36.3	15.79	5.77	0.00	89.0
08:36	126	36.4	15.73	5.76	0.00	89.4
08:37	127	36.6	15.73	5.43	0.00	96.4
08:38	128	36.8	15.63	5.39	0.00	100.0
08:39	128	37.0	15.70	5.38	0.00	102.5
08:40	129	37.2	15.79	5.90	0.00	108.8
08:41	130	37.3	15.66	5.94	0.00	114.4
08:42	131	37.4	15.62	5.96	0.00	125.3
08:43	133	37.6	15.65	5.99	0.00	145.1
08:44	134	37.7	15.71	6.08	0.00	133.1
08:45	135	37.9	15.88	5.59	0.00	126.1
08:46	135	38.2	16.14	6.25	0.00	130.8
08:47	136	38.5	16.02	5.61	0.00	130.6
08:48	136	38.8	15.69	5.33	0.00	130.0
08:49	137	39.1	15.94	5.04	0.00	124.3
08:50	137	39.3	16.14	4.39	0.00	116.7
08:51	137	39.7	16.07	3.69	0.00	112.7
08:52	136	39.9	16.12	3.15	0.00	106.8
08:53	136	40.1	16.23	2.99	0.00	99.0
08:54	136	40.4	16.11	2.51	0.00	87.5
08:55	135	40.7	15.98	2.22	0.00	84.8
08:56	135	40.9	16.33	1.72	0.00	53.1
08:57	134	41.2	16.41	1.45	0.00	41.5
08:58	134	41.4	16.42	1.52	0.00	42.9
08:59	133	41.6	16.46	1.53	0.00	43.6
09:00	133	41.9	16.60	1.60	0.00	38.6
09:01	132	42.1	16.51	1.57	0.00	38.9
09:02	132	42.4	16.63	1.20	0.00	35.3
09:03	131	42.6	16.57	1.18	0.00	35.1
09:04	131	42.8	16.68	0.82	0.00	36.9
09:05	131	43.1	16.56	1.02	0.00	34.5
09:06	130	43.2	16.52	0.63	0.00	32.4
09:07	130	43.4	16.76	0.66	0.00	29.1
09:08	130	43.7	16.76	0.66	0.00	25.9
09:09	129	43.9	16.57	0.64	0.00	24.7
09:10	129	44.1	16.68	0.63	0.00	24.8
09:11	129	44.3	16.93	0.69	0.00	23.7
09:12	128	44.5	17.00	0.71	0.00	20.3
09:13	128	44.7	16.88	0.00	0.00	20.5
09:14	128	45.0	17.14	0.00	0.00	19.0
09:15	127	45.2	17.38	0.00	0.00	19.3
09:16	126	45.4	17.63	0.00	0.00	13.1
09:17	126	45.7	17.89	0.00	0.00	11.7
09:18	125	45.9	18.06	0.00	0.00	11.9
09:19	125	46.0	18.29	0.00	0.00	11.4
Average	128	39.5	16.34	3.80	0.00	66.6

Carbon Monoxide First 30 mins	6.32
Carbon Monoxide Second 30 mins	1.36

Coventry Cremators 1 & 2 & Abatement System

Total Particulate Matter and Hydrogen Chloride

Contract Coventry Crematorium DEM1320
Date 30th & 31st July 2019
Location Cremators 1&2 Abatement System Outlet (Flue To Stack)
Engineer(s) JB
Absorbent H₂O

Test Log	Test H1		Test H2		Test H3	
Barometric Pressure(kPa)	99.9		99.9		99.9	
Gas Meter Temperature(Deg C)	54.2		55.0		39.5	
Oxygen Concentration(%v/v dry)	16.65		16.89		16.34	
Flue Gas Volumetric Flow(Nm ³ /h dry)	2995		2533		2732	
	Start	End	Start	End	Start	End
Time	13:44	14:44	14:56	15:56	08:19	09:19
Gas Meter Reading(Am ³ dry)	378.949	379.399	379.475	379.897	382.207	382.605
Absorber Weight(g)	3428.4	3451.2	3440.7	3462.9	3431.5	3450.9
Filter Reference	CO300719F11		CO310719F12		CO310719F13	
Filter Weight(g)	0.54950	0.54983	0.54982	0.55015	0.53436	0.53465
Probe Rinse Reference	CO310719R1		CO310719R1		CO310719R1	
Probe Rinse Weight(g)	80.12902	80.12926	80.12926	80.12951	80.12951	80.12972
Sample Reference HCl	CO300719 H11		CO300719 H12		CO310719 H13A+B	
Absorbent Volume(ml)	500		500		250	250
Absorbent(mg/l as HCl)	15		15		19	0.36
Blank(mg/l as HCl)	0.11		0.11		0.11	0.11

Calculation: General

Barometric Pressure(kPa)	99.9	99.9	99.9
Gas Meter temperature(Deg C)	54.2	55.0	39.5
Gas Volume Sampled(Am ³ dry)	0.450	0.422	0.398
Gas Volume Sampled(Nm ³ dry)	0.3703	0.3464	0.3429
Mass of Dry Gas(g @ 1292.8 g/Nm ³)	478.66	447.78	443.25
Change in Absorber Weight(g)	22.8	22.2	19.4
Water Vapour Volume(Nm ³ @ 803.9 g/Nm ³)	0.0284	0.0276	0.0241
Gas Volume(Nm ³ wet)	0.3986	0.3740	0.3670
Mass of Wet Gas(g)	501.46	469.98	462.65
Moisture Concentration(%v/v)	7.1	7.4	6.6
Moisture Concentration(%w/w)	4.5	4.7	4.2

Calculation: Particulate

Increase In Filter Weights(g)	0.00057	0.00057	0.00050
Particulate Emission(mg/Nm ³ dry)	1.55	1.65	1.47
Oxygen Concentration(%v/v dry)	16.65	16.89	16.34
Particulate Emission	3.58	4.06	3.17
(mg/Nm ³ @ 11 %v/v Oxygen dry)			
Flue Gas Volumetric Flow(Nm ³ /h dry)	2995	2533	2732
Particulate Emission(g/h)	4.64	4.19	4.01
Required Sample Velocity(Nm/s)	8.65	7.31	7.89
Nozzle Used(mm)	4.0	4.0	4.0
Area of Nozzle(m ²)	0.00001257	0.00001257	0.00001257
Test Duration(mins)	60	60	60
Actual Sample Velocity(Nm/s)	8.18	7.66	7.58
Isokinetic Closure(%)	95	105	96
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)	15	15	19	0.36
Blank(mg/l as HCl)	0.11	0.11	0.11	0.11
Chloride Absorbed(mg/l as HCl)	14.89	14.89	18.89	0.25
Chloride Absorbed(mg as HCl)	7.45	7.45	4.72	0.06
HCl(mg)	7.45	7.45	4.79	
HCl Emission(mg/Nm ³ dry)	20.11	21.49	13.96	
Oxygen Concentration(%v/v dry)	16.65	16.89	16.34	
HCl Emission	46.49	52.74	30.11	
(mg/Nm ³ @ 11 %v/v Oxygen dry)				
Flue Gas Volumetric Flow(Nm ³ /h dry)	2995	2533	2732	
HCl Emission(g/h)	60.22	54.45	38.13	

Coventry Cremators 1 & 2 & Abatement System

Flue Gas Volumetric Flow

Contract Coventry Crematorium DEM1320
 Date 30th & 31st July 2019
 Location Cremators 1&2 Abatement System Outlet (Flue To Stack)
 Engineer(s) JB

Test Log	Test H1	Test H2	Test H3
Flue Gas Temperature(Deg C)	142	136	128
Flue Gas Pitot Head Sample Points(Pa)	83.6	59.3	66.6
Flue Gas Moisture(%v/v)	7.1	7.4	6.6
Flue Gas Moisture(%w/w)	4.5	4.7	4.2
Flue Gas Duct Dimensions(mm)	350 mm Diameter Circular Stack		
Flue Gas Duct Area(m ²)	0.0962		

Calculation

Flue Gas Density(kg/m ³)	0.8368	0.8473	0.8667
Flue Gas Velocity(Am/s)	14.14	11.83	12.39
Flue Gas Volumetric Flowrate(Am ³ /h)	4896	4099	4293
Flue Gas Volumetric Flowrate(Am ³ /h dry)	4548	3796	4010
Flue Gas Volumetric Flowrate(Nm³/h dry)	2995	2533	2732



Coventry Sream 1 - Cremators 1 & 2 & Abatement System Outlet

Data Log

30/07/19

Hg Test

Time	Flue Gas °C	Meter °C	Flue O ₂ %v/v dry	Pitot Head Pa
10:02	139	25.7	13.68	53.1
10:03	139	26.0	13.39	51.8
10:04	138	26.1	13.42	51.4
10:05	138	26.3	14.03	59.9
10:06	138	26.4	14.44	63.9
10:07	137	26.6	14.32	66.0
10:08	138	26.8	13.59	73.5
10:09	139	27.0	12.06	104.2
10:10	139	27.4	14.36	104.4
10:11	140	27.8	15.26	121.7
10:12	140	19.5	15.08	138.3
10:13	141	19.4	12.98	167.3
10:14	143	28.9	13.47	216.8
10:15	144	29.2	14.20	196.1
10:16	143	29.6	14.92	156.9
10:17	144	30.1	15.21	173.9
10:18	144	30.5	12.45	160.1
10:19	144	31.0	13.60	184.9
10:20	145	31.4	13.48	162.3
10:21	144	31.8	13.94	141.7
10:22	144	32.3	13.52	134.6
10:23	144	32.7	13.41	128.1
10:24	144	33.1	13.41	117.7
10:25	143	33.5	13.28	108.0
10:26	143	34.0	13.22	89.9
10:27	142	34.4	12.98	76.0
10:28	142	34.8	12.47	89.0
10:29	143	35.3	12.23	135.1
10:30	145	35.7	12.63	184.7
10:31	147	36.0	13.30	202.1
10:32	146	36.4	14.60	184.8
10:33	147	36.8	16.02	192.9
10:34	147	37.2	15.55	165.8
10:35	148	37.5	15.49	216.3
10:36	149	37.9	14.19	201.1
10:37	149	38.3	12.54	165.4
10:38	147	38.6	12.77	119.3
10:39	146	39.0	12.99	85.2
10:40	145	39.3	12.55	69.0
10:41	144	39.7	11.98	69.8
10:42	144	40.0	11.10	74.2
10:43	144	40.4	10.37	107.5
10:44	145	39.9	10.32	144.8
10:45	148	39.7	11.31	206.3
10:46	150	40.0	12.39	231.3
10:47	151	40.4	13.46	215.5
10:48	150	40.8	14.65	175.2
10:49	149	41.3	14.10	137.5
10:50	149	41.7	13.54	121.6
10:51	148	42.1	13.02	106.3
10:52	147	42.5	12.42	95.2
10:53	146	42.9	12.05	93.6
10:54	146	43.2	11.52	98.4
10:55	146	43.6	10.31	117.2
10:56	148	44.0	10.33	145.4
10:57	149	44.3	10.48	180.2
10:58	150	44.5	11.59	179.9
10:59	150	44.8	12.87	137.9
11:00	149	44.9	12.33	115.2
11:01	148	45.0	11.53	96.2
11:02	148	45.2	11.13	95.0
11:03	147	45.3	11.12	91.9
11:04	147	45.5	11.15	101.5
11:05	148	45.6	11.11	144.6
11:06	149	45.9	11.94	160.0



11:07	150	46.0	11.54	187.0
11:08	151	46.1	11.83	169.2
11:09	151	46.2	12.60	138.2
11:10	150	46.3	12.80	127.0
11:11	150	46.4	13.24	122.5
11:12	149	46.5	13.52	126.8
11:13	149	46.6	13.57	123.9
11:14	149	46.6	12.54	116.5
11:15	148	46.7	11.60	112.2
11:16	148	46.8	11.64	110.6
11:17	148	46.8	11.69	99.1
11:18	148	46.9	12.19	123.4
11:19	149	47.0	12.94	170.4
11:20	149	47.1	13.45	168.7
11:21	149	47.2	13.78	160.3
11:22	149	47.3	13.75	147.8
11:23	148	47.4	13.84	130.7
11:24	148	47.4	14.02	127.8
11:25	147	47.4	14.43	123.6
11:26	147	47.4	14.70	108.0
11:27	146	47.5	14.74	96.0
11:28	145	47.7	14.64	81.4
11:29	144	47.7	14.10	68.0
11:30	143	47.8	13.72	61.3
11:31	143	47.9	13.64	58.3
11:32	142	47.9	13.67	49.7
11:33	142	48.0	13.80	53.6
11:34	142	48.0	13.93	87.1
11:35	143	48.1	14.32	103.2
11:36	142	48.1	16.28	72.8
11:37	141	48.1	14.46	58.4
11:38	140	48.2	13.86	59.6
11:39	140	48.4	14.03	60.0
11:40	140	48.4	14.27	52.8
11:41	139	48.5	15.41	37.2
11:42	139	48.6	14.68	38.4
11:43	138	48.6	15.70	39.9
11:44	138	48.6	13.95	46.8
11:45	138	48.7	14.13	47.7
11:46	137	48.7	14.44	40.3
11:47	137	48.8	16.28	51.3
11:48	136	48.9	16.80	51.3
11:49	137	48.9	15.69	81.3
11:50	138	49.2	12.92	82.5
11:51	139	49.3	12.84	80.1
11:52	138	49.4	13.66	54.6
11:53	138	49.5	13.07	49.5
11:54	137	49.5	13.12	48.8
11:55	137	49.6	13.50	50.7
11:56	136	49.7	13.71	58.9
11:57	137	49.8	13.77	68.0
11:58	138	49.9	13.22	119.2
11:59	141	50.0	14.40	153.1
12:00	143	50.1	15.37	135.7
12:01	142	50.2	15.12	116.1
12:02	143	50.2	14.70	140.6
12:03	144	50.3	15.08	157.4
12:04	145	19.3	15.17	174.9
12:05	146	19.2	15.12	191.4
12:06	147	50.5	15.09	206.7
12:07	147	50.5	16.13	175.7
12:08	146	50.5	15.22	145.1
12:09	147	50.5	15.17	173.2
12:10	148	50.6	14.14	199.5
12:11	149	50.6	13.75	203.6
12:12	150	50.6	13.78	213.6
12:13	151	50.6	13.70	206.7
12:14	151	50.6	15.18	182.7
12:15	151	50.6	14.06	167.2
12:16	150	50.6	13.71	157.3
12:17	150	50.6	13.72	145.1
12:18	150	50.6	13.61	132.9
12:19	149	50.6	13.62	125.1
12:20	149	50.6	13.42	114.6



12:21	150	50.7	14.89	160.5
12:22	151	50.7	14.25	177.6
12:23	151	50.7	14.23	185.2
12:24	153	50.8	15.14	214.6
12:25	152	50.8	16.39	177.0
12:26	151	50.8	16.73	144.5
12:27	150	50.8	14.77	118.7
12:28	151	50.8	14.83	193.7
12:29	153	50.9	14.10	223.0
12:30	154	50.8	14.33	221.3
12:31	155	51.0	15.21	220.3
12:32	155	51.0	15.55	222.2
12:33	155	51.1	14.85	195.5
12:34	155	51.2	15.40	204.8
12:35	156	51.3	14.98	212.1
12:36	156	51.4	15.68	206.6
12:37	156	51.5	14.30	181.5
12:38	155	51.7	12.02	136.8
12:39	153	51.8	13.02	104.2
12:40	152	51.8	13.15	86.0
12:41	151	51.9	12.98	76.3
12:42	150	52.0	12.80	75.3
12:43	150	52.2	12.50	83.9
12:44	149	52.4	12.22	82.5
12:45	149	52.5	11.06	95.7
12:46	149	52.6	11.58	129.7
12:47	150	52.7	12.14	161.0
12:48	151	52.7	12.70	177.9
12:49	152	52.7	13.50	172.8
12:50	152	52.8	14.13	159.8
12:51	151	52.9	14.15	146.0
12:52	150	53.0	13.99	123.0
12:53	150	53.0	13.31	113.1
12:54	149	53.1	12.19	85.3
12:55	148	53.2	12.71	98.0
12:56	148	53.3	12.09	97.1
12:57	147	53.3	13.33	69.6
12:58	146	53.5	12.60	48.3
12:59	145	53.5	11.74	42.7
13:00	144	53.5	11.69	32.4
13:01	143	53.6	11.21	29.7
13:02	142	53.7	11.26	36.5
13:03	142	53.8	12.29	27.4
13:04	141	54.0	11.70	26.3
13:05	141	54.0	11.89	30.9
13:06	141	54.1	12.25	37.2
13:07	141	54.1	13.08	44.6
13:08	140	54.1	13.89	49.5
13:09	140	54.0	14.51	49.3
13:10	139	53.9	14.56	49.5
13:11	139	53.9	14.91	48.1
13:12	139	53.8	15.38	75.4
13:13	141	53.8	14.38	116.5
13:14	143	53.9	15.56	129.2
13:15	144	54.0	16.05	126.2
13:16	144	54.0	16.29	125.0
13:17	144	54.0	15.79	115.9
13:18	143	54.0	16.22	112.3
13:19	143	54.0	15.22	102.0
13:20	143	54.1	15.04	100.9
13:21	143	54.2	15.16	98.3
13:22	143	54.2	15.31	98.2
13:23	143	54.2	15.42	99.1
13:24	143	54.3	15.53	97.4
13:25	143	54.4	15.63	99.2
13:26	143	54.5	15.67	95.5
13:27	143	54.5	15.72	95.2
13:28	143	54.6	15.76	96.4
13:29	143	54.5	15.89	105.1
13:30	143	54.7	16.05	105.7
13:31	143	54.7	16.09	104.0
13:32	143	54.5	16.13	105.3
Average	145	45.9	13.72	119.3

Coventry Sream 1 - Cremators 1 & 2 & Abatement System Outlet

Mercury

Contract Coventry Crematorium, DEM1320
Date 30th July 2019
Location Cremators 1 & 2 Flue Gas Abatement System Outlet
Engineer(s) JB
Absorbent 4% K₂CR₂O₇ / 20% HNO₃ in H₂O

Test Log	Hg Test	
Barometric Pressure(kPa)	101.3	
Gas Meter Temperature(Deg C)	45.9	
Oxygen Concentration(%v/v dry)	13.72	
Flue Gas Volumetric Flow(Nm ³ /h dry)	3505	
	Start	End
Time	10:02	13:32
Gas Meter Reading(Am ³ dry)	377.471	378.905
Absorber Weight(g)	3512.7	3607.4
Filter Reference	CO300719 HgF1	
Filter Fraction Analysed	1	
Filter(µg as Hg)	0.39	
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	CO300719 Hg1 A+B	
Absorbent Volume(ml)	250	250
Absorbent(µg/l as Hg)	610	4.3
Absorbent Blank(µg/l as Hg)	4.3	4.3

Calculation: General

Barometric Pressure(kPa)	101.3
Gas Meter Temperature(Deg C)	45.9
Gas Volume Sampled(Am ³ dry)	1.434
Gas Volume Sampled(Nm ³ dry)	1.2274
Mass of Dry Gas(g @ 1292.8 g/Nm ³)	1586.83
Change in Absorber Weight(g)	94.7
Water Vapour Volume(Nm ³ @ 803.9 g/Nm ³)	0.1177
Gas Volume(Nm ³ wet)	1.3452
Mass of Wet Gas(g)	1681.48
Moisture Concentration(%v/v)	8.8
Moisture Concentration(%w/w)	5.6



Calculation: Mercury

Filter(μg as Hg)	0.39
Probe Rinse(μg as Hg)	0.00
Absorbent(μg as Hg)	152.50
Total Mercury Sampled(μg)	152.89
Mercury Emission($\mu\text{g}/\text{Nm}^3$ dry)	124.56
Oxygen Concentration(%v/v dry)	13.72
Mercury Emission	171.49
($\mu\text{g}/\text{Nm}^3$ @ 11 %v/v Oxygen dry)	
Flue Gas Volumetric Flowrate(Nm^3/h dry)	3505
Mercury Emission(g/h)	0.437
Required Sample Velocity(Nm/s)	10.12
Nozzle Used(mm)	3.5
Area of Nozzle(m^2)	0.00000962
Test Duration(mins)	210
Actual Sample Velocity(Nm/s)	10.13
Isokinetic Closure(%)	100

Coventry Sream 1 - Cremators 1 & 2 & Abatement System Outlet

Flue Gas Volumetric Flow

Contract Coventry Crematorium, DEM1320
 Date 30th July 2019
 Location Cremators 1 & 2 Flue Gas Abatement System Outlet
 Engineer(s) JB

Test Log	Hg Test
Flue Gas Temperature(Deg C)	145
Flue Gas Pitot Head Sample Points(Pa)	119.3
Flue Gas Moisture(%v/v)	8.8
Flue Gas Moisture(%w/w)	5.6
Flue Gas Duct Dimensions(mm)	350 mm Diameter Circular Flue
Flue Gas Duct Area(m ²)	0.0962

Calculation

Flue Gas Density(kg/m ³)	0.8254
Flue Gas Velocity(Am/s)	17.00
Flue Gas Volumetric Flowrate(Am ³ /h)	5889
Flue Gas Volumetric Flowrate(Am ³ /h dry)	5373
Flue Gas Volumetric Flowrate(Nm³/h dry)	3505

Coventry Cremators 3 & 4 & Abatement System

Data Log

31 July 2019

Test H1

Time	Flue Gas °C	Meter °C	Flue O ₂ %v/v dry	CO mg/Nm ³ c.	VOC mg/Nm ³ c.	Sample Point Pa
10:13	91	53.2	16.79	6.27	0.00	165.1
10:14	92	53.3	16.32	2.43	0.00	192.2
10:15	92	53.3	16.58	2.03	0.00	195.9
10:16	93	53.4	16.44	0.00	0.00	188.5
10:17	94	53.5	16.44	0.00	0.00	213.7
10:18	94	53.6	16.34	0.00	0.00	198.3
10:19	94	53.7	16.33	0.00	0.00	176.6
10:20	95	53.9	16.33	0.58	0.00	196.2
10:21	95	54.0	16.52	0.00	0.00	157.4
10:22	95	54.1	16.21	0.00	0.00	168.7
10:23	95	54.1	16.24	0.00	0.00	207.6
10:24	97	54.2	16.32	0.58	0.00	255.2
10:25	97	54.3	16.40	0.59	0.00	239.4
10:26	98	54.4	16.43	0.59	0.00	252.9
10:27	99	54.5	16.44	0.60	0.00	275.4
10:28	100	54.6	16.40	0.00	0.00	262.6
10:29	100	54.7	16.42	0.00	0.00	265.4
10:30	101	54.7	16.45	0.00	0.00	254.4
10:31	101	54.8	16.37	0.00	0.00	263.6
10:32	103	54.9	16.35	0.58	0.00	286.9
10:33	103	55.0	16.51	0.61	0.00	271.5
10:34	104	55.1	16.46	0.00	0.00	275.4
10:35	104	55.0	16.48	0.60	0.00	271.5
10:36	104	55.1	16.34	0.00	0.00	261.8
10:37	104	55.2	16.33	0.00	0.00	265.7
10:38	104	55.2	16.45	0.00	0.00	258.1
10:39	104	55.2	16.43	0.00	0.00	229.3
10:40	104	55.3	16.39	0.00	0.00	227.5
10:41	104	55.4	16.05	0.00	0.00	225.9
10:42	104	55.5	16.26	0.00	0.00	243.8
10:43	104	55.5	16.39	0.00	0.00	223.3
10:44	104	55.6	16.35	0.00	0.00	209.8
10:45	104	55.7	16.18	0.00	0.00	198.7
10:46	104	55.7	16.23	0.00	0.00	196.1
10:47	103	55.8	16.24	0.00	0.00	179.8
10:48	103	55.9	16.14	0.00	0.00	169.7
10:49	103	55.9	16.18	0.00	0.00	169.7
10:50	103	55.9	16.15	0.00	0.00	170.5
10:51	102	56.0	16.22	0.00	0.00	167.9
10:52	102	56.0	16.18	0.00	0.00	157.7
10:53	102	56.1	16.16	0.00	0.00	152.4
10:54	101	56.1	16.17	0.00	0.00	139.7
10:55	101	56.1	16.10	0.00	0.00	147.7
10:56	102	56.1	15.54	0.00	0.00	202.2
10:57	102	56.2	16.12	0.00	0.00	193.1
10:58	102	56.3	16.63	0.00	0.00	166.7
10:59	101	56.3	16.46	0.00	0.00	163.4
11:00	101	56.3	16.46	0.00	0.00	174.8
11:01	102	56.3	16.28	0.00	0.00	205.8
11:02	102	56.4	16.11	0.00	0.00	182.4
11:03	101	56.3	16.29	0.00	0.00	142.3
11:04	101	56.2	16.33	0.00	0.00	138.6
11:05	101	56.3	16.37	0.00	0.00	131.3
11:06	101	56.2	16.26	0.00	0.00	158.3
11:07	101	56.4	16.15	0.00	0.00	188.2
11:08	101	56.4	16.26	0.00	0.00	182.1
11:09	101	56.3	16.24	0.00	0.00	180.9
11:10	101	56.4	16.29	0.00	0.00	147.6
11:11	101	56.5	16.67	0.00	0.00	146.8
11:12	101	56.5	16.77	0.00	0.00	165.9
11:13	101	56.4	16.54	0.00	0.00	193.5
Average	100	55.3	16.33	0.25	0.00	201.5

Carbon Monoxide First 30 mins	0.52
Carbon Monoxide Second 30 mins	0.00

Coventry Cremators 3 & 4 & Abatement System

Data Log

31 July 2019

Test H2

Time	Flue Gas °C	Meter °C	Flue O ₂ %v/v dry	CO mg/Nm ³ c.	VOC mg/Nm ³ c.	Sample Point Pa
15:00	107	55.7	16.97	0.00	0.00	247.1
15:01	106	55.6	16.80	0.00	0.00	194.2
15:02	105	55.5	16.01	0.00	0.00	182.1
15:03	104	55.4	15.91	0.00	0.00	194.4
15:04	106	55.4	16.20	0.00	0.00	295.2
15:05	108	55.3	16.39	0.00	0.00	321.8
15:06	108	55.2	16.28	0.00	0.00	275.9
15:07	109	55.1	16.59	0.00	0.00	304.9
15:08	110	55.0	17.60	6.95	0.00	326.3
15:09	108	55.0	17.46	10.81	0.00	233.5
15:10	106	54.9	17.04	2.06	0.00	141.8
15:11	105	54.8	16.79	0.00	0.00	110.9
15:12	103	54.7	16.83	0.00	0.00	89.7
15:13	103	54.7	16.93	0.00	0.00	90.7
15:14	102	54.7	16.92	0.00	0.00	84.1
15:15	102	54.7	16.69	0.00	0.00	72.4
15:16	101	54.7	16.62	0.00	0.00	61.3
15:17	101	54.6	16.58	0.00	0.00	61.7
15:18	100	54.5	16.62	0.00	0.00	60.3
15:19	100	54.5	16.64	0.00	0.00	64.7
15:20	100	54.5	16.67	0.00	0.00	62.4
15:21	100	54.5	16.72	0.00	0.00	62.7
15:22	99	54.5	16.80	0.00	0.00	75.3
15:23	99	54.5	16.48	0.00	0.00	89.8
15:24	99	54.4	16.50	0.00	0.00	85.8
15:25	99	54.4	16.61	0.00	0.00	88.2
15:26	99	54.4	16.50	0.00	0.00	105.8
15:27	99	54.4	16.28	0.00	0.00	104.3
15:28	99	54.3	16.45	0.00	0.00	100.6
15:29	99	54.4	16.54	0.00	0.00	82.6
15:30	98	54.4	16.58	0.00	0.00	74.0
15:31	98	54.4	16.48	0.00	0.00	68.9
15:32	98	54.4	16.68	0.00	0.00	58.7
15:33	98	54.4	16.68	0.00	0.00	57.3
15:34	97	54.3	16.82	0.00	0.00	53.6
15:35	97	54.3	17.03	0.00	0.00	53.3
15:36	97	54.3	17.19	0.00	0.00	66.3
15:37	99	54.3	18.04	0.00	0.00	243.2
15:38	99	54.3	18.76	0.00	0.00	134.3
15:39	97	54.4	18.43	0.00	0.00	60.4
15:40	97	54.4	18.07	0.00	0.00	50.8
15:41	96	54.4	18.15	0.00	0.00	50.5
15:42	96	54.4	18.24	0.00	0.00	49.7
15:43	96	54.4	18.41	0.00	0.00	62.7
15:44	96	54.4	16.99	0.00	0.00	84.0
15:45	96	54.4	16.68	0.00	0.00	84.4
15:46	96	54.4	16.82	0.00	0.00	95.6
15:47	96	54.5	17.05	0.00	0.00	96.3
15:48	96	54.5	17.12	0.00	0.00	96.3
15:49	96	54.6	17.21	0.00	0.00	97.7
15:50	96	54.5	17.24	0.00	0.00	94.9
15:51	96	54.5	17.22	0.00	0.00	96.8
15:52	96	54.6	17.28	0.00	0.00	97.2
15:53	96	54.6	17.29	0.00	0.00	94.4
15:54	96	54.6	17.31	0.00	0.00	84.2
15:55	96	54.7	17.15	0.00	0.00	81.6
15:56	96	54.8	17.14	0.00	0.00	80.1
15:57	95	54.8	17.81	0.00	0.00	56.1
15:58	95	54.8	18.49	0.00	0.00	66.8
15:59	95	54.8	17.10	0.00	0.00	73.4
16:00	95	54.8	17.15	0.00	0.00	71.4
Average	100	54.7	17.02	0.32	0.00	111.6

Carbon Monoxide First 30 mins	0.66
Carbon Monoxide Second 30 mins	0.00

Coventry Cremators 3 & 4 & Abatement System

Data Log 01 August 2019

Test H3

Time	Flue Gas °C	Meter °C	Flue O ₂ %v/v dry	CO mg/Nm ³ c.	VOC mg/Nm ³ c.	Sample Point Pa
07:56	91	38.2	15.81	12.70	0.00	187.9
07:57	92	38.2	15.32	6.70	0.00	223.8
07:58	94	38.2	15.47	1.80	0.00	237.2
07:59	95	38.2	15.70	0.49	0.00	226.3
08:00	96	38.3	15.58	0.00	0.00	220.9
08:01	96	38.4	15.28	0.84	0.00	183.0
08:02	97	38.6	15.03	5.56	0.00	213.9
08:03	98	38.7	15.40	7.37	0.00	208.0
08:04	98	38.9	15.22	5.94	0.00	195.6
08:05	99	39.1	15.42	9.70	0.00	215.5
08:06	100	39.3	15.46	7.96	0.00	206.9
08:07	100	39.5	15.27	4.64	0.00	184.9
08:08	100	39.8	15.42	2.84	0.00	182.9
08:09	100	39.9	15.23	4.80	0.00	175.8
08:10	101	40.2	15.36	5.64	0.00	168.2
08:11	100	40.4	15.21	4.42	0.00	145.0
08:12	101	40.7	15.10	2.93	0.00	159.3
08:13	101	40.9	15.38	2.07	0.00	152.0
08:14	101	41.2	15.21	1.06	0.00	123.5
08:15	100	41.5	14.85	0.60	0.00	105.9
08:16	100	41.8	14.59	0.42	0.00	94.2
08:17	100	42.0	14.34	0.41	0.00	115.7
08:18	101	42.3	14.56	0.78	0.00	197.7
08:19	101	42.6	16.12	0.91	0.00	155.4
08:20	102	42.8	15.62	0.50	0.00	186.0
08:21	102	43.0	15.17	0.71	0.00	204.1
08:22	102	43.2	15.84	0.74	0.00	165.1
08:23	102	43.5	15.88	0.53	0.00	151.2
08:24	103	43.7	15.19	0.47	0.00	213.9
08:25	104	44.0	15.50	0.49	0.00	230.9
08:26	104	44.2	15.91	0.87	0.00	240.7
08:27	106	44.4	16.45	0.66	0.00	271.5
08:28	107	44.6	15.53	3.75	0.00	293.3
08:29	108	44.9	15.71	5.56	0.00	263.5
08:30	107	45.0	15.98	7.47	0.00	229.8
08:31	106	45.2	15.47	3.50	0.00	234.4
08:32	105	45.4	15.62	3.02	0.00	217.9
08:33	105	45.6	15.22	2.15	0.00	215.8
08:34	105	45.8	15.42	1.37	0.00	198.9
08:35	106	46.0	15.06	0.81	0.00	217.3
08:36	106	46.2	15.51	1.32	0.00	201.8
08:37	107	46.3	15.79	1.45	0.00	234.5
08:38	106	46.5	15.96	2.41	0.00	214.7
08:39	105	46.7	15.89	2.01	0.00	223.8
08:40	105	46.9	15.82	1.34	0.00	207.1
08:41	105	47.1	15.76	1.19	0.00	222.0
08:42	105	47.3	15.71	1.23	0.00	211.0
08:43	105	47.5	15.50	0.99	0.00	197.8
08:44	106	47.8	15.53	0.94	0.00	209.7
08:45	106	48.0	15.45	1.18	0.00	229.8
08:46	106	48.1	15.57	0.50	0.00	225.0
08:47	105	48.3	15.68	0.51	0.00	201.1
08:48	105	48.5	15.29	0.47	0.00	205.2
08:49	106	48.6	15.65	0.83	0.00	256.8
08:50	107	48.8	15.70	0.51	0.00	262.8
08:51	108	49.0	15.79	0.52	0.00	272.5
08:52	108	49.1	15.99	0.52	0.00	295.2
08:53	108	49.3	16.09	0.53	0.00	283.1
08:54	108	49.4	15.93	0.54	0.00	304.8
08:55	107	49.6	16.09	0.53	0.00	284.3
08:56	107	49.7	16.99	0.00	0.00	255.9
Average	103	43.9	15.53	2.34	0.00	210.0

Carbon Monoxide First 30 mins	3.13
Carbon Monoxide Second 30 mins	1.57

Coventry Cremators 3 & 4 & Abatement System

Total Particulate Matter and Hydrogen Chloride

Contract	Coventry Crematorium DEM1320
Date	31st July & 1st August 2019
Location	Cremators 3 & 4 Abatement System Outlet (Flue To Stack)
Engineer(s)	JB
Absorbent	H ₂ O

Test Log	Test H1		Test H2		Test H3	
Barometric Pressure(kPa)	99.9		99.9		99.9	
Gas Meter Temperature(Deg C)	55.3		54.7		43.9	
Oxygen Concentration(%v/v dry)	16.33		17.02		15.53	
Flue Gas Volumetric Flow(Nm ³ /h dry)	4779		3587		4939	
	Start	End	Start	End	Start	End
Time	10:13	11:13	15:00	16:00	07:56	08:56
Gas Meter Reading(Am ³ dry)	380.907	381.647	384.368	384.942	384.973	385.693
Absorber Weight(g)	3428.4	3480.8	3451.0	3488.1	3453.4	3496.8
Filter Reference	CO310719F21		CO310719F22		CO010719F23	
Filter Weight(g)	0.52725	0.52749	0.53347	0.53368	0.53222	0.53247
Probe Rinse Reference	CO010819R2		CO010819R2		CO010819R2	
Probe Rinse Weight(g)	76.49754	76.49780	76.49780	76.49802	76.49802	76.49829
Sample Reference HCl	CO310719 H21		CO310719 H22		CO010819 H23A+B	
Absorbent Volume(ml)	500		500		250	250
Absorbent(mg/l as HCl)	1.9		3.8		3.2	0.13
Blank(mg/l as HCl)	0.11		0.11		0.11	0.11

Calculation: General

Barometric Pressure(kPa)	99.9	99.9	99.9
Gas Meter temperature(Deg C)	55.3	54.7	43.9
Gas Volume Sampled(Am ³ dry)	0.740	0.574	0.720
Gas Volume Sampled(Nm ³ dry)	0.6068	0.4716	0.6117
Mass of Dry Gas(g @ 1292.8 g/Nm ³)	784.53	609.75	790.83
Change in Absorber Weight(g)	52.4	37.1	43.4
Water Vapour Volume(Nm ³ @ 803.9 g/Nm ³)	0.0652	0.0462	0.0540
Gas Volume(Nm ³ wet)	0.6720	0.5178	0.6657
Mass of Wet Gas(g)	836.93	646.85	834.23
Moisture Concentration(%v/v)	9.7	8.9	8.1
Moisture Concentration(%w/w)	6.3	5.7	5.2

Calculation: Particulate

Increase In Filter Weights(g)	0.00050	0.00044	0.00052
Particulate Emission(mg/Nm ³ dry)	0.82	0.92	0.85
Oxygen Concentration(%v/v dry)	16.33	17.02	15.53
Particulate Emission	1.77	2.33	1.56
(mg/Nm ³ @ 11 %v/v Oxygen dry)			
Flue Gas Volumetric Flow(Nm ³ /h dry)	4779	3587	4939
Particulate Emission(g/h)	3.92	3.31	4.18
Required Sample Velocity(Nm/s)	13.80	10.36	14.26
Nozzle Used(mm)	4.0	4.0	4.0
Area of Nozzle(m ²)	0.00001257	0.00001257	0.00001257
Test Duration(mins)	60	60	60
Actual Sample Velocity(Nm/s)	13.41	10.43	13.52
Isokinetic Closure(%)	97	101	95
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)	1.9	3.8	3.2	0.13
Blank(mg/l as HCl)	0.11	0.11	0.11	0.11
Chloride Absorbed(mg/l as HCl)	1.79	3.69	3.09	0.02
Chloride Absorbed(mg as HCl)	0.90	1.85	0.77	0.01
HCl(mg)	0.90	1.85	0.78	
HCl Emission(mg/Nm ³ dry)	1.47	3.91	1.27	
Oxygen Concentration(%v/v dry)	16.33	17.02	15.53	
HCl Emission	3.18	9.90	2.34	
(mg/Nm ³ @ 11 %v/v Oxygen dry)				
Flue Gas Volumetric Flow(Nm ³ /h dry)	4779	3587	4939	
HCl Emission(g/h)	7.05	14.03	6.28	



Coventry Cremators 3 & 4 & Abatement System

Flue Gas Volumetric Flow

Contract Coventry Crematorium DEM1320
Date 31st July & 1st August 2019
Location Cremators 3 & 4 Abatement System Outlet (Flue To Stack)
Engineer(s) JB

Test Log	Test H1	Test H2	Test H3
Flue Gas Temperature(Deg C)	100	100	103
Flue Gas Pitot Head Sample Points(Pa)	201.5	111.6	210.0
Flue Gas Moisture(%v/v)	9.7	8.9	8.1
Flue Gas Moisture(%w/w)	6.3	5.7	5.2
Flue Gas Duct Dimensions(mm)	350 mm Diameter Circular Flue		
Flue Gas Duct Area(m ²)	0.0962		

Calculation

Flue Gas Density(kg/m ³)	0.9228	0.9266	0.9208
Flue Gas Velocity(Am/s)	20.90	15.52	21.36
Flue Gas Volumetric Flowrate(Am ³ /h)	7239	5374	7398
Flue Gas Volumetric Flowrate(Am ³ /h dry)	6536	4895	6798
Flue Gas Volumetric Flowrate(Nm³/h dry)	4779	3587	4939

Coventry Stream 2 - Cremators 3 & 4 & Abatement System Outlet

Data Log

31/07/19

Hg Test

Time	Flue Gas °C	Meter °C	Flue O ₂ %v/v dry	Pitot Head Pa
11:34	106	57.0	15.07	120.0
11:35	105	57.0	15.04	97.5
11:36	105	56.9	14.49	95.1
11:37	105	56.9	14.77	112.7
11:38	105	56.8	14.84	97.3
11:39	104	56.8	15.08	98.4
11:40	106	56.7	15.41	149.1
11:41	106	56.7	15.93	123.4
11:42	105	56.6	15.20	100.3
11:43	105	56.6	14.59	87.1
11:44	105	19.5	14.39	94.8
11:45	105	19.4	14.52	100.0
11:46	105	56.5	14.66	107.5
11:47	105	56.5	15.03	101.4
11:48	106	56.5	15.14	140.2
11:49	107	56.5	15.16	148.8
11:50	109	56.5	15.43	165.7
11:51	109	56.4	13.58	157.0
11:52	110	56.4	13.84	149.7
11:53	109	56.4	14.59	147.0
11:54	109	56.4	14.84	175.0
11:55	108	56.3	14.73	173.3
11:56	109	56.3	14.94	173.3
11:57	109	56.2	14.28	159.8
11:58	110	56.2	13.56	163.7
11:59	110	56.1	13.83	142.0
12:00	110	56.1	13.89	151.0
12:01	109	56.1	14.11	144.6
12:02	108	56.1	14.28	141.2
12:03	107	56.0	14.38	121.0
12:04	107	56.0	14.32	118.3
12:05	107	56.0	14.69	107.1
12:06	106	56.0	14.24	86.3
12:07	106	55.9	14.08	96.8
12:08	106	55.9	14.74	97.7
12:09	105	55.9	14.71	82.3
12:10	104	56.0	14.47	65.4
12:11	103	55.9	14.14	56.5
12:12	103	55.9	14.08	53.6
12:13	102	55.9	14.12	53.9
12:14	102	55.9	14.44	53.8
12:15	102	55.9	14.20	64.7
12:16	103	55.9	13.98	95.3
12:17	103	55.9	15.36	82.8
12:18	104	55.9	14.55	110.4
12:19	104	55.9	14.90	110.9
12:20	105	55.9	15.08	115.0
12:21	105	55.9	15.28	117.1
12:22	105	55.9	15.44	112.4
12:23	105	55.9	15.63	110.3
12:24	105	55.8	15.64	100.3
12:25	104	55.8	15.56	93.5
12:26	104	55.8	15.60	90.7
12:27	104	55.8	14.42	89.2
12:28	104	55.8	15.31	88.1
12:29	104	55.8	16.02	95.9
12:30	104	55.8	15.64	92.0
12:31	105	55.8	14.60	84.6
12:32	105	55.8	15.73	93.9
12:33	105	55.8	16.46	100.5
12:34	104	55.9	15.28	97.0
12:35	104	55.9	14.96	84.5
12:36	104	55.8	15.75	89.7
12:37	104	55.9	16.06	95.5
12:38	105	55.8	16.19	100.7



12:39	105	55.9	16.28	92.5
12:40	105	55.9	16.17	88.1
12:41	105	55.8	16.04	101.5
12:42	105	55.8	15.55	103.9
12:43	104	55.8	15.48	96.4
12:44	104	55.8	15.48	98.4
12:45	105	55.8	15.67	104.5
12:46	105	55.8	15.72	89.8
12:47	104	55.8	16.05	71.5
12:48	104	55.8	15.81	74.7
12:49	104	55.8	15.32	82.1
12:50	103	55.8	15.26	76.6
12:51	104	55.8	15.72	99.9
12:52	105	55.8	16.87	108.8
12:53	104	55.8	16.95	91.4
12:54	104	55.8	15.28	88.4
12:55	104	55.8	14.90	88.4
12:56	105	55.8	14.95	82.0
12:57	104	55.8	15.41	63.4
12:58	103	55.8	15.78	58.8
12:59	103	55.8	15.80	66.3
13:00	103	55.7	15.56	86.2
13:01	103	55.7	15.21	71.4
13:02	103	55.7	15.63	71.0
13:03	103	55.7	15.60	71.0
13:04	102	55.7	15.80	65.9
13:05	102	55.6	15.65	71.6
13:06	102	55.6	15.71	58.0
13:07	102	55.6	15.70	71.4
13:08	102	55.7	15.60	64.2
13:09	102	55.6	15.81	61.1
13:10	102	55.6	15.61	71.3
13:11	101	55.6	15.71	59.7
13:12	101	55.6	15.72	58.9
13:13	101	55.6	15.60	69.9
13:14	101	55.6	15.75	58.4
13:15	101	55.6	15.76	59.2
13:16	100	55.7	15.82	45.6
13:17	100	55.6	15.50	54.7
13:18	100	55.7	16.30	42.4
13:19	99	55.7	14.31	32.9
13:20	99	55.7	14.70	26.9
13:21	100	55.7	15.44	95.9
13:22	101	55.8	14.46	121.3
13:23	103	55.8	14.90	120.2
13:24	103	55.8	15.50	107.4
13:25	102	55.8	15.59	78.7
13:26	102	55.8	15.49	65.6
13:27	102	55.7	15.44	72.3
13:28	103	55.8	14.46	119.5
13:29	105	55.8	14.41	151.3
13:30	105	55.7	15.26	109.3
13:31	104	55.7	14.97	93.2
13:32	104	55.6	14.82	102.8
13:33	104	55.6	14.49	110.5
13:34	104	55.7	14.81	103.6
13:35	104	55.7	14.76	101.0
13:36	104	19.3	14.76	107.6
13:37	105	19.2	14.43	120.1
13:38	106	55.6	14.59	117.7
13:39	106	55.6	14.89	131.0
13:40	107	55.6	15.02	149.6
13:41	106	55.5	14.90	142.2
13:42	105	55.5	14.79	129.1
13:43	107	55.5	16.15	169.1
13:44	109	55.5	14.19	164.8
13:45	110	55.5	13.34	163.8
13:46	111	55.5	14.13	170.7
13:47	110	55.5	14.70	165.5
13:48	110	55.5	14.83	171.5
13:49	109	55.5	14.52	171.0
13:50	109	55.5	13.36	173.1
13:51	110	55.5	13.41	163.7
13:52	110	55.4	13.47	166.0



13:53	111	55.4	14.08	165.1
13:54	111	55.6	14.28	170.1
13:55	110	55.7	14.60	169.4
13:56	110	55.8	14.64	163.8
13:57	110	55.7	14.46	173.6
13:58	110	55.6	14.53	171.1
13:59	111	55.4	14.49	164.5
14:00	111	55.2	13.99	162.8
14:01	111	55.0	14.18	163.7
14:02	110	54.9	14.30	163.9
14:03	109	54.8	14.52	152.2
14:04	108	54.8	14.22	134.2
14:05	108	54.8	14.13	132.0
14:06	108	54.8	14.13	128.7
14:07	109	54.8	14.30	136.1
14:08	109	54.8	14.38	134.5
14:09	108	54.8	14.26	135.9
14:10	107	54.8	14.54	127.8
14:11	106	54.7	14.42	119.7
14:12	106	54.8	14.26	108.3
14:13	106	54.9	14.13	106.6
14:14	107	54.9	13.39	104.3
14:15	107	54.9	14.58	115.3
14:16	107	54.9	13.81	106.8
14:17	106	54.9	14.89	87.0
14:18	105	54.9	13.94	103.0
14:19	104	55.0	15.32	94.3
14:20	104	55.0	15.06	98.1
14:21	105	55.0	14.96	103.5
14:22	105	55.0	15.07	103.9
14:23	106	55.0	15.24	104.7
14:24	106	55.1	15.52	108.2
14:25	106	55.1	15.77	106.7
14:26	105	55.1	15.90	103.1
14:27	105	55.0	15.95	102.8
14:28	104	54.9	16.02	85.6
14:29	104	54.8	15.78	72.0
14:30	103	54.7	15.77	69.8
14:31	103	54.7	15.93	72.0
14:32	103	54.6	15.80	71.9
14:33	103	54.6	15.56	62.8
14:34	103	54.6	15.68	72.3
14:35	104	54.6	15.44	72.3
14:36	103	54.6	15.93	63.3
14:37	103	54.6	16.01	61.4
14:38	102	54.7	16.15	60.1
14:39	103	54.7	15.90	72.0
14:40	103	54.7	14.40	71.6
14:41	103	54.7	15.86	59.3
14:42	103	54.7	15.59	71.9
Average	105	54.9	15.02	105.4

Coventry Stream 2 - Cremators 3 & 4 & Abatement System Outlet

Mercury

Contract Coventry Crematorium, DEM1320
 Date 31st July 2019
 Location Cremators 3 & 4 Flue Gas Abatement System Outlet
 Engineer(s) JB
 Absorbent 4% K₂CR₂O₇ / 20% HNO₃ in H₂O

Test Log	Hg Test	
Barometric Pressure(kPa)	101.3	
Gas Meter Temperature(Deg C)	54.9	
Oxygen Concentration(%v/v dry)	15.02	
Flue Gas Volumetric Flow(Nm ³ /h dry)	3490	
	Start	End
Time	11:34	14:42
Gas Meter Reading(Am ³ dry)	381.832	383.224
Absorber Weight(g)	3487.4	3568.9
Filter Reference	CO310719 HgF2	
Filter Fraction Analysed	1	
Filter(µg as Hg)	0.09	
Filter Blank(µg as Hg)	0.04	
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	CO310719 Hg2 A+B	
Absorbent Volume(ml)	250	250
Absorbent(µg/l as Hg)	58	2.8
Absorbent Blank(µg/l as Hg)	4.3	4.3

Calculation: General

Barometric Pressure(kPa)	101.3
Gas Meter Temperature(Deg C)	54.9
Gas Volume Sampled(Am ³ dry)	1.392
Gas Volume Sampled(Nm ³ dry)	1.1590
Mass of Dry Gas(g @ 1292.8 g/Nm ³)	1498.40
Change in Absorber Weight(g)	81.5
Water Vapour Volume(Nm ³ @ 803.9 g/Nm ³)	0.1014
Gas Volume(Nm ³ wet)	1.2604
Mass of Wet Gas(g)	1579.90
Moisture Concentration(%v/v)	8.0
Moisture Concentration(%w/w)	5.2



Calculation: Mercury

Filter(μg as Hg)	0.05
Probe Rinse(μg as Hg)	0.00
Absorbent(μg as Hg)	14.13
Total Mercury Sampled(μg)	14.18
Mercury Emission($\mu\text{g}/\text{Nm}^3$ dry)	12.23
Oxygen Concentration(%v/v dry)	15.02
Mercury Emission	20.53
($\mu\text{g}/\text{Nm}^3$ @ 11 %v/v Oxygen dry)	
Flue Gas Volumetric Flowrate(Nm^3/h dry)	3490
Mercury Emission(g/h)	0.043
Required Sample Velocity(Nm/s)	10.07
Nozzle Used(mm)	3.5
Area of Nozzle(m^2)	0.00000962
Test Duration(mins)	188
Actual Sample Velocity(Nm/s)	10.68
Isokinetic Closure(%)	106

Coventry Stream 2 - Cremators 3 & 4 & Abatement System Outlet

Flue Gas Volumetric Flow

Contract Coventry Crematorium, DEM1320
 Date 31st July 2019
 Location Cremators 3 & 4 Flue Gas Abatement System Outlet
 Engineer(s) JB

Test Log

Hg Test

Flue Gas Temperature(Deg C)	105
Flue Gas Pitot Head Sample Points(Pa)	105.4
Flue Gas Moisture(%v/v)	8.0
Flue Gas Moisture(%w/w)	5.2
Flue Gas Duct Dimensions(mm)	350 mm Diameter Circular Flue
Flue Gas Duct Area(m ²)	0.0962

Calculation

Flue Gas Density(kg/m ³)	0.9151
Flue Gas Velocity(Am/s)	15.18
Flue Gas Volumetric Flowrate(Am ³ /h)	5257
Flue Gas Volumetric Flowrate(Am ³ /h dry)	4834

Coventry Cremators 1 & 2 & Abatement System

Emissions Monitoring July 2019

Test Instrumentation Calibration Data

	Siemens Ultramat 23		Signal 3030PM
	CO	O ₂	VOC
Date of Check	30/07/2019	30/07/2019	30/07/2019
Time of Check	09:30	09:30	13:00
Test Reference	Hg,H1,H2	Hg,H1,H2	H1&H2
Zero reading at analyser	0 mg/m ³	20.95%	0.0 ppm
Span reading at analyser	498 mg/m ³	0.01%	50.5 ppm
Zero check down line	0 mg/m ³	20.95%	0.0 ppm
Span check down line	496 mg/m ³	0.03%	50.5 ppm
Zero reading post test at analyser	0 mg/m ³	20.95%	0.1 ppm
Date of Check	30/07/2019	30/07/2019	30/07/2019
Time of Check	16:15	16:15	16:30
Test Reference	Hg,H1,H2	Hg,H1,H2	H1&H2
Zero reading at analyser	0 mg/m ³	21.10%	-0.1 ppm
Span reading at analyser	496 mg/m ³	0.01%	50.3 ppm
Zero check down line	0 mg/m ³	21.10%	-0.1 ppm
Span check down line	494 mg/m ³	0.01%	50.3 ppm
Zero in air post test at analyser	0 mg/m ³	21.10%	-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 ³	2
Propane in synthetic air Oxygen	DRM	AGG2010-2-2 -	50.3 ppm -	2 -

Coventry Cremators 1 & 2 & Abatement System

Emissions Monitoring July 2019

Test Instrumentation Calibration Data

	Siemens Ultramat 23		Signal 3030PM
	CO	O ₂	VOC
Date of Check	31/07/2019	31/07/2019	31/07/2019
Time of Check	07:45	07:45	08:00
Test Reference	Stream 1 - H1 Stream 2- H1,Hg,H2	Stream 1 - H1 Stream 2- H1,Hg,H2	Stream 1 - H1 Stream 2- H1,H2
Zero reading at analyser	0 mg/m ³	20.95%	0.0 ppm
Span reading at analyser	498 mg/m ³	0.01%	50.5 ppm
Zero check down line	0 mg/m ³	20.95%	0.0 ppm
Span check down line	496 mg/m ³	0.03%	50.5 ppm
Zero reading post test at analyser	0 mg/m ³	20.95%	0.1 ppm
Date of Check	31/07/2019	31/07/2019	31/07/2019
Time of Check	16:30	16:30	16:40
Test Reference	Stream 1 - H1 Stream 2- H1,Hg,H2	Stream 1 - H1 Stream 2- H1,Hg,H2	Stream 1 - H1 Stream 2- H1,H2
Zero reading at analyser	0 mg/m ³	21.00%	-0.1 ppm
Span reading at analyser	496 mg/m ³	0.01%	50.3 ppm
Zero check down line	0 mg/m ³	21.00%	-0.1 ppm
Span check down line	494 mg/m ³	0.01%	50.3 ppm
Zero in air post test at analyser	0 mg/m ³	21.00%	-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 ³	2
Propane in synthetic air	DRM	AGG2010-2-2	50.3 ppm	2
Oxygen		-	-	-

Coventry Cremators 1 & 2 & Abatement System

Emissions Monitoring July 2019

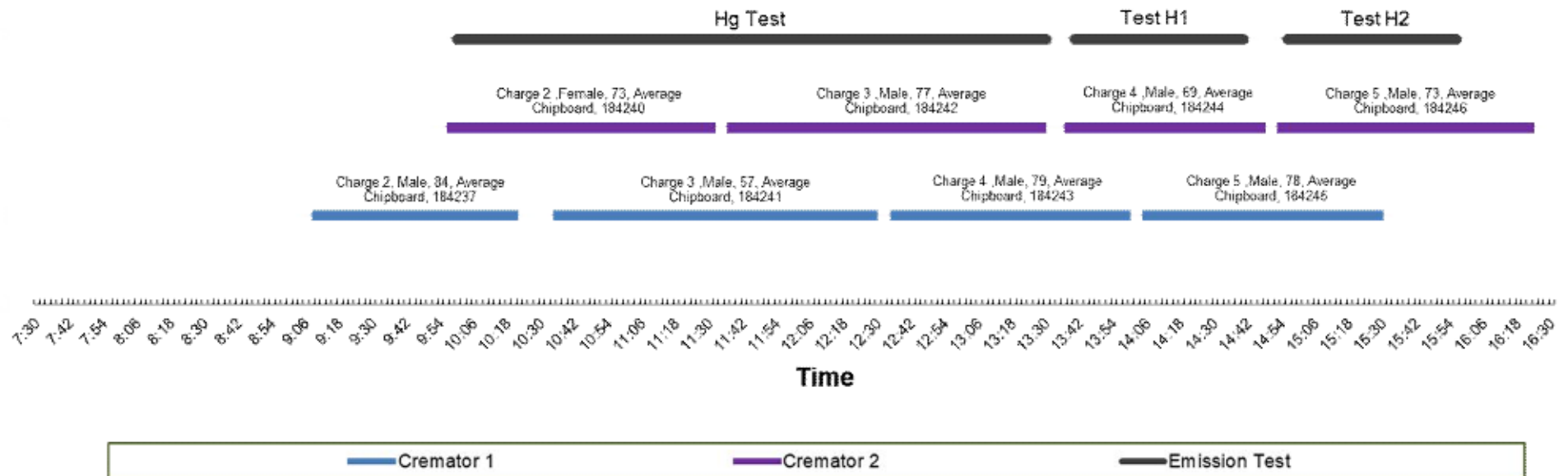
Test Instrumentation Calibration Data

	Siemens Ultramat 23		Signal 3030PM
	CO	O ₂	VOC
Date of Check	01/08/2019	01/08/2019	01/08/2019
Time of Check	07:30	07:30	07:40
Test Reference	Stream 2 - H1	Stream 2 - H1	Stream 2 - H1
Zero reading at analyser	0 mg/m ³	20.95%	0.0 ppm
Span reading at analyser	498 mg/m ³	0.01%	50.5 ppm
Zero check down line	0 mg/m ³	20.95%	0.0 ppm
Span check down line	496 mg/m ³	0.03%	50.5 ppm
Zero reading post test at analyser	0 mg/m ³	20.95%	0.1 ppm
Date of Check	01/08/2019	01/08/2019	01/08/2019
Time of Check	09:20	09:20	09:30
Test Reference	Stream 2 - H1	Stream 2 - H1	Stream 2 - H1
Zero reading at analyser	0 mg/m ³	20.95%	-0.1 ppm
Span reading at analyser	497 mg/m ³	0.01%	50.3 ppm
Zero check down line	0 mg/m ³	20.95%	-0.1 ppm
Span check down line	495 mg/m ³	0.01%	50.3 ppm
Zero in air post test at analyser	0 mg/m ³	20.95%	-0.1 ppm

Calibration Gases

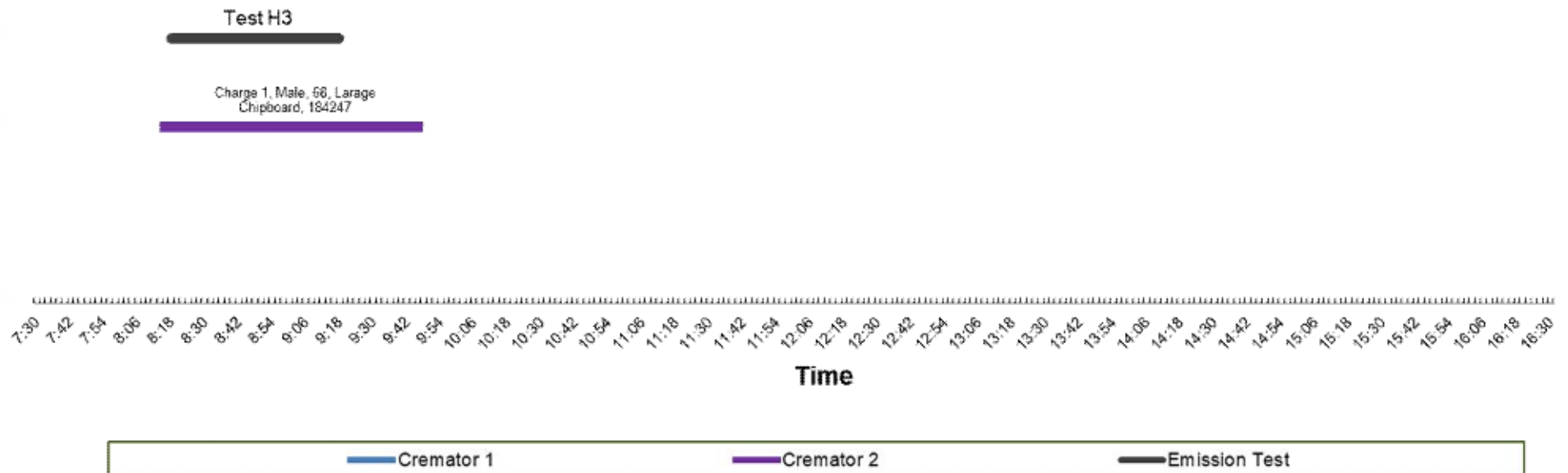
Gas	Supplier	Cylinder No.	Certified Conc.	Analytical Tolerance ± %
Carbon monoxide in Nitrogen	DRM	AGG2010-1-2	397 ppm 496 mg/m ³	2
Propane in synthetic air	DRM	AGG2010-2-2	50.3 ppm	2
Oxygen		-	-	-

Coventry Stream 1 - Cremators 1 & 2 & Abatement System Emission Tests 30/07/2019 Plant Operation & Test Periods

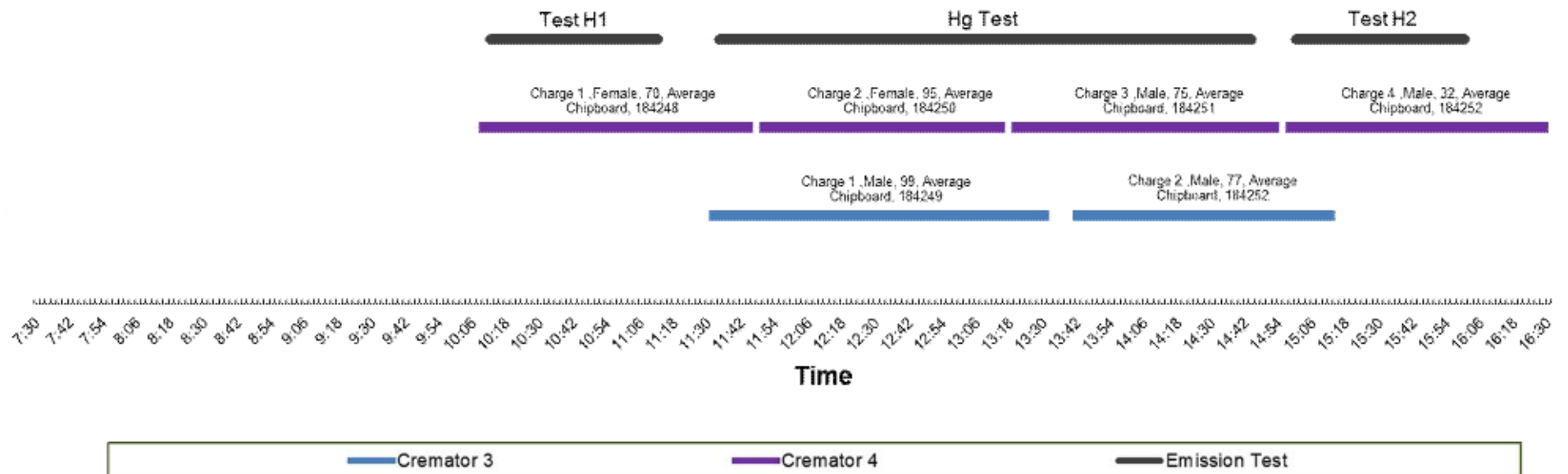




Coventry Stream 1 - Cremators 1 & 2 & Abatement System Emission Tests 31/07/2019 Plant Operation & Test Periods

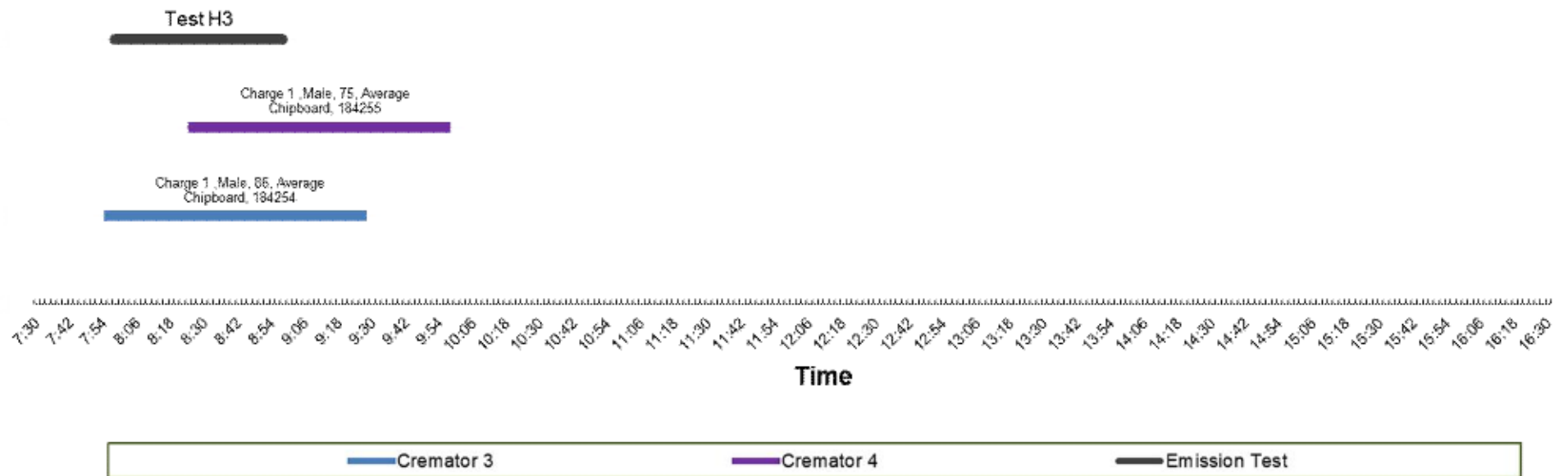


Coventry Stream 2 - Cremators 3 & 4 & Abatement System Emission Tests 30/07/2019 Plant Operation & Test Periods





Coventry Stream 2 - Cremators 3 & 4 & Abatement System Emission Tests 01/08/2019 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	CO300719FOB	17	0.55448	0.55449
	CO300719F11	R19	0.5495	0.54983
	CO310719F12	R20	0.54982	0.55015
	CO310719F13	U1	0.53436	0.53465
Rinses	CO300719ROB		78.65128	78.65131
	CO310719R1		80.12902	80.12972

Reference			Clean Dry Weight g	Dirty Dry Weight g
Filters	CO310719FOB	18	0.56454	0.56455
	CO310719F21	U2	0.52725	0.52749
	CO310719F22	U3	0.53347	0.53368
	CO010719F23	U4	0.53222	0.53247
Rinses	CO010819ROB		77.62597	77.62614
	CO010819R2		76.49754	76.49829

Concept Life Sciences Certificate of Analysis

Hedfield House
Hedfield Street
Carnbrook
Manchester
M16 9TE
Tel: 0181 874 9400
Fax: 0181 874 2404

Report Number: 838723-1

Date of Report: 30-Aug-2019

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

Customer Contact: . Reports

Customer Job Reference: DEM1320

Customer Purchase Order: 50001878

Date Job Received at Concept: 06-Aug-2019

Date Analysis Started: 07-Aug-2019

Date Analysis Completed: 30-Aug-2019

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

Customers are responsible for information provided where, if incorrect, it could affect the validity of the results.

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 QMSection 15 of the Concept Life Sciences Analytical Services Quality Manual



Report checked
and authorised by :
Lauren Clarke
Customer Service Advisor

Issued by :
Lauren Clarke
Customer Service Advisor

Validity unknown
Digitally signed by Lauren Clarke
DN: cn=Lauren Clarke, o=Davies & Co (Environmental) Ltd, email=lauren.clarke@davies-co.co.uk, c=GB

Concept Reference: 838723						
Customer Reference: DEM1320						
Impinger(DI water) Analyzed as Impinger(DI water)						
Hydrogen Chloride						
Concept Reference		838723 001	838723 002	838723 003	838723 004	838723 005
Customer Sample Reference		CO010719 I11	CO010719 I12	CO010719 I13	CO010719 I13A	CO010719 I13 B
Test Sample		AR	AR	AR	AR	AR
Date Sampled		30 JUL 2019	30 JUL 2019	30 JUL 2019	31 JUL 2019	31 JUL 2019
Determinand	Method	LOD	Units	Symbol		
Hydrogen Chloride	IC	0.06	mg/l	U	15	15
					0.11	19
						0.38

Concept Reference: 838723						
Customer Reference: DEM1320						
Impinger(DI water) Analyzed as Impinger(DI water)						
Hydrogen Chloride						
Concept Reference		838723 006	838723 007	838723 008	838723 009	
Customer Sample Reference		CO010719 I21	CO010719 I122	CO010719 I21A	CO010719 I122B	
Test Sample		AR	AR	AR	AR	
Date Sampled		31 JUL 2019	31 JUL 2019	01 AUG 2019	01 AUG 2019	
Determinand	Method	LOD	Units	Symbol		
Hydrogen Chloride	IC	0.06	mg/l	U	1.9	3.4
					3.2	0.13

Concept Reference: 838723						
Customer Reference: 14 M 1320						
Impinger (4%K2Cr2O7/20%HNO3) Analyzed as Impinger (4%K2Cr2O7/20%HNO3)						
Mercury						
Concept Reference		838723 010	838723 011	838723 012	838723 013	838723 014
Customer Sample Reference		CO010719 H2A	CO010719 H2B	CO010719 H2ELAN-K	CO010719 H2SA	CO010719 H2SB
Test Sample		AR	AR	AR	AR	AR
Date Sampled		30 JUL 2019	30 JUL 2019	30 JUL 2019	31 JUL 2019	31 JUL 2019
Determinand	Method	LOD	Units	Symbol		
Mercury	CVAAS (HF Digest BS EN 12411)	0.5	µg/l	U	6.0	4.3
					5.8	2.6
						0.6

Concept Reference: 838723						
Customer Reference: 14 M 1320						
Filter Analyzed as Filter						
Mercury						
Concept Reference		838723 010	838723 011	838723 015		
Customer Sample Reference		CO010719 H2F1	CO010719 H2F5-ANK	CO010719 H2F2		
Test Sample		AR	AR	AR		
Date Sampled		30 JUL 2019	30 JUL 2019	31 JUL 2019		
Determinand	Method	LOD	Units	Symbol		
Mercury	CVAAS (HF Digest BS EN 12411)	0.5	µg/l	U	0.38 ^{11/19}	0.04 ^{11/19}
						0.29 ^{11/19}

Index to symbols used in 838723-1

Value	Description
AR	As Received
131	Result is a blend of the sample of concentration this to a GC Filter
13	Results have been blank corrected.
U	Analysis is UFAS corrected.