



EMISSIONS MONITORING SURVEY

Prepared for:

Babcock & Wilcox Volund Limited.

Margam Green Energy Plant

Harbour Way

Margam

Port Talbot

Neath Port Talbot

SA13 2NW

Permit Number	: EPR/DP3137EG
Variation Number	: ...
Installation	: A1 Incinerator
Visit Details	: Compliance – November 2020
Job Number	: P4246
Report Number	: R003
Report Issue Date	: 15th January 2021
Survey Dates	: 23rd - 26th November 2020

Prepared by:

Environmental Compliance Limited

Unit G1

Main Avenue


Treforest Industrial Estate

Pontypridd

CF37 5BF.

Tel: 01443 841760

Fax: 01443 841761

Report Issue:		FINAL	
Report Prepared by:		Report Reviewed & Approved by MCERTS Level Two Technical Endorsements TE1, TE2, TE3 & TE4	
Name:	Harry Round	Name:	Andy Barnes
		MCERTS No:	MM 03 235
		Signature:	
Date:	5 th January 2021	Date:	15 th January 2021

This report is not to be used for contractual or engineering purposes unless this approval sheet is signed where indicated by the approver and the report is designated "FINAL".



Environmental Compliance Limited

Babcock & Wilcox Volund Limited
Permit No : EPR/DP3137EG
Variation No : ...
Report Ref : P4246 : R003

Installation Name : A1 Incinerator
Visit Details : Compliance – November 2020
Survey Dates : 23rd - 26th November 2020
Report Issue Date. : 15th January 2021

This report has been prepared by Environmental Compliance Limited (ECL) in their professional capacity as Environmental Consultants. The contents of the report reflect the conditions that prevailed and the information available or supplied at the time of its preparation. The report, and the information contained therein, is provided by ECL solely for use and reliance by the Client in performance of ECLs duties and liabilities under its contract with the Client. Until ECL has received payment in full as detailed in the quotation or contract the contents of this report remain the legal property of ECL. The contents of the report do not, in any way, purport to include any manner of legal advice or opinion.

Any operating information and CEMS data used in this report has been supplied by the client.

This report should not be reproduced, (except in full) without the written approval of the laboratory.

Should the Client wish to release this report to a Third Party for the party's reliance, Environmental Compliance Ltd may, at its discretion, agree to such release provided that:

- Environmental Compliance Ltd gives written agreement prior to such release and ECL has received payment in full for all works/services undertaken;
- By release of the report to the Third Party, that Third Party does not acquire any rights, contractual or otherwise, whatsoever against Environmental Compliance Ltd and, accordingly, Environmental Compliance Ltd assume no duties, liabilities or obligations to that Third Party;
- Environmental Compliance Ltd accepts no responsibility for any loss or damage incurred by the Client or for any conflict of Environmental Compliance Ltd interests arising out of the Clients' release of this report to the Third Party.

In the event that a report is revised and re-issued, the client shall ensure that any earlier versions of the report, and any copies thereof, are void and such copies should be marked with the words "superseded and revised".

Opinions and Interpretation expressed within this report are outside the scope of the UKAS accreditation.

MCERTS requirements mean that comparison of results with emissions limit values is not permitted within this report.

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date. : 15th January 2021

TABLE OF CONTENTS

Section	Description	Page Number
	Document Control Sheet	
PART 1	EXECUTIVE SUMMARY	4
1	MONITORING OBJECTIVES	4
1.1	Monitoring Results	5
1.2	Operating Information	6
2	MONITORING DEVIATIONS	7
PART 2	SUPPORTING INFORMATION	8
3	SAMPLING STAFF DETAILS	8
4	SAMPLING PROTOCOLS / METHODOLOGIES	9
5	SAMPLE POINT DESCRIPTIONS	10
	EQUIPMENT IDs	11
	TABLES	13
	VELOCITY TRAVERSE PROFILES	20
	FIELD CALIBRATION AND SAMPLING DATA	22
	LABORATORY ANALYSIS RESULTS	28
	UNCERTAINTY CALCULATIONS	38

PART 1 - EXECUTIVE SUMMARY

1 Monitoring Objectives

Environmental Compliance Ltd (ECL) was commissioned by **Babcock & Wilcox Volund Limited** to undertake an emission monitoring survey at their **Margam Green Energy Plant**. This report presents the findings of the study.

The monitoring at this installation was carried out in accordance with our quotation reference **DHFB/P4246/Q002**, for compliance check monitoring of emissions to air. The substances requested for monitoring at each emissions point are listed below:

Substances to be monitored	Emission Point Identification
	A1
Velocity / Flowrate	• U
Oxygen	• U
Dioxins / Furans	• U
PCBs	• U
PAHs	• U
Heavy Metals (Cd, Tl, Sb, As, Pb, Cr, Co, Cu, Mn, Ni & V)	• U
Mercury (Hg)	• U

- Denotes the substances to be monitored.

U

Denotes UKAS accreditation is held for monitoring that substance, but does not mean that it has been claimed which will depend on whether the testing could be completed in accordance with the Standard Reference Method.

Special Requirements: During Normal Operation.

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

1.1 Monitoring Results

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty %	Reference Conditions 273 K, 101.3 kPa	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation Claimed For Test Result	Tick if non-conforming test (see Section 2)	Operating Status
A1	Volumetric Flowrate	...	88.47338	m ³ /sec	4	Stack Conditions	23/11/2020	12:00 – 13:05	BS EN 16911-1:2013 & MID	UKAS / MCERTS		Normal
	Volumetric Flowrate	...	51.27988	m ³ /sec	6	Dry & 6% O ₂	23/11/2020	12:00 – 13:05	BS EN 16911-1:2013 & MID	UKAS / MCERTS		
	Dioxin & Furans \$	0.1	0.0028	ng/m ³	13	Dry & 6% O ₂	24/11/2020	09:50 – 16:29	BS EN 1948-1:2006 & MID	UKAS / MCERTS	✓	
	PCBs \$	...	0.0584	ng/m ³	11	Dry & 6% O ₂	24/11/2020	09:50 – 16:29	BS EN 1948-1 & 4:2010	UKAS / MCERTS	✓
	PAH \$	...	6.93	µg/m ³	15	Dry & 6% O ₂	25/11/2020	09:25 – 15:43	BS ISO 11338:2003	NU	✓
	Heavy Metals* \$	0.5	0.062	mg/m ³	5	Dry & 6% O ₂	23/11/2020	15:15 – 16:24	BS EN 14385:2004 & MID	UKAS / MCERTS	✓	
	Cadmium / Thallium \$	0.05	0.00088	mg/m ³	5	Dry & 6% O ₂	23/11/2020	15:15 – 16:24	BS EN 14385:2004 & MID	UKAS / MCERTS	✓	
	Mercury \$	0.05	0.0013	mg/m ³	8	Dry & 6% O ₂	23/11/2020	15:15 – 16:24	BS EN 14385:2004 & MID	UKAS / MCERTS	✓	

(* Sum of Sb, As, Pb, Cr, Co, Cu, Mn, Ni & V)

The volumetric flowrate shown above is that from the initial pitot traverse.

Any other flow measurements made during isokinetic sampling and/ or repeat traverses are shown later in the tables section.

Notes

Emission Limit Value
 Periodic Monitoring Result
 Uncertainty
 Reference Conditions
 Monitoring Method Reference
 Accreditation for use of Method
 Operating Status
 \$
 NU
 NA

The emission limit value is that stated in the permit and will be expressed as a concentration or a mass emission.
 The result given is expressed in the same terms and units as the emission limit value.
 The uncertainty associated with the quoted result is at the 95% confidence interval. The Uncertainty results **DO NOT** take into account the effect of the sample location limitations.
 All results are expressed at 273 K and 101.3kPa. The oxygen and moisture corrections are stated.
 The method stated is in accordance with the Environment Agency Technical Guidance Note M2, or other method approved by the Environment Agency.
The details indicate the accreditation for the use of the complete monitoring method, e.g. MCERTs, UKAS. If use of the method is not accredited " NA" is stated.
 The details indicate the feedstock and the loading rate of the plant during monitoring.
 Chemical Analysis on sample reagents was performed by an External Laboratory as detailed in Section 4
 UKAS Accreditation Held but UKAS Accreditation cannot be claimed for the test as sampling did not comply with the Standard Reference Method (SRM), see section 2 & 5
Method is NOT UKAS Accredited.

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date. : 15th January 2021

1.2 Operating Information

Any operating information and CEMS data below has been supplied by the client.

Emission Point Reference	Process Type	Process Duration	Fuel	Feedstock	Abatement	Load	Comparison of Operator CEMS and Periodic Monitoring Results					
							Parameter	Date	Time	CEMS Results	Periodic Monitoring Results	Units
A1	Continuous	Continuous	Wood	Wood Grade 2-4	PAC, Lime & SNCR Injection, NH ₃ .	100%	...	...	...	NP	...	...

Notes:

Process Type State whether the process is a continuous or batch process.
 Process Duration If a batch process, state the duration, frequency and details of the portion of the batch sampled. If continuous state "NA"
 Fuel If applicable, state the fuel type If not applicable state "NA"
 Feedstock State the feedstock type
 Abatement State the type and whether operational during monitoring. If not applicable state "NA"
 Load State the normal load, throughput or rating of the plant
 CEMS Data Enter this data for each CEM installed if it has been provided by operator otherwise state "NP" (NOT PROVIDED)

2 Monitoring Deviations

The objective of the survey was to measure the concentrations of pollutants from the processes / locations as detailed in Section 1. This survey meets the requirements of the site's **PPC Permit Number: EPR/DP3137EG** where UKAS and MCERTS accreditation has and could be claimed for the testing in the monitoring results table.

There were modifications to the sampling procedures (TPDs) listed in section 4, as follows:

Due to high duct gas velocity, in order to maintain isokinetic sampling, it was necessary to use a nozzle with diameter smaller than the recommended minimum of 8mm minimum stated in BS EN 13284-1:2017. Note that there is no absolute minimum nozzle size stated in the standard, as long as the uncertainty of the nozzle area is < 5%. So this does not need to be described as a non-conforming test.

There were no substance deviations from the original and agreed emissions monitoring schedule.

Non-conforming tests are as follows:

Following the closure of one of the main UKAS accredited laboratories, there is currently insufficient availability of UKAS accredited laboratory analysis for stack **PAH** samples. After discussions with the EA, we have been advised that the current EA stance at national level, is to accept results for **PAH** samples that do not have UKAS accreditation for analysis, as long as they are sampled under UKAS/MCERTS accreditation. The samples in this report are affected and so although sampled to the requirements of UKAS/MCERTS, the reported results are NU (not accredited).

Dioxins & Furans, PCBs, PAHs and Heavy Metals & Mercury: In order to facilitate sampling, the sample train had to be broken during port changes. This was due to the platform shelter being constructed between the two sample ports, meaning the sampling equipment had to be broken to safely move it around the stack.

The Uncertainty of the reported concentrations for these pollutant results DOES NOT take into account the effect of non-conformities or sample location limitations

Homogeneity tests have not been completed for pollutants at the following locations: **A1**. Such tests were not requested by the client.

PART 2 – SUPPORTING INFORMATION

3 SAMPLING STAFF DETAILS

Site Sampling Team

Names of Site Team	Dates on Site	MCERTS No.	LEVEL	Technical Endorsements
Harry Round	23 – 26/11/2020	MM 14 1278	2	TE1, TE2, TE3, TE4
Scott Hackett	24 – 26/11/2020	MM 07 889	2	TE1, TE2, TE3, TE4
Peter Brockway	23 – 26/11/2020	MM 17 1459	2	TE1, TE4
Zac Watkinson	23 – 26/11/2020	MM 20 1612	Trainee	...

Report Reviewer

Name	MCERTS No.	LEVEL	Technical Endorsements
Andy Barnes	MM 03 235	2	TE1, TE2, TE3, TE4

Technical Endorsement Key:-

- TE1 – Isokinetic** Particulates, Temperature & Velocity Profiles, Oxygen.
TE2 – Isokinetic Extractive Pollutants:- Metals, Dioxin & Furans, PAHs, PCBs, HCl, HF.
TE3 – Non-Isokinetic Extractive Pollutants:- Speciated VOCs, HF, HCl, Cyanide.
TE4 – Continuous Analysers (Combustion Gases):- TVOC, CO, NOx, SO2.

4 SAMPLING PROTOCOLS / METHODOLOGIES

Details of the substances monitored, the standard methods used and the Environmental Compliance Limited Technical Procedures used during this survey are shown in the table below. Detailed sampling protocols are included in a separate document which will be sent with the report.

In all cases, where analysis of collected samples was required, the analysis was by a subcontract laboratory. Details of the sub-contract laboratory are shown on the analysis certificates in this report. The UKAS/MCERTs accreditation status of the analysis is also indicated on the certificates.

Any required modifications to the Technical Procedure Documents (TPDs) specified below will be detailed in section 2 of this report.

Determinand	External Reference Method	ECL Technical Procedure Number
Velocity and Flowrate	BS EN 16911-1:2013 & MID	ECL/ TPD/ 022A
Metals (with mercury)	BS EN 14385:2004 & MID	ECL / TPD / 029
Dioxins & Furans	BS EN 1948-1:2006	ECL / TPD / 031
PCBs	BS EN 1948-4:2010	ECL / TPD / 031
Oxygen (PG350)	BS EN 14789: 2017	ECL / TPD / 033D
PAHs	ISO 11338:2003	ECL / TPD / 037
Moisture	BS EN 14790: 2017	ECL / TPD / 082

5 SAMPLE POINT DESCRIPTIONS

The homogeneity test is applicable to combustion processes, but may also be requested by the regulator for non-combustion processes.

Homogeneity testing has not been completed at this location.

The test is not usually required for stacks with sampling plane areas of $< 1\text{m}^2$ (below 1.13m in diameter for circular ducts).

The Uncertainty of the reported concentrations for these pollutant results DOES NOT take into account the effect of non-conformities or sample location limitations.

The sample location that was monitored is detailed below:

A1

The stack diameter is 2.40m and the sample platform width back from the sample port is 4m.

Two sample ports are located on the stack at 90 degrees to each other and are located on the same plane.

These sample ports are located at a height of approximately 1.2m from the working sample platform.

Access to the sample platform was attained by means of permanent ladder accessed from outside the main production building. Platform is approximately 45m from ground level. Two scaffold shelters were constructed, one at the base of the stack and one on the stack's platform.

Two transformers, with 6 x 110v (4x16amp, 2x32amp) sockets on each, are supplied at the base of the stack on request.

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
Permit No : EPR/DP3137EG
Variation No : ...
Report Ref : P4246 : R003

Installation Name : A1 Incinerator
Visit Details : Compliance – November 2020
Survey Dates : 23rd - 26th November 2020
Report Issue Date. : 15th January 2021

EQUIPMENT IDs
(Pre site checklist from SSP)

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date. : 15th January 2021

PRE SITE EQUIPMENT CHECKLIST/ EQUIPMENT USED

(Completed before departure to site and when on site in full)

Equipment	Equip. Type	ID No:	ID No:	ID No:	ID No:	ID No:	ID No:	ID No:	ID No:
MST console/pump	E001	U003							
MST Nozzle set		648							
MST "S" Type Pitot		769							
MST Probe		1197							
MST Hot Box		977							
MST Impinger Arm		391							
		655							
Barometer		627							
Site Balance		1069							
Site Check weights		190							
		191							
Horiba	E002	1065							
Heated Probe / Filter		632							
Chiller		970							
MFC									
Heated Line		875							
FID	E003								
Heated Line									
Heated Probe / Filter									
Testo	E004								
FTIR	E005								
Heated Probe / Filter									
Heated Line									
Stackmite	E006								
"L" Type Pitot									
Digital Manometer									
Stack Thermocouple									
Thermocouple Reader		1198							
Nozzle Set									
Workhorse Pumps	E007								
Stack Thermocouple									
Tube Thermocouple									
Meter Thermocouple									
High Vac Gauge									
Dioxin Thermocouple		937							

Quantity of Ice Required / Used for Survey	14	Bags (2kg bags)
--	----	-----------------

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
Permit No : EPR/DP3137EG
Variation No : ...
Report Ref : P4246 : R003

Installation Name : A1 Incinerator
Visit Details : Compliance – November 2020
Survey Dates : 23rd - 26th November 2020
Report Issue Date. : 15th January 2021

TABLES

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date. : 15th January 2021

Table 1 - Dioxins and Furans

Data Recorded from Incinerator - Stack A1

Emission Parameter		Units	Test D&F & PCBs	
Stack Diameter		metres	2.4	
-		-	-	
Area of sample plane		m ²	4.524	
Moisture Content		%	18.97	
Moisture Expanded Uncertainty		%(Relative)	5.23	
Stack Temperature		°C	119	
Oxygen Concentration		%	5.63	
Gas velocity (as Measured)		m/sec	16.5456	
Gas velocity (Reference Conditions)		m/sec*	9.5025	
Volumetric Flowrate (as Measured)		m ³ /sec	74.8506	
Volumetric Flowrate (Reference Conditions)		m ³ /sec*	42.9885	
Sample Date		24/11/2020		
Sample Period		09:50 - 16:29		
Sample Reference		ECL/20/6244-6246		
Sample Volume (Reference Conditions)		m ³ *	6.31	
Isokinetic Sampling Rate		%	100.14	
Species	Sample Reference: ECL/20/6244-6246		Blank Reference: ECL/20/6247-6249	
	Conc. ng/m ³ *	TEQ ng/m ³ *	Conc. ng/m ³ *	TEQ ng/m ³ *
Dioxins 2,3,7,8 Isomers	0.026	0.0011	0.0011	0.000039
Total Dioxins Non – Targeted	0.00	...	0.00	...
Furans 2,3,7,8 Isomers	0.014	0.0017	0.00038	0.000023
Total Furans Non – Targeted	0.00	...	0.00	...
TOTAL	...	0.0028	...	0.00006
Range	...	0.0028 - 0.0028	Blank < 10% of ELV?	YES
% Uncertainty	...	13		

*Reference Conditions 273K, 101.3kPa, 6% Oxygen, Dry Gas. NB: For each congener, where the blank concentration exceeds or equals the measured concentration, the blank value has been substituted. Refer to the table of individual congeners for more detailed information.

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

Table 1B - Dioxins and Furans

Data Recorded from Incinerator - Stack A1 on the 24/11/20, 09:50 - 16:29

Species	Blank Reference: ECL/20/6247-6249 TEQ ng/m³*	EEC Toxic Equivalent Factor (TEF)	Sample Ref.: ECL/20/6244-6246		WHO Humans & Mammals (TEF)	Humans & Mammals TEQ ng/m³*	WHO Fish (TEF)	Fish TEQ ng/m³*	WHO Birds (TEF)	Birds TEQ ng/m³*
			Concentration ng/m³*	TEQ ng/m³*						
Dioxins - 2,3,7,8 Isomers										
2,3,7,8 - TCDD	0.000016	1	0.00030	0.00030	1	0.00030	1	0.00030	1	0.00030
1,2,3,7,8 - PeCDD	0.000016	0.5	0.00067	0.00033	1	0.00067	1	0.00067	1	0.00067
1,2,3,4,7,8 - HxCDD	0.000002	0.1	0.00059	0.000059	0.1	0.00059	0.5	0.00029	0.05	0.000029
1,2,3,6,7,8 - HxCDD	0.000002	0.1	0.0015	0.00015	0.1	0.00015	0.01	0.000015	0.01	0.000015
1,2,3,7,8,9 - HxCDD	0.000002	0.1	0.0011	0.00011	0.1	0.00011	0.01	0.000011	0.1	0.00011
1,2,3,4,6,7,8 - HpCDD	0.000002	0.01	0.011	0.00011	0.01	0.00011	0.001	0.000011	0.001	0.000011
OCDD	0.000001	0.001	0.011	0.000011	0.0001	0.000001	0	...	0	...
Total Dioxins - Non - Targeted Isomers										
TCDD	...	0	0.000000	...	0	...	0	...	0	...
PeCDD	...	0	0.000000	...	0	...	0	...	0	...
HxCDD	...	0	0.000000	...	0	...	0	...	0	...
HpCDD	...	0	0.000000	...	0	...	0	...	0	...
Furans - 2,3,7,8 Isomers										
2,3,7,8 - TCDF	0.000002	0.1	0.0029	0.00029	0.1	0.00029	0.05	0.00014	1	0.0029
1,2,3,7,8 - PeCDF	0.000001	0.05	0.0018	0.000091	0.05	0.000091	0.05	0.000091	0.1	0.00018
2,3,4,7,8 - PeCDF	0.000008	0.5	0.0019	0.00095	0.5	0.00095	0.5	0.00095	1	0.0019
1,2,3,4,7,8 - HxCDF	0.000002	0.1	0.00095	0.000095	0.1	0.000095	0.1	0.000095	0.1	0.000095
1,2,3,6,7,8 - HxCDF	0.000002	0.1	0.0011	0.00011	0.1	0.00011	0.1	0.00011	0.1	0.00011
2,3,4,6,7,8 - HxCDF	0.000006	0.1	0.0011	0.00011	0.1	0.00011	0.1	0.00011	0.1	0.00011
1,2,3,7,8,9 - HxCDF	0.000002	0.1	0.00014	0.000014	0.1	0.000014	0.1	0.000014	0.1	0.000014
1,2,3,4,6,7,8 - HpCDF	0.000001	0.01	0.0029	0.000029	0.01	0.000029	0.01	0.000029	0.01	0.000029
1,2,3,4,7,8,9 - HpCDF	0.000000	0.01	0.00027	0.000003	0.01	0.000003	0.01	0.000003	0.01	0.000003
OCDF	0.000000	0.001	0.00093	0.000001	0.0001	0.000000	0.0001	0.000000	0.0001	0.000000
Total Furans - Non - Targeted Isomers										
TCDF	...	0	0.000000	...	0	...	0	...	0	...
PeCDF	...	0	0.000000	...	0	...	0	...	0	...
HxCDF	...	0	0.000000	...	0	...	0	...	0	...
HpCDF	...	0	0.000000	...	0	...	0	...	0	...
TOTAL	0.000062	...	...	0.0028	...	0.0031	...	0.0028	...	0.0065
Range	...	...	...	0.0028 - 0.0028	...	0.0031 - 0.0031	...	0.0028 - 0.0028	...	0.0065 - 0.0065
% Uncertainty	...	...	...	13	...	13	...	14	...	17

*Reference Conditions 273K, 101.3kPa, 6% Oxygen, Dry Gas. NB: For each congener, where the blank concentration exceeds or equals the measured concentration, the blank value has been substituted. This is presented as shaded cells. Where the Limit of Detection applies, concentrations are presented in italics.

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

Table 2 - PCBs

Data Recorded from Incinerator - Stack A1

Date	Sample Period	Average Stack Temperature	Moisture	Oxygen	Sample Volume	Volumetric Flowrate	Isokinetic Sampling Rate
		°C	%	%	m ³ *	m ³ /sec*	%
24/11/2020	09:50 - 16:29	119.34	18.97	5.63	6.31	42.99	100.14

Species	Blank Ref.: ECL/20/6247-6249 ng/m ³ *	Sample Ref.; ECL/20/6244-6246 ng/m ³ *	WHO Humans & Mammals (TEF)	Humans & Mammals TEQ ng/m ³ *	WHO Fish (TEF)	Fish TEQ ng/m ³ *	WHO Birds (TEF)	Birds TEQ ng/m ³ *
PCB BZ#105	0.001061	0.008410	0.0001	0.0000008	0.000005	0.0000000	0.00010	0.0000008
PCB BZ#114	0.000032	0.000760	0.0005	0.0000004	0.000005	0.0000000	0.00010	0.0000001
PCB BZ#118	0.002281	0.019798	0.0001	0.0000020	0.000005	0.0000001	0.00001	0.0000002
PCB BZ#123	0.000032	0.000634	0.0001	0.0000001	0.000005	0.0000000	0.00001	0.0000000
PCB BZ#126	0.000063	0.002059	0.1	0.00021	0.005000	0.000010	0.10000	0.00021
PCB BZ#156	0.000158	0.001489	0.0005	0.0000007	0.000005	0.0000000	0.00010	0.0000001
PCB BZ#157	0.000048	0.000697	0.0005	0.0000003	0.000005	0.0000000	0.00010	0.0000001
PCB BZ#167	0.000048	0.000618	0.00001	0.0000000	0.000005	0.0000000	0.00001	0.0000000
PCB BZ#169	0.000000	0.000554	0.01	0.0000055	0.000050	0.0000000	0.00100	0.0000006
PCB BZ#189	0.000079	0.000855	0.0001	0.0000001	0.000005	0.0000000	0.00001	0.0000000
PCB BZ#77	0.000681	0.020748	0.0001	0.0000021	0.000100	0.0000021	0.05000	0.0010
PCB BZ#81	0.000032	0.001806	0.0001	0.0000002	0.000500	0.0000009	0.10000	0.00018
TOTAL	0.0045	0.0584	...	0.00022	...	0.000013	...	0.0014
Range	...	...	...	0.00022 - 0.00022	...	0.000013 - 0.000013	...	0.0014 - 0.0014
% Uncertainty	...	11	...	21	...	17	...	16

*Reference Conditions 273K, 101.3kPa, 6% Oxygen, Dry Gas. NB: For each congener, where the blank concentration exceeds or equals the measured concentration, the blank value has been substituted. This is presented as shaded cells.

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

Table 3 - PAH

Data Recorded from Incinerator - Stack A1

Emission Parameter	Units	Test PAH		
Stack Diameter	metres	2.4		
-	-	-		
Area of sample plane	m ²	4.524		
Moisture Content	%	16.82		
Moisture Expanded Uncertainty	%(Relative)	5		
Stack Temperature	°C	118		
Oxygen Concentration	%	5.71		
Gas velocity (as Measured, Adjusted for Smooth Walls)	m/sec	18.1250		
Gas velocity (Reference Conditions)	m/sec*	10.6965		
Volumetric Flowrate (as Measured)	m ³ /sec	81.9954		
Volumetric Flowrate (Reference Conditions)	m ³ /sec*	48.3899		
Sample Date	25/11/2020			
Sample Period	09:25 - 15:43			
Sample Volume (Reference Conditions)	m ³ *	6.858		
Isokinetic Sampling Rate	%	100.84		
Determinand	Concentration (µg/m ³)*	Expanded Uncertainty % Relative	Mass Emission g/hr*	Blank Concentration (µg/m ³)*
Sample Reference	ECL/20/6250-6252			ECL/20/6253-6255
Anthanthrene	0.0015	> 100	0.00025	0.0015
Benzo(a)Anthracene	0.0018	> 100	0.00032	0.0018
Benzo(a)pyrene	0.0015	> 100	0.00025	0.0015
Benzo(b)fluoranthene	0.0015	> 100	0.00025	0.0015
Benzo(b)naphtho(2,1-d)thiophene	0.0054	18	0.00094	0.0054
Benzo(c)phenanthrene	0.0015	> 100	0.00025	0.0015
Benzo(ghi)Perylene	0.0015	> 100	0.00025	0.0015
Benzo(k)fluoranthene	0.0015	> 100	0.00025	0.0015
Cholanthrene	0.0015	> 100	0.00025	0.0015
Chrysene	0.0016	> 100	0.00028	0.0016
Cyclopenta(cd)pyrene	0.0015	> 100	0.00025	0.0015
Dibenzo (ai) pyrene	0.0015	> 100	0.00025	0.0015
Dibenzo(ah)Anthracene	0.0015	> 100	0.00025	0.0015
Fluoranthene	0.050	18	0.0088	0.050
Indeno(123-cd)Pyrene	0.0015	> 100	0.00025	0.0015
Naphthalene	6.85	18	1.19	6.85
Total (Excluding Non-Detects)	6.91	15	...	6.93
Total (Including Non-Detects)	6.93	15		

*Reference Conditions (273K, 101.3kPa, 6% Oxygen, Dry Gas)

Values in *italics* are "non-detect" and represent the analysis technique limit of detection.

For each PAH, where the blank concentration is greater than or equal to the measured concentration, the blank value has been substituted and is highlighted by shading (or *italics* if originally a non-detect).

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

Table 4A – Metals

Sampling Location: Incinerator A1

Test Heavy Metals											
Stack Profile:	Circular	Units	Gas velocity (as Measured. Adjusted for Smooth Walls):						20.4881	m/sec	
Diameter:	2.40	m	Gas velocity (Reference Conditions):						11.7899	m/sec *	
			Volumetric Flowrate (as Measured):						92.6858	m³/sec	
Area of sample plane:	4.524	m²	Volumetric Flowrate (Reference Conditions):						53.3361	m³/sec *	
Moisture Content:	18.65	%	Sample Date:						23/11/2020		
Stack Temperature:	119	°C	Sample Period:						15:15 - 16:24		
Barometric Pressure:	1007	mbar	Sample Volume:						1.381	m³	
Measured Oxygen:	5.66	%	Isokinetic Rate (95% < ISOKx > 115%):						105.91	%	
*Reference Conditions: (273K, 101.3kPa, 6% Oxygen, Dry Gas)											
Trace Element	Symbol	Mass (mg)			ECU/20/6256 - 6261			Emission Rate (g/hr)*	Uncertainty (%)	ECU/20/6262 - 6267	
					Concentration (mg/m³)*					Blank	
		Particulate Phase	Vapour Phase	Total Element Phase	Particulate Phase	Vapour Phase	Total Element Phase		Total Element Phase	Mass (mg)	Conc. (mg/m³)
Antimony	Sb	0.0015	0.00021	0.0017	0.0011	0.00015	0.0012	0.24	14	0.00073	0.00053
Arsenic	As	0.0029	0.00029	0.0032	0.0021	0.00021	0.0023	0.44	11	0.00070	0.00050
Cadmium	Cd	0.00050	0.00016	0.00066	0.00036	0.00011	0.00048	0.091	11	0.00063	0.00046
Chromium	Cr	0.0020	0.0050	0.0070	0.0014	0.0036	0.0051	0.98	9	0.0020	0.0015
Cobalt	Co	0.00050	0.00016	0.00066	0.00036	0.00011	0.00048	0.091	11	0.00063	0.00046
Copper	Cu	0.0061	0.0023	0.0084	0.0044	0.0017	0.0061	1.17	10	0.00096	0.00070
Lead	Pb	0.036	0.018	0.054	0.026	0.013	0.039	7.56	11	0.00093	0.00067
Manganese	Mn	0.0035	0.0020	0.0055	0.0025	0.0014	0.0040	0.76	12	0.0011	0.00082
Mercury	Hg	0.000080	0.0017	0.0018	0.000058	0.0013	0.0013	0.25	12	0.00093	0.00068
Nickel	Ni	0.0028	0.0016	0.0044	0.0020	0.0012	0.0032	0.61	10	0.00080	0.00058
Thallium	Tl	0.00040	0.00016	0.00056	0.00029	0.00011	0.00040	0.077	12	0.00053	0.00038
Vanadium	V	0.00040	0.000079	0.00048	0.00029	0.000057	0.00035	0.067	11	0.00047	0.00034
Mercury		0.000080	0.0017	0.0018	0.000058	0.0013	0.0013	0.25	8	0.00093	0.00068
Cadmium & Thallium		0.00090	0.00031	0.0012	0.00065	0.00023	0.00088	0.17	5	0.0012	0.00084
Antimony, Arsenic, Chromium, Cobalt, Copper, Lead, Manganese, Nickel & Vanadium		0.056	0.030	0.086	0.041	0.022	0.062	11.92	5	0.0084	0.0061

Blank < 10% of ELV
 Blank < 10% of ELV
 Blank < 10% of ELV

Note: Uncertainty for each metals group is based on the summation in quadrature of the individual standard uncertainties (in mg/m³) of each contributing metal. Combined standard uncertainty of each group is converted to 95% confidence (multiplication by k = 2) before being expressed as a percentage of the combined group concentration.

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

Table 4B – Metals Efficiencies

Metals groups have been selected. Efficiencies will only be displayed for individual elements if the group total concentration is greater than 30% of the associated ELV.				
Recovery in the final impinger must be < 10% of the total combined element mass (i.e. filter, probe rinse & impingers) to pass - ONLY if the element makes up > 1% of the total mass of all metals collected				
Trace Element	Symbol	Final Impinger (%)	< 10%?	< 1% of Total?
Antimony	Sb	N/A	N/A	NO
Arsenic	As	N/A	N/A	NO
Cadmium	Cd	N/A	N/A	NO
Chromium	Cr	N/A	N/A	NO
Cobalt	Co	N/A	N/A	YES
Copper	Cu	N/A	N/A	NO
Lead	Pb	N/A	N/A	NO
Manganese	Mn	N/A	N/A	NO
Mercury	Hg	N/A	N/A	NO
Nickel	Ni	N/A	N/A	NO
Thallium	Tl	N/A	N/A	NO
Vanadium	V	N/A	N/A	YES

Combined Groups	ELV mg/m ³	Result < 30% ELV?
Mercury	0.05	YES
Cadmium & Thallium	0.05	YES
Antimony, Arsenic, Chromium, Cobalt, Copper, Lead, Manganese, Nickel & Vanadium	0.5	YES

Environmental Compliance Limited

Babcock & Wilcox Volund Limited

Permit No : EPR/DP3137EG

Variation No : ...

Report Ref : P4246 : R003

Installation Name

: A1 Incinerator

Visit Details

: Compliance – November 2020

Survey Dates

: 23rd - 26th November 2020

Report Issue Date.

: 15th January 2021

VELOCITY TRAVERSE PROFILES

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
Permit No : EPR/DP3137EG
Variation No : ...
Report Ref : P4246 : R003

Installation Name : A1 Incinerator
Visit Details : Compliance – November 2020
Survey Dates : 23rd - 26th November 2020
Report Issue Date : 15th January 2021

Environmental Compliance Limited	Traverse Data Profoma	Date of Measurement	23/11/2020
----------------------------------	-----------------------	---------------------	------------

Company	B&W Volund Ltd	Stack Diameter Port A (mm)	2400	Average Stack Diameter (mm)	2400	Pitot tube coefficient	0.85
Site	Margam	Stack Diameter Port B (mm)	2400	Port Length (mm)	250	Pitot Id	769
Location	Incinerator	Duct Length Port A (mm)		Average Duct Length (mm) L		Stack Thermocouple ID	1198
Stack	A1	Duct Length Port B (mm)		Duct width (mm) B		Stack Temp Reader ID	121
Job No	P4246	Duct Length Port C (mm)		Barometric Pressure. (mb)	1007	Manometer ID	120
Operators	HR / PB / ZW	Duct Length Port D (mm)		Ave Static Press. (mm H ₂ O)	-19.00	Barometer ID	627

Pre - Traverse Checks Carried Out	Time	Pass/ Fail
Pre - Traverse PITOT Visual Inspection	12:00:00	Pass
Pre - Traverse PITOT Leak Check	12:02:00	Pass

Smooth Walls

Static Pressure Readings (mm H ₂ O)			
Port A	Port B	Port C	Port D
-19.00	-19.00		

Port/ Point	Distance to Point (mm)	Time	Temperature Readings (°C)			(ΔP) Pitot Readings (mm H ₂ O)			Average Temp. (°C)	Average (ΔP) (mm H ₂ O)	Swirl Test ° From Reference
			1	2	3	1	2	3			
A1	78	12:06:00	118.0	118.0	118.0	16.00	17.00	16.50	118.0	16.50	11
A2	251	12:09:00	118.0	118.0	118.0	17.50	17.50	17.00	118.0	17.33	11
A3	465	12:12:00	118.0	118.0	118.0	20.00	19.50	20.00	118.0	19.83	10
A4	776	12:15:00	118.0	118.0	118.0	24.50	24.00	25.00	118.0	24.50	9
A5	1624	12:18:00	118.0	118.0	118.0	30.00	30.00	30.00	118.0	30.00	9
A6	1935	12:21:00	118.0	118.0	118.0	32.00	32.00	32.00	118.0	32.00	10
A7	2149	12:24:00	118.0	118.0	118.0	32.00	32.00	30.00	118.0	31.33	9
A8	2322	12:27:00	118.0	118.0	118.0	30.00	30.00	30.00	118.0	30.00	10
B1	78	12:30:00	118.0	118.0	118.0	16.00	16.00	16.00	118.0	16.00	12
B2	251	12:33:00	118.0	118.0	118.0	17.00	17.00	16.50	118.0	16.83	11
B3	465	12:36:00	118.0	118.0	118.0	19.00	20.00	20.00	118.0	19.67	11
B4	776	12:39:00	118.0	118.0	118.0	22.00	23.00	23.00	118.0	22.67	11
B5	1624	12:42:00	118.0	118.0	118.0	25.00	24.50	24.50	118.0	24.67	9
B6	1935	12:45:00	118.0	118.0	118.0	25.00	25.00	25.00	118.0	25.00	10
B7	2149	12:48:00	118.0	118.0	118.0	30.00	30.00	30.00	118.0	30.00	10
B8	2322	12:51:00	118.0	118.0	118.0	30.00	30.00	32.00	118.0	30.67	9
Blockage Check @ A1 (L-Type Pitot Only)			Mean			Mean			1888.0	387.0	Total
			Difference <5% from Initial ?			Difference <5% from Initial ?			118.0	32.0	Max
									118.0	16.0	Min
									118.0	24.2	Average

Stagnation Check (S-type Pitot Only)	Time	Reading
Static Pressure Via Positive Leg (mm H ₂ O)	12:55:00	-19.00
Static Pressure Via Negative Leg (mm H ₂ O)	12:58:00	-19.00
Difference (Pa) < 1 mm H ₂ O ?		0.00

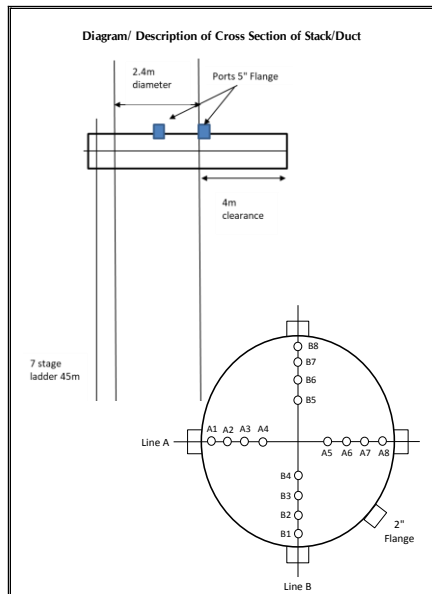
Post - Traverse Checks Carried Out	Time	Pass/ Fail
Post - Traverse PITOT Visual Inspection	13:02:00	Pass
Post - Traverse PITOT Leak Check	13:05:00	Pass

Average temp (K)	391.000
------------------	---------

Suitability of Sampling Position	Actual Stack Conditions
Highest/lowest flow pressure ratio < 9:1?	2:1
Maximum deviation of flow from axis < 15°?	12
X-sectional area for stacks = πr^2	4.52 m ²
X-sectional area for ducts = L x B	m ²
Suitability of Position for Sampling	OK

Stack Moisture	18.15	%	Gas Velocity (as Measured) Adjusted for Smooth Walls	19.55691	m/sec
Measured Oxygen	5.67	%	Gas Velocity (Reference Conditions) Adjusted for Smooth Walls	11.33534	m/sec*
Measured Carbon Dioxide	14.48	%	Volumetric Flowrate (as Measured) Adjusted for Smooth Walls	88.47338	m ³ /sec
Dry Gas Molecular Weight	30.54360	g/g mole	Volumetric Flowrate (Ref Cond) Adjusted for Smooth Walls	51.27988	m ³ /sec*

*Reference Conditions: 273K, 101.3kPa, 6% Oxygen, Dry Gas NOTE: Velocity / volume flowrate calculations exclude contributions from the measurement point(s) where swirl > 15°



Notes
Including expected or actual deviations from procedures / non-conformities

Compliance With Positional Requirements?

Height of sample ports from Platform	1.2m
Number of sample ports	2
Width of platform (port back to handrail)	4m

Nearest downstream disturbance	Inlet	15m
Nearest upstream disturbance	Exit	20m

Disturbances are classed as bends, fans or diameter variations

Environmental Compliance Limited

Babcock & Wilcox Volund Limited

Permit No : EPR/DP3137EG

Variation No : ...

Report Ref : P4246 : R003

Installation Name

: A1 Incinerator

Visit Details

: Compliance – November 2020

Survey Dates

: 23rd - 26th November 2020

Report Issue Date.

: 15th January 2021

FIELD CALIBRATION AND SAMPLING DATA

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
Permit No : EPR/DP3137EG
Variation No : ...
Report Ref : P4246 : R003

Installation Name : A1 Incinerator
Visit Details : Compliance – November 2020
Survey Dates : 23rd - 26th November 2020
Report Issue Date. : 15th January 2021

[illegible]

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

METALS DATA SAMPLING PROFORMA										Date of Measurement		23/11/2020			
ECU/TPD		029		Time taken to change Parts?		5		Start Time		15:15		End Time		16:24	
Client		BAW Volund Ltd		Stack Profile		Circular		Console id		U003		Barometer id		627	
Site		Margam		Stack Area (m ²)		4.52		Pump id		U003		Nozzle id		648	
Location		Incinerator		Barometric Pressure (mb)		1007		Probe id		1197		Nozzle size		6.04	
Stack ID		A1		Static Pres. (mm H ₂ O)		-19		DCM Yd		0.9844		Filter Id		QMA	
Test No.		Heavy Metals		Pilot coefficient		0.85		APid		47.21		Pilot ID		769	
Job No		P4246		Probe Heater Setting (°C)		100		Impinger id		391		Pilot Box ID		977	
ECU Site Staff		HR / HR / ZW		Pilot Box Setting (°C)		100		Balance id		1069					
NB: Leak Check - Record Actual leak rate or '0' but not 'less than' values Sample Leak 1 Leak 2 Leak 3 Leak 4 Leak 5 Total Start Volume 240974.0 Final Volume 362045.2 Total Volume 1471.2 Leak Check First Second Third Fourth Fifth Leak rate Umin 0.2 Vacuum "Hg -12 Time of Check 14:15 Set Rate Umin .25 Leak < 2%? YES															
Dry O ₂ % Atmospheric 5.66 Dry Carbon Dioxide % 14.48 Reference Oxygen Percentage 6 Original K Factor Settings Meter Temp. 20 Stack Temp. 120 %Moisture 15.00 Silica < 10% Spent at End of Test? YES K factor 2.2															
Leak checks DO NOT NEED to be performed (BUT ARE ALLOWED at the end of the test or when mixing between sample parts. EVEN when discarding some are made)															
Traverse Point A1 A2 A3 A4 A5 A6 A7 A8 Total Time/Point (mins) 0 - 4 4 - 8 8 - 12 12 - 16 16 - 20 20 - 24 24 - 28 28 - 32 AP (mm H2O) 16.00 17.50 20.00 24.50 32.00 32.00 30.00 30.00 21.3 K factor 2.20 2.20 2.20 2.20 2.20 2.20 2.20 2.20 55.6 AB (Orifice) 35.20 38.50 44.00 53.90 70.40 70.40 66.00 66.00 21.8 Meter (Tm in) 19.00 22.00 22.00 23.00 23.00 22.00 22.00 21.00 18.3 Meter (Tm out) 17.00 17.00 18.00 18.00 19.00 19.00 19.00 19.00 118.0 Stack Temp (Tt) 118.00 118.00 118.00 118.00 118.00 118.00 118.00 118.00 14.6 Impinger 1 Outlet 14.00 14.00 15.00 15.00 15.00 15.00 15.00 15.00 -2.625 Vacuum (" Hg) -2.00 -2.00 -2.00 -3.00 -3.00 -3.00 -3.00 -3.00															
Traverse Point B8 B7 B6 B5 B4 B3 B2 B1 Total Time/Point(mins) 32 - 36 36 - 40 40 - 44 44 - 48 48 - 52 52 - 56 56 - 60 60 - 64 AP (mm H2O) 30.00 30.00 32.00 30.00 25.00 24.00 22.00 22.00 26.9 K factor 2.20 2.20 2.20 2.20 2.20 2.20 2.20 2.20 59.1 AB (Orifice) 66.00 66.00 70.40 66.00 53.00 52.00 48.00 48.00 20.6 Meter (Tm in) 20.00 21.00 21.00 21.00 21.00 21.00 20.00 20.00 119.0 Meter (Tm out) 18.00 18.00 18.00 18.00 18.00 18.00 18.00 18.00 17.00 Stack Temp (Tt) 119.00 119.00 119.00 119.00 119.00 119.00 119.00 119.00 16.3 Impinger 1 Outlet 15.00 16.00 16.00 16.00 16.00 17.00 17.00 17.00 -4 Vacuum (" Hg) -4.00 -4.00 -4.00 -4.00 -4.00 -4.00 -4.00 -4.00															
Traverse Point Time/Point(mins) AP (mm H2O) K factor AB (Orifice) Meter (Tm in) Meter (Tm out) Stack Temp (Tt) Impinger 1 Outlet Vacuum (" Hg)															
Impinger 1 HNO ₃ / H ₂ O SOU 4167 Start Weight (g) 626.2 End Weight (g) 783.7 Total weight (g) 157.5 Impinger 2 HNO ₃ / H ₂ O SOU 4167 Start Weight (g) 606.7 End Weight (g) 663.7 Total weight (g) 57 Impinger 3 HNO ₃ / H ₂ O SOU 4167 Start Weight (g) 692.8 End Weight (g) 706.4 Total weight (g) 13.6 Impinger 4 Empty SOU Start Weight (g) 487.3 End Weight (g) 490.4 Total weight (g) 3.1 Impinger 5 H ₂ SO ₄ / KMnO ₄ SOU 4175 Start Weight (g) 702.5 End Weight (g) 704.1 Total weight (g) 1.6 Impinger 6 H ₂ SO ₄ / KMnO ₄ SOU 4175 Start Weight (g) 707.9 End Weight (g) 708.7 Total weight (g) 0.8 Impinger 7 Silica SOU Start Weight (g) 858.5 End Weight (g) 873.7 Total weight (g) 15.2 Total (g) 248.8															
PRE-Sample PITOT Visual Inspection Time 14:04 Pass 1 (Y/N) Y PRE-Sample PITOT Leak Check Time 14:06 Pass 1 (Y/N) Y Post-Sample Blockage Check (L-Trap Only) Time 14:06 Pass 1 (Y/N) Y POST-Sample PITOT Visual Inspection Time 16:35 Pass 1 (Y/N) Y POST-Sample PITOT Leak Check Time 16:37 Pass 1 (Y/N) Y Additional Moisture Weighings Item Name Start Weight (g) End Weight (g) Total weight (g)															

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date. : 15th January 2021

Oxygen Calibration Summary – 23rd November 2020

Units

Mean Initial Direct Zero
 Mean Confirmation Direct Zero
 Difference in Direct Zero
 Repeatability at Zero
 <2 x Repeatability at Zero?

Mean Pre Test Zero
 % of Measurement Range?
 Detection Limit (LOD)

Actual Applied Span Concentration

Mean Pre Test System Zero
 Difference $\leq \pm 2\%$ of Span Value?

Mean Post Test Direct Zero
 % of Certified Range?
 Zero Drift $\leq \pm 5\%$ of Applied Span?

Mean Pre Test System Span
 Difference $\leq \pm 2\%$ of Span Value ?

Mean Post Test Direct Span
 Span Drift $\leq \pm 5\%$ Span Value?

Horiba PG 350 Measurement Ranges:	
	O ₂
	25
	%Vol
Zero Values (Direct)	
	0.00
	0.00
	0.00
	0.20
	YES
Pre Zero Values (System)	
	0.06
	0.23%
	0.20
Applied Span:	
	O ₂
	14.89
Pre Test System Zero Values	
	0.06
	0.39%
Post Test Direct Zero Values	
	0.01
	0.02%
	0.04%
Pre Test System Span Values	
	14.79
	0.66%
Post Test Direct Span Values	
	14.88
	0.08%

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

Oxygen Calibration Summary – 24th November 2020

Units

Mean Initial Direct Zero
 Mean Confirmation Direct Zero
 Difference in Direct Zero
 Repeatability at Zero
 <2 x Repeatability at Zero?

Mean Pre Test Zero
 % of Measurement Range?
 Detection Limit (LOD)

Actual Applied Span Concentration

Mean Pre Test System Zero
 Difference $\leq \pm 2\%$ of Span Value ?

Mean Post Test Direct Zero
 % of Certified Range?
 Zero Drift $\leq \pm 5\%$ of Applied Span?

Mean Pre Test System Span
 Difference $\leq \pm 2\%$ of Span Value ?

Mean Post Test Direct Span
 Span Drift $\leq \pm 5\%$ Span Value ?

Horiba PG 350 Measurement Ranges:	
	O ₂
	25
	%Vol
Zero Values (Direct)	
	-0.01
	-0.02
	0.01
	0.20
	YES
Pre Zero Values (System)	
	0.06
	0.24%
	0.20
Applied Span:	
	O ₂
	14.89
Pre Test System Zero Values	
	0.06
	0.40%
Post Test Direct Zero Values	
	0.00
	0.00%
	0.03%
Pre Test System Span Values	
	14.83
	0.38%
Post Test Direct Span Values	
	14.89
	0.02%

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date. : 15th January 2021

Oxygen Calibration Summary – 25th November 2020

Units

Mean Initial Direct Zero
 Mean Confirmation Direct Zero
 Difference in Direct Zero
 Repeatability at Zero
 <2 x Repeatability at Zero?

Mean Pre Test Zero
 % of Measurement Range?
 Detection Limit (LOD)

Actual Applied Span Concentration

Mean Pre Test System Zero
 Difference $\leq \pm 2\%$ of Span Value ?

Mean Post Test Direct Zero
 % of Certified Range?
 Zero Drift $\leq \pm 5\%$ of Applied Span?

Mean Pre Test System Span
 Difference $\leq \pm 2\%$ of Span Value ?

Mean Post Test Direct Span
 Span Drift $\leq \pm 5\%$ Span Value?

Horiba PG 350 Measurement Ranges:	
	O ₂
	25
	%Vol
Zero Values (Direct)	
	-0.01
	-0.02
	0.01
	0.20
	YES
Pre Zero Values (System)	
	0.10
	0.40%
	0.20
Applied Span:	
	O ₂
	14.89
Pre Test System Zero Values	
	0.10
	0.68%
Post Test Direct Zero Values	
	0.00
	0.00%
	0.03%
Pre Test System Span Values	
	14.86
	0.20%
Post Test Direct Span Values	
	14.90
	0.08%

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
Permit No : EPR/DP3137EG
Variation No : ...
Report Ref : P4246 : R003

Installation Name : A1 Incinerator
Visit Details : Compliance – November 2020
Survey Dates : 23rd - 26th November 2020
Report Issue Date. : 15th January 2021

LABORATORY ANALYSIS RESULTS

Laboratory analysis for Metals & Mercury was subcontracted to RPS laboratories, a UKAS Accredited Testing Laboratory, Number 0605. RPS DO hold UKAS & MCERTS accreditation for this analysis. As required by the MCERTS Performance Standard for Organisations, the analysis results are shown below.

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

Results Summary

Report No.: 20-01442-1

Customer Reference: Not Supplied

Customer Order No: P4246 C1914

Customer Sample No	ECL/20/6256	ECL/20/6257	ECL/20/6258	ECL/20/6259	ECL/20/6260	ECL/20/6261	ECL/20/6262	ECL/20/6263	ECL/20/6264	ECL/20/6265	ECL/20/6266	ECL/20/6267
RPS Sample No	6809	6810	6811	6812	6813	6814	6815	6816	6817	6818	6819	6820
Sample Matrix	FILTER	SOLUTION	SOLUTION	SOLUTION	SOLUTION	SOLUTION	FILTER	SOLUTION	SOLUTION	SOLUTION	SOLUTION	SOLUTION
Sampling Date	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020
Determinand	CAS No	Codes	SOP	RL	Units							
volume of sample supplied		U	N/A	n/a	ml		136	530	255	362	340	
arsenic	7440-38-2	UM	M31	0.2	ug	2.3				< 0.2		
cadmium	7440-43-9	UM	M31	0.2	ug	< 0.2				< 0.2		
cobalt	7440-48-4	UM	M31	0.2	ug	< 0.2				< 0.2		
chromium	7440-47-3	UM	M31	0.3	ug	1.7				1.6		
copper	7440-50-8	UM	M31	0.2	ug	3.3				0.3		
manganese	7439-96-5	UM	M31	0.2	ug	1.9				0.8		
nickel	7440-02-0	UM	M31	0.5	ug	1.0				0.5		
lead	7439-92-1	UM	M31	0.3	ug	30.3				0.6		
antimony	7440-36-0	UM	M31	0.4	ug	1.3				< 0.4		
thallium	7440-28-0	UM	M31	0.2	ug	< 0.2				< 0.2		
vanadium	7440-62-2	UM	M31	0.2	ug	< 0.2				< 0.2		
arsenic	7440-38-2	UM	M31	0.3	ug	0.6				< 0.3		
cadmium	7440-43-9	UM	M31	0.3	ug	< 0.3				< 0.3		
cobalt	7440-48-4	UM	M31	0.3	ug	< 0.3				< 0.3		
chromium	7440-47-3	UM	M31	0.3	ug	0.3				< 0.3		
copper	7440-50-8	UM	M31	0.4	ug	2.8				< 0.4		
manganese	7439-96-5	UM	M31	0.2	ug	1.6				< 0.2		
nickel	7440-02-0	UM	M31	0.1	ug	1.8				< 0.1		
lead	7439-92-1	UM	M31	0.2	ug	6.0				< 0.2		
antimony	7440-36-0	UM	M31	0.2	ug	0.2				< 0.2		
thallium	7440-28-0	UM	M31	0.2	ug	< 0.2				< 0.2		
vanadium	7440-62-2	UM	M31	0.2	ug	< 0.2				< 0.2		
arsenic	7440-38-2	UM	M31	0.3	ug/L		0.4	< 0.3		< 0.3	< 0.3	
cadmium	7440-43-9	UM	M31	0.2	ug/L		< 0.2	< 0.2		< 0.2	< 0.2	
cobalt	7440-48-4	UM	M31	0.2	ug/L		< 0.2	< 0.2		< 0.2	< 0.2	
chromium	7440-47-3	UM	M31	0.2	ug/L		0.4	< 0.2		< 0.2	< 0.2	
copper	7440-50-8	UM	M31	0.4	ug/L		4.2	< 0.4		< 0.4	< 0.4	
manganese	7439-96-5	UM	M31	0.2	ug/L		3.6	< 0.2		< 0.2	< 0.2	
nickel	7440-02-0	UM	M31	0.3	ug/L		2.9	< 0.3		< 0.3	< 0.3	
lead	7439-92-1	UM	M31	0.2	ug/L		34.0	< 0.2		< 0.2	< 0.2	
antimony	7440-36-0	UM	M31	0.2	ug/L		0.3	< 0.2		< 0.2	< 0.2	
thallium	7440-28-0	UM	M31	0.2	ug/L		< 0.2	< 0.2		< 0.2	< 0.2	
vanadium	7440-62-2	UM	M31	0.1	ug/L		< 0.1	< 0.1		< 0.1	< 0.1	
mercury	7439-97-6	UM	M112	0.03	ug	< 0.03			< 0.03			
mercury	7439-97-6	UM	M112	0.5	ug/l		< 0.5	< 0.5		< 0.5	< 0.5	
mercury	7439-97-6	UM	M112	0.5	ug/l			1.4	2.5		1.1	0.8
mercury	7439-97-6	UM	M112	0.03	ug/l		0.37			0.30		

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021



371 Millbrook Rd West
 Southampton
 SO15 0HW

Tel: 02380 786979

UKAS accredited testing laboratory No. 1668

Name of Client : Environmental Compliance Ltd Test Certificate No: 88564
 Address : Unit 1G, Main Avenue, Treforest Industrial Estate, Pontypridd, CF37 5BF

ANALYSIS OF PCDDs and PCDFs

Job Reference: P4246
 Sample Identifier : ECL/20/6244 - ECL/20/6246
 Sample No: 88564
 Order No: C1925
 Sample Type: Stack
 Sample Condition : conforming
 Instrument : Thermo DFS
 GC Column : DB5
 Calibration File : 41220
 Date of Receipt : 01/12/20
 Date of Analysis : 11/12/20
 Date of Report : 14/12/20
 Test Method : 2002b
 Blank : 71220
 Sample size: 1

expressed as ng /sample

Congener	Conc	TEFs	TEQ ¹	TEQ ²	DL	REC%
2378-TCDD	0.0019	1.0000	0.0019	0.0019	0.0004	81
12378-PCDD	0.0042	0.5000	0.0021	0.0021	0.0004	80
123478-HxCDD	0.0037	0.1000	0.0004	0.0004	0.0003	86
123678-HxCDD	0.0095	0.1000	0.0009	0.0009	0.0003	79
123789-HxCDD	0.007	0.1000	0.0007	0.0007	0.0003	
1234678-HpCDD	0.0687	0.0100	0.0007	0.0007	0.0002	71
OCDD	0.0716	0.0010	0.0001	0.0001	0.0003	66
2378-TCDF	0.0183	0.1000	0.0018	0.0018	0.0007	71
12378-PCDF	0.0115	0.0500	0.0006	0.0006	0.0005	105
23478-PCDF	0.012	0.5000	0.006	0.006	0.0004	77
123478-HxCDF	0.006	0.1000	0.0006	0.0006	0.0002	78
123678-HxCDF	0.007	0.1000	0.0007	0.0007	0.0002	80
234678-HxCDF	0.0072	0.1000	0.0007	0.0007	0.0002	78
123789-HxCDF	0.0009	0.1000	0.0001	0.0001	0.0002	104
1234678-HpCDF	0.0181	0.0100	0.0002	0.0002	0.0001	78
1234789-HpCDF	0.0017	0.0100	0.0000	0.0000	0.0001	84
OCDF	0.0059	0.0010	0.0000	0.0000	0.0002	64
TEQ (NATO)			0.0174	0.0174		

* Isomer Not detected
 TEQ Toxic Equivalent Value
 TEF Toxic Equivalent Factor
 Conc Concentration
 DL Detection Value
 TEQ¹ Concentration of Non Detected Congeners at Detection Limit
 TEQ² Concentration of Non Detected Congeners at Zero



1668

Reported by : Karolina Pettit
 Position : Manager

Signature : K. Pettit

The analysis was performed in accordance with EN1948-2:2006 and this European Standard, i.e. EN1948-3:2006

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021



Marchwood Scientific Services

**371 Millbrook Rd West
 Southampton
 SO15 0HW**

Tel: 02380 786979

UKAS accredited testing laboratory No. 1668

Name of Client : Environmental Compliance Ltd Test Certificate No: 88564
 Address : Unit 1G, Main Avenue, Treforest Industrial Estate, Pontypridd, CF37 5BF

ANALYSIS OF PCBs

Job Reference: P4246
 Sample Identifier : ECL/20/6244 - ECL/20/6246
 Sample No: 88564
 Order No: C1925
 Sample Type: Stack
 Sample Condition : conforming
 Instrument : Micromass Ultima NT
 GC Column : DB5
 Calibration File : 91220
 Date of Receipt : 01/12/20
 Date of Analysis : 11/12/20
 Date of Report : 14/12/20
 Test Method : 2002
 Blank : 71220
 Sample size: 1

expressed as ng /sample

Congener	Conc	TEFs	TEQ1	TEQ2	DL	Rec %
PCB-105	0.0531	0.00003	0.0000	0.0000	0.0003	78
PCB-114	0.0048	0.00003	0.0000	0.0000	0.0003	86
PCB-118	0.125	0.00003	0.0000	0.0000	0.0003	73
PCB-123	0.004	0.00003	0.0000	0.0000	0.0003	77
PCB-126	0.013	0.10000	0.0013	0.0013	0.0005	96
PCB-156	0.0094	0.00003	0.0000	0.0000	0.0004	73
PCB-157	0.0044	0.00003	0.0000	0.0000	0.0004	71
PCB-167	0.0039	0.00003	0.0000	0.0000	0.0004	76
PCB-169	0.0035	0.03000	0.0001	0.0001	0.0001	85
PCB-189	0.0054	0.00003	0.0000	0.0000	0.0006	75
PCB-77	0.131	0.00010	0.0000	0.0000	0.0004	80
PCB-81	0.0114	0.00030	0.0000	0.0000	0.0003	84
TEQ (WHO)-2005- Mammals			0.0014	0.0014		
PCB-60						97
PCB-159						108

* Isomer Not detected
 TEQ Toxic Equivalent Value
 TEF Toxic Equivalent Factor
 Conc Concentration
 DL Detection Value
 REC Recovery
 TEQ¹ Concentration of Non Detected Congeners at Detection Limit
 TEQ² Concentration of Non Detected Congeners at Zero



1668

Reported by : Karolina Pettit
 Position : Manager

Signature : *K. Pettit*

The analysis was performed in accordance with EN1948-2:2006 and this European Standard, i.e. EN1948-4:2010

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
Permit No : EPR/DP3137EG
Variation No : ...
Report Ref : P4246 : R003

Installation Name : A1 Incinerator
Visit Details : Compliance – November 2020
Survey Dates : 23rd - 26th November 2020
Report Issue Date. : 15th January 2021

Additional Information

Measurement Information

Test Certificate No: 88564

	Institution	Environmental Compliance Ltd	
	Person	n/a	
	Site sampling location	P4246	
	Date : Time	24/11/2020	
Precision		Dioxins	PCBs
Uncertainty		7%	3%
		15%	3.50%
Sample storage	Location	Millbrook	Millbrook
	Temperature	21	21
	Date into storage	01/12/20	01/12/20
Extraction	Date	09/12/20	09/12/20
	Standard Concentration	1 ng	1ng
	Date Added	09/12/20	09/12/20
	Compartments Filter/XAD, Impingers	0.75/0.25	0.75/0.25
Concentration			
	Final Volume	30ul	30ul
Recovery Standards			
	Date Added	10/12/20	10/12/20
	Extract volume at injection	30ul	30ul
	Date of Analysis	11/12/20	11/12/20

The analysis was performed in accordance with EN1948-2:2006 and this European Standard, i.e. EN1948-3:2006

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021



371 Millbrook Rd West
 Southampton
 SO15 0HW

Tel: 02380 786979

UKAS accredited testing laboratory No. 1668

Name of Client : Environmental Compliance Ltd Test Certificate No: 88565
 Address : Unit 1G, Main Avenue, Treforest Industrial Estate, Pontypridd, CF37 5BF

ANALYSIS OF PCDDs and PCDFs

Job Reference: P4246
 Sample Identifier : ECL/20/6247 - ECL/20/6249
 Sample No: 88565
 Order No: C1925
 Sample Type: Stack
 Sample Condition : conforming
 Instrument : Thermo DFS
 GC Column : DB5
 Calibration File : 41220
 Date of Receipt : 01/12/20
 Date of Analysis : 11/12/20
 Date of Report : 14/12/20
 Test Method : 2002b
 Blank : 71220
 Sample size: 1

expressed as ng /sample

Congener	Conc	TEFs	TEQ ¹	TEQ ²	DL	REC%
2378-TCDD	*	1.0000	0.0001	0.0000	0.0001	83
12378-PCDD	*	0.5000	0.0001	0.0000	0.0002	85
123478-HxCDD	*	0.1000	0.0000	0.0000	0.0001	93
123678-HxCDD	*	0.1000	0.0000	0.0000	0.0001	83
123789-HxCDD	*	0.1000	0.0000	0.0000	0.0001	
1234678-HpCDD	0.0011	0.0100	0.0000	0.0000	0.0001	77
OCDD	0.0054	0.0010	0.0000	0.0000	0.0003	74
2378-TCDF	*	0.1000	0.0000	0.0000	0.0001	79
12378-PCDF	*	0.0500	0.0000	0.0000	0.0001	92
23478-PCDF	*	0.5000	0.0000	0.0000	0.0001	89
123478-HxCDF	*	0.1000	0.0000	0.0000	0.0001	86
123678-HxCDF	*	0.1000	0.0000	0.0000	0.0001	83
234678-HxCDF	0.0004	0.1000	0.0000	0.0000	0.0001	88
123789-HxCDF	*	0.1000	0.0000	0.0000	0.0001	95
1234678-HpCDF	0.0006	0.0100	0.0000	0.0000	0.0001	80
1234789-HpCDF	*	0.0100	0.0000	0.0000	0.0001	88
OCDF	0.0007	0.0010	0.0000	0.0000	0.0002	69
TEQ (NATO)			0.0004	0.0001		

* Isomer Not detected
 TEQ Toxic Equivalent Value
 TEF Toxic Equivalent Factor
 Conc Concentration
 DL Detection Value
 TEQ¹ Concentration of Non Detected
 Congeners at Detection Limit
 TEQ² Concentration of Non Detected
 Congeners at Zero



1668

Reported by : Karolina Pettit
 Position : Manager

Signature : K. Pettit

The analysis was performed in accordance with EN1948-2:2006 and this European Standard, i.e. EN1948-3:2006

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021



Marchwood Scientific Services

**371 Millbrook Rd West
 Southampton
 SO15 0HW**

Tel: 02380 786979

UKAS accredited testing laboratory No. 1668

Name of Client : Environmental Compliance Ltd Test Certificate No: 88565
 Address : Unit 1G, Main Avenue, Treforest Industrial Estate, Pontypridd, CF37 5BF

ANALYSIS OF PCBs

Job Reference: P4246
 Sample Identifier : ECL/20/6247 - ECL/20/6249
 Sample No: 88565
 Order No: C1925
 Sample Type: Stack
 Sample Condition : conforming
 Instrument : Micromass Ultima NT
 GC Column : DB5
 Calibration File : 91220
 Date of Receipt : 01/12/20
 Date of Analysis : 11/12/20
 Date of Report : 14/12/20
 Test Method : 2002
 Blank : 71220
 Sample size: 1

expressed as ng /sample

Congener	Conc	TEFs	TEQ1	TEQ2	DL	Rec %
PCB-105	0.0067	0.00003	0.0000	0.0000	0.0003	76
PCB-114	*	0.00003	0.0000	0.0000	0.0002	87
PCB-118	0.0144	0.00003	0.0000	0.0000	0.0002	71
PCB-123	*	0.00003	0.0000	0.0000	0.0002	76
PCB-126	*	0.10000	0.0000	0.0000	0.0004	102
PCB-156	0.001	0.00003	0.0000	0.0000	0.0002	75
PCB-157	0.0003	0.00003	0.0000	0.0000	0.0003	74
PCB-167	0.0003	0.00003	0.0000	0.0000	0.0002	77
PCB-169	*	0.03000	0.0000	0.0000	0.0000	89
PCB-189	*	0.00003	0.0000	0.0000	0.0005	80
PCB-77	0.0043	0.00010	0.0000	0.0000	0.0001	88
PCB-81	0.0002	0.00030	0.0000	0.0000	0.0001	88
TEQ (WHO)-2005- Mammals			0.0000	0.0000		
PCB-60						94
PCB-159						108

* Isomer Not detected
 TEQ Toxic Equivalent Value
 TEF Toxic Equivalent Factor
 Conc Concentration
 DL Detection Value
 REC Recovery
 TEQ¹ Concentration of Non Detected Congeners at Detection Limit
 TEQ² Concentration of Non Detected Congeners at Zero



1668

Reported by : Karolina Pettit
 Position : Manager

Signature : *K. Pettit*

The analysis was performed in accordance with EN1948-2:2006 and this European Standard, i.e. EN1948-4:2010

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
Permit No : EPR/DP3137EG
Variation No : ...
Report Ref : P4246 : R003

Installation Name : A1 Incinerator
Visit Details : Compliance – November 2020
Survey Dates : 23rd - 26th November 2020
Report Issue Date. : 15th January 2021

Additional Information

Measurement Information

Test Certificate No: 88565

	Institution	Environmental Compliance Ltd	
	Person	n/a	
	Site sampling location	P4246	
	Date : Time	24/11/2020	
Precision		Dioxins	PCBs
		7%	3%
Uncertainty		15%	3.50%
Sample storage	Location	Millbrook	Millbrook
	Temperature	21	21
	Date into storage	01/12/20	01/12/20
Extraction	Date	09/12/20	09/12/20
	Standard Concentration	1 ng	1ng
	Date Added	09/12/20	09/12/20
	Compartments Filter/XAD, Impingers	0.75/0.25	0.75/0.25
Concentration			
	Final Volume	30ul	30ul
Recovery Standards			
	Date Added	10/12/20	10/12/20
	Extract volume at injection	30ul	30ul
	Date of Analysis	11/12/20	11/12/20

The analysis was performed in accordance with EN1948-2:2006 and this European Standard, i.e. EN1948-3:2006

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021



371 Millbrook Rd West
 Southampton
 SO15 0HW

Tel: 02380 786979

Name of Client : Environmental Compliance Ltd Test Certificate No: 88566
 Address : Unit 1G, Main Avenue, Treforest Industrial Estate, Pontypridd, CF37 5BF

ANALYSIS OF PAH

Job Reference: P4246 Date of Receipt : 01/12/20
 Sample Identifier : ECL/20/6250 - ECL/20/6252 Date of Analysis : 12/12/20
 Sample No: 88566 Date of Report : 15/12/20
 Order No: C1925
 Sample Condition : normal Test Method : 2002
 Instrument : TSQ8000EVO Blank : 71020
 GC Column : EUPAH Sample Size : 1
 Calibration File : 111220

expressed as ug /sample

Congener	Conc	DL	Rec %
Anthanthrene	*	0.01	
Benzo(a)anthracene	*	0.01	75
Benzo(a)pyrene	*	0.01	64
Benzo(b)fluoranthene	*	0.01	85
Benzo(b)naphth(2,1-d)thiophene	0.0116	0.01	
Benzo(c)phenanthrene	*	0.01	
Benzo(ghi)perylene	*	0.01	53
Benzo(k)fluoranthene	*	0.01	87
Cholanthrene	*	0.01	
Chrysene	*	0.01	77
Cyclopenta (c,d)pyrene	*	0.01	
Dibenzo(a,i)pyrene	*	0.01	
Dibenzo(ah)anthracene	*	0.01	49
Fluoranthene	0.0950	0.01	86
Indeno(1,2,3-cd)pyrene	*	0.01	52
Naphthalene	39.9	0.01	67

* Not Detected
 Conc Concentration
 DL Detection Value

Reported by : Karolina Pettit
 Position : Manager

Signature : *K. Pettit*

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date. : 15th January 2021



371 Millbrook Rd West
 Southampton
 SO15 0HW

Tel: 02380 786979

Name of Client : Environmental Compliance Ltd Test Certificate No: 88567
 Address : Unit 1G, Main Avenue, Treforest Industrial Estate, Pontypridd, CF37 5BF

ANALYSIS OF PAH

Job Reference: P4246 Date of Receipt : 01/12/20
 Sample Identifier : ECL/20/6253 - ECL/20/6255 Date of Analysis : 12/12/20
 Sample No: 88567 Date of Report : 15/12/20
 Order No: C1925
 Sample Condition : normal Test Method : 2002
 Instrument : TSQ8000EVO Blank : 71220
 GC Column : EUPAH Sample Size : 1
 Calibration File : 111220

expressed as ug /sample

Congener	Conc	DL	Rec %
Anthanthrene	*	0.01	
Benzo(a)anthracene	0.0125	0.01	55
Benzo(a)pyrene	*	0.01	37
Benzo(b)fluoranthene	*	0.01	55
Benzo(b)naphth(2,1-d)thiophene	0.0370	0.01	
Benzo(c)phenanthrene	*	0.01	
Benzo(ghi)perylene	*	0.01	29
Benzo(k)fluoranthene	*	0.01	52
Cholanthrene	*	0.01	
Chrysene	0.0109	0.01	57
Cyclopenta (c,d)pyrene	*	0.01	
Dibenzo(a,i)pyrene	*	0.01	
Dibenzo(ah)anthracene	*	0.01	29
Fluoranthene	0.345	0.01	72
Indeno(1,2,3-cd)pyrene	*	0.01	28
Naphthalene	47.0	0.01	44

* Not Detected
 Conc Concentration
 DL Detection Value

Reported by : Karolina Pettit
 Position : Manager

Signature : *K. Pettit*

Environmental Compliance Limited

Babcock & Wilcox Volund Limited

Permit No : EPR/DP3137EG

Variation No : ...

Report Ref : P4246 : R003

Installation Name

Visit Details

Survey Dates

Report Issue Date.

: A1 Incinerator

: Compliance – November 2020

: 23rd - 26th November 2020

: 15th January 2021

UNCERTAINTY CALCULATIONS

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

Stack Reference A1

Measurement Uncertainty Calculations - Velocity at Stack Conditions

Contribution From	Standard u/c (mm H ₂ O)	
Pitot Calibration Uncertainty Contribution	0.121	A
Manometer Calibration Uncertainty Contribution	0.121	B
Variation in Actual Pitot reading at sample points	0.31	C
Combined u/c (mm H ₂ O) =	Combined u/c (mm H ₂ O)	
SQRT (A/ $\sqrt{3}$) ² + (B/ $\sqrt{3}$) ² + (C/ $\sqrt{3}$) ²	0.21	
Expanded Uncertainty of Flow Measurements (mm H₂O)	0.41	
	Standard u/c (K)	
Temperature Calibration (K)	1.96	D
Variation in Actual Temp reading at sample points	0.00	E
Combined u/c of Temp (K)	Combined u/c (K)	
SQRT ((D/ $\sqrt{3}$) ² + (E/ $\sqrt{3}$) ²)	1.13	
Expanded Uncertainty of Temp Measurements (K)	2.26	
Measured Average Velocity (m/s) at Stack Conds	19.66	
Maximum Average Velocity (m/s) at Stack Conds	19.88	
Standard Uncertainty Velocity at Stack Conditions (%)	1.14	
Expanded Uncertainty Velocity (at Stack Conditions)	2.27 (%)	

Measurement Uncertainty Calculations - Flowrate at Stack Conditions

Contribution From	Standard u/c (m ³)
Area (m ²)	0.04524
Measured Average Flowrate (m ³ /s) at Stack Conds	88.92
Maximum Average Flowrate (m ³ /s) at Stack Conds	90.83
Standard Uncertainty Flowrate (m ³ /s) at Stack Conditions (%)	2.15
Expanded Uncertainty Flowrate (m³/s) at Stack Conditions	4.30 (%)

Measurement Uncertainty Calculations - Flowrate at STP & Wet Gas

Contribution From	Standard u/c (%)
Temperature Calibration (K)	0.5
Barometer Calibration	0.5
Measured Average Flowrate (m ³ /s) at STP Wet	61.72
Maximum Average Flowrate (m ³ /s) at STP Wet	63.26
Standard Uncertainty Flowrate (m ³ /s) at STP Wet	2.50
Expanded Uncertainty Flowrate (m³/s) at STP Wet	5.01 (%)

Measurement Uncertainty Calculations - Flowrate at STP & Dry Gas

Contribution From	Standard u/c (%)
Moisture Uncertainty (% v/v)	0.25
Measured Average Flowrate (m ³ /s) at STP Dry	50.51
Maximum Average Flowrate (m ³ /s) at STP Dry	51.94
Standard Uncertainty Flowrate (m ³ /s) at STP Dry	2.82
Expanded Uncertainty Flowrate (m³/s) at STP Dry	5.64 (%)

Measurement Uncertainty Calculations - Flowrate at STP, Dry Gas & Ref Oxygen

Contribution From	Standard u/c (%)
Oxygen Uncertainty (% v/v)	0.057
Measured Average Flowrate (m ³ /s) at STP Dry & Ref Oxygen	51.63
Maximum Average Flowrate (m ³ /s) at STP Dry & Ref Oxygen	53.28
Standard Uncertainty Flowrate (m ³ /s) at STP Dry & Ref Oxygen	3.20
Expanded Uncertainty Flowrate (m³/s) at STP Dry & Ref O₂	6.40 (%)

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

Site: Margam
 Location: A1

Dioxin	Recovered Mass ng	LOD ng	LAB Method Uncert (%) K=2 %age	as Mass (ng)	Standard Uncertainty Symbol	ng
2,3,7,8 - TCDD	0.00190	0.000100	30	0.000570	u2,3,7,8 - TCDD	0.000285
1,2,3,7,8 - PeCDD	0.00420	0.000200	30	0.00126	u1,2,3,7,8 - PeCDD	0.000630
1,2,3,4,7,8 - HxCDD	0.00370	0.000100	30	0.00111	u1,2,3,4,7,8 - HxCDD	0.000555
1,2,3,6,7,8 - HxCDD	0.00950	0.000100	30	0.00285	u1,2,3,6,7,8 - HxCDD	0.00143
1,2,3,7,8,9 - HxCDD	0.00700	0.000100	30	0.00210	u1,2,3,7,8,9 - HxCDD	0.00105
1,2,3,4,6,7,8 - HpCDD	0.0687	0.000100	30	0.0206	u1,2,3,4,6,7,8 - HpCDD	0.0103
OCDD	0.0716	0.000300	30	0.0215	uOCDD	0.0107
2,3,7,8 - TCDF	0.0183	0.000100	30	0.00549	u2,3,7,8 - TCDF	0.00275
1,2,3,7,8 - PeCDF	0.0115	0.000100	30	0.00345	u1,2,3,7,8 - PeCDF	0.00173
2,3,4,7,8 - PeCDF	0.0120	0.000100	30	0.00360	u2,3,4,7,8 - PeCDF	0.00180
1,2,3,4,7,8 - HxCDF	0.00600	0.000100	30	0.00180	u1,2,3,4,7,8 - HxCDF	0.000900
1,2,3,6,7,8 - HxCDF	0.00700	0.000100	30	0.00210	u1,2,3,6,7,8 - HxCDF	0.00105
2,3,4,6,7,8 - HxCDF	0.00720	0.000100	30	0.00216	u2,3,4,6,7,8 - HxCDF	0.00108
1,2,3,7,8,9 - HxCDF	0.000900	0.000100	50	0.000450	u1,2,3,7,8,9 - HxCDF	0.000225
1,2,3,4,6,7,8 - HpCDF	0.0181	0.000100	30	0.00543	u1,2,3,4,6,7,8 - HpCDF	0.00272
1,2,3,4,7,8,9 - HpCDF	0.00170	0.000100	30	0.000510	u1,2,3,4,7,8,9 - HpCDF	0.000255
OCDF	0.00590	0.000200	30	0.00177	uOCDF	0.000885

PCB	Recovered Mass ng	LAB Method Uncert (%) K=2 Percentage	as Mass (ng)	Standard Uncertainty Symbol	ng
PCB BZ#105	0.0531	20	0.0106	uPCB BZ#105	0.00531
PCB BZ#114	0.00480	20	0.000960	uPCB BZ#114	0.000480
PCB BZ#118	0.125	20	0.0250	uPCB BZ#118	0.0125
PCB BZ#123	0.00400	20	0.000800	uPCB BZ#123	0.000400
PCB BZ#126	0.0130	20	0.00260	uPCB BZ#126	0.00130
PCB BZ#156	0.00940	20	0.00188	uPCB BZ#156	0.000940
PCB BZ#157	0.00440	20	0.000880	uPCB BZ#157	0.000440
PCB BZ#167	0.00390	20	0.000780	uPCB BZ#167	0.000390
PCB BZ#169	0.00350	20	0.000700	uPCB BZ#169	0.000350
PCB BZ#189	0.00540	20	0.00108	uPCB BZ#189	0.000540
PCB BZ#77	0.131	20	0.0262	uPCB BZ#77	0.0131
PCB BZ#81	0.0114	20	0.00228	uPCB BZ#81	0.00114

Measured Values			Standard Uncertainty @ 95%		
Sampled Volume (V _m)	6.698	m ³	uV _m	0.001	m ³
Meter Correction Factor (Y _d)	0.984	...	...	...	...
Meter Temperature (T _m)	292.031	k	uT _m	1.5	k
Average Differential Pressure (ΔH)	38.992	mmH ₂ O	uDH	0.25	mmH ₂ O
Barometric Pressure (p _b)	756.810	mmHg	up _b	3.8	mmHg
ΔH + p _s (p _m)	101.282	kPa	...	...	...
Oxygen content (O _{2,m})	5.629	% by volume	uO _{2,m} = σ/√n	0.01	% by volume
Moisture Content (H ₂ O)	18.966	% by volume	uH ₂ O	0.50	% by volume

Note: In the following calculations, the sensitivity coefficient (C) is estimated using:

$$C_i = \frac{\partial f}{\partial x_i}$$

stack pressure uncertainty component (up_s) & measured temperature of dry gas uncertainty component (uT_{m,Dry})

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.920$$

Where results are required at wet conditions, the following correction factor is used to convert the data from the dry gas meter:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.920	0.920	0.0000890	0.0000223
up _b	0.924	0.915	0.00121	0.00454
uT _m	0.925	0.915	0.00315	0.00472
H ₂ O	...	...	...	...

$$\frac{uf_s}{f_s} = \left(\frac{(u\Delta H)^2 + (uP_s)^2}{(P_m/101.3)} \right)^2 + \left(\frac{uT_m}{(T_m/273.15)} \right)^2 + \left(\frac{uH_2O}{(100/(100 - H_2O))} \right)^2 = 0.00583$$

Uncertainty in volume @ reference conditions due to volume correction factor uncertainty component (uV_{std}) & volume uncertainty component (uV_m)

$$V_{std} = V_{measured} \times f_s = 6.161$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty m ³
Effect of uV _{std}	6.200	6.122	6.698	0.0390
Effect of uV _m	6.162	6.160	0.920	0.000920

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s} \right)^2 + \left(\frac{uV_m}{V_m} \right)^2} = 0.2615$$

Uncertainty of oxygen correction factor (uO₂)

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 0.976 \quad uCorr_{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} =$$

$$\therefore uf_{O_2} = \frac{uCorr_{O_2}}{f_{O_2}} \times 100 = 2.36 \%$$

Environmental Compliance Limited

Babcock & Wilcox Volund Limited

Permit No : EPR/DP3137EG

Variation No : ...

Report Ref : P4246 : R003

Installation Name : A1 Incinerator

Visit Details : Compliance – November 2020

Survey Dates : 23rd - 26th November 2020

Report Issue Date. : 15th January 2021

Uncertainty in final dioxin measurement @ reference conditions due to mass uncertainty component (uM)

Dioxin	Maximum ng/Nm ³	Minimum ng/Nm ³	Sensitivity	uM ng/Nm ³
2,3,7,8 - TCDD	0.000346	0.000256	0.158	0.0000451
1,2,3,7,8 - PeCDD	0.000765	0.000565	0.158	0.0000998
1,2,3,4,7,8 - HxCDD	0.000674	0.000498	0.158	0.0000879
1,2,3,6,7,8 - HxCDD	0.00173	0.00128	0.158	0.000226
1,2,3,7,8,9 - HxCDD	0.00127	0.000942	0.158	0.000166
1,2,3,4,6,7,8 - HpCDD	0.0125	0.00925	0.158	0.00163
OCDD	0.0130	0.00964	0.158	0.00170
2,3,7,8 - TCDF	0.00333	0.00246	0.158	0.000435
1,2,3,7,8 - PeCDF	0.00209	0.00155	0.158	0.000273
2,3,4,7,8 - PeCDF	0.00219	0.00162	0.158	0.000285
1,2,3,4,7,8 - HxCDF	0.00109	0.000808	0.158	0.000143
1,2,3,6,7,8 - HxCDF	0.00127	0.000942	0.158	0.000166
2,3,4,6,7,8 - HxCDF	0.00131	0.000969	0.158	0.000171
1,2,3,7,8,9 - HxCDF	0.000178	0.000107	0.158	0.0000356
1,2,3,4,6,7,8 - HpCDF	0.00330	0.00244	0.158	0.000430
1,2,3,4,7,8,9 - HpCDF	0.00310	0.00229	0.158	0.000404
OCDF	0.00107	0.000794	0.158	0.000140

Uncertainty in final PCB measurement @ reference conditions due to mass uncertainty component (uM)

PCB	Maximum ng/Nm ³	Minimum ng/Nm ³	Sensitivity	uM ng/Nm ³
PCB BZ#105	0.00925	0.00757	0.158	0.000841
PCB BZ#114	0.000836	0.000684	0.158	0.0000760
PCB BZ#118	0.0218	0.0178	0.158	0.00198
PCB BZ#123	0.000697	0.000570	0.158	0.0000634
PCB BZ#126	0.00226	0.00185	0.158	0.000206
PCB BZ#156	0.00164	0.00134	0.158	0.000149
PCB BZ#157	0.000767	0.000627	0.158	0.0000697
PCB BZ#167	0.000679	0.000556	0.158	0.0000618
PCB BZ#169	0.000610	0.000499	0.158	0.0000554
PCB BZ#189	0.000941	0.000770	0.158	0.0000855
PCB BZ#77	0.0228	0.0187	0.158	0.00207
PCB BZ#81	0.00199	0.00163	0.158	0.000181

Uncertainty in final measurement @ reference conditions due to uncertainty component arising from leak and/or loss in the sample system (uL)

Dioxin	uL ng/Nm ³
2,3,7,8 - TCDD	3.475E-06
1,2,3,7,8 - PeCDD	7.681E-06
1,2,3,4,7,8 - HxCDD	6.767E-06
1,2,3,6,7,8 - HxCDD	0.0000174
1,2,3,7,8,9 - HxCDD	0.0000128
1,2,3,4,6,7,8 - HpCDD	0.000126
OCDD	0.000131
2,3,7,8 - TCDF	0.0000335
1,2,3,7,8 - PeCDF	0.0000210
2,3,4,7,8 - PeCDF	0.0000219
1,2,3,4,7,8 - HxCDF	0.0000110
1,2,3,6,7,8 - HxCDF	0.0000128
2,3,4,6,7,8 - HxCDF	0.0000132
1,2,3,7,8,9 - HxCDF	1.646E-06
1,2,3,4,6,7,8 - HpCDF	0.0000331
1,2,3,4,7,8,9 - HpCDF	3.109E-06
OCDF	0.0000108

Uncertainty in final measurement @ reference conditions due to uncertainty component arising from leak and/or loss in the sample system (uL)

PCB	uL ng/Nm ³
PCB BZ#105	0.0000971
PCB BZ#114	8.779E-06
PCB BZ#118	0.000229
PCB BZ#123	7.315E-06
PCB BZ#126	0.0000238
PCB BZ#156	0.0000172
PCB BZ#157	8.047E-06
PCB BZ#167	7.133E-06
PCB BZ#169	6.401E-06
PCB BZ#189	9.876E-06
PCB BZ#77	0.000240
PCB BZ#81	0.0000208

Uncertainty in final measurement @ Reference Conditions due to uVsp

Dioxin	Maximum ng/Nm ³	Minimum ng/Nm ³	Sensitivity	uVsp mg/Nm ³
2,3,7,8 - TCDD	0.000314	0.000289	0.0000489	0.0000128
1,2,3,7,8 - PeCDD	0.000695	0.000638	0.000108	0.0000283
1,2,3,4,7,8 - HxCDD	0.000612	0.000562	0.0000953	0.0000249
1,2,3,6,7,8 - HxCDD	0.00157	0.00144	0.000245	0.0000640
1,2,3,7,8,9 - HxCDD	0.00116	0.00106	0.000180	0.0000471
1,2,3,4,6,7,8 - HpCDD	0.0114	0.0104	0.00177	0.000463
OCDD	0.0118	0.0109	0.00184	0.000482
2,3,7,8 - TCDF	0.00303	0.00278	0.000471	0.000123
1,2,3,7,8 - PeCDF	0.00190	0.00175	0.000296	0.0000774
2,3,4,7,8 - PeCDF	0.00198	0.00182	0.000309	0.0000808
1,2,3,4,7,8 - HxCDF	0.000992	0.000912	0.000155	0.0000404
1,2,3,6,7,8 - HxCDF	0.00116	0.00106	0.000180	0.0000471
2,3,4,6,7,8 - HxCDF	0.00119	0.00109	0.000185	0.0000485
1,2,3,7,8,9 - HxCDF	0.000149	0.000137	0.0000232	6.061E-06
1,2,3,4,6,7,8 - HpCDF	0.000299	0.000275	0.000466	0.000122
1,2,3,4,7,8,9 - HpCDF	0.000281	0.000258	0.000438	0.0000114
OCDF	0.000976	0.000896	0.000152	0.0000397

Uncertainty in final measurement @ Reference Conditions due to uVsp

PCB	Maximum ng/Nm ³	Minimum ng/Nm ³	Sensitivity	uVsp mg/Nm ³
PCB BZ#105	0.00878	0.00807	0.00137	0.000358
PCB BZ#114	0.000794	0.000729	0.000124	0.0000323
PCB BZ#118	0.0207	0.0190	0.00322	0.000842
PCB BZ#123	0.000662	0.000608	0.000103	0.0000269
PCB BZ#126	0.00215	0.00198	0.000335	0.0000876
PCB BZ#156	0.00155	0.00143	0.000242	0.0000633
PCB BZ#157	0.000728	0.000669	0.000113	0.0000296
PCB BZ#167	0.000645	0.000593	0.000100	0.0000263
PCB BZ#169	0.000579	0.000532	0.0000901	0.0000236
PCB BZ#189	0.000893	0.000820	0.000139	0.0000364
PCB BZ#77	0.0217	0.0199	0.00337	0.000882
PCB BZ#81	0.00189	0.00173	0.000294	0.0000768

$$u_{combined} = \sqrt{\sum (u_M)^2 + (u_L)^2 + (uV_{sp})^2}$$

Dioxin	Combined Uncertainty ng/Nm ³	Expanded Uncertainty ng/Nm ³	Measured Concentration ng/Nm ³	% of Measured Concentration
2,3,7,8 - TCDD	0.0000470	0.0000941	0.000301	31.268
1,2,3,7,8 - PeCDD	0.000104	0.000208	0.000665	31.268
1,2,3,4,7,8 - HxCDD	0.0000916	0.000183	0.000586	31.268
1,2,3,6,7,8 - HxCDD	0.000235	0.000470	0.00150	31.268
1,2,3,7,8,9 - HxCDD	0.000173	0.000347	0.00111	31.268
1,2,3,4,6,7,8 - HpCDD	0.00170	0.00340	0.0109	31.268
OCDD	0.00177	0.00355	0.0113	31.268
2,3,7,8 - TCDF	0.000453	0.000906	0.00290	31.268
1,2,3,7,8 - PeCDF	0.000285	0.000570	0.00182	31.268
2,3,4,7,8 - PeCDF	0.000297	0.000594	0.00190	31.268
1,2,3,4,7,8 - HxCDF	0.000149	0.000297	0.000950	31.268
1,2,3,6,7,8 - HxCDF	0.000173	0.000347	0.00111	31.268
2,3,4,6,7,8 - HxCDF	0.000178	0.000357	0.00114	31.268
1,2,3,7,8,9 - HxCDF	0.0000362	0.0000724	0.000143	50.771
1,2,3,4,6,7,8 - HpCDF	0.000448	0.000896	0.00287	31.268
1,2,3,4,7,8,9 - HpCDF	0.000421	0.000842	0.00269	31.268
OCDF	0.000146	0.000292	0.000934	31.268

Total (ng/Nm³) 0.040 12.9

$$u_{combined} = \sqrt{\sum (u_M)^2 + (u_L)^2 + (uV_{sp})^2}$$

PCB	Combined Uncertainty ng/Nm ³	Expanded Uncertainty ng/Nm ³	Measured Concentration ng/Nm ³	% of Measured Concentration
PCB BZ#105	0.000919	0.00184	0.00841	21.855
PCB BZ#114	0.0000831	0.000166	0.000760	21.855
PCB BZ#118	0.00216	0.00433	0.0198	21.855
PCB BZ#123	0.0000692	0.000138	0.000634	21.855
PCB BZ#126	0.000225	0.000450	0.00206	21.855
PCB BZ#156	0.000163	0.000325	0.00149	21.855
PCB BZ#157	0.0000762	0.000152	0.000697	21.855
PCB BZ#167	0.0000675	0.000135	0.000618	21.855
PCB BZ#169	0.0000606	0.000121	0.000554	21.855
PCB BZ#189	0.0000935	0.000187	0.000855	21.855
PCB BZ#77	0.00227	0.00453	0.0207	21.855
PCB BZ#81	0.000197	0.000395	0.00181	21.855

Total (ng/Nm³) 0.06 11.3

$$u_{combined} = \sqrt{\sum (u_{f_{o_2}})^2 + (\text{Uncertainty of Measurement of Determinand})^2}$$

Dioxin	% of Measured Concentration	Measurement Uncertainty Oxygen Corr ¹ Factor	Overall Measurement Uncertainty Inc O ₂ Corr ¹ factor (Ucombined)	New Combined Uncertainty ng/m ³
2,3,7,8 - TCDD	31.268	2.360	31.356	0.0000471
1,2,3,7,8 - PeCDD	31.268	2.360	31.356	0.000104
1,2,3,4,7,8 - HxCDD	31.268	2.360	31.356	0.0000917
1,2,3,6,7,8 - HxCDD	31.268	2.360	31.356	0.000235
1,2,3,7,8,9 - HxCDD	31.268	2.360	31.356	0.000173
1,2,3,4,6,7,8 - HpCDD	31.268	2.360	31.356	0.00170
OCDD	31.268	2.360	31.356	0.00177
2,3,7,8 - TCDF	31.268	2.360	31.356	0.000454
1,2,3,7,8 - PeCDF	31.268	2.360	31.356	0.000285
2,3,4,7,8 - PeCDF	31.268	2.360	31.356	0.000297
1,2,3,4,7,8 - HxCDF	31.268	2.360	31.356	0.000149
1,2,3,6,7,8 - HxCDF	31.268	2.360	31.356	0.000173
2,3,4,6,7,8 - HxCDF	31.268	2.360	31.356	0.000178
1,2,3,7,8,9 - HxCDF	50.771	2.360	50.825	0.0000362
1,2,3,4,6,7,8 - HpCDF	31.268	2.360	31.356	0.000448
1,2,3,4,7,8,9 - HpCDF	31.268	2.360	31.356	0.000421
OCDF	31.268	2.360	31.356	0.000146

$$u_{combined} = \sqrt{\sum (u_{f_{o_2}})^2 + (\text{Uncertainty of Measurement of Determinand})^2}$$

PCB	% of Measured Concentration	Measurement Uncertainty Oxygen Corr ¹ Factor	Overall Measurement Uncertainty Inc O ₂ Corr ¹ factor (Ucombined)	New Combined Uncertainty ng/m ³
PCB BZ#105	21.855	2.360	21.982	0.000920
PCB BZ#114	21.855	2.360	21.982	0.0000832
PCB BZ#118	21.855	2.360	21.982	0.00217
PCB BZ#123	21.855	2.360	21.982	0.0000693
PCB BZ#126	21.855	2.360	21.982	0.000225
PCB BZ#156	21.855	2.360	21.982	0.000163
PCB BZ#157	21.855	2.360	21.982	0.0000763
PCB BZ#167	21.855	2.360	21.982	0.0000676
PCB BZ#169	21.855	2.360	21.982	0.0000607
PCB BZ#189	21.855	2.360	21.982	0.0000936
PCB BZ#77	21.855	2.360	21.982	0.00227
PCB BZ#81	21.855	2.360	21.982	0.000198

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

Uncertainty - Adjusted for TEQ / TEF

Dioxin	TEQ ng/m ³	Uncertainty ng/Nm ³	Conc ng/Nm ³	WHO Humans & Mammals (TEF)	Uncertainty ng/Nm ³	Conc ng/Nm ³	WHO Fish (TEF)	Uncertainty ng/Nm ³	Conc ng/Nm ³	WHO Birds (TEF)	Uncertainty ng/Nm ³	Conc ng/Nm ³
2,3,7,8 - TCDD	1	0.0000942	0.000301	1	0.0000942	0.000301	1	0.0000942	0.000301	1	0.0000942	0.000301
1,2,3,7,8 - PeCDD	0.5	0.000104	0.000333	1	0.000208	0.000665	1	0.000208	0.000665	1	0.000208	0.000665
1,2,3,4,7,8 - HxCDD	0.1	0.0000183	0.0000586	0.1	0.0000183	0.0000586	0.5	0.0000917	0.000293	0.05	9.170E-06	0.0000293
1,2,3,6,7,8 - HxCDD	0.1	0.0000471	0.000150	0.1	0.0000471	0.000150	0.01	4.709E-06	0.0000150	0.01	4.709E-06	0.0000150
1,2,3,7,8,9 - HxCDD	0.1	0.0000347	0.000111	0.1	0.0000347	0.000111	0.01	3.470E-06	0.0000111	0.1	0.0000347	0.000111
1,2,3,4,6,7,8 - HpCDD	0.01	0.0000341	0.000109	0.01	0.0000341	0.000109	0.001	3.405E-06	0.0000109	0.001	3.405E-06	0.0000109
OCDD	0.001	3.549E-06	0.0000113	0.0001	3.549E-07	1.134E-06	...	...	...	...	...	...
2,3,7,8 - TCDF	0.1	0.0000907	0.000290	0.1	0.0000907	0.000290	0.05	0.0000454	0.000145	1	0.0000907	0.000290
1,2,3,7,8 - PeCDF	0.05	0.0000285	0.0000911	0.05	0.0000285	0.0000911	0.05	0.0000285	0.0000911	0.1	0.0000570	0.000182
1,2,3,4,7,8 - PeCDF	0.5	0.0000297	0.0000950	0.5	0.0000297	0.0000950	0.5	0.0000297	0.0000950	1	0.0000297	0.0000950
1,2,3,4,7,8 - HxCDF	0.1	0.0000297	0.0000950	0.1	0.0000297	0.0000950	0.1	0.0000297	0.0000950	0.1	0.0000297	0.0000950
1,2,3,6,7,8 - HxCDF	0.1	0.0000347	0.000111	0.1	0.0000347	0.000111	0.1	0.0000347	0.000111	0.1	0.0000347	0.000111
1,2,3,4,6,7,8 - HxCDF	0.1	0.0000357	0.000114	0.1	0.0000357	0.000114	0.1	0.0000357	0.000114	0.1	0.0000357	0.000114
1,2,3,7,8,9 - HxCDF	0.1	7.241E-06	0.0000143	0.1	7.241E-06	0.0000143	0.1	7.241E-06	0.0000143	0.1	7.241E-06	0.0000143
1,2,3,4,6,7,8 - HpCDF	0.01	8.972E-06	0.0000287	0.01	8.972E-06	0.0000287	0.01	8.972E-06	0.0000287	0.01	8.972E-06	0.0000287
1,2,3,4,7,8,9 - HpCDF	0.01	8.426E-07	2.693E-06	0.01	8.426E-07	2.693E-06	0.01	8.426E-07	2.693E-06	0.01	8.426E-07	2.693E-06
OCDF	0.001	2.924E-07	9.345E-07	0.0001	2.924E-08	9.345E-08	0.0001	2.924E-08	9.345E-08	0.0001	2.924E-08	9.345E-08
TOTAL	...	0.000	0.003	...	0.000	0.003	...	0.000	0.003	...	0.001	0.006
% Uncertainty	...	...	12.789	...	...	12.856	...	...	13.844	...	...	17.2

Uncertainty - Adjusted for TEF

PCB	WHO Humans & Mammals (TEF)	Uncertainty ng/Nm ³	Conc ng/Nm ³	WHO Fish (TEF)	Uncertainty ng/Nm ³	Conc ng/Nm ³	WHO Birds (TEF)	Uncertainty ng/Nm ³	Conc ng/Nm ³
PCB BZ#105	0.0001	1.840E-07	8.410E-07	0.000005	9.202E-09	4.205E-08	0.0001	1.840E-07	8.410E-07
PCB BZ#114	0.0005	8.318E-08	3.801E-07	0.000005	8.318E-10	3.801E-09	0.0001	1.664E-08	7.602E-08
PCB BZ#118	0.0001	4.332E-07	1.980E-06	0.000005	2.166E-08	9.899E-08	0.00001	4.332E-08	1.980E-07
PCB BZ#123	0.0001	1.386E-08	6.335E-08	0.000005	6.932E-10	3.168E-09	0.00001	1.386E-09	6.335E-09
PCB BZ#126	0.1	0.0000451	0.000206	0.005	2.253E-06	0.0000103	0.1	0.0000451	0.000206
PCB BZ#156	0.0005	1.629E-07	7.444E-07	0.000005	1.629E-09	7.444E-09	0.0001	3.258E-08	1.489E-07
PCB BZ#157	0.0005	7.625E-08	3.484E-07	0.000005	7.625E-10	3.484E-09	0.0001	1.525E-08	6.969E-08
PCB BZ#167	0.00001	1.352E-09	6.177E-09	0.000005	6.759E-10	3.088E-09	0.00001	1.352E-09	6.177E-09
PCB BZ#169	0.01	1.213E-06	5.543E-06	0.00005	6.065E-09	2.772E-08	0.001	1.213E-07	5.543E-07
PCB BZ#189	0.0001	1.872E-08	8.553E-08	0.000005	9.358E-10	4.276E-09	0.00001	1.872E-09	8.553E-09
PCB BZ#77	0.0001	4.540E-07	2.075E-06	0.0001	4.540E-07	2.075E-06	0.05	0.000227	0.00104
PCB BZ#81	0.0001	3.951E-08	1.806E-07	0.0005	1.976E-07	9.028E-07	0.1	0.0000395	0.000181
TOTAL	...	0.000045	0.00022	...	0.0000023	0.000013	...	0.00023	0.0014
% Uncertainty	...	...	20.7	...	...	17.1	...	...	16.5

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

Site: Margam
 Location: A1

PAH	Recovered Mass µg	Non Detect?	LAB Method Uncert (%) K=2 %	as Mass (µg)	Standard Uncertainty (µg)
Anthanthrene	0.0100	Yes	100	0.0100	0.00500
Benzo(a)Anthracene	0.0100	Yes	100	0.0100	0.00500
Benzo(a)pyrene	0.0100	Yes	100	0.0100	0.00500
Benzo(b)fluoranthene	0.0100	Yes	100	0.0100	0.00500
Benzo(b)naphtho(2,1-d)thiophene	0.0116	No	15	0.00174	0.000870
Benzo(c)phenanthrene	0.0100	Yes	100	0.0100	0.00500
Benzo(ghi)Perylene	0.0100	Yes	100	0.0100	0.00500
Benzo(k)fluoranthene	0.0100	Yes	100	0.0100	0.00500
Cholanthrene	0.0100	Yes	100	0.0100	0.00500
Chrysene	0.0100	Yes	100	0.0100	0.00500
Cyclopenta(cd)pyrene	0.0100	Yes	100	0.0100	0.00500
Dibenzo (ai) pyrene	0.0100	Yes	100	0.0100	0.00500
Dibenzo(ah)Anthracene	0.0100	Yes	100	0.0100	0.00500
Fluoranthene	0.0950	No	15	0.0143	0.00713
Indeno(123-cd)Pyrene	0.0100	Yes	100	0.0100	0.00500
Naphthalene	39.90	No	15	5.99	2.99

Measured Values			Standard Uncertainty @ 95%		
Sampled Volume (V _m)	7.30	m ³	uV _m	0.001	m ³
Meter Correction Factor (Y _d)	0.98	...	...	...	...
Meter Temperature (T _m)	292.09	K	uT _m	1.5	K
Average Differential Pressure (ΔH)	47.55	mmH ₂ O	uΔH	0.25	mmH ₂ O
Barometric Pressure (p _b)	758.31	mmHg	up _b	3.8	mmHg
ΔH + ps (p _m)	101.57	kPa	...	...	...
Oxygen content (O _{2,m})	5.71	% by volume	uO _{2,m} = σ/√n	0.041	% by volume
Moisture Content (H ₂ O)	16.82	% by volume	uH ₂ O	0.44	% by volume

Note: In the following calculations, the sensitivity coefficient (C) is estimated using: $C_i = \frac{\partial f}{\partial x_i}$

For each factor, uncertainty is then calculated by $C_i u_i$ where C is the sensitivity coefficient, u is the standard uncertainty and i is the index identifying the contributing factor e.g. i = uV_m, uT_m etc.

Uncertainty in correction factor to STP due to measured ΔH uncertainty component (uΔH), measured stack pressure uncertainty component (up_b) & measured temperature of dry gas uncertainty component (uT_{m, dry})

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.92$$

Where results are required at wet conditions, the following correction factor is used to convert the data from the dry gas meter:

$$f_{s, wet} = \frac{100}{(100 - H_2O)} = 1.00$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.92	0.92	0.0000890	0.0000223
up _b	0.93	0.92	0.00121	0.00454
uT _m	0.93	0.92	0.00316	0.00474
H ₂ O	...	...	...	...

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_b)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{(100/(100 - H_2O))}\right)^2} = 0.00584$$

Uncertainty in volume @ STP due to volume correction factor uncertainty component (uV_{std}) & volume uncertainty component (uV_m)

$$V_{std} = V_{measured} \times f_s = 6.73$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty m ³
Effect of uV _{std}	6.77	6.69	7.30	0.0426
Effect of uV _m	6.73	6.73	0.92	0.000922

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.31$$

Uncertainty of oxygen correction factor (uf_{O2})

$$f_{O_2} = \frac{20.9\% - O_{2, ref}}{20.9\% - O_{2, measured}} = 0.98 \quad uCorr_{O_2} = \frac{20.9\% - O_{2, ref}}{(20.9\% - O_{2, measured}) \times (20.9\% - O_{2, measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 0.0232$$

$$\therefore uf_{O_2} = \frac{uCorr_{O_2}}{f_{O_2}} \times 100 = 2.37 \%$$

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

Uncertainty in final PAH measurement @ reference conditions due to mass uncertainty component (uM)

PAH	Maximum µg/Nm ³	Minimum µg/Nm ³	Sensitivity	uM µg/Nm ³
Anthanthrene	0.00219	0.000729	0.15	0.000729
Benzo(a)Anthracene	0.00219	0.000729	0.15	0.000729
Benzo(a)pyrene	0.00219	0.000729	0.15	0.000729
Benzo(b)fluoranthene	0.00219	0.000729	0.15	0.000729
Benzo(b)naphtho(2,1-d)thiophene	0.00182	0.00156	0.15	0.000127
Benzo(c)phenanthrene	0.00219	0.000729	0.15	0.000729
Benzo(ghi)Perylene	0.00219	0.000729	0.15	0.000729
Benzo(k)fluoranthene	0.00219	0.000729	0.15	0.000729
Cholanthrene	0.00219	0.000729	0.15	0.000729
Chrysene	0.00219	0.000729	0.15	0.000729
Cyclopenta(cd)pyrene	0.00219	0.000729	0.15	0.000729
Dibenzo (ai) pyrene	0.00219	0.000729	0.15	0.000729
Dibenzo(ah)Anthracene	0.00219	0.000729	0.15	0.000729
Fluoranthene	0.0149	0.0128	0.15	0.00104
Indeno(123-cd)Pyrene	0.00219	0.000729	0.15	0.000729
Naphthalene	6.25	5.38	0.15	0.44

Uncertainty in final measurement @ reference conditions due to uncertainty component arising from leak and/or loss in the sample system (uL)

PAH	uL ng/Nm ³
Anthanthrene	0.0000168
Benzo(a)Anthracene	0.0000168
Benzo(a)pyrene	0.0000168
Benzo(b)fluoranthene	0.0000168
Benzo(b)naphtho(2,1-d)thiophene	0.0000195
Benzo(c)phenanthrene	0.0000168
Benzo(ghi)Perylene	0.0000168
Benzo(k)fluoranthene	0.0000168
Cholanthrene	0.0000168
Chrysene	0.0000168
Cyclopenta(cd)pyrene	0.0000168
Dibenzo (ai) pyrene	0.0000168
Dibenzo(ah)Anthracene	0.0000168
Fluoranthene	0.000160
Indeno(123-cd)Pyrene	0.0000168
Naphthalene	0.0672

Uncertainty in final measurement @ Reference Conditions due to uVstp

PAH	Maximum ng/Nm ³	Minimum ng/Nm ³	Sensitivity	uVstp mg/Nm ³
Anthanthrene	0.00153	0.00139	0.000217	0.0000675
Benzo(a)Anthracene	0.00153	0.00139	0.000217	0.0000675
Benzo(a)pyrene	0.00153	0.00139	0.000217	0.0000675
Benzo(b)fluoranthene	0.00153	0.00139	0.000217	0.0000675
Benzo(b)naphtho(2,1-d)thiophene	0.00177	0.00162	0.000252	0.0000783
Benzo(c)phenanthrene	0.00153	0.00139	0.000217	0.0000675
Benzo(ghi)Perylene	0.00153	0.00139	0.000217	0.0000675
Benzo(k)fluoranthene	0.00153	0.00139	0.000217	0.0000675
Cholanthrene	0.00153	0.00139	0.000217	0.0000675
Chrysene	0.00153	0.00139	0.000217	0.0000675
Cyclopenta(cd)pyrene	0.00153	0.00139	0.000217	0.0000675
Dibenzo (ai) pyrene	0.00153	0.00139	0.000217	0.0000675
Dibenzo(ah)Anthracene	0.00153	0.00139	0.000217	0.0000675
Fluoranthene	0.0145	0.0132	0.00206	0.000641
Indeno(123-cd)Pyrene	0.00153	0.00139	0.000217	0.0000675
Naphthalene	6.10	5.56	0.87	0.27

$$u_{combined} = \sqrt{(u_M)^2 + (u_L)^2 + (u_{Vstp})^2}$$

PAH	Combined Uncertainty ng/Nm ³	Expanded Uncertainty ng/Nm ³	Measured Concentration ng/Nm ³	% of Measured Concentration
Anthanthrene	0.000732	0.00146	0.00146	> 100
Benzo(a)Anthracene	0.000732	0.00146	0.00146	> 100
Benzo(a)pyrene	0.000732	0.00146	0.00146	> 100
Benzo(b)fluoranthene	0.000732	0.00146	0.00146	> 100
Benzo(b)naphtho(2,1-d)thiophene	0.000150	0.000301	0.00169	17.78
Benzo(c)phenanthrene	0.000732	0.00146	0.00146	> 100
Benzo(ghi)Perylene	0.000732	0.00146	0.00146	> 100
Benzo(k)fluoranthene	0.000732	0.00146	0.00146	> 100
Cholanthrene	0.000732	0.00146	0.00146	> 100
Chrysene	0.000732	0.00146	0.00146	> 100
Cyclopenta(cd)pyrene	0.000732	0.00146	0.00146	> 100
Dibenzo (ai) pyrene	0.000732	0.00146	0.00146	> 100
Dibenzo(ah)Anthracene	0.000732	0.00146	0.00146	> 100
Fluoranthene	0.00123	0.00246	0.0139	17.78
Indeno(123-cd)Pyrene	0.000732	0.00146	0.00146	> 100
Naphthalene	0.52	1.03	5.82	17.78

Total (ng/Nm³) 5.85 17.67

Where recovered mass is detailed as "Non-Detect", uncertainties are assumed to be equal to or greater than 100%

$$u_{combined} = \sqrt{(u_{f_{m_i}})^2 + (Uncertainty\ of\ Measurement\ of\ Determinand)^2}$$

PAH	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ² Factor	Overall Measurement Uncertainty Inc O ₂ Corr ² Factor (U _{combined})	New Expanded Uncertainty ng/Nm ³
Anthanthrene	> 100	2.37	> 100	> 100
Benzo(a)Anthracene	> 100	2.37	> 100	> 100
Benzo(a)pyrene	> 100	2.37	> 100	> 100
Benzo(b)fluoranthene	> 100	2.37	> 100	> 100
Benzo(b)naphtho(2,1-d)thiophene	17.78	2.37	17.94	0.000301
Benzo(c)phenanthrene	> 100	2.37	> 100	> 100
Benzo(ghi)Perylene	> 100	2.37	> 100	> 100
Benzo(k)fluoranthene	> 100	2.37	> 100	> 100
Cholanthrene	> 100	2.37	> 100	> 100
Chrysene	> 100	2.37	> 100	> 100
Cyclopenta(cd)pyrene	> 100	2.37	> 100	> 100
Dibenzo (ai) pyrene	> 100	2.37	> 100	> 100
Dibenzo(ah)Anthracene	> 100	2.37	> 100	> 100
Fluoranthene	17.78	2.37	17.94	0.00247
Indeno(123-cd)Pyrene	> 100	2.37	> 100	> 100
Naphthalene	17.78	2.37	17.94	1.04

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

Site: Margam
 Location: A1

$$u_{\text{phase (mg/m}^3\text{)}} = \frac{u_{\text{method}} \times \text{Mass}_{\text{pg}}}{200000} \quad u_{\text{mass}} = \sqrt{\sum (u_{\text{particulate}})^2 + (u_{\text{vapour}})^2}$$

Metal	Particulate mg	Vapour mg	LAB Method Uncert (%) K=2		Standard Uncertainty		Combined Standard	
			Particulate Phase	Vapour Phase	Particulate Phase mg/m ³	Vapour Phase mg/m ³	Uncertainty of Measured Mass Symbol	mg/m ³
Antimony	1.500	0.210	15	16	0.000113	0.0000168	uMSb	0.000114
Arsenic	2.900	0.289	11	12	0.000160	0.0000173	uMAs	0.000160
Cadmium	0.500	0.157	12	10	0.0000300	7.850E-06	uMCd	0.0000310
Chromium	2.000	5.033	12	10	0.000120	0.000252	uMCr	0.000279
Cobalt	0.500	0.157	12	10	0.0000300	7.850E-06	uMCo	0.0000310
Copper	6.100	2.328	12	10	0.000366	0.000116	uMCu	0.000384
Lead	36.300	18.071	13	16	0.00236	0.00145	uMPb	0.00277
Manganese	3.500	1.959	16	10	0.000280	0.0000980	uMMn	0.000297
Mercury	0.0803	1.749	10	12	4.016E-06	0.000105	uMHg	0.000105
Nickel	2.800	1.614	12	9	0.000168	0.0000726	uMNI	0.000183
Thallium	0.400	0.157	14	14	0.0000280	0.0000110	uMTl	0.0000301
Vanadium	0.400	0.0785	12	9	0.0000240	3.533E-06	uMV	0.0000243

Standard Uncertainty @ 95%		
Sampled Volume (V _m)	1.471	m ³
Meter Correction Factor (Y _d)	0.984	...
Meter Temperature (T _m)	292.66	k
Average Differential Pressure (ΔH)	57.34	mmH ₂ O
Barometric Pressure (p _b)	755.31	mmHg
ΔH + ps (p _m)	101.26	kPa
Oxygen content (O _{2,m})	5.66	% by volume
Moisture Content (H ₂ O)	18.65	% by volume
uV _m	0.001	m ³
uT _m	1.5	k
uΔH	0.25	mmH ₂ O
u _p	3.8	mmHg
uO _{2,m}	0.05	% by volume
uH ₂ O	0.50	% by volume

Note: In the following calculations, the sensitivity coefficient (C) is estimated using:

$$C_i = \frac{\partial f}{\partial x_i}$$

Uncertainty in correction factor to STP due to measured ΔH uncertainty component (uΔH), measured stack pressure uncertainty component (u _p) & measured temperature of					Where results are required at wet conditions, the following correction factor is used to convert the data from the dry gas meter:	
$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.918$					$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1$	
	Maximum	Minimum	Sensitivity	ufstp		
uΔH	0.918	0.918	0.0000888	0.0000222		
u _p	0.922	0.913	0.00121	0.00453		
uT _m	0.922	0.913	0.00314	0.00470		
H ₂ O	...	...	...	...
$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{(100/(100-H_2O))}\right)^2} = 0.00579$						

Uncertainty in volume @ STP due to volume correction factor uncertainty component (uV _{std}) & volume uncertainty component (uV _m)				
$V_{std} = V_{measured} \times f_s = 1.350$				
	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty m ³
Effect of uV _{std}	1.359	1.342	1.471	0.00852
Effect of uV _m	1.351	1.349	0.918	0.000918
Combined Standard Uncertainty				
$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.0126$				

Uncertainty of oxygen correction factor (uf _{O2})	
$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 0.65$	
$u_{Corr_{O_2}} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 0.02$	
$\therefore uf_{O_2} = \frac{u_{Corr_{O_2}}}{f_{O_2}} \times 100 = 3.56\%$	

Environmental Compliance Limited

Babcock & Wilcox Volund Limited
 Permit No : EPR/DP3137EG
 Variation No : ...
 Report Ref : P4246 : R003

Installation Name : A1 Incinerator
 Visit Details : Compliance – November 2020
 Survey Dates : 23rd - 26th November 2020
 Report Issue Date : 15th January 2021

Uncertainty in final measurement @ reference conditions due to mass uncertainty component (uM)

Metal	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uM mg/Nm ³
Antimony	0.000877	0.000768	0.481	0.0000547
Arsenic	0.00161	0.00146	0.481	0.0000772
Cadmium	0.000331	0.000301	0.481	0.0000149
Chromium	0.00352	0.00325	0.481	0.000134
Cobalt	0.000331	0.000301	0.481	0.0000149
Copper	0.00424	0.00387	0.481	0.000185
Lead	0.0275	0.0248	0.481	0.00133
Manganese	0.00277	0.00248	0.481	0.000143
Mercury	0.000931	0.000830	0.481	0.0000505
Nickel	0.00221	0.00204	0.481	0.0000881
Thallium	0.000282	0.000254	0.481	0.0000145
Vanadium	0.000242	0.000219	0.481	0.0000117

Uncertainty in final measurement @ reference conditions due to uncertainty component arising from leak and/or loss (assumed 2% max) in the sample system (uL)

Metal	uL mg/Nm ³
Antimony	9.500E-06
Arsenic	0.0000177
Cadmium	3.650E-06
Chromium	0.0000391
Cobalt	3.650E-06
Copper	0.0000468
Lead	0.000302
Manganese	0.0000303
Mercury	0.0000102
Nickel	0.0000245
Thallium	3.095E-06
Vanadium	2.658E-06

Uncertainty in final measurement @ Reference Conditions due to uVstp

Metal	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Antimony	0.000830	0.000815	0.000609	7.656E-06
Arsenic	0.00155	0.00152	0.00114	0.0000143
Cadmium	0.000319	0.000313	0.000234	2.942E-06
Chromium	0.00342	0.00335	0.00251	0.0000315
Cobalt	0.000319	0.000313	0.000234	2.942E-06
Copper	0.00409	0.00402	0.00300	0.0000377
Lead	0.0264	0.0259	0.0194	0.000243
Manganese	0.00265	0.00260	0.00195	0.0000244
Mercury	0.000889	0.000872	0.000652	8.192E-06
Nickel	0.00214	0.00210	0.00157	0.0000198
Thallium	0.000271	0.000266	0.000199	2.494E-06
Vanadium	0.000232	0.000228	0.000171	2.142E-06

$$u_{combined} = \sqrt{\sum (u_M)^2 + (u_L)^2 + (uV_{stp})^2}$$

Metal	Combined Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration
Antimony	0.0000561	0.000112	0.000823	13.630
Arsenic	0.0000805	0.000161	0.00153	10.491
Cadmium	0.0000156	0.0000313	0.000316	9.895
Chromium	0.000143	0.000286	0.00338	8.465
Cobalt	0.0000156	0.0000313	0.000316	9.895
Copper	0.000194	0.000389	0.00406	9.584
Lead	0.00139	0.00277	0.0262	10.602
Manganese	0.000148	0.000296	0.00263	11.265
Mercury	0.0000522	0.000104	0.000880	11.859
Nickel	0.0000935	0.000187	0.00212	8.808
Thallium	0.0000150	0.0000300	0.000268	11.200
Vanadium	0.0000122	0.0000243	0.000230	10.564

$$u_{combined} = \sqrt{\sum (u_{f_{O_2}})^2 + (Uncertainty\ of\ Measurement\ of\ Determinand)^2}$$

Metal	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ^a Factor	Overall Measurement Uncertainty inc O ₂ Corr ^a factor (Ucombined)	New Combined Uncertainty mg/Nm ³
Antimony	13.630	3.560	14.088	0.000058
Arsenic	10.491	3.560	11.079	0.000085
Cadmium	9.895	3.560	10.516	0.000017
Chromium	8.465	3.560	9.183	0.000155
Cobalt	9.895	3.560	10.516	0.000017
Copper	9.584	3.560	10.224	0.000207
Lead	10.602	3.560	11.184	0.001463
Manganese	11.265	3.560	11.814	0.000155
Mercury	11.859	3.560	12.381	0.000054
Nickel	8.808	3.560	9.500	0.000101
Thallium	11.200	3.560	11.753	0.000016
Vanadium	10.564	3.560	11.148	0.000013

Note: Uncertainty for each metals group is based on the summation in quadrature of the individual standard uncertainties (in mg/m³) of each contributing metal. Combined standard uncertainty of each group is converted to 95% confidence (multiplication by k = 2) before being expressed as a percentage of the combined group concentration.