The Pollution Prevention and Control (Scotland) Regulations 2012

Permit: PPC/A/1032878 Dunbar Energy Recovery Facility

Annual Environmental Report
1st January-31st December 2019

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Quality Assurance

This report has been prepared with all reasonable skill, care and diligence. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

Report Details	
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1. Introduction

Dunbar Energy Recovery Facility (ERF) is located on the East coast of Scotland approximately 35 miles from the City of Edinburgh.

The facility has a capacity of 325,000 tonnes per year and will generate electricity to be used internally and exported to the National Grid. The facility design and layout of the steam turbine allows for potential heat export which is a possibility in the future.

In accordance with the requirements of Conditions 3.5.1 of Permit PPC/A/1032878 issued by the Scottish Environmental Protection Agency (SEPA) to Viridor Waste Management Ltd, Viridor is required to submit an annual performance report to SEPA detailing all the requirements of the Permit Condition mentioned above.

This report summarises the environmental data collected from 1st January 2019 to 31st December 2019 and fulfils the requirements of Article 12(2) of the Waste Incineration Directive.

The report will cover the following areas of environmental monitoring:

Section 2 – Point Source Emissions to Air
Section 3 – Point Source Emissions to Water
Section 4 – Residue Quality Monitoring Requirements
Section 5 – Annual Performance Reporting Requirements

2. Point Source Emissions to Air

2.1. Introduction

Permit Condition 6.4.8 and 6.5.9 and Table 2.1 set out the requirements for performance monitoring of the point source emissions to air arising at sample points A1 and A2.

Analysis from periodic monitoring is carried out quarterly, as per Permit Condition 6.5.9, results of which can be seen in the table below.

2.2 Commentary on Data

During the review period, the recorded concentrations remained compliant with the limits set out in Permit Table 6.1, with exception to the emissions events listed below.

Line 1 was in operation for 82.21% of the year and Line 2 for 81.60%.

2.3 SEPA Notifications Issued

The following are the Notifications submitted to SEPA during the 2019. For each of these Notifications Viridor carried out a full investigation with findings submitted to SEPA within the required 14 days. These reports and notifications are available on request to both Viridor and SEPA.

A summary of these Notifications are as follows:

- HCl daily exceedance on Line 2 – 15/01/19
- SO2 half-hourly exceedances on both Line 1 and Line 2 – 07/02/19
- HCl half-hourly exceedance on Line 1 – 12/02/19
- SO2 half-hourly exceedance on Line 2 – 12/02/19
- SO2 half-hourly exceedance on Line 1 – 21/02/19
- Dust half-hourly exceedance on Line 2 – 21/03/19
- TOC invalid readings on both Lines – 29/03/19
- Dust half-hourly exceedance on Line 1 – 14/04/19
- Noise compliant incident – 09/08/19
- CO 95%ile exceedance on Line 1 – 10/10/19
- Dioxins and furans Exceedance – Line 2 – 20/12/19

2.4 Data Tables

Table 1 below details the maximum an average values recorded on the Continuous Emissions Monitoring System (CEMS) for both point A1 and A2.

Table 2 details the results from the quarterly periodic monitoring of emissions at Dunbar ERF by an independent contractor.

Table 1: Emissions to Air from A1 and A2 – Continuous Emissions Monitoring System (CEMS)

Releases to Air from Incinerators – Continuous Monitoring – Annual Figures						
Parameter	**Limit**	**Reference Period**	**A1**		**A2**	
			Max	**Avg**	**Max**	**Avg**
Oxides of nitrogen	200 mg/m^3	Daily mean	185.9	140.8	182.8	138.6
	400 mg/m^3	½ hourly mean	228.1		229.9	
Dust	10 mg/m^3	Daily mean	6.7	0.3	6.7	0.6
	30 mg/m^3	½ hourly mean	32.5		37.5	
Total Organic Carbon (TOC)	10 mg/m^3	Daily mean	0.4	0.0	1.4	0.0
	20 mg/m^3	½ hourly mean	8.7		12.9	
Hydrogen chloride	10 mg/m^3	Daily mean	9.2	4.2	11.2	4.3
	60 mg/m^3	½ hourly mean	91.4		44.7	
Sulphur dioxide	50 mg/m^3	Daily mean	44.9	14.0	40.1	13.9
	200 mg/m^3	½ hourly mean	408.5		280.2	
Carbon monoxide	50 mg/m^3	Daily mean	29.7	2.9	23.7	2.9
	150 mg/m^3	10-minute mean**	1380		654.2	
Ammonia	10 mg/m^3	Daily mean	3.3	0.1	2.3	0.0
	20 mg/m^3	½ hourly mean	6.0		4.3	

*Note. CEMS data figures are adjusted for the method uncertainty
**Note. Carbon Monoxide reported to the 95th Percentile of the 10-minute average

Table 2: Emissions to Air from A1 and A2 – Periodic Emissions Monitoring

Substance / Parameter	Emission Limit Value & unit	A1 Result Q1	A1 Result Q2	A2 Result Q1	A2 Result Q2	Test Method
Nitrous oxide	None set mg/m^3	0.50	0.34	1.1	0.59	M22 / FTIR
Total Particulate Matter	30 mg/m^3	2.3	2.1	4.1	0.45	EN 13284-1
PM_{10}	None set mg/m^3	0.13	0.14	0.14	0.16	BS EN ISO 23210
$PM_{2.5}$	None set mg/m^3	0.13	0.14	0.14	0.15	
Hydrogen fluoride	4 mg/m^3	<0.05	<0.04	<0.07	<0.04	SRM BS ISO 15713
Cd and Th and their compounds	0.05 mg/m^3	0.00084	0.00077	0.0017	<0.001	SRM BS EN 14385
Hg and its compounds	0.05 mg/m^3	0.00087	0.0018	0.00054	0.001	SRM BS EN 13211 / MID 14385
Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V and their compounds	0.5 mg/m^3	0.063	0.053	0.035	0.034	SRM BS EN 14385
Sulphur Dioxide	200 mg/m^3	6.4	25.0	3.3	19.5	EN 14791
Ammonia	20 mg/m^3	<0.10	<0.11	<0.11	<0.16	
Total VOCs (as Carbon)	20 mg/m^3	0.98	0.42	1.3	0.37	EN 12619:2013

Oxides of Nitrogen (as NO_2)	400 mg/m^3	196	198	188	223	EN 14792
Carbon Monoxide	150 mg/m^3	1.8	1.2	0.99	0.61	EN 15058
Oxygen	% v/v	6.8	6.1	6.8	6.49	EN 14789
Water Vapour	% v/v	18.1	17.1	18.1	16.8	EN 14790
Dioxins & Furans (I-TEQ)	0.1 ng/m^3	0.0048	0.000927	0.061	0.0013	SRM BS EN 1948
Dioxins & Furans (WHO-TEQ Humans / Mammals)	None set ng/m^3	0.0045	0.00086	0.052	0.0012	
Dioxins & Furans (WHO-TEQ Fish)	None set ng/m^3	0.0052	0.000971	0.059	0.0013	
Dioxins & Furans (WHO-TEQ Birds)	None set ng/m^3	0.0081	0.00145	0.090	0.0017	
PCBs (WHO-TEQ Humans / Mammals)	None set ng/m^3	0.00040	0.0000181	0.0053	0.000013	
PCBs (WHO-TEQ Fish)	None set ng/m^3	0.000019	0.00000098	0.00025	0.000001	
PCBs (WHO-TEQ Birds)	None set ng/m^3	0.00095	0.0000607	0.0083	0.000085	
Anthanthrene	None set µg/m^3	< 0.88	<0.071	<0.88	0.0	SRM BS ISO 11338
Benzo(a)anthracene	None set µg/m^3	< 0.07	<0.071	<0.07	0.0	
Benzo(a)pyrene	None set µg/m^3	< 0.07	<0.071	<0.07	0.0	
Benzo(b)fluoranthene	None set µg/m^3	< 0.07	<0.071	<0.07	0.0	
Benzo(b)napth(2,1-d)thiophene	None set µg/m^3	< 0.07	<0.071	<0.07	0.0	

Benzo(c)phenanthrene	None set µg/m³	< 0.07	<0.071	<0.07	<0.1	
Benzo(ghi)perylene	None set µg/m³	< 0.15	<0.071	<0.015	<0.1	
Benzo(k)fluoranthene	None set µg/m³	< 0.07	<0.071	<0.07	<0.1	
Cholanthrene	None set µg/m³	< 0.15	<0.071	<0.015	<0.1	
Chrysene	None set µg/m³	< 0.07	<0.071	<0.07 .1	<0.1	
Cyclopenta(cd)pyrene	None set µg/m³	< 0.37	<0.071	<0.37	<0.1	
Dibenzo (a,i) pyrene	None set µg/m³	0.15	0.285	0.15	0.3	
Dibenzo(ah)anthracene	None set µg/m³	< 0.07	<0..071	<0.07	<0.1	
Fluoranthene	None set µg/m³	<0.15	0.071	<0.15	0.1	
Indeno(123-cd)pyrene	None set µg/m³	< 0.15	<0.071	<0.15	<0.1	
Naphthalene	None set µg/m³	4.5	2.6	6.0	3.7	

Substance / Parameter	Emission Limit Value & unit	A1 Result Q3	A1 Result Q4	A2 Result Q3	A2 Result Q4	Test Method
Nitrous oxide	None set mg/m^3	0.52	0.79	0.36	0.62	M22 / FTIR
Total Particulate Matter	30 mg/m^3	1.7	2.7	1.8	1.4	EN 13284-1
PM_{10}	None set mg/m^3	0.16	0.14	0.19	0.15	BS EN ISO 23210
$PM_{2.5}$	None set mg/m^3	0.16	0.14	0.18	0.14	
Hydrogen fluoride	4 mg/m^3	<0.05	<0.055	<0.06	<0.06	SRM BS ISO 15713
Cd and Th and their compounds	0.05 mg/m^3	<0.0007	<0.00069	<0.001	<0.00069	SRM BS EN 14385
Hg and its compounds	0.05 mg/m^3	0.0043	0.0011	0.002	0.0024	SRM BS EN 13211 / MID 14385
Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V and their compounds	0.5 mg/m^3	0.15	0.0080	0.120	0.0056	SRM BS EN 14385
Sulphur Dioxide	200 mg/m^3	8.4	18.9	13.9	11.3	EN 14791
Ammonia	20 mg/m^3	<0.11	<0.12	<0.10	<0.12	
Total VOCs (as Carbon)	20 mg/m^3	0.30	0.27	0.28	0.28	EN 12619:2013

Oxides of Nitrogen (as NO_2)	400 mg/m^3	205	220	204	167	EN 14792
Carbon Monoxide	150 mg/m^3	2.7	3.6	13.4	2.3	EN 15058
Oxygen	% v/v	6.4	6.5	6.7	6.7	EN 14789
Water Vapour	% v/v	18.6	18.9	18.0	18.8	EN 14790
Dioxins & Furans (I-TEQ)	0.1 ng/m^3	0.0034	0.0633	0.056	0.141	SRM BS EN 1948
Dioxins & Furans (WHO-TEQ Humans / Mammals)	None set ng/m^3	0.0033	0.0599	0.054	0.135	
Dioxins & Furans (WHO-TEQ Fish)	None set ng/m^3	0.0035	0.0693	0.061	0.156	
Dioxins & Furans (WHO-TEQ Birds)	None set ng/m^3	0.0051	0.1028	0.095	0.220	
PCBs (WHO-TEQ Humans / Mammals)	None set ng/m^3	0.00028	0.00477	0.00765	0.0102	
PCBs (WHO-TEQ Fish)	None set ng/m^3	0.000013	0.000223	0.00036	0.000479	
PCBs (WHO-TEQ Birds)	None set ng/m^3	0.00068	0.00763	0.01181	0.0155	
Anthanthrene	None set $\mu g/m^3$	<0.06	<0.0031	<0.065	<0.0032	SRM BS ISO 11338
Benzo(a)anthracene	None set $\mu g/m^3$	<0.06	0.0067	<0.065	<0.0032	
Benzo(a)pyrene	None set $\mu g/m^3$	0.12	<0.0031	<0.065	<0.0032	
Benzo(b)fluoranthene	None set $\mu g/m^3$	<0.06	<0.0031	<0.065	<0.0032	
Benzo(b)napth(2,1-d)thiophene	None set $\mu g/m^3$	<0.06	0.0043	<0.065	0.0038	

Benzo(c)phenanthrene	None set µg/m^3	<0.06	0.0037	<0.065	<0.0032	SRM BS ISO 11338
Benzo(ghi)perylene	None set µg/m^3	<0.06	<0.0031	<0.065	<0.0032	
Benzo(k)fluoranthene	None set µg/m^3	<0.06	<0.0031	<0.065	<0.0032	
Cholanthrene	None set µg/m^3	0.18	<0.0031	<0.065	<0.0032	
Chrysene	None set µg/m^3	<0.06	0.0116	<0.065	<0.0038	
Cyclopenta(cd)pyrene	None set µg/m^3	<0.06	<0.0031	<0.065	<0.0032	
Dibenzo (a,i) pyrene	None set µg/m^3	<0.06	<0.0031	<0.065	<0.0032	
Dibenzo(ah)anthracene	None set µg/m^3	<0.06	<0.0031	<0.065	<0.0032	
Fluoranthene	None set µg/m^3	0.06	0.4522	<0.065	0.0768	
Indeno(123-cd)pyrene	None set µg/m^3	<0.06	<0.0031	<0.065	<0.0032	
Naphthalene	None set µg/m^3	0.49	2.17	0.52	1.89	

3. Point Source Emissions to Water

3.1. Introduction

Permit Condition 6.2.3 and Table 6.6 require Viridor to spot sample the water on a weekly basis and is analysed for the parameters specified in Table 6.6.

3.2 Commentary on Data

Table 3: Emissions to water Spot Sampling

Sampling Date Q1	pH	Suspended Solids (mg/l)	Biochemical Oxygen Demand (mg/l)	Temperature (ºC)	Hydrocarbons (ug/l)
8th January	7.6	8	<0.1	Not taken	<0.010
14th January	7.4	5	1.7	Not taken	0.015
21st January	7.6	6	<1.0	Not taken	0.011
6th February	7.3	<5	<1.0	20.4	<0.010
13th February	7.8	<5	<1.0	20.5	0.186
19th February	7.4	6	<1.0	20.5	0.035
27th February	7.3	<5	<1.0	20.7	0.045
7th March	7.6	13	<1.0	19.5	0.049
13th March	7.8	<5	<1.0	20.4	0.013
21ST March	7.7	<5	<1.0	20.3	0.046
28th March	7.8	<25	<1.0	19.9	<0.010
Sampling Date Q2	**pH**	**Suspended Solids (mg/l)**	**Biochemical Oxygen Demand (mg/l)**	**Temperature (ºC)**	**Hydrocarbons (ug/l)**
3rd April	7.8	< 5	< 0.1	Not taken	0.012
13th April	8.2	4.00	1	5.3	< 10
17th April	8.0	3.00	< 1.0	3.7	< 10
25th April	8.2	5.00	2	6	< 10
1st May	8.1	4.00	1	5.5	< 10
9th May	8.2	2.00	< 1.0	4.9	< 10
16th May	8.3	5.00	2	8.9	< 10
23rd May	8.1	10.0	2	7.2	< 10
4th June	9.5	43.0	2	4.6	< 40
10th June	8.9	14.0	< 1	5.2	< 10
17th June	9.3	38.0	3	7.7	< 40
24th June	8.4	5.00	2	4.5	< 20

Sampling Date Q3	pH	Suspended Solids (mg/l)	Biochemical Oxygen Demand (mg/l)	Temperature (ºC)	Hydrocarbons (ug/l)
2nd July	8.3	6.00	2	5.9	<10
8th July	8.5	4.00	1	4.6	<20
17th July	8.2	4.00	1	5.2	34
29th July	8.0	10.0	2	5.9	35
8th August	8.0	5.00	1	5.4	<10
13th August	8.0	6.00	2	4.4	19
23rd August	8.3	2.00	<1	4.6	<100
27th August	8.2	6.00	2	5.4	<10
5th September	8.1	4.00	1	4.3	<10
10th September	8.2	4.00	<1	5.8	<10
16th September	8.1	2.00	<1	5.8	<10
25th September	8.3	6.00	<1	4.5	21
Sampling Date Q4	**pH**	**Suspended Solids (mg/l)**	**Biochemical Oxygen Demand (mg/l)**	**Temperature (ºC)**	**Hydrocarbons (ug/l)**
2nd October	8.1	2.00	<1	7.8	27,<10
10th October	8.4	2.00	<1	4.2	<10
14th October	7.9	4.00	<1	6.5	<10
25th October	8.2	4.00	2	3.0	<10
29th October	8.2	4.00	<1	4.1	<10
4th November	8.3	6.00	<1	4.6	<10
12th November	8.1	1.00	<1	3.7	<10
18th November	8.2	2.00	<1	1.2	29, 12, 17, <10
29th November	8.3	2.00	<1	2.6	<10
5th December	8.3	2.00	<1	3.9	<10
11th December	8.1	4.00	<1	4.8	<10
16th December	8.1	2.00	<1	4.5	23, <10

3.3 Schedule Notices Issued

There are no Permit limits for the parameters specified in Table 6.6.

4. Residue Quality Monitoring Requirements

4.1. Introduction

Permit Condition 7.1.5, 7.1.6 and Table 7.1 require Viridor to undertake residue quality monitoring at minimum monthly intervals for Incinerator Bottom Ash (IBA) and quarterly for Air Pollution Control Residues (APCR).

4.2. Commentary on Data

Compliance with Permit Condition 5.1.1(a) and Condition 7.1.5 is assessed by performing tests to ascertain the Total Organic Carbon (TOC) content of bottom ash at a frequency of not less than once a week for the first 3 months of operation, and not less than once every 3 months thereafter. It is for this reason that sampling results for IBA are at a much shorter frequency during the first quarter of 2019.

Table 4 below details the results of this TOC analysis and Table 5 shows the quarterly APCR analysis results in compliance with Condition 7.1.6 and the contents of Table 7.1.

Table 4: TOC analysis of IBA

Sample Date	Q1 TOC	Sample Date	Q2 TOC	Sample Date	Q3 TOC	Sample Date	Q4 TOC
03/01/19	0.22	02/04/19	0.21	17/07/19	0.23	07/10/19	0.39
07/01/19	0.38	28/04/19	0.20	20/07/19	0.15	14/10/19	0.34
10/01/19	0.38	10/05/19	0.25	10/08/19	0.21	22/10/19	0.47
17/01/19	0.35	20/05/19	0.16	14/08/19	0.27	14/11/19	0.50
21/01/19	0.23	25/05/19	0.22	07/10/19	0.22	26/11/19	0.45
24/01/19	0.50	12/06/19	0.21			03/12/19	0.41
31/01/19	0.39	21/06/19	0.15			16/12/19	0.61
01/02/19	0.84						
05/02/19	0.25						
11/02/209	0.22						

15/02/19	0.46						
15/02/19	0.46						
15/02/19	0.36						
21/02/19	0.18						
21/02/19	0.28						
21/02/19	0.25						
22/02/19	0.40						
22/02/19	0.36						
22/02/19	0.27						
26/02/19	0.20						
07/03/19	0.34						
08/03/19	0.27						
12/03/19	0.24						
16/03/19	0.48						
20/03/19	0.16						
23/03/19	0.26						
24/03/19	0.18						
25/03/19	0.20						

Table 5: Chemical Analysis of APCR

Parameter	Q1	Q2	Q3	Q4
Fluranthene	<0.08	<0.08	<0.08	
Dibenzo(ah)anthracene	<0.08	<0.08	<0.08	<0.08
Coronene	<0.08	<0.08	<0.08	<0.08
Chrysene	<0.08	<0.08	<0.08	<0.08
Benzo(k)fluoranthene	<0.08	<0.08	<0.08	<0.08
Benzo(ghi)perylene	<0.08	<0.08	<0.08	
Benzo(b)fluoranthene	<0.08	<0.08	<0.08	<0.08
Benzo(a)pyrene	<0.08	<0.08	<0.08	<0.08
Benzo(a)anthracene	<0.08	<0.08	<0.08	<0.08
Anthracene	<0.08	<0.08	<0.08	<0.08

Acenaphthylene	<0.08	<0.08	<0.08	<0.08
Acenaphthene	<0.08	<0.08	<0.08	<0.08
Cadmium	165	47	155	144
Mercury (MS)	7.1	4.57	8.41	47.26
Fraction of sample above 4mm%	0.0	0.0	0.0	0.0
Fraction of non-crushable material%	0.0	0.0	0.0	0.0
Total Moisture @105C	1.2	0.1	0.0	0.1
^Free lime Content	16.37	26.85	20.88	20.02
^Dioxins like PCBs	1680	1600	1000	9600
^Dixons & Furans MW	1330	280	1750	1600
Total PAH (Sum of USEPA 16)	<1.28	<0.08	<1.28	<1.28
Pyrene	<0.08	<0.08	<0.08	<0.08
Phenanthrene	<0.08	<0.08	<0.08	<0.08
Naphthalene	<0.08	<0.08	<0.08	<0.08
Indeno(123-cd)prene	<0.08	<0.08	<0.08	<0.08
Fluorene	<0.08	<0.08	<0.08	<0.08

5. Annual Performance Reporting Requirements

5.1 Introduction

Condition 3.5.1 sets out the reporting requirements for the annual environmental report. Section 5 sets out to discharge these conditions including quantities of waste incinerated under Condition 4.2.3, calibration carried out on the Condition 6.3.5 and each abnormal operating event under Condition 5.3.2

5.2 Commentary on Data

Condition 6.3.3 requires an appropriate series of tests be undertaken annually to ensure the satisfactory operation of the CEMS. Viridor has decided to cover this by doing a full QAL2 annually, the results of which can be seen in Tables 7, 8 and 9.

Table 6: Quantities of waste incinerated

Total Waste Incinerated	Q1	Q2	Q3	Q4	2019
Line 1	34,854.15	33,342.86	27,880	28,642.29	124,719.30
Line 2	31,774.26	32,593.70	29,494	32,147.99	126,009.95
Total	66,628.42	65,936.56	57,374	60,790.28	**250,729.25**

Table 7: QAL2 Calibration Results Line 1 Duty

QAL2 CALIBRATION SUMMARY

Parameter	Calibration Function derived from QAL2?	EN 14181 Procedure used to Derive the Calibration Function	Calibration Function Derived	Result of Variability Test	Valid Calibration Range @ REF Conditions	Range after Surrogate Extension @ REF Conditions	Calibration Function to Apply to the Data Acquisition Handling Software (See Conclusions)
Total Particulate Matter (D)	Yes	Procedure B	y = 1.9738x + 0	Pass	0 to 11.46 mg/m³	N/A	y = 1.9738x + 0
Total VOCs	Yes	Procedure C	y = 1.0263x -0.3896	Pass	0 to 2 mg/m³	N/A	y = 1.0263x -0.3896
Oxides of Nitrogen (as NO_2)	Yes	Procedure A	y = 0.966x -1.695	Pass	0 to 277.2 mg/m³	N/A	y = 0.966x -1.695
Sulphur Dioxide	Yes	Procedure A	y = 1.0381x + 0.354	Pass	0 to 39.3 mg/m³	0 to 50 mg/m³	y = 1.0381x + 0.354
Nitrous Oxide	Yes	Procedure C	y = 0.9889x + 0.8035	Pass	0 to 2.7 mg/m³	N/A	y = 0.9889x + 0.8035
Carbon Monoxide	Yes	Procedure A	y = 1.3877x -0.6226	Pass	0 to 38.1 mg/m³	0 to 50 mg/m³	y = 1.3877x -0.6226
Hydrogen Chloride	Yes	Procedure A	y = 1.1896x + 0.2428	Pass	0 to 15.4 mg/m³	N/A	y = 1.1896x + 0.2428
Ammonia	Yes	Procedure C	y = 1.0013x -0.0323	Pass	0 to 2 mg/m³	N/A	y = 1.0013x -0.0323
Water Vapour (% v/v)	Yes	Procedure B	y = 0.9965x + 0	Pass	0 to 21.9 % v/v	N/A	y = 0.9965x + 0
Oxygen (D) (% v/v)	Yes	Procedure B	y = 0.9803x + 0	Pass	0 to 8.1 % v/v	N/A	y = 0.9803x + 0
Volume Flow Rate (m³/s)	Yes	Procedure A	y = 0.9753x	Pass	0 to 59.7 m³/s	N/A	y = 0.9753x

The calibration functions, once applied, only remain valid as long as the QAL3 data remains within control limits, and that there are no manual adjustments made to the CEMs other than those allowed to bring the settings back within the QAL3 control limit.
All calibration functions throughout this report are given in the form y = bx + a, where b is the gradient and a is the intercept.
All calibration functions relate to mg/m³, unless otherwise stated.

Table 8: QAL2 Calibration Results Line 2 Duty

QAL2 CALIBRATION SUMMARY

Parameter	Calibration Function derived from QAL2?	EN 14181 Procedure used to Derive the Calibration Function	Calibration Function Derived	Result of Variability Test	Valid Calibration Range @ REF Conditions	Range after Surrogate Extension @ REF Conditions	Calibration Function to Apply to the Data Acquisition Handling Software (See Conclusions)
Total Particulate Matter (D)	Yes	Procedure B	y = 1.8755x + 0	Pass	0 to 5.35 mg/m³	N/A	y = 1.8755x + 0
Total VOCs	Yes	Procedure C	y = 1.0084x -0.2831	Pass	0 to 2 mg/m³	N/A	y = 1.0084x -0.2831
Oxides of Nitrogen (as NO_2)	Yes	Procedure A	y = 1.0077x + 7.8657	Pass	0 to 294.1 mg/m³	N/A	y = 1.0077x + 7.8657
Sulphur Dioxide	Yes	Procedure A	y = 1.1087x + 4.1374	Pass	0 to 57.2 mg/m³	N/A	y = 1.1087x + 4.1374
Nitrous Oxide	Yes	Procedure A	y = 1.1383x + 0.9164	Pass	0 to 8.7 mg/m³	N/A	y = 1.1383x + 0.9164
Carbon Monoxide	Yes	Procedure A	y = 0.9911x + 0.7627	Pass	0 to 84.2 mg/m³	N/A	y = 0.9911x + 0.7627
Hydrogen Chloride	Yes	Procedure B	y = 1.2518x -0.3004	Pass	0 to 10.6 mg/m³	N/A	y = 1.2518x -0.3004
Ammonia	Yes	Procedure C	y = 0.9481x + 0.0888	Pass	0 to 2 mg/m³	N/A	y = 0.9481x + 0.0888
Water Vapour (% v/v)	Yes	Procedure B	y = 0.994x -0.0696	Pass	0 to 22.3 % v/v	N/A	y = 0.994x -0.0696
Oxygen (D) (% v/v)	Yes	Procedure A	y = 1.0269x -0.004	Pass	0 to 8.6 % v/v	N/A	y = 1.0269x -0.004
Volume Flow Rate (m³/s)	Yes	Procedure D	y = 0.9825x	Pass	0 to 57.9 m³/s	N/A	y = 0.9825x

The calibration functions, once applied, only remain valid as long as the QAL3 data remains within control limits, and that there are no manual adjustments made to the CEMs other than those allowed to bring the settings back within the QAL3 control limit.
All calibration functions throughout this report are given in the form y = bx + a, where b is the gradient and a is the intercept.
All calibration functions relate to mg/m³, unless otherwise stated.

Table 9: QAL2 Calibration Results Standby Analyser

QAL2 CALIBRATION SUMMARY

Parameter	Calibration Function derived from QAL2?	EN 14181 Procedure used to Derive the Calibration Function	Calibration Function Derived	Result of Variability Test	Valid Calibration Range @ REF Conditions	Range after Surrogate Extension @ REF Conditions	Calibration Function to Apply to the Data Acquisition Handling Software (See Conclusions)
Total Particulate Matter (Line 1)	Yes	Procedure B	y = 1.8649x + 0	Pass	0 to 12.04 mg/m³	N/A	y = 1.8649x + 0
Total Particulate Matter (Line 2)	Yes	Procedure B	y = 1.8755x + 0	Pass	0 to 5.43 mg/m³	N/A	y = 1.8755x + 0
Total VOCs	Yes	Procedure C	y = 1.0293x -0.304	Pass	0 to 2 mg/m³	N/A	y = 1.0293x -0.304
Oxides of Nitrogen (as NO_2)	Yes	Procedure A	y = 0.9773x -1.3496	Pass	0 to 275.5 mg/m³	N/A	y = 0.9773x -1.3496
Sulphur Dioxide	Yes	Procedure A	y = 1.0162x -0.0848	Pass	0 to 38.8 mg/m³	0 to 50 mg/m³	y = 1.0162x -0.0848
Nitrous Oxide	Yes	Procedure C	y = 0.9904x + 1.0155	Pass	0 to 2.9 mg/m³	N/A	y = 0.9904x + 1.0155
Carbon Monoxide	Yes	Procedure A	y = 1.3099x + 0.3031	Pass	0 to 37.6 mg/m³	0 to 50 mg/m³	y = 1.3099x + 0.3031
Hydrogen Chloride	Yes	Procedure A	y = 1.2035x -0.3386	Pass	0 to 14.9 mg/m³	N/A	y = 1.2035x -0.3386
Ammonia	Yes	Procedure C	y = 0.9963x + 0.1036	Pass	0 to 2 mg/m³	N/A	y = 0.9963x + 0.1036
Water Vapour (% v/v)	Yes	Procedure B	y = 1.0061x + 0	Pass	0 to 22 % v/v	N/A	y = 1.0061x + 0
Oxygen (S) (% v/v)	Yes	Procedure B	y = 1.0469x + 0	Pass	0 to 8.1 % v/v	N/A	y = 1.0469x + 0

The calibration functions, once applied, only remain valid as long as the QAL3 data remains within control limits, and that there are no manual adjustments made to the CEMs other than those allowed to bring the settings back within the QAL3 control limit.

All calibration functions throughout this report are given in the form y = bx + a, where b is the gradient and a is the intercept.

All calibration functions relate to mg/m³, unless otherwise stated.

5.3 Periods of IED abnormal operation

Abnormal operations:

- 30 minutes – 12th Feb (HCl incident) – Line 1
- 30 minutes – 21st March (Dust incident) – Line 2
- 30 minutes – 14th April (Dust Incident) – Line 1

Line 1 total = 1 hour
Line 2 total = 30 minutes

END OF REPORT