



2499

EMISSIONS MONITORING SURVEY

Prepared for:

Ecobat Solutions
Crescent Works
Willenhall Road
Darlaston
Wednesbury
WS10 8JR

Permit Number	: EPR/DB3704FG
Variation Number	: EPR/DB3704FG/V006
Installation	: Recupyl Shredder Exhaust
Visit Details	: Emissions Testing – 2023
Job Number	: P5350
Report Number	: R002
Report Issue Date	: 24th April 2023
Survey Dates	: 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023

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Report Issue:		FINAL	
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Date:	21 st April 2023	Date:	24 th April 2023

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

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 Report Issue Date : 24th April 2023

TABLE OF CONTENTS

Section	Description	Page Number
PART 1	EXECUTIVE SUMMARY	4
1	MONITORING OBJECTIVES	4
1.1	Monitoring Results	5
1.2	Operating Information	12
2	MONITORING DEVIATIONS	13
PART 2	SUPPORTING INFORMATION	14
3	SAMPLING STAFF DETAILS	14
4	SAMPLING PROTOCOLS / METHODOLOGIES	15
5	SAMPLE POINT DESCRIPTIONS	16
	EQUIPMENT IDs	17
	FIGURES	19
	TABLES	22
	VELOCITY TRAVERSE PROFILES	26
	FIELD CALIBRATION AND SAMPLING DATA	68
	LABORATORY ANALYSIS RESULTS	86
	UNCERTAINTY CALCULATIONS	113

PART 1 - EXECUTIVE SUMMARY

1 Monitoring Objectives

Environmental Compliance Ltd (ECL) was commissioned by **Ecobat Solutions** to undertake an emission monitoring survey at their **Darlaston site**. This report presents the findings of the study.

The monitoring at this installation was carried out in accordance with our quotation reference **AM/P5350/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
	Recupyl Shredder Exhaust
Velocity / Flowrate	● U
Particulates	● U
Total Organic Carbon (TVOC)	● U
Hydrogen Chloride	● U
Hydrogen Fluoride	● U
Selenium	●
Heavy Metals (Cd, Tl, Sb, As, Pb, Cr, Co, Cu, Mn, Ni & V)	● U
Sulphur Dioxide	● U
Chlorinated Dioxins / Furans (PCDDs & PCDFs)	● U
Brominated Dioxins / Furans (PCDDs & PCDFs)	● 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.”*

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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
Recupyl Shredder Exhaust (Week 1)	Volumetric Flowrate	...	0.15036	m³/sec	3	Stack Conditions	31/01/2023	10:30 – 10:43	BS EN 16911-1:2013 & MID	UKAS / MCERTS		Normal
	Volumetric Flowrate	...	0.14361	m³/sec	4	& Wet Gas	31/01/2023		BS EN 16911-1:2013 & MID	UKAS / MCERTS		Normal
	Particulates \$	...	0.69	mg/m³	85	& Wet Gas	31/01/2023	11:17 – 12:17	BS EN 13284-1:2017 & MID	UKAS / MCERTS		Normal
	Particulates \$	...	1.06	mg/m³	55	& Wet Gas	31/01/2023	12:45 – 13:45	BS EN 13284-1:2017 & MID	UKAS / MCERTS		Normal
	Particulates \$	...	1.39	mg/m³	40	& Wet Gas	31/01/2023	14:02 – 15:02	BS EN 13284-1:2017 & MID	UKAS / MCERTS		Normal
	Hydrogen Chloride \$	...	0.07	mg/m³	13	& Wet Gas	31/01/2023	12:45 – 13:45	BS EN 1911:2010	UKAS / MCERTS		Normal
	Hydrogen Fluoride \$	...	0.05	mg/m³	13	& Wet Gas	31/01/2023	12:45 – 13:45	PD CEN/TS 17340:2020	UKAS / MCERTS		Normal
	Sulphur Dioxide \$	...	0.29	mg/m³	13	& Wet Gas	31/01/2023	11:17 – 12:17	BE EN14791:2017	UKAS / MCERTS		Normal
	PCDDs & PCDFs \$	...	0.0018	ng/m³	21	& Wet Gas	01/02/2023	08:05 – 13:47	BS EN 1948-1:2006 & MID	UKAS / MCERTS		Normal
	PBDDs & PBDFs \$	...	0.00346	ng/m³	22	& Wet Gas	01/02/2023		BS EN 1948-1:2006 & MID	NU	✓	Normal
	PCBs \$	...	0.1225	ng/m³	9	& Wet Gas	01/02/2023		BS EN 1948-1 & 4:2010	UKAS / MCERTS		Normal
	..Cadmium & Nickel \$	...	0.014	mg/m³	8	& Wet Gas	02/02/2023	10:20 – 11:20	BS EN 14385:2004 & MID	UKAS / MCERTS		Normal
	..Cadmium & Nickel \$	...	0.0095	mg/m³	8	& Wet Gas	02/02/2023	11:35 – 12:35	BS EN 14385:2004 & MID	UKAS / MCERTS		Normal
	..Cadmium & Nickel \$	...	0.0095	mg/m³	8	& Wet Gas	02/02/2023	12:50 – 13:50	BS EN 14385:2004 & MID	UKAS / MCERTS		Normal
	TVOC as Carbon	...	324.79	mgC/m³	2	& Wet Gas	01/02/2023	11:30 – 12:30	BS EN 12619:2013	UKAS / MCERTS		Normal

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
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 Visit Details : Emissions Testing – 2023
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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
Recupyl Shredder Exhaust (Week 1)	Antimony \$...	0.00082	mg/m ³	13	& Wet Gas	02/02/2023	10:20 – 11:20	BSEN 14385:2004 &MID	UKAS / MCERTS		Normal
	Arsenic \$	...	0.00074	mg/m ³	9	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS	
	Chromium \$	...	0.029	mg/m ³	8	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS	
	Cobalt \$	...	0.0015	mg/m ³	8	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS	
	Copper \$	...	0.0064	mg/m ³	8	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS	
	Lead \$	...	0.012	mg/m ³	11	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS	
	Manganese \$	...	0.0064	mg/m ³	9	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS	
	Thallium \$	...	0.00056	mg/m ³	11	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS	
	Vanadium \$	...	0.00050	mg/m ³	11	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS	
	Selenium \$	...	0.0012	mg/m ³	11	& Wet Gas			BSEN 14385:2004 &MID	NU	✓
	Heavy Metals* \$...	0.059	mg/m ³	5	& Wet Gas			BSEN 14385:2004 &MID	NU	✓	

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

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Ecobat Solutions
 Permit No : EPR/DB3704FG
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 Report Ref : P5350 : R002

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 Visit Details : Emissions Testing – 2023
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 Report Issue Date : 24th April 2023

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Recupyl Shredder Exhaust (Week 2)	Particulates \$...	0.47	mg/m ³	85	& Wet Gas	16/02/2023	10:02 – 11:02	BS EN 13284-1:2017 & MID	UKAS / MCERTS		Normal
	Particulates \$	...	1.41	mg/m ³	28	& Wet Gas		11:25 – 12:25	BS EN 13284-1:2017 & MID	UKAS / MCERTS		Normal
	Particulates \$	...	0.46	mg/m ³	85	& Wet Gas		12:50 – 13:50	BS EN 13284-1:2017 & MID	UKAS / MCERTS		Normal
	Hydrogen Chloride \$	...	0.02	mg/m ³	13	& Wet Gas		11:25 – 12:25	BS EN 1911:2010	UKAS / MCERTS		Normal
	Hydrogen Fluoride \$	...	0.02	mg/m ³	13	& Wet Gas		11:25 – 12:25	PD CEN/TS 17340:2020	UKAS / MCERTS		Normal
	Sulphur Dioxide \$	...	0.11	mg/m ³	13	& Wet Gas		12:50 – 13:50	BE EN14791:2017	UKAS / MCERTS		Normal
	PCDDs & PCDFs \$	...	0.0012	ng/m ³	20	& Wet Gas	15/02/2023	08:40 – 14:40	BS EN 1948-1:2006 & MID	UKAS / MCERTS		Normal
	PBDDs & PBDFs \$	...	0.00357	ng/m ³	19	& Wet Gas			BS EN 1948-1:2006 & MID	NU	✓	Normal
	PCBs \$	...	0.4993	ng/m ³	12	& Wet Gas			BS EN 1948-1 & 4:2010	UKAS / MCERTS		Normal
	Cadmium & Nickel \$	...	0.0096	mg/m ³	10	& Wet Gas	17/03/2023	09:39 – 10:39	BS EN 14385:2004 & MID	UKAS / MCERTS		Normal
	Cadmium & Nickel \$	...	0.017	mg/m ³	10	& Wet Gas	17/03/2023	11:14 – 12:14	BS EN 14385:2004 & MID	UKAS / MCERTS		Normal
	Cadmium & Nickel \$	...	0.0095	mg/m ³	10	& Wet Gas	17/03/2023	12:46 – 13:46	BS EN 14385:2004 & MID	UKAS / MCERTS		Normal
	TVOC as Carbon	...	150.87	mgC/m ³	3	& Wet Gas	15/02/2023	11:00 – 12:00	BS EN 12619:2013	UKAS / MCERTS		Normal

Due to an issue at the sub-contract laboratory, the samples for Heavy Metals, Cadmium & Nickel taken on 14/02/2023 were compromised and had to be repeated on 17/03/2023.

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Ecobat Solutions
 Permit No : EPR/DB3704FG
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Recupyl Shredder Exhaust (Week 2)	Antimony	\$...	0.00085	mg/m ³	13	& Wet Gas	17/03/2023	09:39 – 10:39	BSEN 14385:2004 &MID	UKAS / MCERTS		Normal
	Arsenic	\$...	0.00082	mg/m ³	9	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Chromium	\$...	0.022	mg/m ³	8	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Cobalt	\$...	0.0010	mg/m ³	9	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Copper	\$...	0.017	mg/m ³	9	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Lead	\$...	0.013	mg/m ³	11	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Manganese	\$...	0.0077	mg/m ³	11	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Thallium	\$...	0.00062	mg/m ³	11	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Vanadium	\$...	0.00077	mg/m ³	11	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Selenium	\$...	0.0013	mg/m ³	10	& Wet Gas			BSEN 14385:2004 &MID	NU	✓	
	Heavy Metals*	\$...	0.065	mg/m ³	5	& Wet Gas			BSEN 14385:2004 &MID	NU	✓	

Due to an issue at the sub-contract laboratory, the samples for Heavy Metals, Cadmium & Nickel taken on 14/02/2023 were compromised and had to be repeated on 17/03/2023.

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

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
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Recupyl Shredder Exhaust (Week 3)	Particulates \$...	0.46	mg/m ³	85	& Wet Gas	23/02/2023	08:24 – 09:24	BS EN 13284-1:2017 & MID	UKAS / MCERTS		Normal
	Particulates \$	...	0.46	mg/m ³	85	& Wet Gas	23/02/2023	10:07 – 11:07	BS EN 13284-1:2017 & MID	UKAS / MCERTS		Normal
	Particulates \$	...	0.47	mg/m ³	85	& Wet Gas	23/02/2023	11:50 – 12:50	BS EN 13284-1:2017 & MID	UKAS / MCERTS		Normal
	Hydrogen Chloride \$	...	0.03	mg/m ³	13	& Wet Gas	23/02/2023	10:07 – 11:07	BS EN 1911:2010	UKAS / MCERTS		Normal
	Hydrogen Fluoride \$	...	0.02	mg/m ³	13	& Wet Gas	23/02/2023	10:07 – 11:07	PD CEN/TS 17340:2020	UKAS / MCERTS		Normal
	Sulphur Dioxide \$	...	0.10	mg/m ³	13	& Wet Gas	23/02/2023	08:24 – 09:24	BE EN14791:2017	UKAS / MCERTS		Normal
	PCDDs & PCDFs \$	...	0.00069	ng/m ³	17	& Wet Gas	22/02/2023	08:45 – 14:45	BS EN 1948-1:2006 & MID	UKAS / MCERTS		Normal
	PBDDs & PBDFs \$	...	0.00215	ng/m ³	21	& Wet Gas	22/02/2023		BS EN 1948-1:2006 & MID	NU	✓	Normal
	PCBs \$	...	0.1936	ng/m ³	12	& Wet Gas	22/02/2023		BS EN 1948-1 & 4:2010	UKAS / MCERTS		Normal
	Cadmium & Nickel \$	...	0.066	mg/m ³	8	& Wet Gas	21/02/2023	09:15 – 10:15	BS EN 14385:2004 & MID	UKAS / MCERTS		Normal
	Cadmium & Nickel \$	...	0.021	mg/m ³	8	& Wet Gas	21/02/2023	11:20 – 12:20	BS EN 14385:2004 & MID	UKAS / MCERTS		Normal
	Cadmium & Nickel \$	...	0.018	mg/m ³	6	& Wet Gas	21/02/2023	13:10 – 14:10	BS EN 14385:2004 & MID	UKAS / MCERTS		Normal
TVOC as Carbon	...	137.91	mgC/m ³	2	& Wet Gas	22/02/2023	11:00 – 12:00	BS EN 12619:2013	UKAS / MCERTS		Normal	

Environmental Compliance Limited

Ecobat Solutions
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 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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Recupyl Shredder Exhaust (Week 3)	Antimony	\$...	0.00066	mg/m ³	12	& Wet Gas	21/02/2023	09:15 – 10:15	BSEN 14385:2004 &MID	UKAS / MCERTS		Normal
	Arsenic	\$...	0.00055	mg/m ³	9	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Chromium	\$...	0.0048	mg/m ³	8	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Cobalt	\$...	0.051	mg/m ³	10	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Copper	\$...	0.0071	mg/m ³	9	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Lead	\$...	0.023	mg/m ³	15	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Manganese	\$...	0.043	mg/m ³	9	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Thallium	\$...	0.00042	mg/m ³	11	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Vanadium	\$...	0.00041	mg/m ³	10	& Wet Gas			BSEN 14385:2004 &MID	UKAS / MCERTS		
	Selenium	\$...	0.00087	mg/m ³	10	& Wet Gas			BSEN 14385:2004 &MID	NU	✓	
	Heavy Metals*	\$...	0.13	mg/m ³	6	& Wet Gas			BSEN 14385:2004 &MID	NU	✓	

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

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Report Ref	: P5350 : R002	Report Issue Date	: 24th April 2023

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

The uncertainty figures presented in Table 1.1 for TVOC are “measurement uncertainty” figures, which do not take into account the variability of the measured sample values. The “uncertainty of measurement results” figures, which do include this contribution, are presented in the appendices of the report for these determinands.

Emission Limit Value	The emission limit value is that stated in the permit and will be expressed as a concentration or a mass emission.
Periodic Monitoring Result	The result given is expressed in the same terms and units as the emission limit value.
Uncertainty	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.
Reference Conditions	All results are expressed at 273 K and 101.3kPa. The oxygen and moisture corrections are stated.
Monitoring Method Reference	The method stated is in accordance with the Environment Agency Technical Guidance Note M2, or other method approved by the Environment Agency.
Accreditation for use of Method	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.
Operating Status	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
NU	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
NA	Method is NOT UKAS Accredited.

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 Report Issue Date : 24th April 2023

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
Shredder Exhaust	Batch	N/A	N/A	Lithium Batteries	Scrubber	Normal	...	...	...	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 is 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/DB3704FG** where UKAS and MCERTS accreditation has and could be claimed for the testing in the monitoring results table.

There were no modifications to the sampling procedures (TPDs) listed in section 4.

There were substance deviations from the original and agreed emissions monitoring schedule. These are as follows:

Chlorinated & Brominated Dioxins & Furans & PCBs (Test 1 – 01/02/2023), due to production issues on the day, the sample duration was reduced from 360 minutes to 265 minutes.

Non-conforming tests are as follows:

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 following tests appeared to fail efficiency checks (>5% in final impinger).

All tests for HCl, HF & SO₂.

Metals on 17/03/2023 (As, Cu, Pb, Se & Cd)

However, in all cases, the concentration in the final impinger was very low (at or below the analytical LOD/ blank value, so the efficiency check is not required).

ECL holds UKAS/MCERTS accreditation for the sampling of Brominated Dioxins & Furans (PBDDs & PBDFs) however there are no commercial laboratories in the UK that hold analytical accreditation for this determinand, so accreditation for the results CANNOT be claimed. Furthermore, for some congeners, there are no analysis standards available and so the laboratory could not report a result for those congeners (see detailed results table).

Homogeneity tests have not been completed for pollutants at the following locations: **Recypyl Shredder Exhaust**. Such tests are not applicable to this location (as the duct area is <1m²).

PART 2 – SUPPORTING INFORMATION

3 SAMPLING STAFF DETAILS

Site Sampling Team

Names of Site Team	Dates on Site	MCERTS No.	LEVEL	Technical Endorsements
Scott Hackett	31 st January – 2 nd February 2023	MM 07 889	2	TE1, TE2, TE3, TE4
Geraint Mansfield		MM 22 1713	1	...
Jon Litterick	15 th – 16 th February 2023	MM 03 236	2	TE1, TE2, TE3, TE4
Jesse Whitehouse		MM 22 1697	Trainee	...
Adam May	21 st – 23 rd February 2023	MM 05 626	2	TE1, TE2, TE3, TE4
Zachery Holden		....	Trainee	...
Adam May	17 th March 2023	MM 05 626	2	TE1, TE2, TE3, TE4
Lee Harper		MM 17 1423	2	TE1, TE4

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
Particulates (MST)	BS EN 13284-1:2017 & MID	ECL / TPD / 027
Metals (without mercury)	BS EN 14385:2004 & MID	ECL / TPD / 028
PCDDs & PCDFs	BS EN 1948-1 to 3:2006 & MID	ECL / TPD / 031
PBDDs & PBDFs	BS EN 1948-1 to 3:2006 & MID	ECL / TPD / 031
PCBs	BS EN 1948-4:2010	ECL / TPD / 031
TVOC (Sick F3006)	BS EN 12619: 2013	ECL / TPD / 032B
Hydrogen Chloride.	BS EN 1911:2010	ECL / TPD / 081
Sulphur Dioxide	BS EN 14791:2017	ECL / TPD / 039
Moisture	BS EN 14790: 2017	ECL / TPD / 082
Hydrogen Fluoride	PD CEN/TS 17340:2020	ECL / TPD / 081

Ecobat Solutions
Permit No : EPR/DB3704FG
Variation No : EPR/DB3704FG/V006
Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
Visit Details : Emissions Testing – 2023
Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
Report Issue Date : 24th April 2023

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 1m^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:

Recupyl Shredder Exhaust

The stack diameter is 0.245m and the sample platform width back from the sample port is 5.0m. The sample port was at a height of circa 0.45m above the sample platform.

Access to the sampling location was via temporary platform.

Environmental Compliance Limited

Ecobat Solutions

Permit No : EPR/DB3704FG
Variation No : EPR/DB3704FG/V006
Report Ref : P5350 : R002

Installation Name

Installation Name : Recupyl Shredder Exhaust
Visit Details : Emissions Testing – 2023
Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
Report Issue Date : 24th April 2023

EQUIPMENT IDs
(Pre site checklist from SSP)

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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	U001	U006						
MST Nozzle set		402	219	1267					
MST “S” Type Pitot		635	768						
MST Probe		1330							
MST Hot Box		336	978						
MST Impinger Arm		979	657	980					
Barometer		1320							
Site Balance		1069							
Site Check weights		190							
			191						
Horiba	E002								
Heated Probe / Filter									
Chiller									
MFC									
Heated Line									
FID	E003	997							
Heated Line		1011	1012						
Heated Probe / Filter		920							
Testo	E004								
FTIR	E005								
Heated Probe / Filter									
Heated Line									
Stackmite	E006								
“L” Type Pitot									
Digital Manometer									
Stack Thermocouple		1331							
Thermocouple Reader									
Nozzle Set									
Workhorse Pumps	E007								
Stack Thermocouple									
Tube Thermocouple									
Meter Thermocouple									
High Vac Gauge									
Dioxin Thermocouple		789							

Quantity of Ice Required / Used for Survey	Bags (2kg bags)
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Environmental Compliance Limited

Ecobat Solutions

Permit No : EPR/DB3704FG
Variation No : EPR/DB3704FG/V006
Report Ref : P5350 : R002

Installation Name

: Recupyl Shredder Exhaust
Visit Details : Emissions Testing – 2023
Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
Report Issue Date : 24th April 2023

FIGURES

Ecobat Solutions
Permit No : EPR/DB3704FG
Variation No : EPR/DB3704FG/V006
Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
Visit Details : Emissions Testing – 2023
Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
Report Issue Date : 24th April 2023

Figure 1

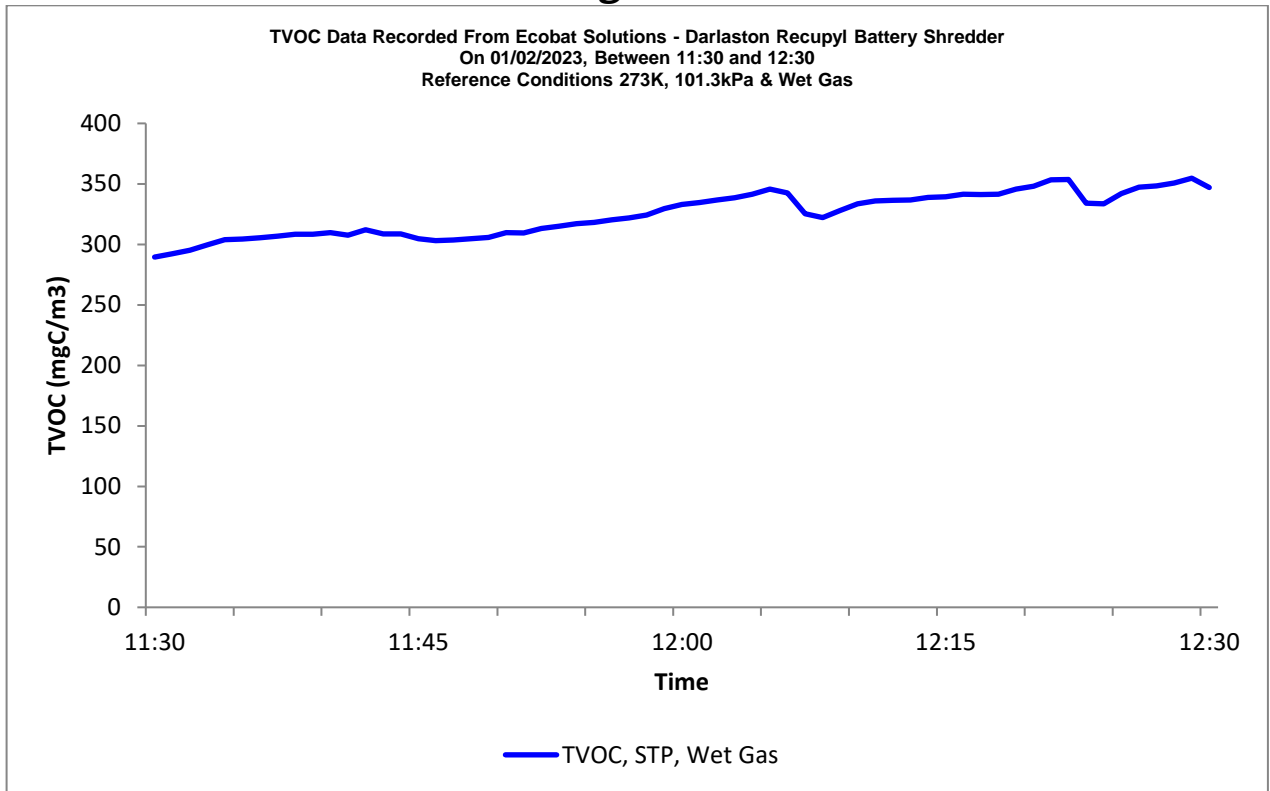
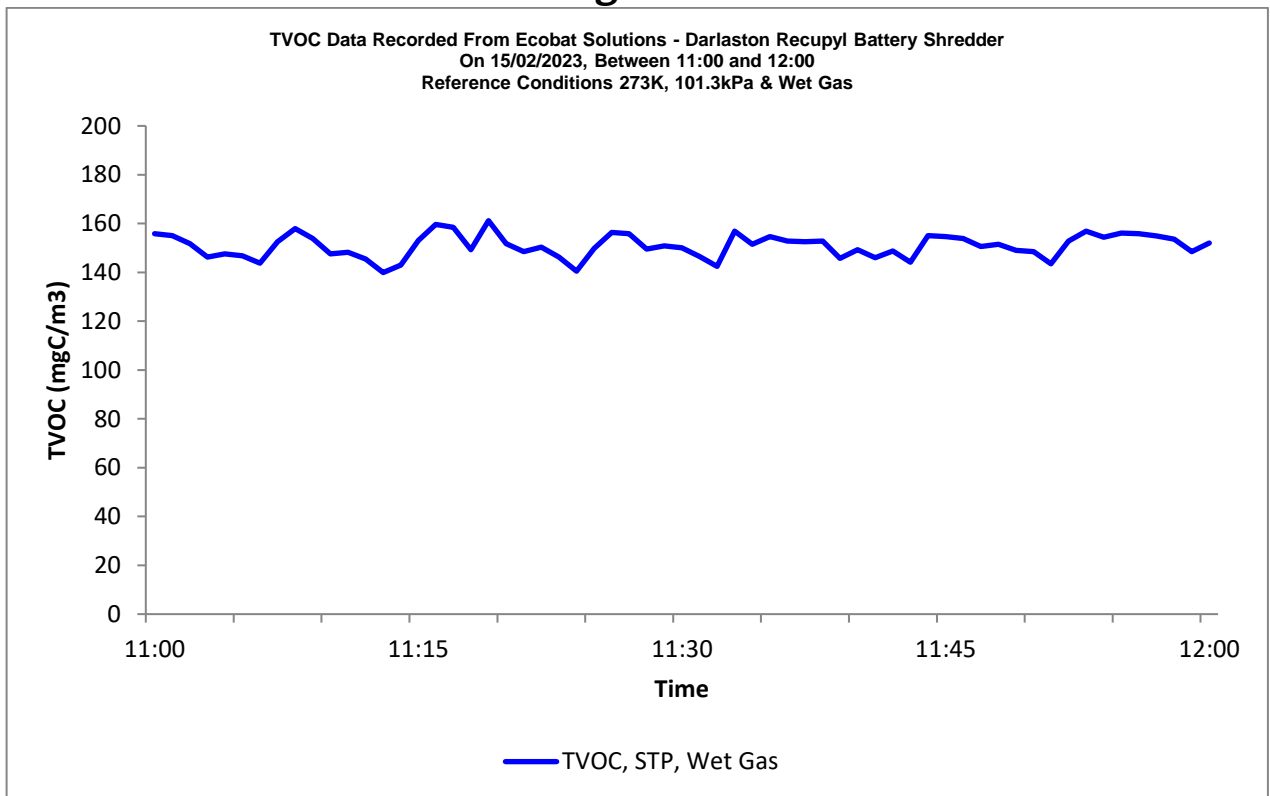


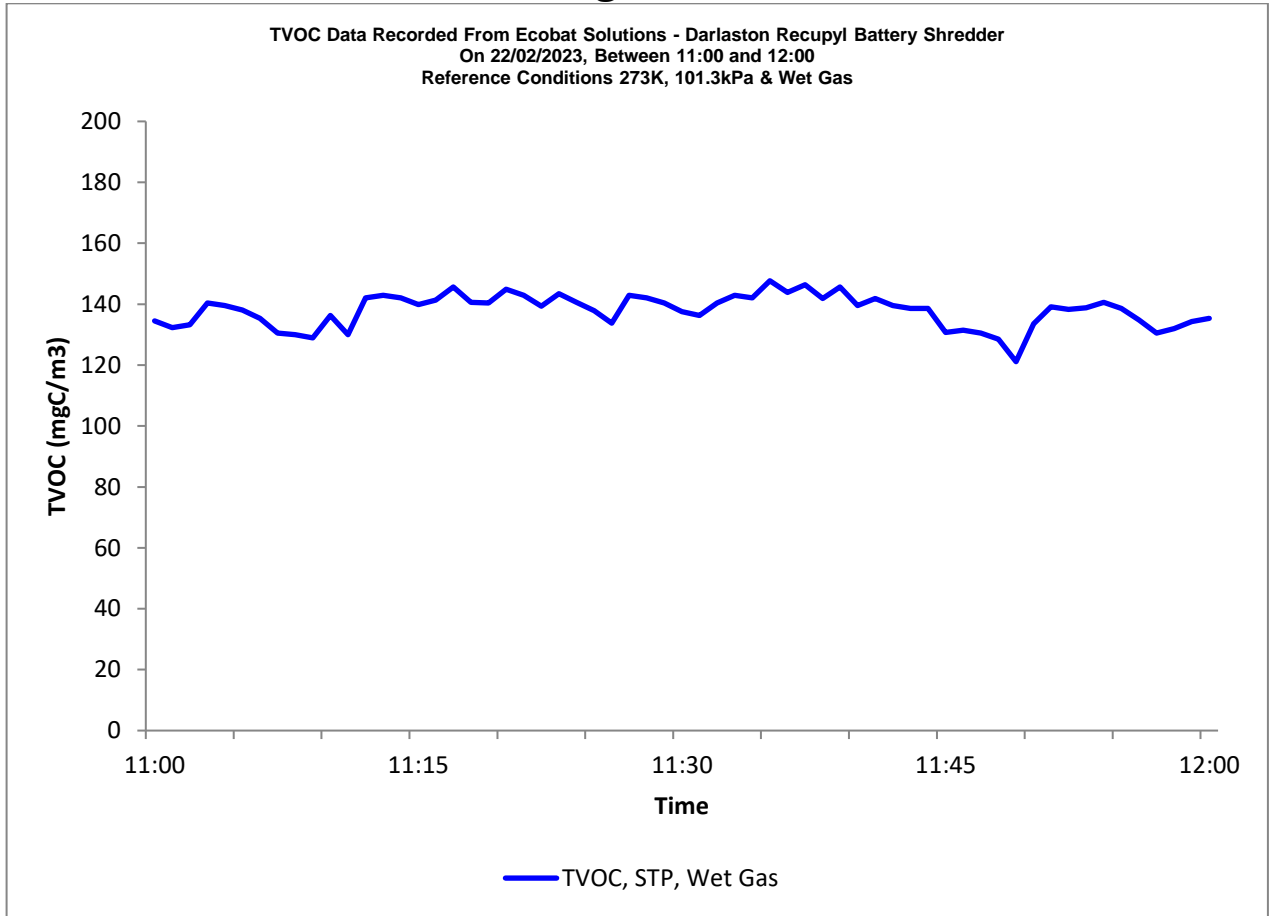
Figure 2



Ecobat Solutions
Permit No : EPR/DB3704FG
Variation No : EPR/DB3704FG/V006
Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
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Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
Report Issue Date : 24th April 2023

Figure 3



Environmental Compliance Limited

Ecobat Solutions

Permit No : EPR/DB3704FG
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Report Ref : P5350 : R002

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: Recupyl Shredder Exhaust
Visit Details : Emissions Testing – 2023
Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
Report Issue Date : 24th April 2023

TABLES

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 1 – TVOC

Data Recorded from Recupyl Shredder Exhaust
 Sample Period: 11:30 – 12:30 on the 1st February 2023
 Volumetric Flowrate (Reference Conditions) = 0.14361 m³/sec *

	Average	Emission Rate
	mg/m ³	Kg/hr
TVOC (as carbon)*	324.79	0.1679

* Reference Conditions (273K, 101.3 kPa & Wet Gas)

Table 2 – TVOC

Data Recorded from Recupyl Shredder Exhaust
 Sample Period: 11:00 – 12:00 on the 15th February 2023
 Volumetric Flowrate (Reference Conditions) = 0.14361 m³/sec *

	Average	Emission Rate
	mg/m ³	Kg/hr
TVOC (as carbon)*	150.87	0.0780

* Reference Conditions (273K, 101.3 kPa & Wet Gas)

Table 3 – TVOC

Data Recorded from Recupyl Shredder Exhaust
 Sample Period: 11:00 – 12:00 on the 22nd February 2023
 Volumetric Flowrate (Reference Conditions) 0.14361 m³/sec *

	Average	Emission Rate
	mg/m ³	Kg/hr
TVOC (as carbon)*	137.91	0.0713

* Reference Conditions (273K, 101.3 kPa & Wet Gas)

Table 4 – Particulates (Test 1), SO₂ (Test 1)

Data Recorded from Exhaust Stack - Recypyl Shredder

Emission Parameter	Units	TPM 1 & SO ₂ 1	Blank
Stack Diameter	metres	0.25	...
Area of Sample Plane	m ²	0.047	...
Moisture Content	%	1.74	...
Oxygen Content	%	20.90	...
Stack Temperature	°C	12	...
Gas Velocity (as Measured. Adjusted for Smooth Walls)	m/sec	3.1888	...
Gas Velocity (Reference Conditions)	m/sec*	3.0448	...
Volumetric Flowrate (as Measured)	m ³ /sec	0.1503	...
Volumetric Flowrate (Reference Conditions)	m ³ /sec*	0.1435	...
Dry Gas Molecular Weight	g/gmole	28.8560	
Sample Date	...	31/01/2023	...
Sample Period	...	11:17 - 12:17	...
Sample Volume (reference Conditions)	m ³ *	0.871	0.871
Isokinetic Sampling Rate	%	98.84	...
Sample Reference (ECL ID)	ECL/23/	0410 & 0411	0416 & 0417
Mass of Particulate Matter Collected	mg	0.60	0.60
Concentration of Particulate Matter	mg/m ³ *	0.69	0.69
Emission Rate of Particulate Matter	g/hr	0.36	...
Expanded Uncertainty (% Relative)	%	85	...
Sample Reference	ECL/23/	0420 & 0421	0422
Mass of Sulphur Dioxide Collected	mg	0.25	0.05
Concentration of Sulphur Dioxide	mg/m ³ *	0.29	0.06
Emission Rate of Sulphur Dioxide	g/hr	0.15	...
Expanded Uncertainty (% Relative)	%	13	...
Impinger Collection Efficiency	%	76	...

* Reference Conditions (273K, 101.3kPa, Wet Gas)

Table 5 – Particulates (Test 2), HCl & HF (Test 1)

Data Recorded from Exhaust Stack - Recupyl Shredder

Emission Parameter	Units	TPM 2 , HCl & HF1	Blank
Stack Diameter	metres	0.25	...
Area of Sample Plane	m ²	0.047	...
Moisture Content	%	1.86	...
Oxygen Content	%	20.90	...
Stack Temperature	°C	12	...
Gas Velocity (as Measured. Adjusted for Smooth Walls)	m/sec	3.1895	...
Gas Velocity (Reference Conditions)	m/sec*	3.0455	...
Volumetric Flowrate (as Measured)	m ³ /sec	0.1504	...
Volumetric Flowrate (Reference Conditions)	m ³ /sec*	0.1436	...
Dry Gas Molecular Weight	g/gmole	28.8560	
Sample Date	...	31/01/2023	...
Sample Period	...	12:45 - 13:45	...
Sample Volume (reference Conditions)	m ³ *	0.871	0.871
Isokinetic Sampling Rate	%	98.85	...
Sample Reference (ECL ID)	ECL/23/	0412 & 0413	0416 & 0417
Mass of Particulate Matter Collected	mg	0.92	0.60
Concentration of Particulate Matter	mg/m ³ *	1.06	0.69
Emission Rate of Particulate Matter	g/hr	0.55	...
Expanded Uncertainty (% Relative)	%	55	...
Sample Reference (ECL ID)	ECL/23/	0423 & 0424	0425
Mass of Hydrogen Chloride Collected	mg	0.06	0.01
Concentration of Hydrogen Chloride	mg/m ³ *	0.07	0.01
Emission Rate of Hydrogen Chloride	g/hr	0.04	...
Expanded Uncertainty (% Relative)	%	13	...
Impinger Collection Efficiency	%	81	...
Sample Reference	ECL/23/	0423 & 0424	0425
Mass of Hydrogen Fluoride Collected	mg	0.04	0.01
Concentration of Hydrogen Fluoride	mg/m ³ *	0.05	0.02
Emission Rate of Hydrogen Fluoride	g/hr	0.03	...
Expanded Uncertainty (% Relative)	%	13	...
Impinger Collection Efficiency	%	72	...

* Reference Conditions (273K, 101.3kPa, Wet Gas)

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 6 – Particulates (Test 3)

Data Recorded from Exhaust Stack - Recupyl Shredder

Emission Parameter	Units	TPM 3	Blank
Stack Diameter	metres	0.25	...
Area of Sample Plane	m ²	0.047	...
Moisture Content	%	1.60	...
Oxygen Content	%	20.90	...
Stack Temperature	°C	13	...
Gas Velocity (as Measured. Adjusted for Smooth Walls)	m/sec	3.1935	...
Gas Velocity (Reference Conditions)	m/sec*	3.0387	...
Volumetric Flowrate (as Measured)	m ³ /sec	0.1506	...
Volumetric Flowrate (Reference Conditions)	m ³ /sec*	0.1433	...
Dry Gas Molecular Weight	g/gmole	28.8560	
Sample Date	...	31/01/2023	...
Sample Period	...	14:02 - 15:02	...
Sample Volume (reference Conditions)	m ³ *	0.923	0.923
Isokinetic Sampling Rate	%	104.98	...
Sample Reference (ECL ID)	ECL/23/	0414 & 0415	0416 & 0417
Mass of Particulate Matter Collected	mg	1.28	0.60
Concentration of Particulate Matter	mg/m ³ *	1.39	0.65
Emission Rate of Particulate Matter	g/hr	0.72	...
Expanded Uncertainty (% Relative)	%	40	...

* Reference Conditions (273K, 101.3kPa, Wet Gas)

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 7 – Chlorinated Dioxins & Furans (Test 1)

Data Recorded from Recupyl Shredder - Stack Exhaust Stack

Emission Parameter	Units	Chlorinated & Brominated D & F 1		
Stack Diameter	metres	0.245		
-	-	-		
Area of sample plane	m ²	0.047		
Moisture Content	%	1.31		
Moisture Expanded Uncertainty	%(Relative)	7.77		
Stack Temperature	°C	12		
Oxygen Concentration	%	21.00		
Gas velocity (as Measured)	m/sec	3.1877		
Gas velocity (Reference Conditions)	m/sec*	3.0408		
Volumetric Flowrate (as Measured)	m ³ /sec	0.1503		
Volumetric Flowrate (Reference)	m ³ /sec*	0.1434		
Sample Date				
		01/02/2023		
Sample Period				
		08:05 - 13:47		
Sample Reference				
		ECL/23/0404 - 0406		
Sample Volume (Reference Conditions)	m ³ *	4.08		
Isokinetic Sampling Rate	%	105.02		
Species	Sample Reference: ECL/23/0404 - 0406		Blank Reference: ECL/23/0407 - 0409	
	Conc. ng/m ³ *	TEQ ng/m ³ *	Conc. ng/m ³ *	TEQ ng/m ³ *
Chlorinated Dioxins 2,3,7,8 Isomers	0.0061	0.0011	0.0046	0.00070
Total Chlorinated Dioxins Non – Targeted Isomers	0.00	...	0.00	...
Chlorinated Furans 2,3,7,8 Isomers	0.0082	0.00077	0.0065	0.00056
Total Chlorinated Furans Non – Targeted Isomers	0.00	...	0.00	...
TOTAL	...	0.0018	...	0.00127
Range	...	0.0000018 - 0.0018	Blank <10% of ELV?	YES
% Uncertainty	...	21		

*Reference Conditions 273K, 101.3kPa, Wet 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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/Voo6
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 7b – Chlorinated Dioxins & Furans (Test 1)

Data Recorded from Recupyl Shredder - Stack Exhaust Stack on the 01/02/23, 08:05 - 13:47

Species	Blank Reference: ECL/23/0407 - 0409 TEQ ng/m ³ *	EEC Toxic Equivalent Factor (TEF)	Sample Ref.: ECL/23/0404 - 0406		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 *
			Concentration ng/m ³ *	TEQ ng/m ³ *						
Chlorinated Dioxins - 2,3,7,8 Isomers										
2,3,7,8 - TCDD	0.00029	1	<i>0.00054</i>	<i>0.00054</i>	1	<i>0.00054</i>	1	<i>0.00054</i>	1	<i>0.00054</i>
1,2,3,7,8 - PCDD	0.00019	0.5	<i>0.00055</i>	<i>0.00028</i>	1	<i>0.00055</i>	1	<i>0.00055</i>	1	<i>0.00055</i>
1,2,3,4,7,8 - HxCDD	0.000080	0.1	<i>0.0010</i>	<i>0.00010</i>	0.1	<i>0.00010</i>	0.5	<i>0.00052</i>	0.05	<i>0.000052</i>
1,2,3,6,7,8 - HxCDD	0.000065	0.1	<i>0.00065</i>	<i>0.000065</i>	0.1	<i>0.00065</i>	0.01	<i>0.000067</i>	0.01	<i>0.000067</i>
1,2,3,7,8,9 - HxCDD	0.000067	0.1	<i>0.00067</i>	<i>0.000067</i>	0.1	<i>0.00067</i>	0.01	<i>0.00007</i>	0.01	<i>0.00007</i>
1,2,3,4,6,7,8 - HpCDD	0.000009	0.01	<i>0.00094</i>	<i>0.000009</i>	0.01	<i>0.00009</i>	0.001	<i>0.00001</i>	0.001	<i>0.00001</i>
OCDD	0.000001	0.001	0.0018	0.000002	0.0001	0.000000	0	...	0	...
Total Chlorinated Dioxins - Non - Targeted Isomers										
TCDD	...	0	0.000000	...	0	...	0	...	0	...
PCDD	...	0	0.000000	...	0	...	0	...	0	...
HxCDD	...	0	0.000000	...	0	...	0	...	0	...
HpCDD	...	0	0.000000	...	0	...	0	...	0	...
Chlorinated Furans - 2,3,7,8 Isomers										
2,3,7,8 - TCDF	0.000042	0.1	<i>0.00059</i>	<i>0.000059</i>	0.1	<i>0.00059</i>	0.05	<i>0.000029</i>	1	<i>0.00059</i>
1,2,3,7,8 - PCDF	0.000021	0.05	<i>0.00061</i>	<i>0.000030</i>	0.05	<i>0.00030</i>	0.05	<i>0.000030</i>	0.1	<i>0.000061</i>
2,3,4,7,8 - PCDF	0.00022	0.5	<i>0.00080</i>	<i>0.00040</i>	0.5	<i>0.00040</i>	0.5	<i>0.00040</i>	1	<i>0.00080</i>
1,2,3,4,7,8 - HxCDF	0.000059	0.1	<i>0.00059</i>	<i>0.000059</i>	0.1	<i>0.00059</i>	0.1	<i>0.000059</i>	0.1	<i>0.000059</i>
1,2,3,6,7,8 - HxCDF	0.000061	0.1	<i>0.00061</i>	<i>0.000061</i>	0.1	<i>0.00061</i>	0.1	<i>0.000061</i>	0.1	<i>0.000061</i>
2,3,4,6,7,8 - HxCDF	0.000083	0.1	<i>0.00083</i>	<i>0.000083</i>	0.1	<i>0.00083</i>	0.1	<i>0.000083</i>	0.1	<i>0.000083</i>
1,2,3,7,8,9 - HxCDF	0.000063	0.1	<i>0.00063</i>	<i>0.000063</i>	0.1	<i>0.00063</i>	0.1	<i>0.000063</i>	0.1	<i>0.000063</i>
1,2,3,4,6,7,8 - HpCDF	0.000006	0.01	<i>0.00097</i>	<i>0.000010</i>	0.01	<i>0.00010</i>	0.01	<i>0.000010</i>	0.01	<i>0.000010</i>
1,2,3,4,7,8,9 - HpCDF	0.000008	0.01	<i>0.00062</i>	<i>0.000008</i>	0.01	<i>0.00008</i>	0.01	<i>0.000008</i>	0.01	<i>0.000008</i>
OCDF	0.000001	0.001	<i>0.0020</i>	<i>0.000002</i>	0.0001	<i>0.000000</i>	0.0001	<i>0.000000</i>	0.0001	<i>0.000000</i>
Total Chlorinated Furans - Non - Targeted Isomers										
TCDF	...	0	0.000000	...	0	...	0	...	0	...
PCDF	...	0	0.000000	...	0	...	0	...	0	...
HxCDF	...	0	0.000000	...	0	...	0	...	0	...
HpCDF	...	0	0.000000	...	0	...	0	...	0	...
TOTAL	0.0013	...	...	0.0018	...	0.0021	...	0.0024	...	0.0029
Range	...	...	...	0.0000018 - 0.0018	...	0.0000002 - 0.0021	...	0 - 0.0024	...	0 - 0.0029
% Uncertainty	...	...	...	21	...	21	...	22	...	22

*Reference Conditions 273K, 101.3kPa, Wet 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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 8 – PCBs (Test 1)

Data Recorded from Recupyl Shredder - Stack Exhaust Stack

Date	Sample Period	Average Stack Temperature	Moisture	Oxygen	Sample Volume	Volumetric Flowrate	Isokinetic Sampling Rate
		°C	%	%	m ³ *	m ³ /sec*	%
01/02/2023	08:05 - 13:47	11.72	1.31	21.00	4.08	0.14	105.02

Species	Blank Ref.: ECL/23/0407 - 0409 ng/m ³ *	Sample Ref.; ECL/23/0404 - 0406 ng/m ³ *	WHO Humans & Mammals TEQ (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	0.003088	0.013406	0.0001	0.0000013	0.000005	0.0000001	0.00010	0.0000013
PCB BZ#114	0.002345	0.003627	0.0005	0.0000018	0.000005	0.0000000	0.00010	0.0000004
PCB BZ#118	0.003872	0.041173	0.0001	0.0000041	0.000005	0.0000002	0.00001	0.0000004
PCB BZ#123	0.002941	0.004509	0.0001	0.0000005	0.000005	0.0000000	0.00001	0.0000000
PCB BZ#126	0.004289	<i>0.004289</i>	0.1	<i>0.00043</i>	0.005000	<i>0.000021</i>	0.10000	<i>0.00043</i>
PCB BZ#156	0.004289	<i>0.004289</i>	0.0005	<i>0.0000021</i>	0.000005	<i>0.0000000</i>	0.00010	<i>0.0000004</i>
PCB BZ#157	0.003897	<i>0.003897</i>	0.0005	<i>0.0000019</i>	0.000005	<i>0.0000000</i>	0.00010	<i>0.0000004</i>
PCB BZ#167	0.004117	<i>0.004117</i>	0.00001	<i>0.0000000</i>	0.000005	<i>0.0000000</i>	0.00001	<i>0.0000000</i>
PCB BZ#169	0.003652	<i>0.003652</i>	0.01	<i>0.000037</i>	0.000050	<i>0.0000002</i>	0.00100	<i>0.0000037</i>
PCB BZ#189	0.004166	<i>0.004166</i>	0.0001	<i>0.0000004</i>	0.000005	<i>0.0000000</i>	0.00001	<i>0.0000000</i>
PCB BZ#77	0.003014	0.032840	0.0001	0.0000033	0.000100	0.0000033	0.05000	0.0016
PCB BZ#81	0.002549	<i>0.002549</i>	0.0001	<i>0.0000003</i>	0.000500	<i>0.0000013</i>	0.10000	<i>0.000025</i>
TOTAL	0.0422	0.1225	...	0.00048	...	0.000027	...	0.0023
Range	...	...	...	0.000011 - 0.00048	...	0.0000036 - 0.000027	...	0.0016 - 0.0023
% Uncertainty	...	9	...	19	...	17	...	15

*Reference Conditions 273K, 101.3kPa, Wet 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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 9 – Brominated Dioxins & Furans (PBDDs & PBDFs) (Test 1)
Data Recorded from Recupyl Shredder - Stack Exhaust Stack

Emission Parameter	Units	Chlorinated & Brominated D & F 1		
Stack Diameter	metres	0.245		
-	-	-		
Area of sample plane	m ²	0.047		
Moisture Content	%	1.31		
Moisture Expanded Uncertainty	%(Relative)	7.77		
Stack Temperature	°C	12		
Oxygen Concentration	%	21.00		
Gas velocity (as Measured)	m/sec	3.1877		
Gas velocity (Reference Conditions)	m/sec*	3.0408		
Volumetric Flowrate (as Measured)	m ³ /sec	0.1503		
Volumetric Flowrate (Reference)	m ³ /sec*	0.1434		
Sample Date				
		01/02/2023		
Sample Period				
		08:05 - 13:47		
Sample Reference				
		ECL/23/0404 - 0406		
Sample Volume (Reference Conditions)	m ³ *	4.08		
Isokinetic Sampling Rate	%	105.02		
Species	Sample Reference: ECL/23/0404 - 0406		Blank Reference: ECL/23/0407 - 0409	
	Conc. ng/m ³ *	TEQ ng/m ³ *	Conc. ng/m ³ *	TEQ ng/m ³ *
Brominated Dioxins 2,3,7,8 Isomers	0.0259	0.00250	0.0337	0.002496
Total Brominated Dioxins Non – Targeted Isomers	0.00	...	0.00	...
Brominated Furans 2,3,7,8 Isomers	0.0885	0.00097	0.08205	0.000835
Total Brominated Furans Non – Targeted Isomers	0.00	...	0.00	...
TOTAL	...	0.00346	...	0.00333
Range	...	0.00022 - 0.0035	Blank <10% of ELV?	YES
% Uncertainty	...	22		

*Reference Conditions 273K, 101.3kPa, Wet 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.

Table 9b – Brominated Dioxins & Furans (PBDDs & PBDFs) (Test 1)

Data Recorded from Recupyl Shredder - Stack Exhaust Stack on the 01/02/23, 08:05 - 13:47

Species	Blank Reference: ECL/23/0407 - 0409 TEQ ng/m ^{3*}	EEC Toxic Equivalent Factor (TEF)	Sample Ref.: ECL/23/0404 - 0406	
			Concentration ng/m ^{3*}	TEQ ng/m ^{3*}
Brominated Dioxins - 2,3,7,8 Isomers				
2,3,7,8 - TBDD	0.000448	1	<i>0.000373</i>	<i>0.000448</i>
1,2,3,7,8 - PBDD	0.000263	0.5	<i>0.00053</i>	<i>0.000263</i>
1,2,3,4,7,8 - HxBDD & 1,2,3,6,7,8 - HxBDD	0.000801 Co-elute	0.1 0.1	<i>0.00782</i>	<i>0.000801</i>
1,2,3,7,8,9 - HxBDD	0.000917	0.1	<i>0.00895</i>	<i>0.000917</i>
1,2,3,4,6,7,8 - HpBDD	0.000056	0.01	<i>0.0022</i>	<i>0.000056</i>
OCDD	0.000010	0.001	0.0060	0.000010
Total Brominated Dioxins - Non - Targeted Isomers				
TBDD	...	0	0.000000	...
PBDD	...	0	0.000000	...
HxBDD	...	0	0.000000	...
HpBDD	...	0	0.000000	...
Brominated Furans - 2,3,7,8 Isomers				
2,3,7,8 - TBDF	0.000054	0.1	<i>0.00045</i>	<i>0.000054</i>
1,2,3,7,8 - PBDF	0.000040	0.05	<i>0.00079</i>	<i>0.000040</i>
2,3,4,7,8 - PBDF	0.000366	0.5	<i>0.00073</i>	<i>0.00037</i>
1,2,3,4,7,8 - HxBDF & 1,2,3,6,7,8 - HxBDF	0.000277 Co-elute	0.1 0.1	<i>0.00112</i>	<i>0.000277</i>
2,3,4,6,7,8 - HxBDF	Not Measured	0.1		
1,2,3,7,8,9 - HxBDF	Not Measured	0.1		
1,2,3,4,6,7,8 - HpBDF	0.000022	0.01	<i>0.0154</i>	<i>0.000154</i>
1,2,3,4,7,8,9 - HpBDF	Not Measured	0.01		
OBDF	0.000075	0.001	<i>0.07009</i>	<i>0.000075</i>
Total Brominated Furans - Non - Targeted Isomers				
TBDF	...	0	0.000000	...
PBDF	...	0	0.000000	...
HxBDF	...	0	0.000000	...
HpBDF	...	0	0.000000	...
TOTAL	0.003331	...	...	0.00346
Range	...	...	...	0.00022 - 0.0035
% Uncertainty	...	...	...	22

*Reference Conditions 273K, 101.3kPa, Wet 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.

1,2,3,4,7,8 - HxBDD & 1,2,3,6,7,8 - HxBDD co-elute (Combined Value Reported)

1,2,3,4,7,8 - HxBDF & 1,2,3,6,7,8 - HxBDF co-elute (Combined Value Reported)

2,3,4,6,7,8 - HxBDF, 1,2,3,7,8,9 - HxBDF & 1,2,3,4,7,8,9 - HpBDF cannot currently be measured by the analytical laboratory (no analytical standard commercially available)

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 10 – Cadmium & Nickel (Test 1) & Heavy Metals (Test 1)

Sampling Location: Recupyl Shredder Exhaust Stack

Test Cd, Ni T1 & Heavy Metals T1											
Stack Profile:	Circular	Units	Gas velocity (as Measured. Adjusted for Smooth Walls):				3.1907	m/sec			
Diameter:	0.25	m	Gas velocity (Reference Conditions):				3.0417	m/sec *			
			Volumetric Flowrate (as Measured):				0.1504	m ³ /sec			
Area of sample plane:	0.047	m ²	Volumetric Flowrate (Reference Conditions):				0.1434	m ³ /sec *			
Moisture Content:	1.63	%	Sample Date:				02/02/2023				
Stack Temperature:	13	°C	Sample Period:				10:20 - 11:20				
Barometric Pressure:	1011	mbar	Sample Volume:				0.932	m ³			
Measured Oxygen:	21.00	%	Isokinetic Rate (95% < ISOKx > 115%):				105.94	%			
*Reference Conditions: (273K, 101.3kPa, Wet Gas)											
Trace Element	Symbol	Mass (mg)			ECL/23/426 - 429			Emission Rate (g/hr)*	Uncertainty (%)	ECL/23/438 - 441	
		Particulate Phase	Vapour Phase	Total Element Phase	Concentration (mg/m ³)*					Blank	
					Particulate Phase	Vapour Phase	Total Element Phase			Mass (mg)	Conc. (mg/m ³)
Antimony	Sb	0.00060	0.00013	0.00073	0.00064	0.00014	0.00082	0.00042	13	0.00076	0.00082
Arsenic	As	0.00050	0.00019	0.00069	0.00054	0.00020	0.00074	0.00038	9	0.00060	0.00064
Cadmium	Cd	0.00050	0.00013	0.00063	0.00054	0.00014	0.00067	0.00035	10	0.00056	0.00061
Chromium	Cr	0.014	0.013	0.027	0.015	0.014	0.029	0.015	8	0.0012	0.0013
Cobalt	Co	0.00070	0.00071	0.0014	0.00075	0.00076	0.0015	0.00078	8	0.00056	0.00061
Copper	Cu	0.0020	0.0039	0.0059	0.0021	0.0042	0.0064	0.0033	8	0.0027	0.0029
Lead	Pb	0.0045	0.0063	0.011	0.0048	0.0067	0.012	0.0060	11	0.0084	0.0090
Manganese	Mn	0.0021	0.0039	0.0060	0.0023	0.0041	0.0064	0.0033	9	0.0011	0.0012
Nickel	Ni	0.0074	0.0046	0.012	0.0079	0.0049	0.013	0.0066	9	0.0012	0.0013
Selenium	Se	0.00070	0.00038	0.0011	0.00075	0.00041	0.0012	0.00060	11	0.00089	0.00096
Thallium	Tl	0.00040	0.00013	0.00053	0.00043	0.00014	0.00056	0.00029	11	0.00046	0.00050
Vanadium	V	0.00040	0.000063	0.00046	0.00043	0.000068	0.00050	0.00026	11	0.00043	0.00046
Cadmium & Nickel		0.0079	0.0047	0.013	0.0085	0.0051	0.014	0.0070	8	0.0018	0.0019
Antimony, Arsenic, Chromium, Cobalt, Copper, Lead, Manganese, Selenium, Thallium & Vanadium		0.026	0.029	0.055	0.028	0.031	0.059	0.030	5	0.017	0.018

No ELV Entered!

No ELV Entered!

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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 10b – Cadmium & Nickel (Test 1) & Heavy Metals Efficiencies (Test 1)

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	3.79	PASS	NO
Arsenic	As	6.31	PASS	NO
Cadmium	Cd	4.63	PASS	NO
Chromium	Cr	0.64	PASS	NO
Cobalt	Co	2.06	PASS	NO
Copper	Cu	5.63	PASS	NO
Lead	Pb	4.04	PASS	NO
Manganese	Mn	5.35	PASS	NO
Nickel	Ni	1.21	PASS	NO
Selenium	Se	8.07	PASS	NO
Thallium	Tl	5.51	N/A	YES
Vanadium	V	3.13	N/A	YES

Combined Groups	ELV mg/m ³	Result <30% ELV?
Cadmium & Nickel	0	NO
Antimony, Arsenic, Chromium, Cobalt, Copper, Lead, Manganese, Selenium, Thallium & Vanadium	0	NO

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/Voo6
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 11 – Cadmium & Nickel (Test 2)

Sampling Location: Recupyl Shredder Exhaust Stack

Test Cadmium & Nickel T2												
Stack Profile:	Circular	Units	Gas velocity (as Measured. Adjusted for Smooth Walls):					3.1951	m/sec			
Diameter:	0.25	m	Gas velocity (Reference Conditions):					3.0432	m/sec *			
			Volumetric Flowrate (as Measured):					0.1506	m ³ /sec			
Area of sample plane:	0.047	m ²	Volumetric Flowrate (Reference Conditions):					0.1435	m ³ /sec *			
Moisture Content:	2.13	%	Sample Date:					02/02/2023				
Stack Temperature:	13	°C	Sample Period:					11:35 - 12:35				
Barometric Pressure:	1011	mbar	Sample Volume:					0.960	m ³			
Measured Oxygen:	21.00	%	Isokinetic Rate (95% < ISOKx > 115%):					109.03	%			
*Reference Conditions: (273K, 101.3kPa, Wet Gas)												
Trace Element	Symbol	Mass (mg)			ECL/23/430 - 433			Emission Rate (g/hr)*	Uncertainty (%)	ECL/23/438 - 441		
		Particulate Phase	Vapour Phase	Total Element Phase	Concentration (mg/m ³)*					Total Element Phase	Blank	
					Particulate Phase	Vapour Phase	Total Element Phase				Mass (mg)	Conc. (mg/m ³)
Cadmium	Cd	0.00050	0.00011	0.00061	0.00052	0.00011	0.00063	0.00033	10	0.00056	0.00059	
Nickel	Ni	0.0055	0.0030	0.0085	0.0057	0.0032	0.0089	0.0046	9	0.0012	0.0013	
Cadmium & Nickel		0.0060	0.0032	0.0092	0.0063	0.0033	0.0095	0.0049	8	0.0018	0.0019	

No ELV Entered!

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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 11b – Cadmium & Nickel Efficiencies (Test 2)

<p>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.</p>				
<p>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</p>				
Trace Element	Symbol	Final Impinger (%)	< 10%?	< 1% of Total?
Cadmium	Cd	4.63	PASS	NO
Nickel	Ni	4.10	PASS	NO

Combined Groups	ELV mg/m ³	Result < 30% ELV?
Cadmium	0	NO
Nickel	0	NO

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 12 – Cadmium & Nickel (Test 3)

Sampling Location: Recupyl Shredder Exhaust Stack

Test Cadmium & Nickel T3												
Stack Profile:	Circular	Units	Gas velocity (as Measured. Adjusted for Smooth Walls):					3.1910	m/sec			
Diameter:	0.25	m	Gas velocity (Reference Conditions):					3.0358	m/sec *			
			Volumetric Flowrate (as Measured):					0.1504	m ³ /sec			
Area of sample plane:	0.047	m ²	Volumetric Flowrate (Reference Conditions):					0.1431	m ³ /sec *			
Moisture Content:	1.14	%	Sample Date:					02/02/2023				
Stack Temperature:	13	°C	Sample Period:					12:50 - 13:50				
Barometric Pressure:	1011	mbar	Sample Volume:					0.946	m ³			
Measured Oxygen:	21.00	%	Isokinetic Rate (95% < ISOKx > 115%):					107.67	%			
*Reference Conditions: (273K, 101.3kPa, Wet Gas)												
Trace Element	Symbol	Mass (mg)			ECL/23/434 - 437			Emission Rate (g/hr)*	Uncertainty (%)	ECL/23/438 - 441		
		Particulate Phase	Vapour Phase	Total Element Phase	Concentration (mg/m ³)*					Total Element Phase	Blank	
					Particulate Phase	Vapour Phase	Total Element Phase				Mass (mg)	Conc. (mg/m ³)
Cadmium	Cd	0.00050	0.00013	0.00063	0.00053	0.00014	0.00067	0.00034	10	0.00056	0.00060	
Nickel	Ni	0.0046	0.0037	0.0083	0.0049	0.0039	0.0088	0.0045	8	0.0012	0.0013	
Cadmium & Nickel		0.0051	0.0039	0.0090	0.0054	0.0041	0.0095	0.0049	8	0.0018	0.0019	

No ELV Entered!

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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 12b – Cadmium & Nickel Efficiencies (Test 3)

<p>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.</p>				
<p>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</p>				
Trace Element	Symbol	Final Impinger (%)	< 10%?	< 1% of Total?
Cadmium	Cd	4.74	PASS	NO
Nickel	Ni	1.44	PASS	NO

Combined Groups	ELV mg/m ³	Result < 30% ELV?
Cadmium	0	NO
Nickel	0	NO

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 13 – Particulates (Test 4)

Data Recorded from Exhaust Stack - Recupyl Shredder

Emission Parameter	Units	TPM 4	Blank
Stack Diameter	metres	0.25	...
Area of Sample Plane	m ²	0.047	...
Moisture Content	%	0.88	...
Oxygen Content	%	20.90	...
Stack Temperature	°C	13	...
Gas Velocity (as Measured. Adjusted for Smooth Walls)	m/sec	3.2002	...
Gas Velocity (Reference Conditions)	m/sec*	3.0240	...
Volumetric Flowrate (as Measured)	m ³ /sec	0.1509	...
Volumetric Flowrate (Reference Conditions)	m ³ /sec*	0.1426	...
Dry Gas Molecular Weight	g/gmole	28.8560	
Sample Date	...	16/02/2023	...
Sample Period	...	10:02 - 11:02	...
Sample Volume (reference Conditions)	m ³ *	1.290	1.290
Isokinetic Sampling Rate	%	102.16	...
Sample Reference (ECL ID)	ECL/23/	0448 & 0449	0454 & 0455
Mass of Particulate Matter Collected	mg	0.60	0.60
Concentration of Particulate Matter	mg/m ³ *	0.47	0.47
Emission Rate of Particulate Matter	g/hr	0.24	...
Expanded Uncertainty (% Relative)	%	85	...

* Reference Conditions (273K, 101.3kPa, Wet Gas)

Table 14 – Particulates (Test 5) HCl & HF (Test 2)

Data Recorded from Exhaust Stack - Recupyl Shredder

Emission Parameter	Units	TPM 5, HCl & HF 2	Blank
Stack Diameter	metres	0.25	...
Area of Sample Plane	m ²	0.047	...
Moisture Content	%	1.07	...
Oxygen Content	%	20.90	...
Stack Temperature	°C	14	...
Gas Velocity (as Measured. Adjusted for Smooth Walls)	m/sec	3.2056	...
Gas Velocity (Reference Conditions)	m/sec*	3.0211	...
Volumetric Flowrate (as Measured)	m ³ /sec	0.1511	...
Volumetric Flowrate (Reference Conditions)	m ³ /sec*	0.1424	...
Dry Gas Molecular Weight	g/gmole	28.8560	
Sample Date	...	16/02/2023	...
Sample Period	...	11:25 - 12:25	...
Sample Volume (reference Conditions)	m ³ *	1.304	1.304
Isokinetic Sampling Rate	%	103.41	...
Sample Reference (ECL ID)	ECL/23/	0450 & 0451	0454 & 0455
Mass of Particulate Matter Collected	mg	1.84	0.60
Concentration of Particulate Matter	mg/m ³ *	1.41	0.46
Emission Rate of Particulate Matter	g/hr	0.72	...
Expanded Uncertainty (% Relative)	%	28	...
Sample Reference (ECL ID)	ECL/23/	461&462	463
Mass of Hydrogen Chloride Collected	mg	0.03	0.02
Concentration of Hydrogen Chloride	mg/m ³ *	0.02	0.02
Emission Rate of Hydrogen Chloride	g/hr	0.01	...
Expanded Uncertainty (% Relative)	%	13	...
Impinger Collection Efficiency	%	71	...
Sample Reference	ECL/23/	461&462	463
Mass of Hydrogen Fluoride Collected	mg	0.03	0.02
Concentration of Hydrogen Fluoride	mg/m ³ *	0.02	0.02
Emission Rate of Hydrogen Fluoride	g/hr	0.01	...
Expanded Uncertainty (% Relative)	%	13	...
Impinger Collection Efficiency	%	71	...

*Reference Conditions (273K, 101.3kPa, Wet Gas)

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 15 – Particulates (Test 6), SO₂ (Test 2)

Data Recorded from Exhaust Stack - Recupyl Shredder

Emission Parameter	Units	TPM 6 & SO ₂ 2	Blank
Stack Diameter	metres	0.25	...
Area of Sample Plane	m ²	0.047	...
Moisture Content	%	0.77	...
Oxygen Content	%	20.90	...
Stack Temperature	°C	14	...
Gas Velocity (as Measured. Adjusted for Smooth Walls)	m/sec	3.2052	...
Gas Velocity (Reference Conditions)	m/sec*	3.0182	...
Volumetric Flowrate (as Measured)	m ³ /sec	0.1511	...
Volumetric Flowrate (Reference Conditions)	m ³ /sec*	0.1423	...
Dry Gas Molecular Weight	g/gmole	28.8560	
Sample Date	...	16/02/2023	...
Sample Period	...	12:50 - 13:50	...
Sample Volume (reference Conditions)	m ³ *	1.317	1.317
Isokinetic Sampling Rate	%	104.57	...
Sample Reference (ECL ID)	ECL/23/	0452 & 0453	0454 & 0455
Mass of Particulate Matter Collected	mg	0.60	0.60
Concentration of Particulate Matter	mg/m ³ *	0.46	0.46
Emission Rate of Particulate Matter	g/hr	0.23	...
Expanded Uncertainty (% Relative)	%	85	...
Sample Reference	ECL/23/	0458 & 0459	0460
Mass of Sulphur Dioxide Collected	mg	0.09	0.15
Concentration of Sulphur Dioxide	mg/m ³ *	0.11	0.11
Emission Rate of Sulphur Dioxide	g/hr	0.06	...
Expanded Uncertainty (% Relative)	%	13	...
Impinger Collection Efficiency	%	68	...

* Reference Conditions (273K, 101.3kPa, Wet Gas)

Table 16 – Chlorinated Dioxins & Furans (Test 2)

Data Recorded from Recupyl Shredder - Stack Exhaust Stack

Emission Parameter	Units	Chlorinated D & F 2		
Stack Diameter	metres	0.245		
-	-	-		
Area of sample plane	m ²	0.047		
Moisture Content	%	0.61		
Moisture Expanded Uncertainty	%(Relative)	10.56		
Stack Temperature	°C	13		
Oxygen Concentration	%	21.00		
Gas velocity (as Measured)	m/sec	3.1895		
Gas velocity (Reference Conditions)	m/sec*	3.0312		
Volumetric Flowrate (as Measured)	m ³ /sec	0.1504		
Volumetric Flowrate (Reference Conditions)	m ³ /sec*	0.1429		
Sample Date				
		15/02/2023		
Sample Period				
		08:40 - 14:40		
Sample Reference				
		ECL/23/0442 - 0444		
Sample Volume (Reference Conditions)	m ³ *	5.45		
Isokinetic Sampling Rate	%	103.62		
Species	Sample Reference: ECL/23/0442 - 0444		Blank Reference: ECL/23/0445 - 0447	
	Conc. ng/m ³ *	TEQ ng/m ³ *	Conc. ng/m ³ *	TEQ ng/m ³ *
Chlorinated Dioxins 2,3,7,8 Isomers	0.016	0.00027	0.010	0.00017
Total Chlorinated Dioxins Non – Targeted Isomers	0.00	...	0.00	...
Chlorinated Furans 2,3,7,8 Isomers	0.013	0.00094	0.0078	0.00075
Total Chlorinated Furans Non – Targeted Isomers	0.00	...	0.00	...
TOTAL	...	0.0012	...	0.00092
Range	...	0.0011 - 0.0012	Blank < 10% of ELV?	NO
% Uncertainty	...	20		

* Reference Conditions 273K, 101.3kPa, Wet 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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 16b – Chlorinated Dioxins & Furans (Test 2)

Data Recorded from Recupyl Shredder - Stack Exhaust Stack on the 15/02/23, 08:40 - 14:40

Species	Blank Reference:	EEC Toxic Equivalent Factor (TEF)	Sample Ref.: ECL/23/0442 - 0444		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 *
	ECL/23/0445 - 0447		Concentration ng/m ³ *	TEQ ng/m ³ *						
Chlorinated Dioxins - 2,3,7,8 Isomers										
2,3,7,8 - TCDD	0.000061	1	<i>0.000051</i>	<i>0.000061</i>	1	<i>0.000061</i>	1	<i>0.000061</i>	1	<i>0.000061</i>
1,2,3,7,8 - PCDD	0.000051	0.5	<i>0.000088</i>	<i>0.000051</i>	1	<i>0.00010</i>	1	<i>0.00010</i>	1	<i>0.00010</i>
1,2,3,4,7,8 - HxCDD	0.000009	0.1	<i>0.00013</i>	<i>0.000013</i>	0.1	<i>0.000013</i>	0.5	<i>0.000063</i>	0.05	<i>0.000006</i>
1,2,3,6,7,8 - HxCDD	0.000009	0.1	0.00070	0.000070	0.1	0.000070	0.01	0.000007	0.01	0.000007
1,2,3,7,8,9 - HxCDD	0.000014	0.1	0.00032	0.000032	0.1	0.000032	0.01	0.000003	0.1	0.000032
1,2,3,4,6,7,8 - HpCDD	0.000019	0.01	0.0032	0.000032	0.01	0.000032	0.001	0.000003	0.001	0.000003
OCDD	0.000008	0.001	0.012	0.000012	0.0001	0.000001	0	...	0	...
Total Chlorinated Dioxins - Non - Targeted Isomers										
TCDD	...	0	0.000000	...	0	...	0	...	0	...
PCDD	...	0	0.000000	...	0	...	0	...	0	...
HxCDD	...	0	0.000000	...	0	...	0	...	0	...
HpCDD	...	0	0.000000	...	0	...	0	...	0	...
Chlorinated Furans - 2,3,7,8 Isomers										
2,3,7,8 - TCDF	0.00012	0.1	0.0010	0.00012	0.1	0.00012	0.05	0.000059	1	0.0012
1,2,3,7,8 - PCDF	0.000007	0.05	0.00071	0.000036	0.05	0.000036	0.05	0.000036	0.1	0.000071
2,3,4,7,8 - PCDF	0.00042	0.5	0.00089	0.00044	0.5	0.00044	0.5	0.00044	1	0.00089
1,2,3,4,7,8 - HxCDF	0.000054	0.1	0.0010	0.00010	0.1	0.00010	0.1	0.00010	0.1	0.00010
1,2,3,6,7,8 - HxCDF	0.000054	0.1	0.00090	0.000090	0.1	0.000090	0.1	0.000090	0.1	0.000090
2,3,4,6,7,8 - HxCDF	0.000063	0.1	0.0010	0.00010	0.1	0.00010	0.1	0.00010	0.1	0.00010
1,2,3,7,8,9 - HxCDF	0.000006	0.1	<i>0.000079</i>	<i>0.000008</i>	0.1	<i>0.000008</i>	0.1	<i>0.000008</i>	0.1	<i>0.000008</i>
1,2,3,4,6,7,8 - HpCDF	0.000022	0.01	0.0040	0.000040	0.01	0.000040	0.01	0.000040	0.01	0.000040
1,2,3,4,7,8,9 - HpCDF	0.000002	0.01	0.00057	0.000006	0.01	0.000006	0.01	0.000006	0.01	0.000006
OCDF	0.000002	0.001	0.0024	0.000002	0.0001	0.000000	0.0001	0.000000	0.0001	0.000000
Total Chlorinated Furans - Non - Targeted Isomers										
TCDF	...	0	0.000000	...	0	...	0	...	0	...
PCDF	...	0	0.000000	...	0	...	0	...	0	...
HxCDF	...	0	0.000000	...	0	...	0	...	0	...
HpCDF	...	0	0.000000	...	0	...	0	...	0	...
TOTAL	0.00092	...	...	0.0012	...	0.0013	...	0.0011	...	0.0027
Range	...	...	...	0.0011 - 0.0012	...	0.0011 - 0.0013	...	0.00088 - 0.0011	...	0.0024 - 0.0027
% Uncertainty	...	...	...	20	...	20	...	22	...	28

* Reference Conditions 273K, 101.3kPa, Wet 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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/Voo6
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 17 – PCBs (Test 2)

Data Recorded from Recupyl Shredder - Stack Exhaust Stack

Date	Sample Period	Average Stack Temperature	Moisture	Oxygen	Sample Volume	Volumetric Flowrate	Isokinetic Sampling Rate
		°C	%	%	m ³ *	m ³ /sec*	%
15/02/2023	08:40 - 14:40	12.50	0.61	21.00	5.45	0.14	103.62

Species	Blank Ref.: ECL/23/0445 - 0447 ng/m ³ *	Sample Ref.: ECL/23/0442 - 0444 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	0.056858	0.068413	0.0001	0.000068	0.000005	0.000003	0.00010	0.000068
PCB BZ#114	0.005631	0.006695	0.0005	0.000033	0.000005	0.000000	0.00010	0.000007
PCB BZ#118	0.152416	0.196252	0.0001	0.000020	0.000005	0.000010	0.00001	0.000020
PCB BZ#123	0.004200	0.005741	0.0001	0.000006	0.000005	0.000000	0.00001	0.000001
PCB BZ#126	0.002513	0.002513	0.1	0.00025	0.005000	0.000013	0.10000	0.00025
PCB BZ#156	0.004732	0.006970	0.0005	0.000035	0.000005	0.000000	0.00010	0.000007
PCB BZ#157	0.001576	0.001576	0.0005	0.000008	0.000005	0.000000	0.00010	0.000002
PCB BZ#167	0.002293	0.002953	0.00001	0.000000	0.000005	0.000000	0.00001	0.000000
PCB BZ#169	0.000521	0.000521	0.01	0.0000052	0.000050	0.000000	0.00100	0.000005
PCB BZ#189	0.000950	0.001339	0.0001	0.000001	0.000005	0.000000	0.00001	0.000000
PCB BZ#77	0.141228	0.192584	0.0001	0.000019	0.000100	0.000019	0.05000	0.0096
PCB BZ#81	0.010473	0.013774	0.0001	0.000014	0.000500	0.000069	0.10000	0.0014
TOTAL	0.3834	0.4993	...	0.00031	...	0.000040	...	0.011
Range	...	...	...	0.0003 - 0.00031	...	0.00004 - 0.00004	...	0.011 - 0.011
% Uncertainty	...	12	...	18	...	13	...	19

*Reference Conditions 273K, 101.3kPa, Wet 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.

Table 18 – Brominated Dioxins & Furans (PBDDs & PBDFs) (Test 2)**Data Recorded from Recupyl Shredder - Stack Exhaust Stack**

Emission Parameter	Units	Brominated D & F 2		
Stack Diameter	metres	0.245		
-	-	-		
Area of sample plane	m ²	0.047		
Moisture Content	%	0.61		
Moisture Expanded Uncertainty	%(Relative)	10.56		
Stack Temperature	°C	13		
Oxygen Concentration	%	21.00		
Gas velocity (as Measured)	m/sec	3.1895		
Gas velocity (Reference Conditions)	m/sec*	3.0312		
Volumetric Flowrate (as Measured)	m ³ /sec	0.1504		
Volumetric Flowrate (Reference Conditions)	m ³ /sec*	0.1429		
Sample Date				
		15/02/2023		
Sample Period				
		08:40 - 14:40		
Sample Reference				
		ECL/23/0442 - 0444		
Sample Volume (Reference Conditions)	m ³ *	5.45		
Isokinetic Sampling Rate	%	103.62		
Species	Sample Reference: ECL/23/0442 - 0444		Blank Reference: ECL/23/0445 - 0447	
	Conc. ng/m ³ *	TEQ ng/m ³ *	Conc. ng/m ³ *	TEQ ng/m ³ *
Brominated Dioxins 2,3,7,8 Isomers	0.1723	0.00254	0.1011	0.001484
Total Brominated Dioxins Non – Targeted Isomers	0.00	...	0.00	...
Brominated Furans 2,3,7,8 Isomers	0.0535	0.00102	0.04290	0.000718
Total Brominated Furans Non – Targeted Isomers	0.00	...	0.00	...
TOTAL	...	0.00357	...	0.00220
Range	...	0.00015 - 0.0036	Blank < 10% of ELV?	NO
% Uncertainty	...	19		

* Reference Conditions 273K, 101.3kPa, Wet 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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Vitr Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 18b – Brominated Dioxins & Furans (PBDDs & PBDFs) (Test 2)

Data Recorded from Recupyl Shredder - Stack Exhaust Stack on the 15/02/23, 08:40 - 14:40

Species	Blank Reference: ECL/23/0445 - 0447 TEQ ng/m ³ *	EEC Toxic Equivalent Factor (TEF)	Sample Ref.: ECL/23/0442 - 0444	
			Concentration ng/m ³ *	TEQ ng/m ³ *
Brominated Dioxins - 2,3,7,8 Isomers				
2,3,7,8 - TBDD	0.000235	1	<i>0.000780</i>	<i>0.000780</i>
1,2,3,7,8 - PBDD	0.000279	0.5	<i>0.00072</i>	<i>0.000359</i>
1,2,3,4,7,8 - HxBDD & 1,2,3,6,7,8 - HxBDD	0.000409 Co-elute	0.1 0.1	<i>0.00545</i>	<i>0.000545</i>
1,2,3,7,8,9 - HxBDD	0.000422	0.1	0.00563	0.000563
1,2,3,4,6,7,8 - HpBDD	0.000053	0.01	0.0152	0.000152
OCDD	0.000087	0.001	0.1445	0.000145
Total Brominated Dioxins - Non - Targeted Isomers				
TBDD	...	0	0.000000	...
PBDD	...	0	0.000000	...
HxBDD	...	0	0.000000	...
HpBDD	...	0	0.000000	...
Brominated Furans - 2,3,7,8 Isomers				
2,3,7,8 - TBDF	0.000025	0.1	0.00028	0.000028
1,2,3,7,8 - PBDF	0.000030	0.05	0.00039	0.000030
2,3,4,7,8 - PBDF	0.000312	0.5	0.00041	0.00031
1,2,3,4,7,8 - HxBDF & 1,2,3,6,7,8 - HxBDF	0.000222 Co-elute	0.1 0.1	0.00504	0.000504
2,3,4,6,7,8 - HxBDF	Not Measured	0.1		
1,2,3,7,8,9 - HxBDF	Not Measured	0.1		
1,2,3,4,6,7,8 - HpBDF	0.000101	0.01	0.0114	0.000114
1,2,3,4,7,8,9 - HpBDF	Not Measured	0.01		
OBDF	0.000029	0.001	0.03595	0.000036
Total Brominated Furans - Non - Targeted Isomers				
TBDF	...	0	0.000000	...
PBDF	...	0	0.000000	...
HxBDF	...	0	0.000000	...
HpBDF	...	0	0.000000	...
TOTAL	0.002202	...	...	0.00357
Range	...	...	...	0.00015 - 0.0036
% Uncertainty	...	...	...	19

* Reference Conditions 273K, 101.3kPa, Wet 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.

1,2,3,4,7,8 - HxBDD & 1,2,3,6,7,8 - HxBDD co-elute (Combined Value Reported)

1,2,3,4,7,8 - HxBDF & 1,2,3,6,7,8 - HxBDF co-elute (Combined Value Reported)

2,3,4,6,7,8 - HxBDF, 1,2,3,7,8,9 - HxBDF & 1,2,3,4,7,8,9 - HpBDF cannot currently be measured by the analytical laboratory (no analytical standard commercially available)

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/Voo6
 Report Ref : P5350 : Roo2

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 19 – Cadmium & Nickel (Test 4) & Heavy Metals (Test 2)

Sampling Location: Recupyl Shredder Exhaust Stack

Test Cd, Ni T4 & Heavy Metals T2												
Stack Profile:	Circular	Units	Gas velocity (as Measured. Adjusted for Smooth Walls):					3.2936	m/sec			
Diameter:	0.25	m	Gas velocity (Reference Conditions):					3.0896	m/sec *			
			Volumetric Flowrate (as Measured):					0.1553	m ³ /sec			
Area of sample plane:	0.047	m ²	Volumetric Flowrate (Reference Conditions):					0.1457	m ³ /sec *			
Moisture Content:	1.09	%	Sample Date:					17/03/2023				
Stack Temperature:	13	°C	Sample Period:					09:39 - 10:39				
Barometric Pressure:	996	mbar	Sample Volume:					0.876	m ³			
Measured Oxygen:	21.00	%	Isokinetic Rate (95% < ISOKx > 115%):					103.72	%			
*Reference Conditions: (273K, 101.3kPa, Wet Gas)												
Trace Element	Symbol	Mass (mg)			ECL/23/1847 - 1850			Emission Rate (g/hr)*	Uncertainty (%)	ECL/23/1859 - 1862		
		Particulate Phase	Vapour Phase	Total Element Phase	Concentration (mg/m ³)*					Total Element Phase	Blank	
					Particulate Phase	Vapour Phase	Total Element Phase				Mass (mg)	Conc. (mg/m ³)
Antimony	Sb	0.00060	0.00015	0.00075	0.00068	0.00017	0.00085	0.00045	13	0.00073	0.00083	
Arsenic	As	0.00050	0.00022	0.00072	0.00057	0.00025	0.00082	0.00043	9	0.00069	0.00079	
Cadmium	Cd	0.00050	0.00015	0.00065	0.00057	0.00017	0.00074	0.00039	10	0.00063	0.00072	
Chromium	Cr	0.0049	0.014	0.019	0.0056	0.016	0.022	0.012	8	0.0014	0.0015	
Cobalt	Co	0.00050	0.00019	0.00069	0.00057	0.00022	0.0010	0.00054	9	0.00090	0.0010	
Copper	Cu	0.0016	0.013	0.015	0.0018	0.015	0.017	0.0090	9	0.0011	0.0013	
Lead	Pb	0.0050	0.0065	0.012	0.0057	0.0074	0.013	0.0069	11	0.0016	0.0019	
Manganese	Mn	0.0043	0.0024	0.0067	0.0049	0.0028	0.0077	0.0040	11	0.0028	0.0032	
Nickel	Ni	0.0065	0.0012	0.0077	0.0074	0.0014	0.0088	0.0046	11	0.0016	0.0018	
Selenium	Se	0.00070	0.00044	0.0011	0.00080	0.00050	0.0013	0.00068	10	0.0011	0.0012	
Thallium	Tl	0.00040	0.00015	0.00055	0.00046	0.00017	0.00062	0.00033	11	0.00053	0.00060	
Vanadium	V	0.00060	0.000074	0.00067	0.00068	0.000084	0.00077	0.00040	11	0.00046	0.00053	
Cadmium & Nickel		0.0070	0.0014	0.0084	0.0080	0.0016	0.0096	0.0050	10	0.0022	0.0026	
Antimony, Arsenic, Chromium, Cobalt, Copper, Lead, Manganese, Selenium, Thallium & Vanadium		0.019	0.038	0.057	0.022	0.043	0.065	0.034	5	0.011	0.013	

Efficiency Failure

Efficiency Failure
 Efficiency Failure

Efficiency Failure

No ELV Entered!

No ELV Entered!

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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

**Table 19b – Cadmium & Nickel (Test 4)
 & Heavy Metals Efficiencies (Test 2)**

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	7.10	PASS	NO
Arsenic	As	11.03	FAIL	NO
Cadmium	Cd	8.19	PASS	NO
Chromium	Cr	3.98	PASS	NO
Cobalt	Co	5.91	PASS	NO
Copper	Cu	15.52	FAIL	NO
Lead	Pb	12.44	FAIL	NO
Manganese	Mn	8.68	PASS	NO
Nickel	Ni	3.09	PASS	NO
Selenium	Se	13.94	FAIL	NO
Thallium	Tl	9.69	N/A	YES
Vanadium	V	3.93	PASS	NO

Combined Groups	ELV mg/m ³	Result <30% ELV?
Cadmium & Nickel	0	NO
Antimony, Arsenic, Chromium, Cobalt, Copper, Lead, Manganese, Selenium, Thallium & Vanadium	0	NO

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 20 – Cadmium & Nickel (Test 5)

Sampling Location: Recupyl Shredder Exhaust Stack

Test Cadmium & Nickel T5												
Stack Profile:	Circular	Units	Gas velocity (as Measured. Adjusted for Smooth Walls):					3.3071	m/sec			
Diameter:	0.25	m	Gas velocity (Reference Conditions):					3.0861	m/sec *			
			Volumetric Flowrate (as Measured):					0.1559	m ³ /sec			
Area of sample plane:	0.047	m ²	Volumetric Flowrate (Reference Conditions):					0.1455	m ³ /sec *			
Moisture Content:	1.88	%	Sample Date:					17/03/2023				
Stack Temperature:	15	°C	Sample Period:					11:14 - 12:14				
Barometric Pressure:	996	mbar	Sample Volume:					0.869	m ³			
Measured Oxygen:	21.00	%	Isokinetic Rate (95% < ISOKx > 115%):					103.00	%			
*Reference Conditions: (273K, 101.3kPa, Wet Gas)												
Trace Element	Symbol	Mass (mg)			ECL/23/1851 - 1854			Emission Rate (g/hr)*	Uncertainty (%)	ECL/23/1859 - 1862		
		Particulate Phase	Vapour Phase	Total Element Phase	Concentration (mg/m ³)*					Total Element Phase	Blank	
					Particulate Phase	Vapour Phase	Total Element Phase				Mass (mg)	Conc. (mg/m ³)
Cadmium	Cd	0.00050	0.00015	0.00065	0.00058	0.00017	0.00075	0.00039	10	0.00063	0.00072	
Nickel	Ni	0.012	0.0023	0.014	0.014	0.0027	0.016	0.0085	10	0.0016	0.0019	
Cadmium & Nickel		0.012	0.0025	0.015	0.014	0.0029	0.017	0.0089	10	0.0022	0.0026	

No ELV Entered!

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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 20b – Cadmium & Nickel Efficiencies (Test 5)

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?
Cadmium	Cd	7.56	PASS	NO
Nickel	Ni	1.21	PASS	NO

Combined Groups	ELV mg/m ³	Result <30% ELV?
Cadmium & Nickel	0	NO

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 21 – Cadmium & Nickel (Test 6)

Sampling Location: Recupyl Shredder Exhaust Stack

Test Cadmium & Nickel T6												
Stack Profile:	Circular	Units	Gas velocity (as Measured. Adjusted for Smooth Walls):					3.3219	m/sec			
Diameter:	0.25	m	Gas velocity (Reference Conditions):					3.0900	m/sec *			
			Volumetric Flowrate (as Measured):					0.1566	m ³ /sec			
Area of sample plane:	0.047	m ²	Volumetric Flowrate (Reference Conditions):					0.1457	m ³ /sec *			
Moisture Content:	3.39	%	Sample Date:					17/03/2023				
Stack Temperature:	16	°C	Sample Period:					12:46 - 13:46				
Barometric Pressure:	996	mbar	Sample Volume:					0.863	m ³			
Measured Oxygen:	21.00	%	Isokinetic Rate (95% < ISOKx > 115%):					102.16	%			
*Reference Conditions: (273K, 101.3kPa, Wet Gas)												
Trace Element	Symbol	Mass (mg)			ECL/23/1855 - 1858			Emission Rate (g/hr)*	Uncertainty (%)	ECL/23/1859 - 1862		
		Particulate Phase	Vapour Phase	Total Element Phase	Concentration (mg/m ³)*					Total Element Phase	Blank	
					Particulate Phase	Vapour Phase	Total Element Phase				Mass (mg)	Conc. (mg/m ³)
Cadmium	Cd	0.00050	0.00015	0.00065	0.00058	0.00017	0.00075	0.00039	10	0.00063	0.00073	
Nickel	Ni	0.0059	0.0017	0.0076	0.0068	0.0019	0.0088	0.0046	10	0.0016	0.0019	
Cadmium & Nickel		0.0064	0.0018	0.0082	0.0074	0.0021	0.0095	0.0050	9	0.0022	0.0026	

Efficiency Failure

No ELV Entered!

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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 21b – Cadmium & Nickel Efficiencies (Test 6)

<p>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.</p>				
<p>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</p>				
Trace Element	Symbol	Final Impinger (%)	<10%?	<1% of Total?
Cadmium	Cd	10.19	FAIL	NO
Nickel	Ni	2.61	PASS	NO

Combined Groups	ELV mg/m ³	Result <30% ELV?
Cadmium & Nickel	0	NO

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 22 – Particulates (Test 7), SO2 (Test 3)

Data Recorded from Exhaust Stack - Recupyl Shredder

Emission Parameter	Units	TPM 7 & SO2 3	Blank
Stack Diameter	metres	0.25	...
Area of Sample Plane	m ²	0.047	...
Moisture Content	%	1.23	...
Oxygen Content	%	20.90	...
Stack Temperature	°C	13	...
Gas Velocity (as Measured. Adjusted for Smooth Walls)	m/sec	3.1930	...
Gas Velocity (Reference Conditions)	m/sec*	3.0349	...
Volumetric Flowrate (as Measured)	m ³ /sec	0.1505	...
Volumetric Flowrate (Reference Conditions)	m ³ /sec*	0.1431	...
Dry Gas Molecular Weight	g/gmole	28.8560	
Sample Date	...	23/02/2023	...
Sample Period	...	08:24 - 09:24	...
Sample Volume (reference Conditions)	m ³ *	1.309	1.309
Isokinetic Sampling Rate	%	103.34	...
Sample Reference (ECL ID)	ECL/23/	0486 & 0487	0492 & 0493
Mass of Particulate Matter Collected	mg	0.60	0.60
Concentration of Particulate Matter	mg/m ³ *	0.46	0.46
Emission Rate of Particulate Matter	g/hr	0.24	...
Expanded Uncertainty (% Relative)	%	85	...
Sample Reference	ECL/23/	0496 & 0497	0498
Mass of Sulphur Dioxide Collected	mg	0.13	0.13
Concentration of Sulphur Dioxide	mg/m ³ *	0.10	0.10
Emission Rate of Sulphur Dioxide	g/hr	0.05	...
Expanded Uncertainty (% Relative)	%	13	...
Impinger Collection Efficiency	%	83	...

* Reference Conditions (273K, 101.3kPa, Wet Gas)

Table 23 – Particulates (Test 8), HCl & HF (Test 3)

Data Recorded from Exhaust Stack - Recupyl Shredder

Emission Parameter	Units	TPM 8, HCl & HF 3	Blank
Stack Diameter	metres	0.25	...
Area of Sample Plane	m ²	0.047	...
Moisture Content	%	1.35	...
Oxygen Content	%	20.90	...
Stack Temperature	°C	14	...
Gas Velocity (as Measured. Adjusted for Smooth Walls)	m/sec	3.1979	...
Gas Velocity (Reference Conditions)	m/sec*	3.0316	...
Volumetric Flowrate (as Measured)	m ³ /sec	0.1508	...
Volumetric Flowrate (Reference Conditions)	m ³ /sec*	0.1429	...
Dry Gas Molecular Weight	g/gmole	28.8560	
Sample Date	...	23/02/2023	...
Sample Period	...	10:07 - 11:07	...
Sample Volume (reference Conditions)	m ³ *	1.300	1.300
Isokinetic Sampling Rate	%	102.70	...
Sample Reference (ECL ID)	ECL/23/	0488 & 0489	0492 & 0493
Mass of Particulate Matter Collected	mg	0.60	0.60
Concentration of Particulate Matter	mg/m ³ *	0.46	0.46
Emission Rate of Particulate Matter	g/hr	0.24	...
Expanded Uncertainty (% Relative)	%	85	...
Sample Reference (ECL ID)	ECL/23/	0499 & 0500	0501
Mass of Hydrogen Chloride Collected	mg	0.03	0.02
Concentration of Hydrogen Chloride	mg/m ³ *	0.03	0.01
Emission Rate of Hydrogen Chloride	g/hr	0.01	...
Expanded Uncertainty (% Relative)	%	13	...
Impinger Collection Efficiency	%	77	...
Sample Reference	ECL/23/	0499 & 0500	0501
Mass of Hydrogen Fluoride Collected	mg	0.03	0.02
Concentration of Hydrogen Fluoride	mg/m ³ *	0.02	0.01
Emission Rate of Hydrogen Fluoride	g/hr	0.01	...
Expanded Uncertainty (% Relative)	%	13	...
Impinger Collection Efficiency	%	71	...

* Reference Conditions (273K, 101.3kPa, Wet Gas)

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 24 – Particulates (Test 9)

Data Recorded from Exhaust Stack - Recupyl Shredder

Emission Parameter	Units	TPM 9	Blank
Stack Diameter	metres	0.25	...
Area of Sample Plane	m ²	0.047	...
Moisture Content	%	1.32	...
Oxygen Content	%	20.90	...
Stack Temperature	°C	13	...
Gas Velocity (as Measured. Adjusted for Smooth Walls)	m/sec	3.1950	...
Gas Velocity (Reference Conditions)	m/sec*	3.0341	...
Volumetric Flowrate (as Measured)	m ³ /sec	0.1506	...
Volumetric Flowrate (Reference Conditions)	m ³ /sec*	0.1430	...
Dry Gas Molecular Weight	g/gmole	28.8560	
Sample Date	...	23/02/2023	...
Sample Period	...	11:50 - 12:50	...
Sample Volume (reference Conditions)	m ³ *	1.282	1.282
Isokinetic Sampling Rate	%	101.23	...
Sample Reference (ECL ID)	ECL/23/	0490 & 0491	0492 & 0493
Mass of Particulate Matter Collected	mg	0.60	0.60
Concentration of Particulate Matter	mg/m ³ *	0.47	0.47
Emission Rate of Particulate Matter	g/hr	0.24	...
Expanded Uncertainty (% Relative)	%	85	...

* Reference Conditions (273K, 101.3kPa, Wet Gas)

Table 25 – Chlorinated Dioxins & Furans (Test 3)

Data Recorded from Recupyl Shredder - Stack Exhaust Stack

Emission Parameter	Units	Chlorinated D & F3		
Stack Diameter	metres	0.245		
-	-	-		
Area of sample plane	m ²	0.047		
Moisture Content	%	1.36		
Moisture Expanded Uncertainty	%(Relative)	6.04		
Stack Temperature	°C	14		
Oxygen Concentration	%	21.00		
Gas velocity (as Measured)	m/sec	3.2204		
Gas velocity (Reference Conditions)	m/sec*	3.0105		
Volumetric Flowrate (as Measured)	m ³ /sec	0.1518		
Volumetric Flowrate (Reference Conditions)	m ³ /sec*	0.1419		
Sample Date 22/02/2023				
Sample Period 08:45 - 14:45				
Sample Reference ECL/23/0480 - 0482				
Sample Volume (Reference Conditions)	m ³ *	7.46		
Isokinetic Sampling Rate	%	98.89		
Species	Sample Reference: ECL/23/0480 - 0482		Blank Reference: ECL/23/0483 - 0485	
	Conc. ng/m ³ *	TEQ ng/m ³ *	Conc. ng/m ³ *	TEQ ng/m ³ *
Chlorinated Dioxins 2,3,7,8 Isomers	0.0079	0.00016	0.00064	0.000026
Total Chlorinated Dioxins Non – Targeted Isomers	0.00	...	0.00	...
Chlorinated Furans 2,3,7,8 Isomers	0.0045	0.00052	0.00016	0.000013
Total Chlorinated Furans Non – Targeted Isomers	0.00	...	0.00	...
TOTAL	...	0.00069	...	0.00004
Range	...	0.00064 - 0.00069	Blank < 10% of ELV?	NO
% Uncertainty	...	17		

* Reference Conditions 273K, 101.3kPa, Wet 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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 25b – Chlorinated Dioxins & Furans (Test 3)

Data Recorded from Recupyl Shredder - Stack Exhaust Stack on the 22/02/23, 08:45 - 14:45

Species	Blank Reference:	EEC Toxic Equivalent Factor (TEF)	Sample Ref.: ECL/23/0480 - 0482		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 *
	ECL/23/0483 - 0485		Concentration ng/m ³ *	TEQ ng/m ³ *						
Chlorinated Dioxins - 2,3,7,8 Isomers										
2,3,7,8 - TCDD	0.000011	1	<i>0.000039</i>	<i>0.000039</i>	1	<i>0.000039</i>	1	<i>0.000039</i>	1	<i>0.000039</i>
1,2,3,7,8 - PCDD	0.000009	0.5	0.00012	0.000058	1	0.00012	1	0.00012	1	0.00012
1,2,3,4,7,8 - HxCDD	0.000002	0.1	0.000090	0.000009	0.1	0.000009	0.5	0.000045	0.05	0.000004
1,2,3,6,7,8 - HxCDD	0.000002	0.1	0.00023	0.000023	0.1	0.000023	0.01	0.000002	0.01	0.000002
1,2,3,7,8,9 - HxCDD	0.000002	0.1	0.00011	0.000011	0.1	0.000011	0.01	0.000001	0.1	0.000011
1,2,3,4,6,7,8 - HpCDD	0.000000	0.01	0.0015	0.000015	0.01	0.000015	0.001	0.000002	0.001	0.000002
OCDD	0.000001	0.001	0.0058	0.000006	0.0001	0.000001	0	...	0	...
Total Chlorinated Dioxins - Non - Targeted Isomers										
TCDD	...	0	0.000000	...	0	...	0	...	0	...
PCDD	...	0	0.000000	...	0	...	0	...	0	...
HxCDD	...	0	0.000000	...	0	...	0	...	0	...
HpCDD	...	0	0.000000	...	0	...	0	...	0	...
Chlorinated Furans - 2,3,7,8 Isomers										
2,3,7,8 - TCDF	0.000002	0.1	0.00059	0.000059	0.1	0.000059	0.05	0.000029	1	0.00059
1,2,3,7,8 - PCDF	0.000001	0.05	0.00026	0.000013	0.05	0.000013	0.05	0.000013	0.1	0.000026
2,3,4,7,8 - PCDF	0.000006	0.5	0.00067	0.00033	0.5	0.00033	0.5	0.00033	1	0.00067
1,2,3,4,7,8 - HxCDF	0.000001	0.1	0.00035	0.000035	0.1	0.000035	0.1	0.000035	0.1	0.000035
1,2,3,6,7,8 - HxCDF	0.000001	0.1	0.00034	0.000034	0.1	0.000034	0.1	0.000034	0.1	0.000034
2,3,4,6,7,8 - HxCDF	0.000001	0.1	0.00037	0.000037	0.1	0.000037	0.1	0.000037	0.1	0.000037
1,2,3,7,8,9 - HxCDF	0.000001	0.1	<i>0.000028</i>	<i>0.000003</i>	0.1	<i>0.000003</i>	0.1	<i>0.000003</i>	0.1	<i>0.000003</i>
1,2,3,4,6,7,8 - HpCDF	0.000001	0.01	0.00100	0.000010	0.01	0.000010	0.01	0.000010	0.01	0.000010
1,2,3,4,7,8,9 - HpCDF	0.000000	0.01	0.00011	0.000001	0.01	0.000001	0.01	0.000001	0.01	0.000001
OCDF	0.000000	0.001	0.00078	0.000001	0.0001	0.000000	0.0001	0.000000	0.0001	0.000000
Total Chlorinated Furans - Non - Targeted Isomers										
TCDF	...	0	0.000000	...	0	...	0	...	0	...
PCDF	...	0	0.000000	...	0	...	0	...	0	...
HxCDF	...	0	0.000000	...	0	...	0	...	0	...
HpCDF	...	0	0.000000	...	0	...	0	...	0	...
TOTAL	0.000039	...	...	0.00069	...	0.00074	...	0.00070	...	0.0016
Range	...	...	...	0.00064 - 0.00069	...	0.0007 - 0.00074	...	0.00066 - 0.0007	...	0.0015 - 0.0016
% Uncertainty	...	...	...	17	...	17	...	18	...	18

* Reference Conditions 273K, 101.3kPa, Wet 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.

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Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/Voo6
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 26 – PCBs (Test 3)

Data Recorded from Recupyl Shredder - Stack Exhaust Stack

Date	Sample Period	Average Stack Temperature	Moisture	Oxygen	Sample Volume	Volumetric Flowrate	Isokinetic Sampling Rate
		°C	%	%	m ³ *	m ³ /sec*	%
22/02/2023	08:45 - 14:45	13.79	1.36	21.00	7.46	0.14	98.89

Species	Blank Ref.: ECL/23/0483 - 0485 ng/m ³ *	Sample Ref.: ECL/23/0480 - 0482 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	0.001475	0.030578	0.0001	0.0000031	0.000005	0.0000002	0.00010	0.0000031
PCB BZ#114	0.000130	0.003044	0.0005	0.0000015	0.000005	0.0000000	0.00010	0.0000003
PCB BZ#118	0.003272	0.083151	0.0001	0.0000083	0.000005	0.0000004	0.00001	0.0000008
PCB BZ#123	0.000060	0.002280	0.0001	0.0000002	0.000005	0.0000000	0.00001	0.0000000
PCB BZ#126	0.000058	0.001569	0.1	0.00016	0.005000	0.0000078	0.10000	0.00016
PCB BZ#156	0.000547	0.005727	0.0005	0.0000029	0.000005	0.0000000	0.00010	0.0000006
PCB BZ#157	0.000169	0.001019	0.0005	0.0000005	0.000005	0.0000000	0.00010	0.0000001
PCB BZ#167	0.000148	0.002213	0.00001	0.0000000	0.000005	0.0000000	0.00001	0.0000000
PCB BZ#169	0.000003	0.000287	0.01	0.0000029	0.000050	0.0000000	0.00100	0.0000003
PCB BZ#189	0.000013	0.000637	0.0001	0.0000001	0.000005	0.0000000	0.00001	0.0000000
PCB BZ#77	0.002079	0.058474	0.0001	0.0000058	0.000100	0.0000058	0.05000	0.0029
PCB BZ#81	0.000107	0.004573	0.0001	0.0000005	0.000500	0.0000023	0.10000	0.00046
TOTAL	0.0081	0.1936	...	0.00018	...	0.000017	...	0.0035
Range	...	...	...	0.00018 - 0.00018	...	0.000017 - 0.000017	...	0.0035 - 0.0035
% Uncertainty	...	12	...	20	...	14	...	19

* Reference Conditions 273K, 101.3kPa, Wet 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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 27 – Brominated Dioxins & Furans (PBDDs & PBDFs) (Test 3)

Data Recorded from Recupyl Shredder - Stack Exhaust Stack

Emission Parameter	Units	Brominated D & F 3		
Stack Diameter	metres	0.245		
-	-	-		
Area of sample plane	m ²	0.047		
Moisture Content	%	1.36		
Moisture Expanded Uncertainty	%(Relative)	6.04		
Stack Temperature	°C	14		
Oxygen Concentration	%	21.00		
Gas velocity (as Measured)	m/sec	3.2204		
Gas velocity (Reference Conditions)	m/sec*	3.0105		
Volumetric Flowrate (as Measured)	m ³ /sec	0.1518		
Volumetric Flowrate (Reference Conditions)	m ³ /sec*	0.1419		
Sample Date 22/02/2023				
Sample Period 08:45 - 14:45				
Sample Reference ECL/23/0480 - 0482				
Sample Volume (Reference Conditions)	m ³ *	7.46		
Isokinetic Sampling Rate	%	98.89		
Species	Sample Reference: ECL/23/0480 - 0482		Blank Reference: ECL/23/0483 - 0485	
	Conc. ng/m ³ *	TEQ ng/m ³ *	Conc. ng/m ³ *	TEQ ng/m ³ *
Brominated Dioxins 2,3,7,8 Isomers	0.1319	0.00166	0.0388	0.001146
Total Brominated Dioxins Non – Targeted Isomers	0.00	...	0.00	...
Brominated Furans 2,3,7,8 Isomers	0.0278	0.00049	0.01373	0.000250
Total Brominated Furans Non – Targeted Isomers	0.00	...	0.00	...
TOTAL	...	0.00215	...	0.00140
Range	...	0.0001 - 0.0022	Blank < 10% of ELV?	NO
% Uncertainty	...	21		

* Reference Conditions 273K, 101.3kPa, Wet 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.

Table 27b – Brominated Dioxins & Furans (PBDDs & PBDFs) (Test 3)

Data Recorded from Recupyl Shredder - Stack Exhaust Stack on the 22/02/23, 08:45 - 14:45

Species	Blank Reference:	EEC Toxic Equivalent Factor (TEF)	Sample Ref.: ECL/23/0480 - 0482	
	ECL/23/0483 - 0485		Concentration ng/m ³ *	TEQ ng/m ³ *
TEQ ng/m ³ *				
Brominated Dioxins - 2,3,7,8 Isomers				
2,3,7,8 - TBDD	0.000227	1	<i>0.000146</i>	<i>0.000227</i>
1,2,3,7,8 - PBDD	0.000163	0.5	0.00027	0.000163
1,2,3,4,7,8 - HxBDD & 1,2,3,6,7,8 - HxBDD	0.000335 Co-elute	0.1 0.1	0.00518	0.000518
1,2,3,7,8,9 - HxBDD	0.000347	0.1	0.00536	0.000536
1,2,3,4,6,7,8 - HpBDD	0.000047	0.01	0.0106	0.000106
OCDD	0.000027	0.001	0.1104	0.000110
Total Brominated Dioxins - Non - Targeted Isomers				
TBDD	...	0	0.000000	...
PBDD	...	0	0.000000	...
HxBDD	...	0	0.000000	...
HpBDD	...	0	0.000000	...
Brominated Furans - 2,3,7,8 Isomers				
2,3,7,8 - TBDF	0.000022	0.1	0.00018	0.000022
1,2,3,7,8 - PBDF	0.000014	0.05	0.00045	0.000022
2,3,4,7,8 - PBDF	0.000148	0.5	0.00047	0.00023
1,2,3,4,7,8 - HxBDF & 1,2,3,6,7,8 - HxBDF	0.000038 Co-elute	0.1 0.1	0.00114	0.000114
2,3,4,6,7,8 - HxBDF	Not Measured	0.1		
1,2,3,7,8,9 - HxBDF	Not Measured	0.1		
1,2,3,4,6,7,8 - HpBDF	0.000017	0.01	0.0082	0.000082
1,2,3,4,7,8,9 - HpBDF	Not Measured	0.01		
OBDF	0.000011	0.001	0.01730	0.000017
Total Brominated Furans - Non - Targeted Isomers				
TBDF	...	0	0.000000	...
PBDF	...	0	0.000000	...
HxBDF	...	0	0.000000	...
HpBDF	...	0	0.000000	...
TOTAL	0.001396	...	...	0.00215
Range	...	...	...	0.0001 - 0.0022
% Uncertainty	...	...	...	21

* Reference Conditions 273K, 101.3kPa, Wet 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.

1,2,3,4,7,8 - HxBDD & 1,2,3,6,7,8 - HxBDD co-elute (Combined Value Reported)

1,2,3,4,7,8 - HxBDF & 1,2,3,6,7,8 - HxBDF co-elute (Combined Value Reported)

2,3,4,6,7,8 - HxBDF, 1,2,3,7,8,9 - HxBDF & 1,2,3,4,7,8,9 - HpBDF cannot currently be measured by the analytical laboratory (no analytical standard commercially available)

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 28 – Cadmium & Nickel (Test 7) & Heavy Metals (Test 3)

Sampling Location: Recupyl Shredder Exhaust Stack

Test Cd, Ni T7 & Heavy Metals T3												
Stack Profile:	Circular	Units	Gas velocity (as Measured. Adjusted for Smooth Walls):						3.2083	m/sec		
Diameter:	0.25	m	Gas velocity (Reference Conditions):						3.0250	m/sec *		
			Volumetric Flowrate (as Measured):						0.1513	m ³ /sec		
Area of sample plane:	0.047	m ²	Volumetric Flowrate (Reference Conditions):						0.1426	m ³ /sec *		
Moisture Content:	1.63	%	Sample Date:						21/02/2023			
Stack Temperature:	14	°C	Sample Period:						09:15 - 10:15			
Barometric Pressure:	1004	mbar	Sample Volume:						1.289	m ³		
Measured Oxygen:	21.00	%	Isokinetic Rate (95% < ISOKx > 115%):						102.08	%		
*Reference Conditions: (273K, 101.3kPa, Wet Gas)												
Trace Element	Symbol	Mass (mg)			ECL/23/502 - 505			Emission Rate (g/hr)*	Uncertainty (%)	ECL/23/514 - 517		
		Particulate Phase	Vapour Phase	Total Element Phase	Concentration (mg/m ³)*					Blank		
					Particulate Phase	Vapour Phase	Total Element Phase			Mass (mg)	Conc. (mg/m ³)	
Antimony	Sb	0.00060	0.00025	0.00085	0.00047	0.00019	0.00066	0.00034	12	0.00073	0.00057	
Arsenic	As	0.00050	0.00021	0.00071	0.00039	0.00016	0.00055	0.00028	9	0.00070	0.00054	
Cadmium	Cd	0.00050	0.00019	0.00069	0.00039	0.00015	0.00054	0.00028	10	0.00063	0.00049	
Chromium	Cr	0.0028	0.0034	0.0062	0.0022	0.0026	0.0048	0.0025	8	0.0019	0.0015	
Cobalt	Co	0.0059	0.060	0.066	0.0046	0.047	0.051	0.026	10	0.0018	0.0014	
Copper	Cu	0.0017	0.0075	0.0092	0.0013	0.0058	0.0071	0.0037	9	0.0010	0.00080	
Lead	Pb	0.0022	0.027	0.029	0.0017	0.021	0.023	0.012	15	0.0042	0.0033	
Manganese	Mn	0.0085	0.047	0.055	0.0066	0.036	0.043	0.022	9	0.0024	0.0019	
Nickel	Ni	0.016	0.069	0.085	0.012	0.054	0.066	0.034	8	0.023	0.018	
Selenium	Se	0.00070	0.00042	0.0011	0.00054	0.00032	0.00087	0.00045	11	0.0011	0.00085	
Thallium	Tl	0.00040	0.00014	0.00054	0.00031	0.00011	0.00042	0.00021	11	0.00053	0.00041	
Vanadium	V	0.00040	0.00012	0.00052	0.00031	0.000096	0.00041	0.00021	10	0.00047	0.00036	
Cadmium & Nickel		0.016	0.069	0.086	0.013	0.054	0.066	0.034	8	0.024	0.019	
Antimony, Arsenic, Chromium, Cobalt, Copper, Lead, Manganese, Selenium, Thallium & Vanadium		0.024	0.15	0.17	0.018	0.11	0.13	0.068	6	0.015	0.012	

No ELV Entered!

No ELV Entered!

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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 28b – Cadmium & Nickel (Test 7) & Heavy Metals Efficiencies (Test 3)

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	3.83	PASS	YES
Arsenic	As	6.85	N/A	YES
Cadmium	Cd	4.68	N/A	YES
Chromium	Cr	2.09	PASS	NO
Cobalt	Co	1.18	PASS	NO
Copper	Cu	1.76	PASS	NO
Lead	Pb	1.72	PASS	NO
Manganese	Mn	1.55	PASS	NO
Nickel	Ni	1.30	PASS	NO
Selenium	Se	8.69	N/A	YES
Thallium	Tl	6.01	N/A	YES
Vanadium	V	3.10	N/A	YES

Combined Groups	ELV mg/m ³	Result <30% ELV?
Cadmium & Nickel	0	NO
Antimony, Arsenic, Chromium, Cobalt, Copper, Lead, Manganese, Selenium, Thallium & Vanadium	0	NO

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 29 – Cadmium & Nickel (Test 8)

Sampling Location: Recupyl Shredder Exhaust Stack

Test Cadmium & Nickel T8												
Stack Profile:	Circular	Units	Gas velocity (as Measured. Adjusted for Smooth Walls):					3.2112	m/sec			
Diameter:	0.25	m	Gas velocity (Reference Conditions):					3.0233	m/sec *			
			Volumetric Flowrate (as Measured):					0.1514	m ³ /sec			
Area of sample plane:	0.047	m ²	Volumetric Flowrate (Reference Conditions):					0.1425	m ³ /sec *			
Moisture Content:	1.71	%	Sample Date:					21/02/2023				
Stack Temperature:	14	°C	Sample Period:					11:20 - 12:20				
Barometric Pressure:	1004	mbar	Sample Volume:					1.315	m ³			
Measured Oxygen:	21.00	%	Isokinetic Rate (95% < ISOKx > 115%):					104.23	%			
*Reference Conditions: (273K, 101.3kPa, Wet Gas)												
Trace Element	Symbol	Mass (mg)			ECL/23/506 - 509			Emission Rate (g/hr)*	Uncertainty (%)	ECL/23/514 - 517		
		Particulate Phase	Vapour Phase	Total Element Phase	Concentration (mg/m ³)*					Total Element Phase	Blank	
					Particulate Phase	Vapour Phase	Total Element Phase				Mass (mg)	Conc. (mg/m ³)
Cadmium	Cd	0.00050	0.00014	0.00064	0.00038	0.00011	0.00049	0.00025	10	0.00063	0.00048	
Nickel	Ni	0.013	0.014	0.027	0.0099	0.011	0.021	0.011	8	0.023	0.018	
Cadmium & Nickel		0.014	0.014	0.028	0.010	0.011	0.021	0.011	8	0.024	0.018	

No ELV Entered!

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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 29b – Cadmium & Nickel Efficiencies (Test 8)

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?
Cadmium	Cd	5.44	PASS	NO
Nickel	Ni	0.90	PASS	NO

Combined Groups	ELV mg/m ³	Result < 30% ELV?
Cadmium & Nickel	0	NO

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 30 – Cadmium & Nickel (Test 9)

Sampling Location: Recupyl Shredder Exhaust Stack

Test Cadmium & Nickel T9												
Stack Profile:	Circular	Units	Gas velocity (as Measured. Adjusted for Smooth Walls):					3.2113	m/sec			
Diameter:	0.25	m	Gas velocity (Reference Conditions):					3.0243	m/sec *			
			Volumetric Flowrate (as Measured):					0.1514	m ³ /sec			
Area of sample plane:	0.047	m ²	Volumetric Flowrate (Reference Conditions):					0.1426	m ³ /sec *			
Moisture Content:	1.82	%	Sample Date:					21/02/2023				
Stack Temperature:	14	°C	Sample Period:					13:10 - 14:10				
Barometric Pressure:	1004	mbar	Sample Volume:					1.300	m ³			
Measured Oxygen:	21.00	%	Isokinetic Rate (95% < ISOKx > 115%):					103.01	%			
*Reference Conditions: (273K, 101.3kPa, Wet Gas)												
Trace Element	Symbol	Mass (mg)			ECL/23/510 - 513			Emission Rate (g/hr)*	Uncertainty (%)	ECL/23/514 - 517		
		Particulate Phase	Vapour Phase	Total Element Phase	Concentration (mg/m ³)*					Total Element Phase	Blank	
					Particulate Phase	Vapour Phase	Total Element Phase				Mass (mg)	Conc. (mg/m ³)
Cadmium	Cd	0.00050	0.00014	0.00064	0.00038	0.00010	0.00049	0.00025	10	0.00063	0.00049	
Nickel	Ni	0.0096	0.0082	0.018	0.0074	0.0063	0.018	0.0092	8	0.023	0.018	
Cadmium & Nickel		0.010	0.0083	0.018	0.0078	0.0064	0.018	0.0095	6	0.024	0.018	

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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Table 30b – Cadmium & Nickel Efficiencies (Test 9)

<p>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.</p>				
<p>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</p>				
Trace Element	Symbol	Final Impinger (%)	< 10%?	< 1% of Total?
Cadmium	Cd	N/A	N/A	NO
Nickel	Ni	N/A	N/A	NO

Combined Groups	ELV mg/m ³	Result < 30% ELV?
Cadmium & Nickel	0.5	YES

Environmental Compliance Limited

Ecobat Solutions
Permit No : EPR/DB3704FG
Variation No : EPR/DB3704FG/V006
Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
Visit Details : Emissions Testing – 2023
Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
Report Issue Date : 24th April 2023

VELOCITY TRAVERSE PROFILES

Environmental Compliance Limited

Ecobat Solutions
Permit No : EPR/DB3704FG
Variation No : EPR/DB3704FG/V006
Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
Visit Details : Emissions Testing – 2023
Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
Report Issue Date : 24th April 2023

FIELD CALIBRATION AND SAMPLING DATA

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

TVOC Calibration Site Log

01/02/2023

TVOC - FIELD DATA SHEET

Client	Ecobat Solutions			Barometric Pressure mb	1008	
Site	Darlaston			Barometer ID	ECL/ID/ 1320	
Date	01/02/2023			Analyser ID	ECL/ID/ 997	
Location	Recupyl Shredder Exhaust			Sonimix/ MFC ID	ECL/ID/ n/a	
Stack ID	Recupyl Shredder Exhaust			Heated Line/ Controller ID	ECL/ID/ 1011 & 1012	
Stack Temp °C	10 - 13c			Heated Line Set Temp °C	180	YES
Ambient Temp (sampling)	1=9.8	2=10.7	3=11.1	Heated Line Length	10	m
Ambient Temp (sampling)	4=	5=	6=	Heated Probe Filter ID	ECL/ID/ 920	
Job No	P5350			Heated Filter Set Temp °C	180	YES
Operators	SH & GM			Logger ID	1005	

Calibration Gas Details

Calibration Gas	Gas Bottle ID	Gas Value	Uncertainty of Gas (k=2)	Analyser Range	Span Gas value used
Zero Gas (Synthetic Air)	Gas/ 2857	...	...	Propane	925.2 ppm
Hydrogen Fuel	Gas/ 2803	...	...	1000 ppm	
Propane (In Air)	Gas/ 2713	925.2 ppm	1%		

Analyser Range should be not less than the expected peak emissions.
Span Gas Values should be either *approximately the half-hourly ELV* **OR** **50% to 90% of the Selected Analyser Range.**

	Direct Calibration (Rear of Analyser)					
	Zero Cal		Span Gas Cal		Zero Check	
	Start Time	End Time	Start Time	End Time	Start Time	End Time
ZERO /SPAN/ ZERO	08:58	09:01	09:03	09:06	09:07	09:10

NOTE: RESPONSE TIME
 Response Time to be carried out at the same time as "Span Check" on system verification (via the sample probe)
 Start Time = when gas turned on. 90% Time = when analyser displays 90% of span gas value used. Response must be within 200 seconds.

Pre-Cal Ambient Temp °C		PRE System Verification Check (Down Line)			
Max	Min	Zero Check		Span Check	
		Start Time	End Time	Start Time	End Time
9.8	9.7	09:15	09:18	09:22	09:25
ZERO / SPAN					

Response Time SYSTEM Span Gas Cal		
Start Time	90% Time	less than 200s (Y/N)
09:21:00	09:21:15	Y

	Start Time	End Time	Location	Production Details
Sample Period	11:30	13:00	Recupyl Shredder Exhaust	Normal Operation
Sample Period				
Sample Period				
Sample Period				
Sample Period				

Post-Cal Ambient Temp °C		POST System Verification Check (Down Line)			
Max	Min	Zero Check		Span Check	
		Start Time	End Time	Start Time	End Time
11.1	11.1	13:28	13:31	13:33	13:36
ZERO / SPAN					

Process Details / Comments

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

TVOC Calibration Summary

01/02/2023

		TVOC ppm
Analyser Range		1000
Repeatability at Zero		2
Span Gas Concentration Applied		925.2
Zero Gas Concentration Applied		0
Direct Cal	Zero	0.00
	Span	925.2
	Zero	0.35
Difference (Zero)		0.3512
<2×Repeatability @ Zero?		YES
Pre Test (System)	Zero	0.77
	Span	929.0
Difference (Zero)		0.7674
<2% Relative to Direct Span		YES
Difference (Span)		3.8368
<2% Relative to Direct Span		YES
Post Test (System)	Zero	1.08
	Span	920.9
Difference (Zero)		0.3122
Zero Drift <2% of Applied Span?		YES
Difference (Span)		8.1549
Span Drift <2% of Applied Span?		YES
Zero and Span Drift <5% of Applied Span?		YES

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing - 2023
 Survey Dates : 31st January - 2nd February, 15th - 16th & 21st - 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

TVOC Calibration Site Log

15/02/2023

TVOC - FIELD DATA SHEET

Client	Ecobat Solutions			Barometric Pressure mb	1007	
Site	Darlaston			Barometer ID	ECL/ID/ 1320	
Date	15/02/2023			Analyser ID	ECL/ID/ 997	
Location	Recupyl Shredder Exhaust			Sonimix/ MFC ID	ECL/ID/ n/a	
Stack ID	Recupyl Shredder Exhaust			Heated Line/ Controller ID	ECL/ID/ 1011 & 1012	
Stack Temp °C	10 - 13c			Heated Line Set Temp °C	180	YES
Ambient Temp (sampling)	1=9	2=10	3=11	Heated Line Length	10	m
Ambient Temp (sampling)	4=11	5=	6=	Heated Probe Filter ID	ECL/ID/ 920	
Job No	P5350			Heated Filter Set Temp °C	180	YES
Operators	JL & JW			Logger ID	1005	

Calibration Gas Details

Calibration Gas	Gas Bottle ID	Gas Value	Uncertainty of Gas (k=2)	Analyser Range	Span Gas value used
Zero Gas (Synthetic Air)	Gas/ 2857	...	...	Propane	925.2 ppm
Hydrogen Fuel	Gas/ 2803	...	...	1000 ppm	
Propane (In Air)	Gas/ 2713	925.2 ppm	1%		

Analyser Range should be not less than the expected peak emissions.
Span Gas Values should be either *approximately the half-hourly ELV* **OR** *50% to 90% of the Selected Analyser Range.*

	Direct Calibration (Rear of Analyser)					
	Zero Cal		Span Gas Cal		Zero Check	
	Start Time	End Time	Start Time	End Time	Start Time	End Time
ZERO /SPAN/ ZERO	09:05	09:10	09:11	09:15	09:16	09:20

NOTE: RESPONSE TIME
 Response Time to be carried out at the same time as "Span Check" on system verification (via the sample probe)
 Start Time = when gas turned on. 90% Time = when analyser displays 90% of span gas value used. Response must be within 200 seconds.

Pre-Cal Ambient Temp °C		PRE System Verification Check (Down Line)				Response Time		
Max	Min	Zero Check		Span Check		SYSTEM Span Gas Cal		
9	9	Start Time	End Time	Start Time	End Time	Start Time	90% Time	less than 200s (Y/N)
		09:22	09:27	09:30	09:35	09:29:00	09:29:30	Y

	Start Time	End Time	Location	Production Details
Sample Period	09:40	14:10	Recupyl Shredder Exhaust	Normal Operation
Sample Period				
Sample Period				
Sample Period				
Sample Period				

Post-Cal Ambient Temp °C		POST System Verification Check (Down Line)			
Max	Min	Zero Check		Span Check	
11	11	Start Time	End Time	Start Time	End Time
		14:15	14:20	14:21	14:26

Process Details / Comments

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

TVOC Calibration Summary

15/02/2023

		TVOC ppm
Analyser Range		1000
Repeatability at Zero		2
Span Gas Concentration Applied		925.2
Zero Gas Concentration Applied		0
Direct Cal	Zero	0.00
	Span	925.2
	Zero	0.91
Difference (Zero)		0.9054
<2×Repeatability @ Zero?		YES
Pre Test (System)	Zero	0.60
	Span	909.7
Difference (Zero)		0.5983
<2% Relative to Direct Span		YES
Difference (Span)		15.5486
<2% Relative to Direct Span		YES
Post Test (System)	Zero	1.86
	Span	900.7
Difference (Zero)		1.2596
Zero Drift <2% of Applied Span?		YES
Difference (Span)		8.9618
Span Drift <2% of Applied Span?		YES
Zero and Span Drift <5% of Applied Span?		YES

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing - 2023
 Survey Dates : 31st January - 2nd February, 15th - 16th & 21st - 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

TVOC Calibration Site Log

22/02/2023

TVOC - FIELD DATA SHEET

Client	Ecobat Solutions			Barometric Pressure mb	995	
Site	Darlaston			Barometer ID	ECL/ID/ 1320	
Date	22/02/2023			Analyser ID	ECL/ID/ 997	
Location	Recupyl Shredder Exhaust			Sonimix/ MFC ID	ECL/ID/ n/a	
Stack ID	Recupyl Shredder Exhaust			Heated Line/ Controller ID	ECL/ID/ 1011 & 1012	
Stack Temp °C	10 - 13c			Heated Line Set Temp °C	180	YES
Ambient Temp (sampling)	1=11	2=11	3=11	Heated Line Length	10	m
Ambient Temp (sampling)	4=12	5=12	6=12	Heated Probe Filter ID	ECL/ID/ 920	
Job No	P5350			Heated Filter Set Temp °C	180	YES
Operators	AM & ZH			Logger ID	1005	

Calibration Gas Details

Calibration Gas	Gas Bottle ID	Gas Value	Uncertainty of Gas (k=2)	Analyser Range	Span Gas value used
Zero Gas (Synthetic Air)	Gas/ 2857	...	...	Propane	925.2 ppm
Hydrogen Fuel	Gas/ 2803	...	...	1000 ppm	
Propane (In Air)	Gas/ 2713	925.2 ppm	1%		

Analyser Range should be not less than the expected peak emissions.
Span Gas Values should be either *approximately the half-hourly ELV* **OR** **50% to 90% of the Selected Analyser Range.**

	Direct Calibration (Rear of Analyser)					
	Zero Cal		Span Gas Cal		Zero Check	
	Start Time	End Time	Start Time	End Time	Start Time	End Time
ZERO /SPAN/ ZERO	08:45	08:48	08:50	08:53	08:55	08:58

NOTE: RESPONSE TIME
 Response Time to be carried out at the same time as "Span Check" on system verification (via the sample probe)
 Start Time = when gas turned on. 90% Time = when analyser displays 90% of span gas value used. Response must be within 200 seconds.

Pre-Cal Ambient Temp °C		PRE System Verification Check (Down Line)			
Max	Min	Zero Check		Span Check	
		Start Time	End Time	Start Time	End Time
11	10	09:06	09:09	09:13	09:16
ZERO / SPAN					

Response Time SYSTEM Span Gas Cal		
Start Time	90% Time	less than 200s (Y/N)
09:11:00	09:11:40	Y

	Start Time	End Time	Location	Production Details
Sample Period	09:30	12:45	Recupyl Shredder Exhaust	Normal Operation
Sample Period				
Sample Period				
Sample Period				
Sample Period				

Post-Cal Ambient Temp °C		POST System Verification Check (Down Line)			
Max	Min	Zero Check		Span Check	
		Start Time	End Time	Start Time	End Time
12	12	12:54	12:57	13:00	13:03
ZERO / SPAN					

Process Details / Comments

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

TVOC Calibration Summary

22/02/2023

		TVOC ppm
Analyser Range		1000
Repeatability at Zero		2
Span Gas Concentration Applied		925.2
Zero Gas Concentration Applied		0
Direct Cal	Zero	0.00
	Span	925.2
	Zero	-0.28
Difference (Zero)		0.2754
< 2× Repeatability @ Zero?		YES
Pre Test (System)	Zero	0.98
	Span	932.3
Difference (Zero)		0.9835
< 2% Relative to Direct Span		YES
Difference (Span)		7.1203
< 2% Relative to Direct Span		YES
Post Test (System)	Zero	0.50
	Span	932.3
Difference (Zero)		0.4799
Zero Drift < 2% of Applied Span?		YES
Difference (Span)		0.0525
Span Drift < 2% of Applied Span?		YES
Zero and Span Drift < 5% of Applied Span?		YES

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Roost

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing - 2023
 Survey Dates : 31st January - 2nd February, 15th - 16th & 21st - 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Particulates (Test 1), SO₂ (Test 1)

Environmental Compliance Limited		PARTICULATE DATA SAMPLING PROFORMA										Date of Measurement		31/01/2023		Rinse Solutions used							
ECU/TPD/		027 & 039										Time taken to change Ports?		0		Start Time		11:17		End Time		12:17	
Client		Ecobat Solutions		Stack Profile		Circular		Console Id		U001		Barometer Id		1330		Test Duration		60		Solution		SOL NO	
Site		Darlaston		Stack Area (m ²)		0.05		Pump Id		U001		Nozzle Id		402		Impinger 1		3% H2O2		DI Water		4818	
Location		Recupyl Shredder		Barometric Pressure (mb)		1010		Probe Id		1330		Nozzle Size		10.09		Start Weight (g)		621.1		Acetone		4795	
Stack ID		Exhaust Stack		Static Pres. (mm H ₂ O)		0.5		DGM Yd		1.0477		Filter Id		3462-238771		End Weight (g)		626.4					
Test No.		TPM 1 & SO ₂ 1		Riot coefficient		0.8		dH2		43.29		Rox ID		635		Total weight (g)		5.3					
Job No.		P350		Probe Heater Setting (°C)		160		Impinger Id		657		Hot Box ID		336		Impinger 2		3% H2O2					
ECL Site Staff		SH & GM		Hot Box Setting (°C)		160		Balance Id		1069		Silica < 50% Spent at End of Test?		YES		Start Weight (g)		4820					
												Original K Factor Settings				Start Weight (g)		651.6					
												Moisture				End Weight (g)		652					
												Meter Temp.		20		Total weight (g)		0.2					
												Stack Temp		12		Item Name		Start Weight (g)					
												%Moisture		1.48		Total weight (g)		0					
Start Volume		567456.0		Leak 1		Leak 2		Leak 3		Leak 4		Leak 5		Total		Impinger 3		Empty					
Final Volume		568327.6		0.0		0.0		0.0		0.0		0.0		871.6		Start Weight (g)		477.2					
Total Volume		871.6		0.0		0.0		0.0		0.0		0.0		871.6		End Weight (g)		479.3					
Leak Check		First		Second		Third		Fourth		Fifth						Total weight (g)		0					
Leak rate l/min		0.2														Item Name		Start Weight (g)					
Vacuum *Hg		10														Total weight (g)		0					
Time of Check		11:10														Item Name		Start Weight (g)					
Set Rate l/min		20														Total weight (g)		2.1					
Leak < 2%?		YES														Item Name		Start Weight (g)					
																Total weight (g)		0					
																Item Name		Start Weight (g)					
																Total weight (g)		0					
																Item Name		Start Weight (g)					
																Total weight (g)		0					
																Item Name		Start Weight (g)					
																Total weight (g)		0					
																Item Name		Start Weight (g)					
																Total weight (g)		0					
																Item Name		Start Weight (g)					
																Total weight (g)		0					
																Item Name		Start Weight (g)					
																Total weight (g)		0					
																Item Name		Start Weight (g)					
																Total weight (g)		0					
																Item Name		Start Weight (g)					
																Total weight (g)		0					
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																Total weight (g)		0					
																Item Name		Start Weight (g)					
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																Item Name		Start Weight (g)					
																Total weight (g)		0					
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																Total weight (g)		0					
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																Item Name		Start Weight (g)					
																Total weight (g)		0					
																Item Name		Start Weight (g)					
																Total weight (g)		0					
																Item Name		Start Weight (g)					
																Total weight (g)		0					

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing - 2023
 Survey Dates : 31st January - 2nd February, 15th - 16th & 21st - 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Particulates (Test 3)

Environmental Compliance Limited										PARTICULATE DATA SAMPLING PROFORMA										Date of Measurement		31/01/2023	
ECL/TPD/ 027										Time taken to change Ports? 0										Start Time		15:02	
Client		Ecobat Solutions		Stack Profile		Circular		Console id		U001		Barometer id		1320		End Time		15:02					
Site		Darlaston		Stack Area (m ²)		0.05		Pump id		U001		Nozzle id		402		Impinger 1		DI H2O					
Location		Recupyl Shredder		Barometric Pressure (mb)		1010		Probe id		1330		Nozzle size		10.09		Start Weight (g)		4818					
Stack ID		Exhaust Stack		Static Pres. (mm H ₂ O)		0.5		DGM Yd		1.0477		Filter ID		3954-247981		End Weight (g)		601.9					
Test No.		TMS 3		Hot coefficient		0.80		DH#		43.29		Pilot ID		635		Total weight (g)		598.6					
Job No		PS350		Probe Heater Setting (°C)		160		Impinger id		657		Hot Box ID		336		Leak weight (g)		-3.3					
Operators		SH & GM		Hot Box Setting (°C)		160		Balance id		1069		Silica < 50% Spent at End of Test?		YES		Impinger 2		DI H2O					
Start Volume										570918.6										Original K Factor Settings		Meter Temp. 20	
Final Volume										570960.6										Stack Temp		12	
Total Volume										942.0										%Moisture		1.48	
Leak Check										First Second Third Fourth Fifth										K factor		23.5	
Leak rate l/min										0.2										Dry O ₂ (% Atmospheric)		21.00	
Vacuum *Hg										12										Reference Oxygen Percentage		n/a	
Time of Check										14:00										Smooth Walls			
Set Rate l/min										14.74										Leak < 4%? YES			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)										0 - 5 5 - 10 10 - 15 15 - 20 20 - 25 25 - 30 30 - 35 35 - 40										Total			
AP (mm H2O)										1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00										Total			
K factor										23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50										Total			
ΔH (Orifice)										23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50										Total			
Meter (Tm in)										24.00 25.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 25.63										Total			
Meter (Tm out)										22.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00 21.13										Total			
Stack Temp (Tg)										13.00 13.00 13.00 13.00 13.00 13.00 13.00 13.00 13.00 13.00										Total			
Impinger T Outlet										14.00 10.00 11.00 12.00 12.00 12.00 12.00 12.00 13.00 12.00										Total			
Vacuum (* Hg)										1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00										Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)										40 - 45 45 - 50 50 - 55 55 - 60										Total			
AP (mm H2O)										1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00										Total			
K factor										23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50										Total			
ΔH (Orifice)										23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50										Total			
Meter (Tm in)										26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00										Total			
Meter (Tm out)										21.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00 21.00										Total			
Stack Temp (Tg)										13.00 13.00 13.00 13.00 13.00 13.00 13.00 13.00 13.00 13.00										Total			
Impinger T Outlet										13.00 14.00 14.00 14.00 14.00 14.00 14.00 14.00 13.75 13.00										Total			
Vacuum (* Hg)										1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00										Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)										120 - 135 135 - 150 150 - 165 165 - 180 180 - 195 195 - 210 210 - 225 225 - 240										Total			
AP (mm H2O)										1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0										Total			
K factor										23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50										Total			
ΔH (Orifice)										23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50										Total			
Meter (Tm in)										20.0 22.0 24.0 24.0 24.0 24.0 25.0 25.0 25.0 23.5										Total			
Meter (Tm out)										16.0 17.0 18.0 19.0 19.0 19.0 20.0 20.0 20.0 19.6										Total			
Stack Temp (Tg)										12.0 12.0 12.0 12.0 12.0 12.0 13.0 12.0 12.0 12.1										Total			
Impinger T Outlet										6.0 8.0 9.0 9.0 11.0 8.0 8.0 8.0 9.0 8.5										Total			
Vacuum (* Hg)										4.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 5.6										Total			
XAD Temperature (°C)										18.00 18.00 18.00 17.00 16.00 19.00 19.00 18.00 17.9										Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)										240 - 255 255 - 265										Total			
AP (mm H2O)										1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0										Total			
K factor										23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50										Total			
ΔH (Orifice)										23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50 23.50										Total			
Meter (Tm in)										25.0 25.0 25.0 25.0 25.0 25.0 25.0 25.0 25.0 25.0										Total			
Meter (Tm out)										20.0 20.0 20.0 20.0 20.0 20.0 20.0 20.0 20.0 20.0										Total			
Stack Temp (Tg)										12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0										Total			
Impinger T Outlet										8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0										Total			
Vacuum (* Hg)										6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0										Total			
XAD Temperature (°C)										18.00 18.00 18.00 18.00 18.00 18.00 18.00 18.00 18.00 18.00										Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			
Stack Temp (Tg)																				Total			
Impinger T Outlet																				Total			
Vacuum (* Hg)																				Total			
Traverse Point										A1 A1 A1 A1 A1 A1 A1 A1 A1 A1										Total			
Time/Point (mins)																				Total			
AP (mm H2O)																				Total			
K factor																				Total			
ΔH (Orifice)																				Total			
Meter (Tm in)																				Total			
Meter (Tm out)																				Total			

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing - 2023
 Survey Dates : 31st January - 2nd February, 15th - 16th & 21st - 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Cadmium & Nickel (Test 3)

METALS DATA SAMPLING PROFORMA										Date of Measurement		02/02/2023						
ECU/TPD/		028		Time taken to change Ports?		0		Start Time		12:50		End Time		13:50				
Client	Ecobat Solutions		Stack Profile	Circular	Console Id	U001		Barometer Id	1320		Rinse Solutions used		SOL NO					
Site	Darlaston		Stack Area (m ²)	0.05	Pump Id	U001		Nozzle Id	402		Impinger 1	HNO ₃ / H ₂ O		Time	12:37			
Location	Recupyl Shredder		Barometric Pressure (mb)	1011	Probe Id	1330		Nozzle size	10.09		SOU	4819		Pass ? (Y/N)	Y			
Stack ID	Exhaust Stack		Static Pres. (mm H ₂ O)	0.50	DGM Yd	1.0477		Filter Id	GMA		Start Weight (g)	617.1		PRE-Sample PTOT Leak Check	Time	12:39		
Test No.	Cadmium & Nickel T3		Pitot coefficient	0.80	AH#	43.29		Pitot ID	635		End Weight (g)	617.8		Post-Sample Blockage Check (L-type Q/LN/L)	Time			
Job No.	PS350		Probe Heater Setting (°C)	180	Impinger Id	657		Hot Box ID	336		Total weight (g)	0.7		Reading (mm H ₂ O)				
ECU Site Staff	SH & GM		Hot Box Setting (°C)	180	Balance Id	1068					Pass (< 5%) ?	Y		PCSF-Sample PTOT Visual Inspection	Time		13:59	
Start Volume	Sample		NBS Leak Checks - Record Actual Leak rate or '0' but not 'less than' values					Original K Factor Settings				Impinger 2	HNO ₃ / H ₂ O					
Final Volume	588340.0		Leak 1	Leak 2	Leak 3	Leak 4	Leak 5	Total			SOU	4819		Pass ? (Y/N)	Y			
Total Volume	966.8		0.0	0.0	0.0	0.0	0.0	966.8	Meter Temp.	20		Start Weight (g)	607.5		PCSF-Sample PTOT Leak Check	Time		13:52
Leak Check	First		Second	Third	Fourth	Fifth			SO2 Moisture	1.48		End Weight (g)	607.5		Pass ? (Y/N)	Y		
Leak rate l/min	0.2								Impurity - 50% Spent at End of Test?	YES		Total weight (g)	0		Additional Moisture Weighings			
Vacuum (° Hg)	10								Dry O ₂ (% Atmospheric)	21.00		Impinger 3	HNO ₃ / H ₂ O					
Time of Check	12:49								Dry Carbon Dioxide %	0.10		SOU	4819		Item Name			
Std Rate l/min	16.2								Reference Oxygen Percentage	n/a		Start Weight (g)	607.5		Start Weight (g)	607.5		
Leak < 2%?	YES								NBS checks DO NOT NEED to be performed (BUT ARE ALLOWED) at the end of the test or when moving between sample ports, EVEN when disconnections are made.		End Weight (g)	607.5		End Weight (g)	607.5			
Traverse Point	A1		A1	A1	A1	A1	A1	A1	A1	A1	A1	Total			Total weight (g)	0		
TimePoint (mins)	0 - 5		5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	35 - 40	35 - 40	Total			Impinger 4	Empty		
AP (mm H2O)	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	Total			SOU	4819		
K factor	23.50		23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	Total			Start Weight (g)	765.3		
AH (Orifice)	23.50		23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	Total			End Weight (g)	766.9		
Meter (Tm in)	23.00		24.00	25.00	25.00	25.00	25.00	25.00	26.00	24.8	24.8	Total			Total weight (g)	4.6		
Meter (Tm out)	20.00		20.00	20.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	Total			Impurity	4.6		
Stack Temp (Tg)	14.00		14.00	13.00	13.00	13.00	14.00	13.00	13.00	13.00	13.4	Total			Impinger 5	Silica		
Impinger T Outlet	8.00		7.00	7.00	7.00	8.00	8.00	8.00	8.00	8.00	7.8	Total			SOU	4819		
Vacuum (° Hg)	2.00		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2	Total			Start Weight (g)	491.7		
Traverse Point	A1		A1	A1	A1	A1	A1	A1	A1	A1	A1	Total			End Weight (g)	483.6		
TimePoint (mins)	40 - 45		45 - 50	50 - 55	55 - 60							Total			Total weight (g)	1.9		
AP (mm H2O)	1.00		1.00	1.00	1.00							Total			Impurity	1.9		
K factor	23.50		23.50	23.50	23.50							Total			SOU	4819		
AH (Orifice)	23.50		23.50	23.50	23.50							Total			Start Weight (g)	765.3		
Meter (Tm in)	26.00		25.00	25.00	25.00							Total			End Weight (g)	766.9		
Meter (Tm out)	21.00		21.00	21.00	21.00							Total			Total weight (g)	4.6		
Stack Temp (Tg)	13.00		14.00	13.00	13.00							Total			Impinger 6	Empty		
Impinger T Outlet	8.00		8.00	9.00	9.00							Total			SOU	4819		
Vacuum (° Hg)	2.00		2.00	2.00	2.00							Total			Start Weight (g)	0		
Traverse Point	A1		A1	A1	A1	A1	A1	A1	A1	A1	A1	Total			End Weight (g)	0		
TimePoint (mins)												Total			Total weight (g)	0		
AP (mm H2O)												Total			Impurity	0		
K factor												Total			SOU	4819		
AH (Orifice)												Total			Start Weight (g)	0		
Meter (Tm in)												Total			End Weight (g)	0		
Meter (Tm out)												Total			Total weight (g)	0		
Stack Temp (Tg)												Total			Impurity	0		
Impinger T Outlet												Total			SOU	4819		
Vacuum (° Hg)												Total			Start Weight (g)	0		

Particulates (Test 4)

PARTICULATE DATA SAMPLING PROFORMA										Date of Measurement		16/02/2023						
ECU/TPD/		027		Time taken to change Ports?		0		Start Time		10:02		End Time		11:02				
Client	Ecobat Solutions		Stack Profile	Circular	Console Id	U001		Barometer Id	1320		Rinse Solutions used		SOL NO					
Site	Darlaston		Stack Area (m ²)	0.05	Pump Id	U001		Nozzle Id	416		Impinger 1	DI H2O		Time	12:37			
Location	Recupyl Shredder		Barometric Pressure (mb)	1003	Probe Id	1330		Nozzle size	12.12		SOU	4819		Pass ? (Y/N)	Y			
Stack ID	Exhaust Stack		Static Pres. (mm H ₂ O)	0.50	DGM Yd	1.0477		Filter Id	2301002995		Start Weight (g)	599.3		PRE-Sample PTOT Leak Check	Time	12:39		
Test No.	TPM 4		Pitot coefficient	0.80	AH#	43.29		Pitot ID	635		End Weight (g)	591.9		Post-Sample Blockage Check (L-type Q/LN/L)	Time			
Job No.	PS350		Probe Heater Setting (°C)	180	Impinger Id	657		Hot Box ID	336		Total weight (g)	-7.4		Reading (mm H ₂ O)				
ECU Site Staff	L+JW		Hot Box Setting (°C)	180	Balance Id	1068					Pass (< 5%) ?	Y		PCSF-Sample PTOT Visual Inspection	Time		11:07	
Start Volume	Sample		NBS Leak Checks - Record Actual Leak rate or '0' but not 'less than' values					Original K Factor Settings				Impinger 2	DI H2O					
Final Volume	636603.0		Leak 1	Leak 2	Leak 3	Leak 4	Leak 5	Total			SOU	4818		Pass ? (Y/N)	Y			
Total Volume	1336.2		0.0	0.0	0.0	0.0	0.0	1336.2	Meter Temp.	20		Start Weight (g)	621		PCSF-Sample PTOT Leak Check	Time		11:05
Leak Check	First		Second	Third	Fourth	Fifth			SO2 Moisture	1.50		End Weight (g)	612.2		Pass ? (Y/N)	Y		
Leak rate l/min	0								Impurity - 50% Spent at End of Test?	YES		Total weight (g)	8.8		Additional Moisture Weighings			
Vacuum (° Hg)	-10								Dry O ₂ (% Atmospheric)	21.00		Impinger 3	DI H2O					
Time of Check	09:55								Dry Carbon Dioxide %	0.10		SOU	4818		Item Name			
Std Rate l/min	23								Reference Oxygen Percentage	n/a		Start Weight (g)	621		Start Weight (g)	621		
Leak < 2%?	YES								NBS checks DO NOT NEED to be performed (BUT ARE ALLOWED) at the end of the test or when moving between sample ports, EVEN when disconnections are made.		End Weight (g)	612.2		End Weight (g)	612.2			
Traverse Point	A1		A1	A1	A1	A1	A1	A1	A1	A1	A1	Total			Total weight (g)	0		
TimePoint (mins)	0 - 5		5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	35 - 40	35 - 40	Total			Impinger 4	Empty		
AP (mm H2O)	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	Total			SOU	4818		
K factor	48.40		48.40	48.40	48.40	48.40	48.40	48.40	48.40	48.40	48.40	Total			Start Weight (g)	849.5		
AH (Orifice)	48.40		48.40	48.40	48.40	48.40	48.40	48.40	48.40	48.40	48.40	Total			End Weight (g)	852.3		
Meter (Tm in)	26.00		26.00	26.00	26.00	27.00	27.00	27.00	27.00	26.50	26.50	Total			Total weight (g)	2.7		
Meter (Tm out)	23.00		23.00	23.00	22.00	22.00	22.00	21.00	21.00	22.25	22.25	Total			Impurity	2.7		
Stack Temp (Tg)	13.00		13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	Total			Impinger 5	Silica		
Impinger T Outlet	12.00		11.00	11.00	13.00	12.00	12.00	11.00	11.00	11.63	11.63	Total			SOU	4818		
Vacuum (° Hg)	2.00		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	Total			Start Weight (g)	784.1		
Traverse Point	A1		A1	A1	A1	A1	A1	A1	A1	A1	A1	Total			End Weight (g)	786.5		
TimePoint (mins)	40 - 45		45 - 50	50 - 55	55 - 60							Total			Total weight (g)	2.4		
AP (mm H2O)	1.00		1.00	1.00	1.00							Total			Impurity	2.4		
K factor	48.40		48.40	48.40	48.40							Total			SOU	4818		
AH (Orifice)	48.40		48.40	48.40	48.40							Total			Start Weight (g)	0		
Meter (Tm in)	27.00		27.00	27.00	27.00							Total			End Weight (g)	0		
Meter (Tm out)	22.00		21.00	22.00	22.00							Total			Total weight (g)	0		
Stack Temp (Tg)	13.00		13.00	13.00	13.00							Total			Impurity	0		
Impinger T Outlet	11.00		11.00	11.00	11.00							Total			SOU	4818		
Vacuum (° Hg)	2.00		2.00	2.00	2.00							Total			Start Weight (g)	0		
Traverse Point	A1		A1	A1	A1	A1	A1	A1	A1	A1	A1	Total			End Weight (g)	0		
TimePoint (mins)												Total			Total weight (g)	0		
AP (mm H2O)												Total			Impurity	0		
K factor												Total			SOU	4818		

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Roost

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing - 2023
 Survey Dates : 31st January - 2nd February, 15th - 16th & 21st - 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Chlorinated & Brominated Dioxins, Furans & PCBs (Test 2)

DIOXIN & FURANS DATA SAMPLING PROFORMA										Date of Measurement				
ECU/PTD/031										15/02/2023				
Time taken to change Ports? 0										Start Time 08:40		End Time 14:40		
Client	Ecobat Solutions	Stack Profile	Circular	Console ID	U001	Barometer ID	1330	Impinger 1	XAD	Rinse Solutions used				
Site	Darlston	Stack Area (m ²)	0.047	Pump ID	U001	Nozzle ID	402	TRAP ID	36	Solution SOL_NO				
Location	Recupyl Shredder	Barometric Pressure (mb)	1007	Probe ID	1330	Nozzle size	10.09	Start Weight (g)	223.7	DCM 4637				
Stack ID	Exhaust Stack	Static Pres. (mm H ₂ O)	0.50	DGM Yd	1.0477	Filter ID	GFA	End Weight (g)	224.4	Acetone 4795				
Test No.	Environmental 0.2.12	Pilot coefficient	0.90	DH ID	43.28	Pilot ID	635	Total weight (g)	0.7	Toluene 4717				
Job No	PS50	Probe Heater Setting (°C)	120	Impinger ID	979	Hot Box ID	336	Impinger 2	Condenser					
Operators	L.J.W	Hot Box Setting (°C)	120	Balance ID	1069	XAD Therm ID	789	Start Weight (g)	340.1	Additional Moisture Weighings				
Sample	Leak 1	Leak 2	Leak 3	Leak 4	Leak 5	Total	Original K Factor Settings	Start Weight (g)	346.2	Item Name				
Start Volume	620563.4						Meter Temp.	End Weight (g)	346.2	Start Weight (g)				
Final Volume	626187.0						Stack Temp	Total weight (g)	6.1	End Weight (g)				
Total Volume	5623.6	0.0	0.0	0.0	0.0	5623.6	%Moisture	Impinger 3	Empty	Total weight (g)				
Leak Check	First	Second	Third	Fourth	Fifth		Blank - Was there a bit of heat?	Start Weight (g)	519.8	Start Weight (g)				
Leak rate l/min	0.1	0.2					Reference Oxygen Percentage	End Weight (g)	522.2	End Weight (g)				
Vacuum "Hg	-11	-12					Dry O ₂ (%) Atmospheric	Total weight (g)	2.4	Item Name				
Time of Check	08:26	14:47					Dry Carbon Dioxide %	0.10		Start Weight (g)				
Set Rate l/min	20	15.82								End Weight (g)				
Leak < 2%?	YES	YES								Total weight (g)				
Leak check ALWAYS needs to be performed when moving between sample ports. Leak check IS ALWAYS required on completion of the sample.														
Traverse Point	A1	A1	A1	A1	A1	A1	A1	A1	A1	Total	Impinger 4	Silica	Total weight (g)	0
TimePoint(mins)	0 - 15	15 - 30	30 - 45	45 - 60	60 - 75	75 - 90	90 - 105	105 - 120	105 - 120	1.0	Start Weight (g)	826.6	Item Name	Start Weight (g)
DP (mm H2O)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	End Weight (g)	844.1	Item Name	Start Weight (g)
K factor	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	Total weight (g)	17.5	Item Name	End Weight (g)
DH (mmHg)	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	Impinger 5		Item Name	Total weight (g)
Meter (Tm in)	17.00	24.00	24.00	24.00	25.00	25.00	25.00	25.00	25.00	23.6	Start Weight (g)		Item Name	Start Weight (g)
Meter (Tm out)	15.00	17.00	19.00	29.00	19.00	19.00	19.00	20.00	19.5	End Weight (g)		Item Name	Start Weight (g)	
Stack Temp (Tg)	11.00	11.00	11.00	12.00	12.00	12.00	12.00	11.5	11.5	Total weight (g)	0	Item Name	End Weight (g)	
Impinger T Outlet	9.00	7.00	6.00	6.00	7.00	7.00	8.00	8.00	7.3	Item Name		Item Name	Start Weight (g)	
Vacuum (T Hg)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.0	Start Weight (g)	0	Item Name	End Weight (g)	
XAD Temperature (°C)	7.00	5.00	5.00	5.00	6.00	5.00	6.00	7.00	5.8	End Weight (g)	0	Item Name	Total weight (g)	
Traverse Point	A1	A1	A1	A1	A1	A1	A1	A1	A1	Total	Impinger 6		Item Name	Start Weight (g)
TimePoint(mins)	120 - 135	135 - 150	150 - 165	165 - 180	180 - 195	195 - 210	210 - 225	225 - 240	225 - 240	1.0	Start Weight (g)		Item Name	Start Weight (g)
DP (mm H2O)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	End Weight (g)		Item Name	Start Weight (g)
K factor	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	Total weight (g)	0	Item Name	End Weight (g)
DH (mmHg)	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	Impinger 7		Item Name	Total weight (g)
Meter (Tm in)	25.0	25.0	25.0	26.0	26.0	26.0	26.0	26.0	25.5	25.5	Start Weight (g)		Item Name	Start Weight (g)
Meter (Tm out)	20.0	20.0	20.0	20.0	20.0	21.0	21.0	21.0	20.4	20.4	End Weight (g)		Item Name	Start Weight (g)
Stack Temp (Tg)	12.0	12.0	13.0	13.0	13.0	13.0	13.0	12.6	12.6	12.6	Total weight (g)	0	Item Name	End Weight (g)
Impinger T Outlet	8.0	8.0	7.0	7.0	8.0	9.0	9.0	8.1	8.1	8.1	Item Name		Item Name	Start Weight (g)
Vacuum (T Hg)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	Start Weight (g)		Item Name	End Weight (g)
XAD Temperature (°C)	5.00	5.00	5.00	5.00	6.00	5.00	7.00	5.00	5.4	5.4	End Weight (g)		Item Name	Total weight (g)
Traverse Point	A1	A1	A1	A1	A1	A1	A1	A1	A1	Total	Impinger 8		Item Name	Start Weight (g)
TimePoint(mins)	240 - 255	255 - 270	270 - 285	285 - 300	300 - 315	315 - 330	330 - 345	345 - 360	345 - 360	1.0	Start Weight (g)		Item Name	Start Weight (g)
DP (mm H2O)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	End Weight (g)		Item Name	Start Weight (g)
K factor	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	Total weight (g)	0	Item Name	End Weight (g)
DH (mmHg)	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	Impinger 9		Item Name	Total weight (g)
Meter (Tm in)	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	Start Weight (g)		Item Name	Start Weight (g)
Meter (Tm out)	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	End Weight (g)		Item Name	Start Weight (g)
Stack Temp (Tg)	13.0	13.0	13.0	13.0	14.0	13.0	14.0	14.0	13.4	13.4	Total weight (g)	0	Item Name	End Weight (g)
Impinger T Outlet	8.0	7.0	8.0	8.0	9.0	10.0	11.0	8.8	8.8	8.8	Item Name		Item Name	Start Weight (g)
Vacuum (T Hg)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	Start Weight (g)		Item Name	End Weight (g)
XAD Temperature (°C)	4.00	5.00	5.00	6.00	6.00	7.00	5.00	8.00	5.8	5.8	End Weight (g)		Item Name	Total weight (g)
Traverse Point										Total				
TimePoint(mins)														
DP (mm H2O)														
K factor														
DH (mmHg)														
Meter (Tm in)														
Meter (Tm out)														
Stack Temp (Tg)														
Impinger T Outlet														
Vacuum (T Hg)														
XAD Temperature (°C)														
Traverse Point														
TimePoint(mins)														
DP (mm H2O)														
K factor														
DH (mmHg)														
Meter (Tm in)														
Meter (Tm out)														
Stack Temp (Tg)														
Impinger T Outlet														
Vacuum (T Hg)														
XAD Temperature (°C)														

Cadmium & Nickel (Test 4) & Heavy Metals (Test 2)

METALS DATA SAMPLING PROFORMA										Date of Measurement				
ECU/PTD/028										17/03/2023				
Time taken to change Ports? 0										Start Time 09:39		End Time 10:39		
Client	Ecobat Solutions	Stack Profile	Circular	Console ID	U006	Barometer ID	1267	Impinger 1	HNO ₃ / H ₂ O ₂	Rinse Solutions used				
Site	Darlston	Stack Area (m ²)	0.05	Pump ID	U006	Nozzle ID	1267	SOL/	4668	Solution SOL_NO				
Location	Recupyl Shredder	Barometric Pressure (mb)	996	Probe ID	1330	Nozzle size	9.81	Start Weight (g)	693.8	5% HNO ₃ 4733				
Stack ID	Exhaust Stack	Static Pres. (mm H ₂ O)	0.5	DGM Yd	0.9292	Filter ID	GMA	End Weight (g)	684	Post-Sample Blockage Check (L-Type, D/L)				
Test No.	CA, Ni T4 & Heavy Metals 12	Pilot coefficient	0.82	AHID	47.46	Pilot ID	768	Total weight (g)	-9.8	Pass (c %)?				
Job No	PS50	Probe Heater Setting (°C)	180	Impinger ID	980	Hot Box ID	978	Impinger 2	HNO ₃ / H ₂ O ₂	Additional Moisture Weighings				
ECL Site Staff	AM, LH	Hot Box Setting (°C)	180	Balance ID	1069			Start Weight (g)	4868	Item Name				
Sample	Leak 1	Leak 2	Leak 3	Leak 4	Leak 5	Total	Original K Factor Settings	Start Weight (g)	733.1	Item Name				
Start Volume	4299447.0						Meter Temp.	End Weight (g)	735.8	Start Weight (g)				
Final Volume	4300444.0						Stack Temp	Total weight (g)	6.7	End Weight (g)				
Total Volume	997.0	0.0	0.0	0.0	0.0	997.0	%Moisture	Impinger 3	HNO ₃ / H ₂ O ₂	Additional Moisture Weighings				
Leak Check	First	Second	Third	Fourth	Fifth		Blank - 30% Spent at end of test?	Start Weight (g)	698.2	Item Name				
Leak rate l/min	0.1						Reference Oxygen Percentage	End Weight (g)	701.1	Item Name				
Vacuum "Hg	15						Dry O ₂ (%) Atmospheric	Total weight (g)	2.9	Item Name				
Time of Check	09:29						Dry Carbon Dioxide %	0.10	13.6	Item Name				
Set Rate l/min	22							13.6	13.6	Item Name				
Leak < 2%?	YES								12.6	Item Name				
Leak check DO NOT NEED to be performed (BUT USE RED/WHI) at the end of the test or when moving between sample ports. EVDN when discussions are made.														
Traverse Point	A1	A1	A1	A1	A1	A1	A1	A1	A1	Total	Impinger 4	Empty	Total weight (g)	0
TimePoint (mins)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	35 - 40	1.0	Start Weight (g)	557.6	Item Name	Start Weight (g)
AP (mm H2O)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	End Weight (g)	558.1	Item Name	Start Weight (g)
K factor	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30	Total weight (g)	0	Item Name	End Weight (g)
AB (Orifice)	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30	Impinger 5	Silica	Item Name	Total weight (g)
Meter (Tm in)	14.00	12.00	12.00	13.00	14.00	14.00	15.00	15.00	13.6	13.6	Start Weight (g)	844.3	Item Name	Start Weight (g)
Meter (Tm out)	14.00	12.00	12.00	13.00	14.00	14.00								

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing - 2023
 Survey Dates : 31st January - 2nd February, 15th - 16th & 21st - 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Cadmium & Nickel (Test 5)

METALS DATA SAMPLING PROFORMA										Date of Measurement		17/03/2023				
ECL/TPD/		028		Time taken to change Ports?		0		Start Time		11:14		End Time		12:14		
Client	Ecobat Solutions			Stack Profile	Circular			Console Id	U1006			Barometer Id	1329			
Site	Darlaston			Stack Area (m²)	0.05			Pump Id	U009			Nozzle Id	1267			
Location	Recupyl Shredder			Barometric Pressure (mb)	996			Probe Id	1330			Nozzle size	9.81			
Stack ID	Exhaust Stack			Static Pres. (mm H ₂ O)	0.5			DGM Yd	0.9292			Filter Id	GMA			
Test No.	Cadmium & Nickel T5			Pilot coefficient	0.82			AH Id	47.46			Pilot ID	768			
Job No.	PS350			Probe Heater Setting (°C)	180			Impinger Id	860			Hot Box ID	978			
ECL Site Staff	AM, LH			Hot Box Setting (°C)	180			Balance Id	1069							
NB: Leak Check - Record Actual leak rate or '0' but not 'less than' values																
Simple		Leak 1	Leak 2	Leak 3	Leak 4	Leak 5	Total	Original K Factor Settings								
Start Volume	4306636.0							Meter Temp.	20							
Final Volume	4301639.0							Stack Temp	10							
Total Volume	1003.0							%Moisture	1.50							
Leak Check	First	Second	Third	Fourth	Fifth	Silica - 50% open at end of test?										
Leak rate l/min	0							YES								
Vacuum (°Hg)	15							Dry O ₂ (W Atmospheric)	21.00			K factor	27.3			
Time of Check	11:10							Dry Carbon Dioxide (%)	0.10			Reference Oxygen Percentage	n/a			
Set Rate l/min	16.82							link checks DO NOT NEED to be performed (BUT ARE ALLOWED) at the end of the test or when swapping between sample ports, EVEN when disconnections are made.								
Leak < 2%?	YES															
Traverse Point	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	Total		
TimePoint (mins)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40								
AP (mm H2O)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
K factor	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30								
AB (Orifice)	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30								
Meter (Tm in)	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00								
Meter (Tm out)	19.00	18.00	19.00	20.00	21.00	21.00	22.00	22.00								
Stack Temp (T _g)	14.00	14.00	14.00	14.00	14.00	15.00	15.00	15.00								
Impinger T Outlet	18.00	18.00	17.00	16.00	16.00	16.00	17.00	16.9								
Vacuum (°Hg)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00								
Traverse Point	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	Total		
TimePoint (mins)	40 - 45	45 - 50	50 - 55	55 - 60												
AP (mm H2O)	1.00	1.00	1.00	1.00												
K factor	27.30	27.30	27.30	27.30												
AB (Orifice)	27.30	27.30	27.30	27.30												
Meter (Tm in)	22.00	22.00	23.00	23.00												
Meter (Tm out)	22.00	22.00	23.00	23.00												
Stack Temp (T _g)	15.00	15.00	15.00	15.00												
Impinger T Outlet	17.00	17.00	17.00	18.00												
Vacuum (°Hg)	5.00	5.00	5.00	5.00												
Traverse Point	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	Total		
TimePoint (mins)	40 - 45	45 - 50	50 - 55	55 - 60												
AP (mm H2O)	1.00	1.00	1.00	1.00												
K factor	27.30	27.30	27.30	27.30												
AB (Orifice)	27.30	27.30	27.30	27.30												
Meter (Tm in)	22.00	22.00	23.00	23.00												
Meter (Tm out)	22.00	22.00	23.00	23.00												
Stack Temp (T _g)	15.00	15.00	15.00	15.00												
Impinger T Outlet	17.00	17.00	17.00	18.00												
Vacuum (°Hg)	5.00	5.00	5.00	5.00												
Traverse Point	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	Total		
TimePoint (mins)	40 - 45	45 - 50	50 - 55	55 - 60												
AP (mm H2O)	1.00	1.00	1.00	1.00												
K factor	27.30	27.30	27.30	27.30												
AB (Orifice)	27.30	27.30	27.30	27.30												
Meter (Tm in)	22.00	22.00	23.00	23.00												
Meter (Tm out)	22.00	22.00	23.00	23.00												
Stack Temp (T _g)	15.00	15.00	15.00	15.00												
Impinger T Outlet	17.00	17.00	17.00	18.00												
Vacuum (°Hg)	5.00	5.00	5.00	5.00												
Traverse Point	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	Total		
TimePoint (mins)	40 - 45	45 - 50	50 - 55	55 - 60												
AP (mm H2O)	1.00	1.00	1.00	1.00												
K factor	27.30	27.30	27.30	27.30												
AB (Orifice)	27.30	27.30	27.30	27.30												
Meter (Tm in)	22.00	22.00	23.00	23.00												
Meter (Tm out)	22.00	22.00	23.00	23.00												
Stack Temp (T _g)	15.00	15.00	15.00	15.00												
Impinger T Outlet	17.00	17.00	17.00	18.00												
Vacuum (°Hg)	5.00	5.00	5.00	5.00												

Cadmium & Nickel (Test 6)

METALS DATA SAMPLING PROFORMA										Date of Measurement		17/03/2023				
ECL/TPD/		028		Time taken to change Ports?		0		Start Time		12:46		End Time		13:46		
Client	Ecobat Solutions			Stack Profile	Circular			Console Id	U006			Barometer Id	1329			
Site	Darlaston			Stack Area (m²)	0.05			Pump Id	U006			Nozzle Id	1267			
Location	Recupyl Shredder			Barometric Pressure (mb)	996			Probe Id	1330			Nozzle size	9.81			
Stack ID	Exhaust Stack			Static Pres. (mm H ₂ O)	0.5			DGM Yd	0.9292			Filter Id	GMA			
Test No.	Cadmium & Nickel T6			Pilot coefficient	0.82			AH Id	47.46			Pilot ID	768			
Job No.	PS350			Probe Heater Setting (°C)	180			Impinger Id	860			Hot Box ID	978			
ECL Site Staff	AM, LH			Hot Box Setting (°C)	180			Balance Id	1069							
NB: Leak Check - Record Actual leak rate or '0' but not 'less than' values																
Simple		Leak 1	Leak 2	Leak 3	Leak 4	Leak 5	Total	Original K Factor Settings								
Start Volume	4302852.0							Meter Temp.	20							
Final Volume	4302852.0							Stack Temp	10							
Total Volume	1016.0							%Moisture	1.50							
Leak Check	First	Second	Third	Fourth	Fifth	Silica - 50% open at end of test?										
Leak rate l/min	0.1							YES								
Vacuum (°Hg)	15							Dry O ₂ (W Atmospheric)	21.00			K factor	27.3			
Time of Check	12:45							Dry Carbon Dioxide (%)	0.10			Reference Oxygen Percentage	n/a			
Set Rate l/min	16.72							link checks DO NOT NEED to be performed (BUT ARE ALLOWED) at the end of the test or when swapping between sample ports, EVEN when disconnections are made.								
Leak < 2%?	YES															
Traverse Point	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	Total		
TimePoint (mins)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40								
AP (mm H2O)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
K factor	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30								
AB (Orifice)	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30								
Meter (Tm in)	22.00	22.00	22.00	22.00	23.00	23.00	23.00	24.00								
Meter (Tm out)	22.00	22.00	22.00	23.00	23.00	23.00	24.00	24.5								
Stack Temp (T _g)	16.00	15.00	15.00	15.00	15.00	15.00	15.00	15.3								
Impinger T Outlet	17.00	17.00	17.00	16.00	17.00	17.00	18.00	17.1								
Vacuum (°Hg)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00								
Traverse Point	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	Total		
TimePoint (mins)	40 - 45	45 - 50	50 - 55	55 - 60												
AP (mm H2O)	1.00	1.00	1.00	1.00												
K factor	27.30	27.30	27.30	27.30												
AB (Orifice)	27.30	27.30	27.30	27.30												
Meter (Tm in)	24.00	24.00	25.00	25.00												
Meter (Tm out)	24.00	24.00	25.00	25.00												
Stack Temp (T _g)	16.00	16.00	16.00	16.00												
Impinger T Outlet	17.00	17.00	17.00	18.00												
Vacuum (°Hg)	5.00	5.00	5.00	5.00												
Traverse Point	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	Total		
TimePoint (mins)	40 - 45	45 - 50	50 - 55	55 - 60												
AP (mm H2O)	1.00	1.00	1.00	1.00												
K factor	27.30	27.30	27.30	27.30												
AB (Orifice)	27.30	27.30	27.30	27.30												
Meter (Tm in)	24.00	24.00	25.00	25.00												
Meter (Tm out)	24.00	24.00	25.00	25.00												
Stack Temp (T _g)	16.00	16.00	16.00	16.00												
Impinger T Outlet	17.00	17.00	17.00	18.00												
Vacuum (°Hg)	5.00	5.00	5.00	5.00												
Traverse Point	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	Total		
TimePoint (mins)	40 - 45	45 - 50	50 - 55	55 - 60												
AP (mm H2O)	1.00	1.00	1.00	1.00												
K factor	27.30	27.30	27.30	27.30												
AB (Orifice)	27.30	27.30	27.30	27.30												
Meter (Tm in)	24.00	24.00	25.00	25.00												
Meter (Tm out)	24.00	24.00	25.00	25.00												
Stack Temp (T _g)	16.00	16.00	16.00	16.00												
Impinger T Outlet	17.00	17.00	17.00	18.00												
Vacuum (°Hg)	5.00	5.00	5.00	5.00												
Traverse Point	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	Total		
TimePoint (mins)	40 - 45	45 - 50	50 - 55	55 - 60												
AP (mm H2O)	1.00	1.00	1.00	1.00												
K factor	27.30	27.30	27.30	27.30												
AB (Orifice)	27.30	27.30	27.30	27.30												
Meter (Tm in)	24.00	24.00	25.00	25.00												
Meter (Tm out)	24.00	24.00	25.00	25.00												
Stack Temp (T _g)	16.00	16.00	16.00	16.00												
Impinger T Outlet	17.00	17.00	17.00	18.00												
Vacuum (°Hg)	5.00	5.00	5.00	5.00												

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Roost

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing - 2023
 Survey Dates : 31st January - 2nd February, 15th - 16th & 21st - 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Particulates (Test 7), SO₂ (Test 3)

Environmental Compliance Limited		PARTICULATE DATA SAMPLING PROFORMA		Date of Measurement		23/02/2023	
ECU/TPD/ 027 & 039		Time taken to change Ports? 0		Start Time 08:24		End Time 09:24	
Client	Ecobat Solutions	Stack Profile	Circular	Console Id	U001	Barometer Id	1320
Site	Darlston	Stack Area (m ²)	0.05	Pump Id	U001	Nozzle Id	219
Location	Recupyl Shredder	Barometric Pressure (mb)	1008	Probe Id	1330	Nozzle Size	12.12
Stack ID	Exhaust Stack	Static Pres. (mm H ₂ O)	0.50	DGM Yd	1.0477	Filter Id	3731-243891
Test No.	TPM 7 & SO ₂ 3	Riot coefficient	0.80	APR	43.29	Rox ID	635
Job No.	PC350	Probe Heater Setting (°C)	160	Impinger Id	978	Hot Box ID	336
ECL Site Staff	AM & ZH	Hot Box Setting (°C)	160	Balance Id	1069		
IF SAMPLING FOR PARTICULATES NO LEAK CHECKS ARE ALLOWED AFTER SAMPLING HAS STARTED (NOT EVEN IF TRAIN IS BROKEN DOWN) FOR OTHER SAMPLING WITHOUT PARTICULATES LEAK CHECKS ARE ALLOWED AFTER SAMPLING HAS STARTED (BUT ARE NOT MANDATORY)							
Sample	Leak 1	Leak 2	Leak 3	Leak 4	Leak 5	Total	
Start Volume	656920.0						
Final Volume	658243.0						
Total Volume	1323.0	0.0	0.0	0.0	0.0	0.0	1323.0
Leak Check	First	Second	Third	Fourth	Fifth		
Leak rate l/min	0						
Vacuum *Hg	2						
Time of Check	08:14						
Set Rate l/min	30						
Leak < 2%?	YES						
Smooth Walls							
Traverse Point	A1	A1	A1	A1	A1	A1	Total
TimePoint (mins)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35
AP (mm H2O)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
K factor	48.40	48.40	48.40	48.40	48.40	48.40	48.40
ΔH (Orifice)	48.40	48.40	48.40	48.40	48.40	48.40	48.40
Meter (Tm in)	16.00	18.00	20.00	22.00	24.00	24.00	24.00
Meter (Tm out)	15.00	15.00	15.00	16.00	16.00	16.00	17.00
Stack Temp (Tg)	12.00	12.00	12.00	13.00	13.00	13.00	12.63
Impinger T Outlet	10.00	10.00	9.00	9.00	9.00	9.00	9.25
Vacuum (* Hg)	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Traverse Point	A1	A1	A1	A1			Total
TimePoint (mins)	40 - 45	45 - 50	50 - 55	55 - 60			
AP (mm H2O)	1.00	1.00	1.00	1.00			1.00
K factor	48.40	48.40	48.40	48.40			
ΔH (Orifice)	48.40	48.40	48.40	48.40			48.40
Meter (Tm in)	24.00	24.00	24.00	24.00			24.00
Meter (Tm out)	18.00	18.00	18.00	18.00			18.50
Stack Temp (Tg)	13.00	13.00	13.00	13.00			13.00
Impinger T Outlet	10.00	10.00	10.00	10.00			10.00
Vacuum (* Hg)	2.00	2.00	2.00	2.00			2.00
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							
Vacuum (* Hg)							
Traverse Point							Total
TimePoint (mins)							
AP (mm H2O)							
K factor							
ΔH (Orifice)							
Meter (Tm in)							
Meter (Tm out)							
Stack Temp (Tg)							
Impinger T Outlet							

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing - 2023
 Survey Dates : 31st January - 2nd February, 15th - 16th & 21st - 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Particulates (Test 9)

Environmental Compliance Limited		PARTICULATE DATA SAMPLING PROFORMA										Date of Measurement		23/02/2023	
ECU/TPD/		027		Time taken to change Ports?		0		Start Time		11:50		End Time		12:50	
Client		Ecobat Solutions		Stack Profile		Circular		Console ID		U001		Barometer ID		1320	
Site		Darlaston		Stack Area (m ²)		0.05		Pump ID		U001		Nozzle ID		219	
Location		Recypyl Shredder		Barometric Pressure (mb)		1.008		Probe ID		1330		Nozzle Size		12.12	
Stack ID		Exhaust Stack		Static Pres. (mm H ₂ O)		0.50		DGM Yd		1.0477		Filter ID		3731-243709	
Test No.		TMS 9		Hot coefficient		0.80		DH#		43.29		Flow ID		635	
Job No		P5350		Probe Heater Setting (°C)		150		Impinger ID		979		Hot Box ID		336	
ECL Site Staff		AM & ZH		Hot Box Setting (°C)		160		Balance ID		1069					
<p>IF SAMPLING FOR PARTICULATES NO LEAK CHECKS ARE ALLOWED AFTER SAMPLING HAS STARTED (NOT EVEN IF TRAIN IS BROKEN DOWN) FOR OTHER SAMPLING WITHOUT PARTICULATES LEAK CHECKS ARE ALLOWED AFTER SAMPLING HAS STARTED (BUT ARE NOT MANDATORY)</p>															
Start Volume		660145.0		Leak 1		Leak 2		Leak 3		Leak 4		Leak 5		Total	
Final Volume		661449.0		0.0		0.0		0.0		0.0		0.0		1304.0	
Total Volume		7681.0		First		Second		Third		Fourth		Fifth			
Leak Check		0.1		0.2		0.3		0.4		0.5		0.6		0.7	
Leak rate l/min		10		12		14		16		18		20		22	
Vacuum °Hg		10		12		14		16		18		20		22	
Time of Check		11:44		11:44		11:44		11:44		11:44		11:44		11:44	
Set Rate l/min		21.98		21.98		21.98		21.98		21.98		21.98		21.98	
Leak < 2%?		YES		YES		YES		YES		YES		YES		YES	
Smooth Walls															
Traverse Point		A1		A1		A1		A1		A1		A1		Total	
TimePoint (mins)		0 - 5		5 - 10		10 - 15		15 - 20		20 - 25		25 - 30		30 - 35	
AP (mm H2O)		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
K factor		48.40		48.40		48.40		48.40		48.40		48.40		48.40	
DH (Orifice)		48.40		48.40		48.40		48.40		48.40		48.40		48.40	
Meter (Tm in)		19.00		20.00		23.00		25.00		25.00		25.00		23.00	
Meter (Tm out)		18.00		17.00		18.00		19.00		19.00		19.00		18.50	
Stack Temp (T _s)		13.00		13.00		13.00		13.00		13.00		13.00		13.00	
Impinger T Outlet		13.00		7.00		6.00		9.00		9.00		10.00		9.25	
Vacuum (°Hg)		2.00		2.00		2.00		2.00		2.00		2.00		2.00	

Rinse Solutions used	
Solution	SOL NO
DI Water	4818
Acetone	4795

Additional Moisture Weighings			
Item Name	Start Weight (g)	End Weight (g)	Total weight (g)
Impinger 1	DI H2O	4818	629.3
Impinger 2	DI H2O	4818	589.3
Impinger 3	DI H2O	4818	537.9
Impinger 4	Empty		0
Impinger 5	Silica	787.5	793
Impinger 6	Empty		0
Impinger 7	Empty		0
Impinger 8	Empty		0
Impinger 9	Empty		0
Impinger 10	Empty		0
Impinger 11	Empty		0
Impinger 12	Empty		0
Impinger 13	Empty		0
Impinger 14	Empty		0
Impinger 15	Empty		0
Impinger 16	Empty		0
Impinger 17	Empty		0
Impinger 18	Empty		0
Impinger 19	Empty		0
Impinger 20	Empty		0
Impinger 21	Empty		0
Impinger 22	Empty		0
Impinger 23	Empty		0
Impinger 24	Empty		0
Impinger 25	Empty		0
Impinger 26	Empty		0
Impinger 27	Empty		0
Impinger 28	Empty		0
Impinger 29	Empty		0
Impinger 30	Empty		0
Impinger 31	Empty		0
Impinger 32	Empty		0
Impinger 33	Empty		0
Impinger 34	Empty		0
Impinger 35	Empty		0
Impinger 36	Empty		0
Impinger 37	Empty		0
Impinger 38	Empty		0
Impinger 39	Empty		0
Impinger 40	Empty		0
Impinger 41	Empty		0
Impinger 42	Empty		0
Impinger 43	Empty		0
Impinger 44	Empty		0
Impinger 45	Empty		0
Impinger 46	Empty		0
Impinger 47	Empty		0
Impinger 48	Empty		0
Impinger 49	Empty		0
Impinger 50	Empty		0
Impinger 51	Empty		0
Impinger 52	Empty		0
Impinger 53	Empty		0
Impinger 54	Empty		0
Impinger 55	Empty		0
Impinger 56	Empty		0
Impinger 57	Empty		0
Impinger 58	Empty		0
Impinger 59	Empty		0
Impinger 60	Empty		0
Impinger 61	Empty		0
Impinger 62	Empty		0
Impinger 63	Empty		0
Impinger 64	Empty		0
Impinger 65	Empty		0
Impinger 66	Empty		0
Impinger 67	Empty		0
Impinger 68	Empty		0
Impinger 69	Empty		0
Impinger 70	Empty		0
Impinger 71	Empty		0
Impinger 72	Empty		0
Impinger 73	Empty		0
Impinger 74	Empty		0
Impinger 75	Empty		0
Impinger 76	Empty		0
Impinger 77	Empty		0
Impinger 78	Empty		0
Impinger 79	Empty		0
Impinger 80	Empty		0
Impinger 81	Empty		0
Impinger 82	Empty		0
Impinger 83	Empty		0
Impinger 84	Empty		0
Impinger 85	Empty		0
Impinger 86	Empty		0
Impinger 87	Empty		0
Impinger 88	Empty		0
Impinger 89	Empty		0
Impinger 90	Empty		0
Impinger 91	Empty		0
Impinger 92	Empty		0
Impinger 93	Empty		0
Impinger 94	Empty		0
Impinger 95	Empty		0
Impinger 96	Empty		0
Impinger 97	Empty		0
Impinger 98	Empty		0
Impinger 99	Empty		0
Impinger 100	Empty		0

Chlorinated & Brominated Dioxins, Furans & PCBs (Test 3)

Environmental Compliance Limited		DIOXIN & FURANS DATA SAMPLING PROFORMA										Date of Measurement		22/02/2023	
ECU/TPD/		031		Time taken to change Ports?		0		Start Time		08:45		End Time		14:45	
Client		Ecobat Solutions		Stack Profile		Circular		Console ID		U001		Barometer ID		1320	
Site		Darlaston		Stack Area (m ²)		0.047		Pump ID		U001		Nozzle ID		402	
Location		Recypyl Shredder		Barometric Pressure (mb)		0.995		Probe ID		1330		Nozzle Size		12.12	
Stack ID		Exhaust Stack		Static Pres. (mm H ₂ O)		0.50		DGM Yd		1.0477		Filter ID		3731-243709	
Test No.		TMS 9		Hot coefficient		0.80		DH#		43.29		Flow ID		635	
Job No		P5350		Probe Heater Setting (°C)		120		Impinger ID		979		Hot Box ID		336	
Operators		AM & ZH		Hot Box Setting (°C)		120		Balance ID		1069		XAD Therm ID		789	
Start Volume		646664.0		Leak 1		Leak 2		Leak 3		Leak 4		Leak 5		Total	
Final Volume		654345.0		0.0		0.0		0.0		0.0		0.0		7681.0	
Total Volume		7681.0		First		Second		Third		Fourth		Fifth			
Leak Check		0.3		0.4		0.5		0.6		0.7		0.8		0.9	
Leak rate l/min		10		12		14		16		18		20		22	
Vacuum °Hg		10		12		14		16		18		20		22	
Time of Check		08:39		14:47		14:47		14:47		14:47		14:47		14:47	
Set Rate l/min		21.3		21.3		21.3		21.3		21.3		21.3		21.3	
Leak < 4%?		YES		YES		YES		YES		YES		YES		YES	
<p>Leak check ALWAYS needs to be performed when mixing between sample ports Leak check (SALWAYS) required on completion of the sample.</p>															
Smooth Walls															
Traverse Point		A1		A1		A1		A1		A1		A1		Total	
TimePoint (mins)		0 - 15		15 - 30		30 - 45		45 - 60		60 - 75		75 - 90		90 - 105	
DP (mm H2O)		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
K factor		48.40		48.40		48.40		48.40		48.40		48.40		48.40	
DH (Orifice)		48.40		48.40		48.40		48.40		48.40		48.40		48.40	
Meter (Tm in)		15.00		16.00		18.00		19.00		19.00		20.00		17.6	
Meter (Tm out)		14.00		14.00		14.00		14.00		14.00		14.00		14.00	
Stack Temp (T _s)		13.00		13.00		13.00		13.00		13.00		13.00		13.5	
Impinger T Outlet		12.00		9.00		9.00		10.00		11.00		13.00		11.1	
Vacuum (°Hg)		8.00		8.00		10.00		10.00		10.00		10.00		9.5	
XAD Temperature (°C)		17.00		8.00		9.00		10.00		10.00		8.00		9.00	
Traverse Point		A1		A1		A1		A1		A1		A1		Total	
TimePoint (mins)		120 - 135		135 - 150		150 - 165		165 - 180		180 - 195		195 - 210		210 - 225	
DP (mm H2O)		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
K factor		48.40		48.40		48.40		48.40		48.40		48.40		48.40	
DH (Orifice)		48.40		48.40		48.40		48.40		48.40		48.40		48.40	
Meter (Tm in)		24.0		24.0		25.0		25.0		25.0		25.0		24.8	
Meter (Tm out)		20.0		20.0		20.0		20.0		20.0		21.0		20.1	
Stack Temp (T _s)		14.0		14.0		14.0		14.0		14.0		14.0		14.0	
Impinger T Outlet		18.0		17.0		13.0		13.0		14.0		15.0		14.0	
Vacuum (°Hg)		10.0		10.0		10.0		10.0		10.0		10.0		10.0	
XAD Temperature (°C)		8.00		10.00		11.00		12.00		12.00		11.00		11.00	
Traverse Point		A1		A1		A1		A1		A1		A1		Total	
TimePoint (mins)		240 - 255		255 - 270		270 - 285		285 - 300		300 - 315		315 - 330		330 - 345	
DP (mm H2O)		1.0		1.0		1.									

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing - 2023
 Survey Dates : 31st January - 2nd February, 15th - 16th & 21st - 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Cadmium & Nickel (Test 9)

METALS DATA SAMPLING PROFORMA										Date of Measurement		21/02/2023		Pilot Quality Control Checks					
ECL/TPD/		028		Time taken to change Parts?		0		Start Time		13:10		End Time		14:10		PRE-Sample PTOT Visual Inspection			
Client		Ecobat Solutions		Stack Profile		Circular		Console Id		U1001		Barometer Id		1320		Time		12:26	
Site		Darlaston		Stack Area (m²)		0.05		Pump Id		U001		Nozzle Id		219		Pass 7 (YN)		Y	
Location		Recupyl Shredder		Barometric Pressure (mb)		1004		Probe Id		1330		Nozzle size		12.12		PRE-Sample PTOT Leak Check		12:28	
Stack ID		Exhaust Stack		Static Pres. (mm H ₂ O)		0.5		DGM Yd		1.0477		Filter Id		GMA		Pass 7 (YN)		Y	
Test No.		Cadmium & Nickel T9		Pilot coefficient		0.80		AM Id		43.29		Pilot ID		635		Post-Sample Blockage Check (L-L type Q/L/L)		Time	
Job No		P5350		Probe Heater Setting (°C)		180		Impinger Id		657		Hot Box ID		336		Reading (mm H ₂ O)		Pass (< 5%) ?	
ECL Site Staff		AM, ZH		Hot Box Setting (°C)		180		Balance Id		1068						PCSF-Sample PTOT Visual Inspection		Time	
Sample		Leak 1		Leak 2		Leak 3		Leak 4		Leak 5		Total		Original K Factor Settings		Impinger 1		HNO ₃ / H ₂ O	
Start Volume		644693.0												Meter Temp.		20		Pass 7 (YN)	
Final Volume		646026.0												Stack Temp		10		PCSF-Sample PTOT Leak Check	
Total Volume		1333.0		0.0		0.0		0.0		0.0		1333.0		SO ₂ Moisture		1.50		Time	
Leak Check		First		Second		Third		Fourth		Fifth		Total		Wet - 50% (Start or End of Test?)		YES		Pass 7 (YN)	
Leak rate (l/min)		0.2												K factor		48.4		Additional Moisture Weighings	
Vacuum (°Hg)		10												Reference Oxygen Percentage		n/a		Item Name	
Time of Check		13:06												Dry O ₂ (W Atmospheric)		0.10		SDU	
Set Rate (l/min)		22.38												Dry Carbon Dioxide %				Start Weight (g)	
Leak < 2%?		YES												Impinger 2		HNO ₃ / H ₂ O		Item Name	
Traverse Point		A1		A1		A1		A1		A1		A1		Total		Impinger 3		HNO ₃ / H ₂ O	
Time/Point (mins)		0 - 5		5 - 10		10 - 15		15 - 20		20 - 25		25 - 30		30 - 35		35 - 40		Item Name	
AP (mm H2O)		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		SDU	
K factor		48.40		48.40		48.40		48.40		48.40		48.40		48.40		48.40		Start Weight (g)	
ΔB (Orifice)		48.40		48.40		48.40		48.40		48.40		48.40		48.40		48.40		End Weight (g)	
Meter (Tm in)		23.00		19.00		21.00		21.00		21.00		21.00		21.00		21.00		Total weight (g)	
Meter (Tm out)		20.00		27.00		25.00		23.00		25.00		25.00		25.00		25.00		Item Name	
Stack Temp (T _{st})		14.00		14.00		14.00		14.00		14.00		14.00		14.00		14.00		Impinger 4	
Impinger T Outlet		13.00		11.00		12.00		13.00		14.00		14.00		14.00		14.00		Empty	
Vacuum (°Hg)		3.00		3.00		3.00		3.00		3.00		3.00		3.00		3.00		SDU	
Traverse Point		A1		A1		A1		A1		A1		A1		Total		Impinger 5		Silica	
Time/Point (mins)		40 - 45		45 - 50		50 - 55		55 - 60										Item Name	
AP (mm H2O)		1.00		1.00		1.00		1.00										SDU	
K factor		48.40		48.40		48.40		48.40										Start Weight (g)	
ΔB (Orifice)		48.40		48.40		48.40		48.40										End Weight (g)	
Meter (Tm in)		22.00		22.00		22.00		22.00										Total weight (g)	
Meter (Tm out)		26.00		26.00		26.00		26.00										Item Name	
Stack Temp (T _{st})		15.00		14.00		15.00		15.00										Impinger 6	
Impinger T Outlet		15.00		15.00		15.00		15.00										SDU	
Vacuum (°Hg)		4.00		4.00		4.00		4.00										Start Weight (g)	
Traverse Point																		End Weight (g)	
Time/Point (mins)																		Total weight (g)	
AP (mm H2O)																		Item Name	
K factor																		Impinger 7	
ΔB (Orifice)																		SDU	
Meter (Tm in)																		Start Weight (g)	
Meter (Tm out)																		End Weight (g)	
Stack Temp (T _{st})																		Total weight (g)	
Impinger T Outlet																		Item Name	
Vacuum (°Hg)																		Start Weight (g)	
Traverse Point																		End Weight (g)	
Time/Point (mins)																		Total weight (g)	
AP (mm H2O)																		Item Name	
K factor																		Impinger 8	
ΔB (Orifice)																		SDU	
Meter (Tm in)																		Start Weight (g)	
Meter (Tm out)																		End Weight (g)	
Stack Temp (T _{st})																		Total weight (g)	
Impinger T Outlet																		Item Name	
Vacuum (°Hg)																		Start Weight (g)	
Traverse Point																		End Weight (g)	
Time/Point (mins)																		Total weight (g)	
AP (mm H2O)																		Item Name	
K factor																		Impinger 9	
ΔB (Orifice)																		SDU	
Meter (Tm in)																		Start Weight (g)	
Meter (Tm out)																		End Weight (g)	
Stack Temp (T _{st})																		Total weight (g)	
Impinger T Outlet																		Item Name	
Vacuum (°Hg)																		Start Weight (g)	
Traverse Point																		End Weight (g)	
Time/Point (mins)																		Total weight (g)	
AP (mm H2O)																		Item Name	
K factor																		Impinger 10	
ΔB (Orifice)																		SDU	
Meter (Tm in)																		Start Weight (g)	
Meter (Tm out)																		End Weight (g)	
Stack Temp (T _{st})																		Total weight (g)	
Impinger T Outlet																		Item Name	
Vacuum (°Hg)																		Start Weight (g)	
Traverse Point																		End Weight (g)	
Time/Point (mins)																		Total weight (g)	
AP (mm H2O)																		Item Name	
K factor																		Impinger 11	
ΔB (Orifice)																		SDU	
Meter (Tm in)																		Start Weight (g)	
Meter (Tm out)																		End Weight (g)	
Stack Temp (T _{st})																		Total weight (g)	
Impinger T Outlet																		Item Name	
Vacuum (°Hg)																		Start Weight (g)	
Traverse Point																		End Weight (g)	
Time/Point (mins)																		Total weight (g)	
AP (mm H2O)																		Item Name	
K factor																		Impinger 12	
ΔB (Orifice)																		SDU	
Meter (Tm in)																		Start Weight (g)	
Meter (Tm out)																		End Weight (g)	
Stack Temp (T _{st})																		Total weight (g)	
Impinger T Outlet																		Item Name	
Vacuum (°Hg)																		Start Weight (g)	
Traverse Point																		End Weight (g)	
Time/Point (mins)																		Total weight (g)	
AP (mm H2O)																		Item Name	
K factor																		Impinger 13	
ΔB (Orifice)																		SDU	
Meter (Tm in)																		Start Weight (g)	
Meter (Tm out)																		End Weight (g)	
Stack Temp (T _{st})																		Total weight (g)	
Impinger T Outlet																		Item Name	
Vacuum (°Hg)																		Start Weight (g)	
Traverse Point																		End Weight (g)	
Time/Point (mins)																		Total weight (g)	
AP (mm H2O)																			

Ecobat Solutions
Permit No : EPR/DB3704FG
Variation No : EPR/DB3704FG/V006
Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
Visit Details : Emissions Testing – 2023
Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
Report Issue Date : 24th April 2023

LABORATORY ANALYSIS RESULTS

Laboratory analysis for Particulates, Hydrogen Chloride, Hydrogen Fluoride, Sulphur Dioxide, Heavy 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.

Laboratory analysis for Chlorinated Dioxins & Furans, PCBs was subcontracted to Marchwood, a UKAS Accredited Testing Laboratory, Number 1668.

Marchwood DO hold UKAS & MCERTS accreditation for this analysis.

As required by the MCERTS Performance Standard for Organisations, the analysis results are shown below.

Laboratory analysis for Brominated Dioxins & Furans was subcontracted to Marchwood, a UKAS Accredited Testing Laboratory, Number 1668.

Marchwood DO NOT 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

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Results Summary

Report No.: 23-01496-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

Customer Sample No	ECL/23/0410	ECL/23/0411	ECL/23/0412	ECL/23/0413	ECL/23/0414	ECL/23/0415	ECL/23/0416	ECL/23/0417	ECL/23/0418
RPS Sample No	160382	160383	160384	160385	160386	160387	160388	160389	160390
Sample Matrix	FILTER	SOLUTION	FILTER	SOLUTION	FILTER	SOLUTION	FILTER	SOLUTION	FILTER
Sampling Date	31/01/2023	31/01/2023	31/01/2023	31/01/2023	31/01/2023	31/01/2023	31/01/2023	31/01/2023	31/01/2023

Determinand	CAS No	Codes	SOP	RL	Units									
particulates		UM	D9	0.04	mg	S/C		0.42		0.48		S/C		S/C
particulates		UM	D9	0.5	mg		< 0.5		< 0.5		0.8		< 0.5	

Comments

Report No.: 23-01496-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

RPS Sample Number	Customer Number	Sample Comments
160382	ECL/23/0410	<0.1 mg
160388	ECL/23/0416	<0.1 mg
160390	ECL/23/0418	<0.1 mg

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/Voo6
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Results Summary

Report No.: 23-01497-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: Not Supplied

Customer Sample No	ECL/23/0420	ECL/23/0421	ECL/23/0422	ECL/23/0423	ECL/23/0424	ECL/23/0425
RPS Sample No	160392	160393	160394	160395	160396	160397
Sample Matrix	SOLUTION	SOLUTION	SOLUTION	SOLUTION	SOLUTION	SOLUTION
Sampling Date	31/01/2023	31/01/2023	31/01/2023	31/01/2023	31/01/2023	31/01/2023

Determinand	CAS No	Codes	SOP	RL	Units						
volume of sample supplied		U	N/A	n/a	ml	427	282	237	526	242	247
hydrogen chloride	7647-01-0	UM	C27	0.05	ug/mL				0.10	< 0.05	< 0.05
sulphur dioxide	7446-09-5	UM	C27	0.05	ug/mL	0.45	0.21	0.22			
hydrogen fluoride	7664-39-3	UM	C27	0.05	ug/mL				0.06	< 0.05	0.06

Results Summary

Report No.: 23-01957-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

Customer Sample No	ECL/23/0458	ECL/23/0459	ECL/23/0460	ECL/23/0461	ECL/23/0462	ECL/23/0463
RPS Sample No	162717	162718	162719	162720	162721	162722
Sample Matrix	SOLUTION	SOLUTION	SOLUTION	SOLUTION	SOLUTION	SOLUTION
Sampling Date	16/02/2023	16/02/2023	16/02/2023	16/02/2023	16/02/2023	16/02/2023

Determinand	CAS No	Codes	SOP	RL	Units						
volume of sample supplied		U	N/A	n/a	ml	342	176	632	416	170	441
hydrogen chloride	7647-01-0	UM	C27	0.05	ug/mL				< 0.05	< 0.05	< 0.05
sulphur dioxide	7446-09-5	UM	C27	0.05	ug/mL	0.19	0.17	0.23			
hydrogen fluoride	7664-39-3	UM	C27	0.05	ug/mL				< 0.05	< 0.05	< 0.05

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 :R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Results Summary

Report No.: 23-01503-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

Customer Sample No	ECL/23/0426	ECL/23/0427	ECL/23/0428	ECL/23/0429	ECL/23/0430	ECL/23/0431	ECL/23/0432	ECL/23/0433	ECL/23/0434	ECL/23/0435	ECL/23/0436
RPS Sample No	160426	160427	160428	160429	160430	160431	160432	160433	160434	160435	160436
Sample Matrix	FILTER	SOLUTION	SOLUTION	SOLUTION	FILTER	SOLUTION	SOLUTION	SOLUTION	FILTER	SOLUTION	SOLUTION
Sampling Date	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023

Determinand	CAS No	Codes	SOP	RL	Units										
volume of sample supplied		U	N/A	n/a	ml		76	485	145		106	385	140	100	515
arsenic	7440-38-2	UM	M31	0.2	ug	< 0.2									
cadmium	7440-43-9	UM	M31	0.2	ug	< 0.2			< 0.2				< 0.2		
cobalt	7440-48-4	UM	M31	0.2	ug	0.3									
chromium	7440-47-3	UM	M31	0.3	ug	0.9									
copper	7440-50-8	UM	M31	0.2	ug	< 0.2									
manganese	7439-96-5	UM	M31	0.2	ug	0.5									
nickel	7440-02-0	UM	M31	0.5	ug	2.8			3.0				2.9		
lead	7439-92-1	UM	M31	0.3	ug	0.3									
antimony	7440-36-0	UM	M31	0.4	ug	< 0.4									
selenium	7782-49-2	U	M31	0.2	ug	< 0.2									
thallium	7440-28-0	UM	M31	0.2	ug	< 0.2									
vanadium	7440-62-2	UM	M31	0.2	ug	< 0.2									
arsenic	7440-38-2	UM	M31	0.3	ug		< 0.3								
cadmium	7440-43-9	UM	M31	0.3	ug		< 0.3			< 0.3				< 0.3	
cobalt	7440-48-4	UM	M31	0.3	ug		0.4								
chromium	7440-47-3	UM	M31	0.3	ug		13.4								
copper	7440-50-8	UM	M31	0.4	ug		1.8								
manganese	7439-96-5	UM	M31	0.2	ug		1.6								
nickel	7440-02-0	UM	M31	0.1	ug		4.6			2.5				1.7	
lead	7439-92-1	UM	M31	0.2	ug		4.2								
antimony	7440-36-0	UM	M31	0.2	ug		< 0.2								
selenium	7782-49-2	U	M31	0.5	ug		< 0.5								
thallium	7440-28-0	UM	M31	0.2	ug		< 0.2								
vanadium	7440-62-2	UM	M31	0.2	ug		< 0.2								
arsenic	7440-38-2	UM	M31	0.3	ug/L			< 0.3	< 0.3						
cadmium	7440-43-9	UM	M31	0.2	ug/L			< 0.2	< 0.2	< 0.2	0.2				< 0.2
cobalt	7440-48-4	UM	M31	0.2	ug/L			1.4	< 0.2						
chromium	7440-47-3	UM	M31	0.2	ug/L			26.6	1.2						
copper	7440-50-8	UM	M31	0.4	ug/L			7.4	2.3						
manganese	7439-96-5	UM	M31	0.2	ug/L			7.3	2.2						
nickel	7440-02-0	UM	M31	0.3	ug/L			9.2	1.0		7.0	2.5			7.0

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/Voo6
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Results Summary

Report No.: 23-01503-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

Customer Sample No	ECL/23/0426	ECL/23/0427	ECL/23/0428	ECL/23/0429	ECL/23/0430	ECL/23/0431	ECL/23/0432	ECL/23/0433	ECL/23/0434	ECL/23/0435	ECL/23/0436
RPS Sample No	160426	160427	160428	160429	160430	160431	160432	160433	160434	160435	160436
Sample Matrix	FILTER	SOLUTION	SOLUTION	SOLUTION	FILTER	SOLUTION	SOLUTION	SOLUTION	FILTER	SOLUTION	SOLUTION
Sampling Date	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023

Determinand	CAS No	Codes	SOP	RL	Units							
lead	7439-92-1	UM	M31	0.2	ug/L			12.0	3.0			
antimony	7440-36-0	UM	M31	0.2	ug/L			< 0.2	< 0.2			
selenium	7782-49-2	U	M31	0.6	ug/L			< 0.6	< 0.6			
thallium	7440-28-0	UM	M31	0.2	ug/L			< 0.2	< 0.2			
vanadium	7440-62-2	UM	M31	0.1	ug/L			< 0.1	< 0.1			

Results Summary

Report No.: 23-01503-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

Customer Sample No	ECL/23/0437	ECL/23/0438	ECL/23/0439	ECL/23/0440	ECL/23/0441
RPS Sample No	160437	160438	160439	160440	160441
Sample Matrix	SOLUTION	FILTER	SOLUTION	SOLUTION	SOLUTION
Sampling Date	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023

Determinand	CAS No	Codes	SOP	RL	Units						
lead	7439-92-1	UM	M31	0.2	ug/L					< 0.2	< 0.2
antimony	7440-36-0	UM	M31	0.2	ug/L					< 0.2	< 0.2
selenium	7782-49-2	U	M31	0.6	ug/L					< 0.6	< 0.6
thallium	7440-28-0	UM	M31	0.2	ug/L					< 0.2	< 0.2
vanadium	7440-62-2	UM	M31	0.1	ug/L					< 0.1	< 0.1

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Results Summary

Report No.: 23-01503-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

Customer Sample No	ECL/23/0437	ECL/23/0438	ECL/23/0439	ECL/23/0440	ECL/23/0441
RPS Sample No	160437	160438	160439	160440	160441
Sample Matrix	SOLUTION	FILTER	SOLUTION	SOLUTION	SOLUTION
Sampling Date	02/02/2023	02/02/2023	02/02/2023	02/02/2023	02/02/2023

Determinand	CAS No	Codes	SOP	RL	Units					
volume of sample supplied		U	N/A	n/a	ml	150		170	209	115
arsenic	7440-38-2	UM	M31	0.2	ug		< 0.2			
cadmium	7440-43-9	UM	M31	0.2	ug		< 0.2			
cobalt	7440-48-4	UM	M31	0.2	ug		< 0.2			
chromium	7440-47-3	UM	M31	0.3	ug		0.7			
copper	7440-50-8	UM	M31	0.2	ug		< 0.2			
manganese	7439-96-5	UM	M31	0.2	ug		0.4			
nickel	7440-02-0	UM	M31	0.5	ug		0.7			
lead	7439-92-1	UM	M31	0.3	ug		< 0.3			
antimony	7440-36-0	UM	M31	0.4	ug		< 0.4			
selenium	7782-49-2	U	M31	0.2	ug		< 0.2			
thallium	7440-28-0	UM	M31	0.2	ug		< 0.2			
vanadium	7440-62-2	UM	M31	0.2	ug		< 0.2			
arsenic	7440-38-2	UM	M31	0.3	ug			< 0.3		
cadmium	7440-43-9	UM	M31	0.3	ug			< 0.3		
cobalt	7440-48-4	UM	M31	0.3	ug			< 0.3		
chromium	7440-47-3	UM	M31	0.3	ug			0.3		
copper	7440-50-8	UM	M31	0.4	ug			2.4		
manganese	7439-96-5	UM	M31	0.2	ug			0.6		
nickel	7440-02-0	UM	M31	0.1	ug			0.4		
lead	7439-92-1	UM	M31	0.2	ug			8.0		
antimony	7440-36-0	UM	M31	0.2	ug			0.3		
selenium	7782-49-2	U	M31	0.5	ug			< 0.5		
thallium	7440-28-0	UM	M31	0.2	ug			< 0.2		
vanadium	7440-62-2	UM	M31	0.2	ug			< 0.2		
arsenic	7440-38-2	UM	M31	0.3	ug/L				< 0.3	< 0.3
cadmium	7440-43-9	UM	M31	0.2	ug/L	< 0.2			< 0.2	< 0.2
cobalt	7440-48-4	UM	M31	0.2	ug/L				< 0.2	< 0.2
chromium	7440-47-3	UM	M31	0.2	ug/L				0.6	0.6
copper	7440-50-8	UM	M31	0.4	ug/L				< 0.4	< 0.4
manganese	7439-96-5	UM	M31	0.2	ug/L				< 0.2	0.3
nickel	7440-02-0	UM	M31	0.3	ug/L	0.8			0.4	0.4

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Results Summary

Report No.: 23-01956-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

Customer Sample No	ECL/23/0448	ECL/23/0449	ECL/23/0450	ECL/23/0451	ECL/23/0452	ECL/23/0453	ECL/23/0454	ECL/23/0455	ECL/23/0456	ECL/23/0457
RPS Sample No	162707	162708	162709	162710	162711	162712	162713	162714	162715	162716
Sample Matrix	FILTER	SOLUTION	FILTER	SOLUTION	FILTER	SOLUTION	FILTER	SOLUTION	FILTER	SOLUTION
Sampling Date	16/02/2023	16/02/2023	16/02/2023	16/02/2023	16/02/2023	16/02/2023	16/02/2023	16/02/2023	16/02/2023	16/02/2023

Determinand	CAS No	Codes	SOP	RL	Units									
particulates		UM	D9	0.04	mg	S/C		1.34		S/C		S/C		S/C
particulates		UM	D9	0.5	mg		< 0.5		< 0.5		< 0.5		< 0.5	< 0.5

Comments

Report No.: 23-01956-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

RPS Sample Number	Customer Number	Sample Comments
162707	ECL/23/0448	<0.1 mg
162711	ECL/23/0452	<0.1 mg
162713	ECL/23/0454	<0.1 mg
162715	ECL/23/0456	<0.1 mg

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Results Summary

Report No.: 23-03559-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: P5350

Customer Sample No	ECL/23/1847	ECL/23/1848	ECL/23/1849	ECL/23/1850	ECL/23/1851	ECL/23/1852	ECL/23/1853	ECL/23/1854	ECL/23/1855	ECL/23/1856	ECL/23/1857
RPS Sample No	170624	170625	170626	170627	170628	170629	170630	170631	170632	170633	170634
Sample Matrix	FILTER	SOLUTION	SOLUTION	SOLUTION	FILTER	SOLUTION	SOLUTION	SOLUTION	FILTER	SOLUTION	SOLUTION
Sampling Date	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023

Determinand	CAS No	Codes	SOP	RL	Units											
volume of sample supplied		U	N/A	n/a	ml		60	470	265		60	495	245		54	400
arsenic	7440-38-2	UM	M31	0.2	ug	< 0.2										
cadmium	7440-43-9	UM	M31	0.2	ug	< 0.2			< 0.2				< 0.2			
cobalt	7440-48-4	UM	M31	0.2	ug	0.2										
chromium	7440-47-3	UM	M31	0.3	ug	0.7										
copper	7440-50-8	UM	M31	0.2	ug	< 0.2										
manganese	7439-96-5	UM	M31	0.2	ug	1.8										
nickel	7440-02-0	UM	M31	0.5	ug	0.6		0.6				0.6				
lead	7439-92-1	UM	M31	0.3	ug	0.4										
antimony	7440-36-0	UM	M31	0.4	ug	< 0.4										
selenium	7782-49-2	U	M31	0.2	ug	< 0.2										
thallium	7440-28-0	UM	M31	0.2	ug	< 0.2										
vanadium	7440-62-2	UM	M31	0.2	ug	< 0.2										
arsenic	7440-38-2	UM	M31	0.3	ug		< 0.3									
cadmium	7440-43-9	UM	M31	0.3	ug		< 0.3			< 0.3					< 0.3	
cobalt	7440-48-4	UM	M31	0.3	ug		< 0.3									
chromium	7440-47-3	UM	M31	0.3	ug		4.2									
copper	7440-50-8	UM	M31	0.4	ug		1.4									
manganese	7439-96-5	UM	M31	0.2	ug		2.5									
nickel	7440-02-0	UM	M31	0.1	ug		5.9			11.2					5.3	
lead	7439-92-1	UM	M31	0.2	ug		4.6									
antimony	7440-36-0	UM	M31	0.2	ug		< 0.2									
selenium	7782-49-2	U	M31	0.5	ug		< 0.5									
thallium	7440-28-0	UM	M31	0.2	ug		< 0.2									
vanadium	7440-62-2	UM	M31	0.2	ug		0.4									
arsenic	7440-38-2	UM	M31	0.3	ug/L			< 0.3	< 0.3							
cadmium	7440-43-9	UM	M31	0.2	ug/L			0.2	< 0.2		< 0.2	< 0.2				< 0.2
cobalt	7440-48-4	UM	M31	0.2	ug/L			0.3	< 0.2							
chromium	7440-47-3	UM	M31	0.2	ug/L			29.0	2.9							
copper	7440-50-8	UM	M31	0.4	ug/L			23.6	8.8							
manganese	7439-96-5	UM	M31	0.2	ug/L			3.9	2.2							
nickel	7440-02-0	UM	M31	0.3	ug/L			2.1	0.9		4.4	0.7				3.7
lead	7439-92-1	UM	M31	0.2	ug/L			10.8	5.4							

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Results Summary

Report No.: 23-03559-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: P5350

Customer Sample No	ECL/23/1847	ECL/23/1848	ECL/23/1849	ECL/23/1850	ECL/23/1851	ECL/23/1852	ECL/23/1853	ECL/23/1854	ECL/23/1855	ECL/23/1856	ECL/23/1857
RPS Sample No	170624	170625	170626	170627	170628	170629	170630	170631	170632	170633	170634
Sample Matrix	FILTER	SOLUTION	SOLUTION	SOLUTION	FILTER	SOLUTION	SOLUTION	SOLUTION	FILTER	SOLUTION	SOLUTION
Sampling Date	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023

Determinand	CAS No	Codes	SOP	RL	Units								
antimony	7440-36-0	UM	M31	0.2	ug/L			< 0.2	< 0.2				
selenium	7782-49-2	U	M31	0.6	ug/L			< 0.6	< 0.6				
thallium	7440-28-0	UM	M31	0.2	ug/L			< 0.2	< 0.2				
vanadium	7440-62-2	UM	M31	0.1	ug/L			< 0.1	< 0.1				

Results Summary

Report No.: 23-03559-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: P5350

Customer Sample No	ECL/23/1858	ECL/23/1859	ECL/23/1860	ECL/23/1861	ECL/23/1862
RPS Sample No	170635	170636	170637	170638	170639
Sample Matrix	SOLUTION	FILTER	SOLUTION	SOLUTION	SOLUTION
Sampling Date	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023

Determinand	CAS No	Codes	SOP	RL	Units					
antimony	7440-36-0	UM	M31	0.2	ug/L			< 0.2	< 0.2	
selenium	7782-49-2	U	M31	0.6	ug/L			< 0.6	< 0.6	
thallium	7440-28-0	UM	M31	0.2	ug/L			< 0.2	< 0.2	
vanadium	7440-62-2	UM	M31	0.1	ug/L			< 0.1	< 0.1	

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/Voo6
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Results Summary

Report No.: 23-03559-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: P5350

Customer Sample No	ECL/23/1858	ECL/23/1859	ECL/23/1860	ECL/23/1861	ECL/23/1862
RPS Sample No	170635	170636	170637	170638	170639
Sample Matrix	SOLUTION	FILTER	SOLUTION	SOLUTION	SOLUTION
Sampling Date	17/03/2023	17/03/2023	17/03/2023	17/03/2023	17/03/2023

Determinand	CAS No	Codes	SOP	RL	Units					
volume of sample supplied		U	N/A	n/a	ml	329		65	454	180
arsenic	7440-38-2	UM	M31	0.2	ug		< 0.2			
cadmium	7440-43-9	UM	M31	0.2	ug		< 0.2			
cobalt	7440-48-4	UM	M31	0.2	ug		< 0.2			
chromium	7440-47-3	UM	M31	0.3	ug		0.5			
copper	7440-50-8	UM	M31	0.2	ug		< 0.2			
manganese	7439-96-5	UM	M31	0.2	ug		1.1			
nickel	7440-02-0	UM	M31	0.5	ug		< 0.5			
lead	7439-92-1	UM	M31	0.3	ug		< 0.3			
antimony	7440-36-0	UM	M31	0.4	ug		< 0.4			
selenium	7782-49-2	U	M31	0.2	ug		< 0.2			
thallium	7440-28-0	UM	M31	0.2	ug		< 0.2			
vanadium	7440-62-2	UM	M31	0.2	ug		< 0.2			
arsenic	7440-38-2	UM	M31	0.3	ug			< 0.3		
cadmium	7440-43-9	UM	M31	0.3	ug			< 0.3		
cobalt	7440-48-4	UM	M31	0.3	ug			< 0.3		
chromium	7440-47-3	UM	M31	0.3	ug			< 0.3		
copper	7440-50-8	UM	M31	0.4	ug			< 0.4		
manganese	7439-96-5	UM	M31	0.2	ug			0.7		
nickel	7440-02-0	UM	M31	0.1	ug			< 0.1		
lead	7439-92-1	UM	M31	0.2	ug			< 0.2		
antimony	7440-36-0	UM	M31	0.2	ug			< 0.2		
selenium	7782-49-2	U	M31	0.5	ug			< 0.5		
thallium	7440-28-0	UM	M31	0.2	ug			< 0.2		
vanadium	7440-62-2	UM	M31	0.2	ug			< 0.2		
arsenic	7440-38-2	UM	M31	0.3	ug/L				< 0.3	< 0.3
cadmium	7440-43-9	UM	M31	0.2	ug/L	< 0.2			< 0.2	< 0.2
cobalt	7440-48-4	UM	M31	0.2	ug/L				< 0.2	1.7
chromium	7440-47-3	UM	M31	0.2	ug/L				0.7	1.3
copper	7440-50-8	UM	M31	0.4	ug/L				< 0.4	1.8
manganese	7439-96-5	UM	M31	0.2	ug/L				0.5	4.1
nickel	7440-02-0	UM	M31	0.3	ug/L	0.6			0.4	4.6
lead	7439-92-1	UM	M31	0.2	ug/L				0.5	5.1

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Results Summary

Report No.: 23-02221-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

Customer Sample No	ECL/23/0486	ECL/23/0487	ECL/23/0488	ECL/23/0489	ECL/23/0490	ECL/23/0491	ECL/23/0492	ECL/23/0493	ECL/23/0494	ECL/23/0495
RPS Sample No	163817	163818	163819	163820	163821	163822	163823	163824	163825	163826
Sample Matrix	FILTER	SOLUTION	FILTER	SOLUTION	FILTER	SOLUTION	FILTER	SOLUTION	FILTER	SOLUTION
Sampling Date	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023

Determinand	CAS No	Codes	SOP	RL	Units									
particulates		UM	D9	0.04	mg	S/C		S/C		S/C		S/C		S/C
particulates		UM	D9	0.5	mg		< 0.5		< 0.5		< 0.5		< 0.5	

Comments

Report No.: 23-02221-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

RPS Sample Number	Customer Number	Sample Comments
163817	ECL/23/0486	<0.1 mg
163819	ECL/23/0488	<0.1 mg
163821	ECL/23/0490	<0.1 mg
163823	ECL/23/0492	<0.1 mg
163825	ECL/23/0494	<0.1 mg

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Results Summary

Report No.: 23-02222-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

Customer Sample No	ECL/23/0496	ECL/23/0497	ECL/23/0498	ECL/23/0499	ECL/23/0500	ECL/23/0501
RPS Sample No	163827	163828	163829	163830	163831	163832
Sample Matrix	SOLUTION	SOLUTION	SOLUTION	SOLUTION	SOLUTION	SOLUTION
Sampling Date	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023	23/02/2023

Determinand	CAS No	Codes	SOP	RL	Units						
volume of sample supplied		U	N/A	n/a	ml	562	177	572	382	157	347
hydrogen chloride	7647-01-0	UM	C27	0.05	ug/mL				0.07	< 0.05	< 0.05
sulphur dioxide	7446-09-5	UM	C27	0.05	ug/mL	0.19	0.19	0.23			
hydrogen fluoride	7664-39-3	UM	C27	0.05	ug/mL				< 0.05	< 0.05	< 0.05

Results Summary

Report No.: 23-02223-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

Customer Sample No	ECL/23/0502	ECL/23/0503	ECL/23/0504	ECL/23/0505	ECL/23/0506	ECL/23/0507	ECL/23/0508	ECL/23/0509	ECL/23/0510	ECL/23/0511	ECL/23/0512
RPS Sample No	163833	163834	163835	163836	163837	163838	163839	163840	163841	163842	163843
Sample Matrix	FILTER	SOLUTION	SOLUTION	SOLUTION	FILTER	SOLUTION	SOLUTION	SOLUTION	FILTER	SOLUTION	SOLUTION
Sampling Date	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023

Determinand	CAS No	Codes	SOP	RL	Units						
antimony	7440-36-0	UM	M31	0.2	ug/L			0.4	< 0.2		
selenium	7782-49-2	U	M31	0.6	ug/L			< 0.6	< 0.6		
thallium	7440-28-0	UM	M31	0.2	ug/L			< 0.2	< 0.2		
vanadium	7440-62-2	UM	M31	0.1	ug/L			0.2	< 0.1		

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Results Summary

Report No.: 23-02223-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

Customer Sample No	ECL/23/0502	ECL/23/0503	ECL/23/0504	ECL/23/0505	ECL/23/0506	ECL/23/0507	ECL/23/0508	ECL/23/0509	ECL/23/0510	ECL/23/0511	ECL/23/0512
RPS Sample No	163833	163834	163835	163836	163837	163838	163839	163840	163841	163842	163843
Sample Matrix	FILTER	SOLUTION	SOLUTION	SOLUTION	FILTER	SOLUTION	SOLUTION	SOLUTION	FILTER	SOLUTION	SOLUTION
Sampling Date	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023

Determinand	CAS No	Codes	SOP	RL	Units										
volume of sample supplied		U	N/A	n/a	ml		81	535	162		114	539	175	118	489
arsenic	7440-38-2	UM	M31	0.2	ug	< 0.2									
cadmium	7440-43-9	UM	M31	0.2	ug	< 0.2			< 0.2				< 0.2		
cobalt	7440-48-4	UM	M31	0.2	ug	1.8									
chromium	7440-47-3	UM	M31	0.3	ug	1.9									
copper	7440-50-8	UM	M31	0.2	ug	0.5									
manganese	7439-96-5	UM	M31	0.2	ug	2.6									
nickel	7440-02-0	UM	M31	0.5	ug	4.0			8.0					3.9	
lead	7439-92-1	UM	M31	0.3	ug	1.3									
antimony	7440-36-0	UM	M31	0.4	ug	< 0.4									
selenium	7782-49-2	U	M31	0.2	ug	< 0.2									
thallium	7440-28-0	UM	M31	0.2	ug	< 0.2									
vanadium	7440-62-2	UM	M31	0.2	ug	< 0.2									
arsenic	7440-38-2	UM	M31	0.3	ug		< 0.3								
cadmium	7440-43-9	UM	M31	0.3	ug		< 0.3			< 0.3				< 0.3	
cobalt	7440-48-4	UM	M31	0.3	ug		4.1								
chromium	7440-47-3	UM	M31	0.3	ug		0.9								
copper	7440-50-8	UM	M31	0.4	ug		1.2								
manganese	7439-96-5	UM	M31	0.2	ug		5.9								
nickel	7440-02-0	UM	M31	0.1	ug		11.9			5.0				5.7	
lead	7439-92-1	UM	M31	0.2	ug		0.9								
antimony	7440-36-0	UM	M31	0.2	ug		< 0.2								
selenium	7782-49-2	U	M31	0.5	ug		< 0.5								
thallium	7440-28-0	UM	M31	0.2	ug		< 0.2								
vanadium	7440-62-2	UM	M31	0.2	ug		< 0.2								
arsenic	7440-38-2	UM	M31	0.3	ug/L			< 0.3	< 0.3						
cadmium	7440-43-9	UM	M31	0.2	ug/L			0.3	< 0.2		< 0.2	< 0.2			< 0.2
cobalt	7440-48-4	UM	M31	0.2	ug/L			111	4.8						
chromium	7440-47-3	UM	M31	0.2	ug/L			6.1	0.8						
copper	7440-50-8	UM	M31	0.4	ug/L			13.7	1.0						
manganese	7439-96-5	UM	M31	0.2	ug/L			86.2	5.3						
nickel	7440-02-0	UM	M31	0.3	ug/L			127	6.8		26.0	1.4			16.0
lead	7439-92-1	UM	M31	0.2	ug/L			49.6	3.1						

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Results Summary

Report No.: 23-02223-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

Customer Sample No	ECL/23/0513	ECL/23/0514	ECL/23/0515	ECL/23/0516	ECL/23/0517
RPS Sample No	163844	163845	163846	163847	163848
Sample Matrix	SOLUTION	FILTER	SOLUTION	SOLUTION	SOLUTION
Sampling Date	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023

Determinand	CAS No	Codes	SOP	RL	Units					
volume of sample supplied		U	N/A	n/a	ml	191		92	560	103
arsenic	7440-38-2	UM	M31	0.2	ug		< 0.2			
cadmium	7440-43-9	UM	M31	0.2	ug		< 0.2			
cobalt	7440-48-4	UM	M31	0.2	ug		< 0.2			
chromium	7440-47-3	UM	M31	0.3	ug		0.8			
copper	7440-50-8	UM	M31	0.2	ug		< 0.2			
manganese	7439-96-5	UM	M31	0.2	ug		0.4			
nickel	7440-02-0	UM	M31	0.5	ug		0.7			
lead	7439-92-1	UM	M31	0.3	ug		< 0.3			
antimony	7440-36-0	UM	M31	0.4	ug		< 0.4			
selenium	7782-49-2	U	M31	0.2	ug		< 0.2			
thallium	7440-28-0	UM	M31	0.2	ug		< 0.2			
vanadium	7440-62-2	UM	M31	0.2	ug		< 0.2			
arsenic	7440-38-2	UM	M31	0.3	ug			< 0.3		
cadmium	7440-43-9	UM	M31	0.3	ug			< 0.3		
cobalt	7440-48-4	UM	M31	0.3	ug			0.5		
chromium	7440-47-3	UM	M31	0.3	ug			0.7		
copper	7440-50-8	UM	M31	0.4	ug			< 0.4		
manganese	7439-96-5	UM	M31	0.2	ug			0.7		
nickel	7440-02-0	UM	M31	0.1	ug			0.8		
lead	7439-92-1	UM	M31	0.2	ug			1.9		
antimony	7440-36-0	UM	M31	0.2	ug			< 0.2		
selenium	7782-49-2	U	M31	0.5	ug			< 0.5		
thallium	7440-28-0	UM	M31	0.2	ug			< 0.2		
vanadium	7440-62-2	UM	M31	0.2	ug			< 0.2		
arsenic	7440-38-2	UM	M31	0.3	ug/L				< 0.3	< 0.3
cadmium	7440-43-9	UM	M31	0.2	ug/L	< 0.2			< 0.2	< 0.2
cobalt	7440-48-4	UM	M31	0.2	ug/L				0.7	7.2
chromium	7440-47-3	UM	M31	0.2	ug/L				0.5	0.9
copper	7440-50-8	UM	M31	0.4	ug/L				< 0.4	2.0
manganese	7439-96-5	UM	M31	0.2	ug/L				0.9	8.2
nickel	7440-02-0	UM	M31	0.3	ug/L	2.0			37.3	9.5
lead	7439-92-1	UM	M31	0.2	ug/L				1.2	13.0

Environmental Compliance Limited

Ecobat Solutions
 Permit No
 Variation No
 Report Ref

: EPR/DB3704FG
 : EPR/DB3704FG/V006
 : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Results Summary

Report No.: 23-02223-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0267 P5350

Customer Sample No	ECL/23/0513	ECL/23/0514	ECL/23/0515	ECL/23/0516	ECL/23/0517
RPS Sample No	163844	163845	163846	163847	163848
Sample Matrix	SOLUTION	FILTER	SOLUTION	SOLUTION	SOLUTION
Sampling Date	21/02/2023	21/02/2023	21/02/2023	21/02/2023	21/02/2023

Determinand	CAS No	Codes	SOP	RL	Units					
antimony	7440-36-0	UM	M31	0.2	ug/L				< 0.2	< 0.2
selenium	7782-49-2	U	M31	0.6	ug/L				< 0.6	< 0.6
thallium	7440-28-0	UM	M31	0.2	ug/L				< 0.2	< 0.2
vanadium	7440-62-2	UM	M31	0.1	ug/L				< 0.1	< 0.1

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

276611 Dioxin / PCB Results

Sample Type : Stack
 MSS Sample Ref : 276611
 Customer Sample Ref : ECL/23/0404 - ECL/23/0406
 Sample Condition : Non-Conforming ⁽¹⁾
 Test Method : 2002b

Congener	LOD	Detected	Lower Bound	Upper Bound	Recovery	Sampling Recovery	UKAS
Dioxins/Furans	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
2378-TCDD	0.00219	< 0.00219	0.0000	0.00219	92		M
12378-PeCDD	0.00225	< 0.00225	0.0000	0.00112	91		M
123478-HxCDD	0.00427	< 0.00427	0.0000	0.00043	82		M
123678-HxCDD	0.00264	< 0.00264	0.0000	0.00026	80		M
123789-HxCDD	0.00274	< 0.00274	0.0000	0.00027			M
1234678-HpCDD	0.00383	< 0.00383	0.0000	0.00004	72		M
OCDD	0.00371	0.00715	0.00001	0.00001	52		M
Dioxins Total			0.00001	0.00432			M
2378-TCDF	0.00240	< 0.00240	0.0000	0.00024	88		M
12378-PeCDF	0.00248	< 0.00248	0.0000	0.00012		116	M
23478-PeCDF	0.00246	0.00326	0.00163	0.00163	76		M
123478-HxCDF	0.00241	< 0.00241	0.0000	0.00024	84		M
123678-HxCDF	0.00250	< 0.00250	0.0000	0.00025	88		M
234678-HxCDF	0.00340	< 0.00340	0.0000	0.00034	87		M
123789-HxCDF	0.00257	< 0.00257	0.0000	0.00026		94	M
1234678-HpCDF	0.00242	0.00394	0.00004	0.00004	76		M
1234789-HpCDF	0.00255	< 0.00255	0.0000	0.00003		92	M
OCDF	0.00375	0.00797	0.00001	0.00001	46		M
Furans Total			0.00168	0.00315			M
Dioxin/Furan Total			0.00168	0.00748			M
DL PCB/WHO12	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
PCB-81	0.0104	< 0.0104	0.0000	0.00000	93		M
PCB-77	0.0123	0.134	0.00001	0.00001	97		M
PCB-123	0.00215	0.0184	0.00000	0.00000	91		M
PCB-118	0.0158	0.168	0.00001	0.00001	88		M
PCB-114	0.00517	0.0148	0.00000	0.00000	96		M
PCB-105	0.0126	0.0547	0.00000	0.00000	98		M
PCB-126	0.0175	< 0.0175	0.0000	0.00175	95		M
PCB-167	0.0168	< 0.0168	0.0000	0.00000	96		M
PCB-156	0.0175	< 0.0175	0.0000	0.00000	100		M
PCB-157	0.0159	< 0.0159	0.0000	0.00000	99		M
PCB-169	0.0149	< 0.0149	0.0000	0.00045	92		M
PCB-189	0.0170	< 0.0170	0.0000	0.00000	99		M
PCB-60						103	M
PCB-159						119	M
WHO12 Total			0.00002	0.00223			M

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

276611 Brominated Dioxin Results

Sample Type : Stack
 MSS Sample Ref : 276611
 Customer Sample Ref : ECL/23/0404 - ECL/23/0406
 Sample Condition : Conforming
 Test Method : 2002b

Congener	LOD	Detected	Lower Bound	Upper Bound	Recovery	Sampling Recovery	UKAS
Dioxins/Furans	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
2,3,7,8-TBDD	0.00152	< 0.00152	0.0000	0.00152	107		N
1,2,3,7,8-PBDD	0.00215	< 0.00215	0.0000	0.00108	128		N
1,2,3,4,7,8/ 1,2,3,6,7,8-HxBDD	0.0319	< 0.0319	0.0000	0.00319	101		N
1,2,3,7,8,9-HxBDD	0.0365	< 0.0365	0.0000	0.00365			N
1,2,3,4,6,7,8-HpBDD	0.00915	< 0.00915	0.0000	0.00009	89		N
OBDD	0.0244	< 0.0244	0.0000	0.00002	73		N
Dioxins total			0.0000	0.00956			
2,3,7,8-TBDF	0.00184	< 0.00184	0.0000	0.00018	127		
1,2,3,7,8-PBDF	0.00324	< 0.00324	0.0000	0.00016			N
2,3,4,7,8-PBDF	0.00298	< 0.00298	0.0000	0.00149	107		N
1,2,3,4,7,8/ 1,2,3,6,7,8-HxBDF	0.00455	< 0.00455	0.0000	0.00046	107		N
1,2,3,4,6,7,8-HpBDF	0.00783	0.0627	0.00063	0.00063	95		N
OBDF	0.115	0.286	0.00029	0.00029	31		N
Furans total			0.00091	0.00321			
2,4,6,8-TBDD						96	
Dioxin/Furan total			0.00091	0.0128			

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

276612 Dioxin / PCB Results

Sample Type : Stack
 MSS Sample Ref : 276612
 Customer Sample Ref : ECL/23/0407 - ECL/23/0409
 Sample Condition : Non-Conforming⁽¹⁾
 Test Method : 2002b

Congener	LOD	Detected	Lower Bound	Upper Bound	Recovery	Sampling Recovery	UKAS
Dioxins/Furans	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
2378-TCDD	0.00119	< 0.00119	0.0000	0.00119	101		M
12378-PeCDD	0.00155	< 0.00155	0.0000	0.00077	92		M
123478-HxCDD	0.00327	< 0.00327	0.0000	0.00033	84		M
123678-HxCDD	0.00264	< 0.00264	0.0000	0.00026	79		M
123789-HxCDD	0.00274	< 0.00274	0.0000	0.00027			M
1234678-HpCDD	0.00383	< 0.00383	0.0000	0.00004	75		M
OCDD	0.00371	< 0.00371	0.0000	0.00000	58		M
Dioxins Total			0.0000	0.00287			M
2378-TCDF	0.00170	< 0.00170	0.0000	0.00017	89		M
12378-PeCDF	0.00170	< 0.00170	0.0000	0.00009		114	M
23478-PeCDF	0.00180	< 0.00180	0.0000	0.00090	79		M
123478-HxCDF	0.00241	< 0.00241	0.0000	0.00024	88		M
123678-HxCDF	0.00250	< 0.00250	0.0000	0.00025	81		M
234678-HxCDF	0.00340	< 0.00340	0.0000	0.00034	88		M
123789-HxCDF	0.00257	< 0.00257	0.0000	0.00026		97	M
1234678-HpCDF	0.00242	< 0.00242	0.0000	0.00002	76		M
1234789-HpCDF	0.00310	< 0.00310	0.0000	0.00003		102	M
OCDF	0.00475	< 0.00475	0.0000	0.00000	49		M
Furans Total			0.0000	0.00230			M
Dioxin/Furan Total			0.0000	0.00517			M
DL PCB/WHO12	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
PCB-81	0.0104	< 0.0104	0.0000	0.00000	106		M
PCB-77	0.0123	< 0.0123	0.0000	0.00000	100		M
PCB-123	0.0120	< 0.0120	0.0000	0.00000	91		M
PCB-118	0.0158	< 0.0158	0.0000	0.00000	85		M
PCB-114	0.00517	0.00957	0.00000	0.00000	90		M
PCB-105	0.0126	< 0.0126	0.0000	0.00000	90		M
PCB-126	0.0175	< 0.0175	0.0000	0.00175	98		M
PCB-167	0.0168	< 0.0168	0.0000	0.00000	107		M
PCB-156	0.0175	< 0.0175	0.0000	0.00000	95		M
PCB-157	0.0159	< 0.0159	0.0000	0.00000	94		M
PCB-169	0.0149	< 0.0149	0.0000	0.00045	88		M
PCB-189	0.0170	< 0.0170	0.0000	0.00000	87		M
PCB-60						102	M
PCB-159						120	M
WHO12 Total			0.00000	0.00221			M

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

276612 Brominated Dioxin Results

Sample Type : Stack
 MSS Sample Ref : 276612
 Customer Sample Ref : ECL/23/0407 - ECL/23/0409
 Sample Condition : Conforming
 Test Method : 2002b

Congener	LOD	Detected	Lower Bound	Upper Bound	Recovery	Sampling Recovery	UKAS
Dioxins/Furans	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
2,3,7,8-TBDD	0.00183	< 0.00183	0.0000	0.00183	102		N
1,2,3,7,8-PBDD	0.00215	< 0.00215	0.0000	0.00107	98		N
1,2,3,4,7,8/ 1,2,3,6,7,8-HxBDD	0.0327	< 0.0327	0.0000	0.00327	88		N
1,2,3,7,8,9-HxBDD	0.0374	< 0.0374	0.0000	0.00374			N
1,2,3,4,6,7,8-HpBDD	0.0230	< 0.0230	0.0000	0.00023	61		N
OBDD	0.0403	< 0.0403	0.0000	0.00004	37		N
Dioxins total			0.0000	0.0102			
2,3,7,8-TBDF	0.00222	< 0.00222	0.0000	0.00022	108		
1,2,3,7,8-PBDF	0.00324	< 0.00324	0.0000	0.00016			N
2,3,4,7,8-PBDF	0.00299	< 0.00299	0.0000	0.00149	92		N
1,2,3,4,7,8/ 1,2,3,6,7,8-HxBDF	0.0113	< 0.0113	0.0000	0.00113	83		N
1,2,3,4,6,7,8-HpBDF	0.00906	< 0.00906	0.0000	0.00009	61		N
OBDF	0.306	< 0.306	0.0000	0.00031	8		N
Furans total			0.0000	0.00341			
2,4,6,8-TBDD						82	
Dioxin/Furan total			0.0000	0.0136			

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

283712 Dioxin / PCB Results

Sample Type : Stack
 MSS Sample Ref : 283712
 Customer Sample Ref : ECL/23/0442 - ECL/23/0444
 Sample Condition : Conforming
 Test Method : 2002b

Congener	LOD	Detected	Lower Bound	Upper Bound	Recovery	Sampling Recovery	UKAS
Dioxins/Furans	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
2378-TCDD	0.00028	< 0.00028	0.0000	0.00028	99		M
12378-PeCDD	0.00048	< 0.00048	0.0000	0.00024	93		M
123478-HxCDD	0.00069	< 0.00069	0.0000	0.00007	86		M
123678-HxCDD	0.00070	0.00382	0.00038	0.00038	83		M
123789-HxCDD	0.00073	0.00177	0.00018	0.00018			M
1234678-HpCDD	0.00049	0.0177	0.00018	0.00018	84		M
OCDD	0.00040	0.0644	0.00006	0.00006	80		M
Dioxins Total			0.00080	0.00138			M
2378-TCDF	0.00054	0.00572	0.00057	0.00057	88		M
12378-PeCDF	0.00068	0.00388	0.00019	0.00019		112	M
23478-PeCDF	0.00061	0.00483	0.00241	0.00241	85		M
123478-HxCDF	0.00047	0.00559	0.00056	0.00056	83		M
123678-HxCDF	0.00046	0.00491	0.00049	0.00049	78		M
234678-HxCDF	0.00042	0.00547	0.00055	0.00055	85		M
123789-HxCDF	0.00043	< 0.00043	0.0000	0.00004		90	M
1234678-HpCDF	0.00032	0.0217	0.00022	0.00022	80		M
1234789-HpCDF	0.00039	0.00312	0.00003	0.00003		105	M
OCDF	0.00022	0.0131	0.00001	0.00001	75		M
Furans Total			0.00504	0.00508			M
Dioxin/Furan Total			0.00584	0.00647			M
DL PCB/WHO12	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
PCB-105	0.00370	0.373	0.00001	0.00001	124		M
PCB-114	0.00333	0.0365	0.00000	0.00000	128		M
PCB-118	0.00318	1.07	0.00003	0.00003	115		M
PCB-123	0.00348	0.0313	0.00000	0.00000	117		M
PCB-126	0.00068	0.0136	0.00136	0.00136	112		M
PCB-156	0.00195	0.0380	0.00000	0.00000	105		M
PCB-157	0.00205	0.00699	0.00000	0.00000	108		M
PCB-167	0.00185	0.0161	0.00000	0.00000	106		M
PCB-169	0.00009	< 0.00009	0.0000	0.00000	94		M
PCB-189	0.00069	0.00730	0.00000	0.00000	94		M
PCB-77	0.00109	1.05	0.00011	0.00011	89		M
PCB-81	0.00136	0.0751	0.00002	0.00002	63		M
PCB-60						110	M
PCB-159						105	M
WHO12 Total			0.00154	0.00154			M

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

283712 Brominated Dioxin Results

Sample Type : Stack
 MSS Sample Ref : 283712
 Customer Sample Ref : ECL/23/0442 - ECL/23/0444
 Sample Condition : Conforming
 Test Method : 2002b

Congener	LOD	Detected	Lower Bound	Upper Bound	Recovery	Sampling Recovery	UKAS
Dioxins/Furans	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
2,3,7,8-TBDD	0.00425	< 0.00425	0.0000	0.00425	68		N
1,2,3,7,8-PBDD	0.00392	< 0.00392	0.0000	0.00196	121		N
1,2,3,4,7,8/ 1,2,3,6,7,8-HxBDD	0.0297	< 0.0297	0.0000	0.00297	102		N
1,2,3,7,8,9-HxBDD	0.0307	< 0.0307	0.0000	0.00307			N
1,2,3,4,6,7,8-HpBDD	0.0827	< 0.0827	0.0000	0.00083	72		N
OBDD	0.788	< 0.788	0.0000	0.00079	19 ⁽¹⁾		N
Dioxins total			0.0000	0.0139			
2,3,7,8-TBDF	0.00150	< 0.00150	0.0000	0.00015	112		
1,2,3,7,8-PBDF	0.00215	< 0.00215	0.0000	0.00011			N
2,3,4,7,8-PBDF	0.00226	< 0.00226	0.0000	0.00113	106		N
1,2,3,4,7,8/ 1,2,3,6,7,8-HxBDF	0.0275	< 0.0275	0.0000	0.00275	126		N
1,2,3,4,6,7,8-HpBDF	0.0120	0.0623	0.00062	0.00062	138		N
OBDF	0.145	0.196	0.00020	0.00020	13 ⁽¹⁾		N
Furans total			0.00082	0.00496			
2,4,6,8-TBDD						57	
Dioxin/Furan total			0.00082	0.0188			

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

283713 Dioxin / PCB Results

Sample Type : Stack
 MSS Sample Ref : 283713
 Customer Sample Ref : ECL/23/0445 -ECL/23/0447
 Sample Condition : Conforming
 Test Method : 2002b

Congener	LOD	Detected	Lower Bound	Upper Bound	Recovery	Sampling Recovery	UKAS
Dioxins/Furans	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
2378-TCDD	0.00033	< 0.00033	0.0000	0.00033	101		M
12378-PeCDD	0.00056	< 0.00056	0.0000	0.00028	100		M
123478-HxCDD	0.00048	< 0.00048	0.0000	0.00005	85		M
123678-HxCDD	0.00050	< 0.00050	0.0000	0.00005	85		M
123789-HxCDD	0.00052	0.00078	0.00008	0.00008			M
1234678-HpCDD	0.00037	0.0106	0.00011	0.00011	89		M
OCDD	0.00035	0.0426	0.00004	0.00004	86		M
Dioxins Total			0.00023	0.00094			M
2378-TCDF	0.00071	0.00638	0.00064	0.00064	93		M
12378-PeCDF	0.00076	< 0.00076	0.0000	0.00004		120	M
23478-PeCDF	0.00068	0.00460	0.00230	0.00230	92		M
123478-HxCDF	0.00036	0.00292	0.00029	0.00029	84		M
123678-HxCDF	0.00035	0.00294	0.00029	0.00029	85		M
234678-HxCDF	0.00030	0.00341	0.00034	0.00034	91		M
123789-HxCDF	0.00031	< 0.00031	0.0000	0.00003		98	M
1234678-HpCDF	0.00024	0.0120	0.00012	0.00012	83		M
1234789-HpCDF	0.00029	0.00083	0.00001	0.00001		118	M
OCDF	0.00019	0.00821	0.00001	0.00001	80		M
Furans Total			0.00400	0.00407			M
Dioxin/Furan Total			0.00423	0.00500			M
DL PCB/WHO12	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
PCB-105	0.00288	0.310	0.00001	0.00001	96		M
PCB-114	0.00255	0.0307	0.00000	0.00000	93		M
PCB-118	0.00240	0.831	0.00002	0.00002	93		M
PCB-123	0.00254	0.0229	0.00000	0.00000	96		M
PCB-126	0.00069	0.0137	0.00137	0.00137	118		M
PCB-156	0.00080	0.0258	0.00000	0.00000	98		M
PCB-157	0.00084	0.00859	0.00000	0.00000	101		M
PCB-167	0.00089	0.0125	0.00000	0.00000	97		M
PCB-169	0.00010	0.00284	0.00009	0.00009	104		M
PCB-189	0.00056	0.00518	0.00000	0.00000	86		M
PCB-77	0.00127	0.770	0.00008	0.00008	100		M
PCB-81	0.00145	0.0571	0.00002	0.00002	80		M
PCB-60						116	M
PCB-159						114	M
WHO12 Total			0.00158	0.00158			M

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

283713 Brominated Dioxin Results

Sample Type : Stack
 MSS Sample Ref : 283713
 Customer Sample Ref : ECL/23/0445 -ECL/23/0447
 Sample Condition : Conforming
 Test Method : 2002b

Congener	LOD	Detected	Lower Bound	Upper Bound	Recovery	Sampling Recovery	UKAS
Dioxins/Furans	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
2,3,7,8-TBDD	0.00128	< 0.00128	0.0000	0.00128	64		N
1,2,3,7,8-PBDD	0.00304	< 0.00304	0.0000	0.00152	115		N
1,2,3,4,7,8/ 1,2,3,6,7,8-HxBDD	0.0223	< 0.0223	0.0000	0.00223	91		N
1,2,3,7,8,9-HxBDD	0.0230	< 0.0230	0.0000	0.00230			N
1,2,3,4,6,7,8-HpBDD	0.0288	< 0.0288	0.0000	0.00029	61		N
OBDD	0.473	< 0.473	0.0000	0.00047	18 ⁽¹⁾		N
Dioxins total			0.0000	0.00809			
2,3,7,8-TBDF	0.00138	< 0.00138	0.0000	0.00014	108		
1,2,3,7,8-PBDF	0.00324	< 0.00324	0.0000	0.00016			N
2,3,4,7,8-PBDF	0.00340	< 0.00340	0.0000	0.00170	100		N
1,2,3,4,7,8/ 1,2,3,6,7,8-HxBDF	0.0121	< 0.0121	0.0000	0.00121	96		N
1,2,3,4,6,7,8-HpBDF	0.0101	0.0548	0.00055	0.00055	64		N
OBDF	0.0643	0.159	0.00016	0.00016	13 ⁽¹⁾		N
Furans total			0.00071	0.00391			
2,4,6,8-TBDD						65	
Dioxin/Furan total			0.00071	0.0120			

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

283714 Dioxin / PCB Results

Sample Type : Stack
 MSS Sample Ref : 283714
 Customer Sample Ref : ECL/23/0480 - ECL/23/0482
 Sample Condition : Conforming
 Test Method : 2002b

Congener	LOD	Detected	Lower Bound	Upper Bound	Recovery	Sampling Recovery	UKAS
Dioxins/Furans	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
2378-TCDD	0.00029	< 0.00029	0.0000	0.00029	99		M
12378-PeCDD	0.00041	0.00086	0.00043	0.00043	97		M
123478-HxCDD	0.00036	0.00067	0.00007	0.00007	81		M
123678-HxCDD	0.00035	0.00173	0.00017	0.00017	84		M
123789-HxCDD	0.00035	0.00083	0.00008	0.00008			M
1234678-HpCDD	0.00030	0.0115	0.00012	0.00012	87		M
OCDD	0.00020	0.0430	0.00004	0.00004	86		M
Dioxins Total			0.00091	0.00120			M
2378-TCDF	0.00037	0.00439	0.00044	0.00044	94		M
12378-PeCDF	0.00035	0.00196	0.00010	0.00010		97	M
23478-PeCDF	0.00034	0.00496	0.00248	0.00248	86		M
123478-HxCDF	0.00023	0.00259	0.00026	0.00026	85		M
123678-HxCDF	0.00024	0.00252	0.00025	0.00025	81		M
234678-HxCDF	0.00021	0.00275	0.00028	0.00028	86		M
123789-HxCDF	0.00021	< 0.00021	0.0000	0.00002		85	M
1234678-HpCDF	0.00016	0.00743	0.00007	0.00007	84		M
1234789-HpCDF	0.00018	0.00084	0.00001	0.00001		96	M
OCDF	0.00014	0.00580	0.00001	0.00001	77		M
Furans Total			0.00389	0.00391			M
Dioxin/Furan Total			0.00481	0.00511			M
DL PCB/WHO12	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
PCB-105	0.00198	0.228	0.00001	0.00001	110		M
PCB-114	0.00196	0.0227	0.00000	0.00000	105		M
PCB-118	0.00184	0.620	0.00002	0.00002	95		M
PCB-123	0.00200	0.0170	0.00000	0.00000	97		M
PCB-126	0.00043	0.0117	0.00117	0.00117	109		M
PCB-156	0.00215	0.0427	0.00000	0.00000	97		M
PCB-157	0.00219	0.00760	0.00000	0.00000	95		M
PCB-167	0.00193	0.0165	0.00000	0.00000	97		M
PCB-169	0.00015	0.00214	0.00006	0.00006	94		M
PCB-189	0.00082	0.00475	0.00000	0.00000	82		M
PCB-77	0.00068	0.436	0.00004	0.00004	97		M
PCB-81	0.00062	0.0341	0.00001	0.00001	93		M
PCB-60						106	M
PCB-159						124	M
WHO12 Total			0.00131	0.00131			M

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

283714 Brominated Dioxin Results

Sample Type : Stack
 MSS Sample Ref : 283714
 Customer Sample Ref : ECL/23/0480 - ECL/23/0482
 Sample Condition : Conforming
 Test Method : 2002b

Congener	LOD	Detected	Lower Bound	Upper Bound	Recovery	Sampling Recovery	UKAS
Dioxins/Furans	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
2,3,7,8-TBDD	0.00109	< 0.00109	0.0000	0.00109	103		N
1,2,3,7,8-PBDD	0.00203	< 0.00203	0.0000	0.00101	118		N
1,2,3,4,7,8/ 1,2,3,6,7,8-HxBDD	0.0386	< 0.0386	0.0000	0.00386	98		N
1,2,3,7,8,9-HxBDD	0.0400	< 0.0400	0.0000	0.00400			N
1,2,3,4,6,7,8-HpBDD	0.0790	< 0.0790	0.0000	0.00079	72		N
OBDD	0.823	< 0.823	0.0000	0.00082	22		N
Dioxins total			0.0000	0.0116			
2,3,7,8-TBDF	0.00136	< 0.00136	0.0000	0.00014	99		
1,2,3,7,8-PBDF	0.00332	< 0.00332	0.0000	0.00017			N
2,3,4,7,8-PBDF	0.00348	< 0.00348	0.0000	0.00174	100		N
1,2,3,4,7,8/ 1,2,3,6,7,8-HxBDF	0.00850	< 0.00850	0.0000	0.00085	118		N
1,2,3,4,6,7,8-HpBDF	0.00368	0.0614	0.00061	0.00061	105		N
OBDF	0.0685	0.129	0.00013	0.00013	17 ⁽¹⁾		N
Furans total			0.00074	0.00363			
2,4,6,8-TBDD						95	
Dioxin/Furan total			0.00074	0.0152			

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

283715 Dioxin / PCB Results

Sample Type : Stack
 MSS Sample Ref : 283715
 Customer Sample Ref : ECL/23/0483 -ECL/23/0485
 Sample Condition : Conforming
 Test Method : 2002b

Congener	LOD	Detected	Lower Bound	Upper Bound	Recovery	Sampling Recovery	UKAS
	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
Dioxins/Furans							
2378-TCDD	0.00008	< 0.00008	0.0000	0.00008	94		M
12378-PeCDD	0.00014	< 0.00014	0.0000	0.00007	90		M
123478-HxCDD	0.00012	< 0.00012	0.0000	0.00001	81		M
123678-HxCDD	0.00012	< 0.00012	0.0000	0.00001	76		M
123789-HxCDD	0.00013	< 0.00013	0.0000	0.00001			M
1234678-HpCDD	0.00010	< 0.00010	0.0000	0.00000	81		M
OCDD	0.00026	0.00410	0.00000	0.00000	77		M
Dioxins Total			0.00000	0.00020			M
2378-TCDF	0.00012	< 0.00012	0.0000	0.00001	83		M
12378-PeCDF	0.00010	< 0.00010	0.0000	0.00000		120	M
23478-PeCDF	0.00009	< 0.00009	0.0000	0.00004	84		M
123478-HxCDF	0.00008	< 0.00008	0.0000	0.00001	77		M
123678-HxCDF	0.00007	< 0.00007	0.0000	0.00001	74		M
234678-HxCDF	0.00007	< 0.00007	0.0000	0.00001	82		M
123789-HxCDF	0.00007	< 0.00007	0.0000	0.00001		100	M
1234678-HpCDF	0.00005	0.00042	0.00000	0.00000	75		M
1234789-HpCDF	0.00005	0.00006	0.00000	0.00000		118	M
OCDF	0.00012	< 0.00012	0.0000	0.00000	73		M
Furans Total			0.00000	0.00009			M
Dioxin/Furan Total			0.00001	0.00029			M
DL PCB/WHO12	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
PCB-105	0.00049	0.0110	0.00000	0.00000	90		M
PCB-114	0.00045	0.00097	0.00000	0.00000	90		M
PCB-118	0.00043	0.0244	0.00000	0.00000	90		M
PCB-123	0.00045	< 0.00045	0.0000	0.00000	88		M
PCB-126	0.00043	< 0.00043	0.0000	0.00004	109		M
PCB-156	0.00022	0.00408	0.00000	0.00000	106		M
PCB-157	0.00023	0.00126	0.00000	0.00000	104		M
PCB-167	0.00022	0.00110	0.00000	0.00000	106		M
PCB-169	0.00002	< 0.00002	0.0000	0.00000	96		M
PCB-189	0.00010	< 0.00010	0.0000	0.00000	106		M
PCB-77	0.00029	0.0155	0.00000	0.00000	96		M
PCB-81	0.00025	0.00080	0.00000	0.00000	97		M
PCB-60						109	M
PCB-159						125	M
WHO12 Total			0.00000	0.00005			M

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

283715 Brominated Dioxin Results

Sample Type : Stack
 MSS Sample Ref : 283715
 Customer Sample Ref : ECL/23/0483 -ECL/23/0485
 Sample Condition : Conforming
 Test Method : 2002b

Congener	LOD	Detected	Lower Bound	Upper Bound	Recovery	Sampling Recovery	UKAS
Dioxins/Furans	ng/Sample	ng/Sample	ng/Sample	ng/Sample	%	%	
2,3,7,8-TBDD	0.00169	< 0.00169	0.0000	0.00169	116		N
1,2,3,7,8-PBDD	0.00243	< 0.00243	0.0000	0.00121	118		N
1,2,3,4,7,8/ 1,2,3,6,7,8-HxBDD	0.0250	< 0.0250	0.0000	0.00250	89		N
1,2,3,7,8,9-HxBDD	0.0259	< 0.0259	0.0000	0.00259			N
1,2,3,4,6,7,8-HpBDD	0.0352	< 0.0352	0.0000	0.00035	56		N
OBDD	0.199	< 0.199	0.0000	0.00020	14 ⁽¹⁾		N
Dioxins total			0.0000	0.00855			
2,3,7,8-TBDF	0.00161	< 0.00161	0.0000	0.00016	110		
1,2,3,7,8-PBDF	0.00210	< 0.00210	0.0000	0.00011			N
2,3,4,7,8-PBDF	0.00220	< 0.00220	0.0000	0.00110	98		N
1,2,3,4,7,8/ 1,2,3,6,7,8-HxBDF	0.00286	< 0.00286	0.0000	0.00029	111		N
1,2,3,4,6,7,8-HpBDF	0.0129	< 0.0129	0.0000	0.00013	74		N
OBDF	0.0807	< 0.0807	0.0000	0.00008	13 ⁽¹⁾		N
Furans total			0.0000	0.00186			
2,4,6,8-TBDD						104	
Dioxin/Furan total			0.0000	0.0104			

Environmental Compliance Limited

Ecobat Solutions
Permit No : EPR/DB3704FG
Variation No : EPR/DB3704FG/V006
Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
Visit Details : Emissions Testing – 2023
Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
Report Issue Date : 24th April 2023

UNCERTAINTY CALCULATIONS

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

TVOC Measurement Uncertainty – (Test 1)

Recupyl Shredder Exhaust - TVOC - Measurement Uncertainty - Uncertainty Calculations Table 1

Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Min Certified Ranges
			TVOC 0 - 15 mgC/m ³
Lack of fit ⁽¹⁾	u_{lof}	Rectangular (Divisor = $\sqrt{3}$)	2.00
Span drift ⁽²⁾	$u_{d,s}$	Rectangular (Divisor = $\sqrt{3}$)	0.54
Repeatability Standard Deviation (span) ⁽³⁾	u_r	Normal (Divisor = 1)	39.67
Losses / leakage in the sample system ⁽⁴⁾	u_{loss}	Rectangular (Divisor = $\sqrt{3}$)	25.58
Temperature dependant span drift ⁽⁵⁾	u_t	Rectangular (Divisor = $\sqrt{3}$)	2.40
Interferents ⁽¹⁾	u_i	Rectangular (Divisor = $\sqrt{3}$)	16.67
Uncertainty of Reference Gas ⁽⁶⁾	u_{ref}	Rectangular (Divisor = $\sqrt{3}$)	25.75
Effect of Voltage Fluctuation ⁽⁷⁾	u_v	Rectangular (Divisor = $\sqrt{3}$)	0.50
Effect of Oxygen Synergism ⁽⁷⁾	u_{syn}	Rectangular (Divisor = $\sqrt{3}$)	4.73

Note:

when $(x_{i,max} - x_{i,adj}) = (x_{i,min} - x_{i,adj})$, then $u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$

- 1 Expressed as a percentage of the certified range
- 2 Expressed as maximum drift per 24hr period as percentage of the certified range
- 3 Expressed as a percentage of the certified range
- 4 Expressed as a percentage of the certified range
- 5 Expressed as a percentage of the certified range per one degree centigrade
- 6 Expressed as standard uncertainty in units of measurement i.e. mg/m³ / %Vol taking account of an additional uncertainty of 2% for gas blending
- 7 Expressed as a percentage of the certified range

Recupyl Shredder Exhaust - TVOC - Measurement Uncertainty - Uncertainty Calculations Table 2

Performance Characteristics	Uncertainty	Value of Standard Uncertainty	*TVOC 0 - 15 mgC/m ³
Lack of fit	u_{lof}	$u(x_i) = \frac{u_{lof} \times R_i}{\sqrt{3}} =$	0.17
Span drift	$u_{d,s}$	$u(x_i) = \frac{u_{d,s} \times R_i}{\sqrt{3}} =$	0.047
Repeatability Standard Deviation (span)	u_r	$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}} =$	5.95
Losses / leakage in the sample system	u_{loss}	$u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$	2.22
Temperature dependant span drift	u_t	$u(x_i) = \frac{u_t}{100} \times R_i \times \sqrt{\frac{(x_{i,max} - x_{adj})^2 + (x_{i,min} - x_{adj})(x_{i,max} - x_{adj}) + (x_{i,min} - x_{adj})^2}{3}}$	0.15
Interferents	u_i	$u(x_i) = \frac{u_i \times R_i}{\sqrt{3}} =$	1.44
Uncertainty of Reference Gas	u_{ref}	$u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$	14.87
Effect of Voltage Fluctuation	u_v		0.043
Effect of Oxygen Synergism	u_{syn}		0.41
Combined Standard Uncertainty		$u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$	16.24
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP} = 2 \times u_c$	32.48
Applied Span Concentration			1486.80
Measured Span Concentration, STP Dry Gas			1485.49
Expanded measurement uncertainty as % of Applied Span			2 %

* Sick F3006 FID

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

TVOC Uncertainty of Measurement Results – (Test 1)

Recupyl Shredder Exhaust - TVOC - Uncertainty of Measurement Results - Calculations Part 1

Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Divisor	Min Certified Range
				TVOC 0 - 15 mgC/m ³
Lack of fit ⁽¹⁾	u_{lof}	Rectangular	$\sqrt{3}$	2.00
Span drift ⁽²⁾	u_{ds}			0.54
Losses / leakage in the sample system ⁽⁴⁾	u_{loss}			0.41
Temperature dependant span drift ⁽⁵⁾	u_t			2.40
Interferents ⁽¹⁾	u_i			16.67
Effect of Voltage Fluctuation ⁽⁷⁾	u_v			0.50
Effect of Oxygen Synergism ⁽⁷⁾	u_{svn}			4.73

Notes:

For rectangular distributions, $u(x_i) = \frac{u \times R_i}{\sqrt{3}}$

For $u(x_i) = \Delta x_i \sqrt{\frac{(x_{i,max} - x_{i,adj})^2 + (x_{i,min} - x_{i,adj})^2 + (x_{i,max} - x_{i,min})^2}{3}}$, when $|x_{i,max} - x_{i,adj}| = |x_{i,min} - x_{i,adj}|$, then $u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$

Where $u(x_i) = \frac{\sigma}{\sqrt{n}}$ (See note 6 below), $\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$

Performance Characteristics	Uncertainty (Units of final measurement)	Distribution	Divisor	TVOC 0 - 15 mgC/m ³
Lack of fit	u_{lof}	Rectangular	$\sqrt{3}$	0.17
Span drift	$u_{d.s}$			0.047
Temperature dependant span drift	u_t			0.14
Interferents	u_i			1.44
Effect of Voltage Fluctuation (See Note)	u_v			0.043
Effect of Oxygen Synergism (See Note)	u_{svn}			0.41

Recupyl Shredder Exhaust - TVOC - Uncertainty of Measurement Results - Calculations Part 2

Performance Characteristics	Uncertainty (Units of final measurement)	Date & Time	TVOC 0 - 15 mgC/m ³
Losses / leakage in the sample system	u_{loss}	00/01/00 11:30 - 12:30	1.35
Standard Error of Measured Value	u_{SE}	00/01/00 11:30 - 12:30	2.31

Effect on Uncertainty Caused by Oxygen

$$u_{Corr_{O_2}} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})(20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Meas} = 1.00$$

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.0000$$

$$u_{f_{O_2}} = \frac{u_{Corr_{O_2}}}{f_{O_2}} \times 100 = 0.00 \%$$

The effect of oxygen on the overall uncertainties (below) is incorporated using the following equation:-

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

Where oxygen or moisture correction is required, uncertainty based on the standard error of the measured peripheral value is converted to units of final measurement using a sensitivity coefficient C,

$$\therefore u(x_i) = C_i u_i \text{ where } C_i = \frac{\partial f}{\partial x_i}$$

Recupyl Shredder Exhaust - TVOC - Uncertainty of Measurement Results - Calculations Part 3

Uncertainty	Date & Time	*TVOC 0 - 15 mgC/m ³
Measured Concentration	00/01/00 11:30 - 12:30	324.79
Expanded Uncertainty as Percentage of Measured Concentration		2 %

Combined Standard Uncertainty

Expanded uncertainty (at 95% confidence) $U_{Exp} = 2 \times u_c$

- Expressed as a percentage of the certified range
- Expressed as a percentage of the certified range as maximum drift per 24hr period
- Expressed as a percentage of the certified range
- Expressed as a percentage of the applied span concentration
- Expressed as a percentage of the certified range per one degree centigrade
- Where the uncertainty of moisture is taken from the manual extract test calculations.
- Expressed as a percentage of the certified range
- Where no uncertainty is presented above, the uncertainty is >100%

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

TVOC Measurement Uncertainty – (Test 2)

Recupyl Shredder Exhaust - TVOC - Measurement Uncertainty - Uncertainty Calculations Table 1

Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Min Certified Ranges
			TVOC 0 - 15 mgC/m ³
Lack of fit ⁽¹⁾	u_{lof}	Rectangular (Divisor = $\sqrt{3}$)	2.00
Span drift ⁽²⁾	$u_{d,s}$	Rectangular (Divisor = $\sqrt{3}$)	0.54
Repeatability Standard Deviation (span) ⁽³⁾	u_r	Normal (Divisor = 1)	101.90
Losses / leakage in the sample system ⁽⁴⁾	u_{loss}	Rectangular (Divisor = $\sqrt{3}$)	103.66
Temperature dependant span drift ⁽⁵⁾	u_t	Rectangular (Divisor = $\sqrt{3}$)	2.40
Interferents ⁽¹⁾	u_i	Rectangular (Divisor = $\sqrt{3}$)	16.67
Uncertainty of Reference Gas ⁽⁶⁾	u_{ref}	Rectangular (Divisor = $\sqrt{3}$)	25.75
Effect of Voltage Fluctuation ⁽⁷⁾	u_v	Rectangular (Divisor = $\sqrt{3}$)	0.50
Effect of Oxygen Synergism ⁽⁷⁾	u_{syn}	Rectangular (Divisor = $\sqrt{3}$)	4.73

Note:

when $|x_{i,max} - x_{i,adj}| = |x_{i,min} - x_{i,adj}|$, then $u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$

- Expressed as a percentage of the certified range
- Expressed as maximum drift per 24hr period as percentage of the certified range
- Expressed as a percentage of the certified range
- Expressed as a percentage of the certified range
- Expressed as a percentage of the certified range per one degree centigrade
- Expressed as standard uncertainty in units of measurement i.e. mg/m³ / %Vol taking account of an additional uncertainty of 2% for gas blending
- Expressed as a percentage of the certified range

Recupyl Shredder Exhaust - TVOC - Measurement Uncertainty - Uncertainty Calculations Table 2

Performance Characteristics	Uncertainty	Value of Standard Uncertainty	*TVOC 0 - 15 mgC/m ³
Lack of fit	u_{lof}	$u(x_i) = \frac{u_{lof} \times R_i}{\sqrt{3}} =$	0.17
Span drift	$u_{d,s}$	$u(x_i) = \frac{u_{d,s} \times R_i}{\sqrt{3}} =$	0.047
Repeatability Standard Deviation (span)	u_r	$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}} =$	15.29
Losses / leakage in the sample system	u_{loss}	$u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$	8.98
Temperature dependant span drift	u_t	$u(x_i) = \frac{u_t}{100} \times R_i \times \sqrt{\frac{(x_{i,max} - x_{adj})^2 + (x_{i,min} - x_{adj})(x_{i,max} - x_{adj}) + (x_{i,min} - x_{adj})^2}{3}}$	0.21
Interferents	u_i	$u(x_i) = \frac{u_i \times R_i}{\sqrt{3}} =$	1.44
Uncertainty of Reference Gas	u_{ref}	$u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$	14.87
Effect of Voltage Fluctuation	u_v		0.043
Effect of Oxygen Synergism	u_{syn}		0.41
Combined Standard Uncertainty		$u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$	23.19
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP} = 2 \times u_c$	46.37
Applied Span Concentration			1486.80
Measured Span Concentration, STP Dry Gas			1462.56
Expanded measurement uncertainty as % of Applied Span			3 %

* Sick F3006 FID

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

TVOC Uncertainty of Measurement Results – (Test 2)

Recupyl Shredder Exhaust - TVOC - Uncertainty of Measurement Results - Calculations Part 1

Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Divisor	Min Certified Range
				TVOC 0 - 15 mgC/m ³
Lack of fit ⁽¹⁾	u_{lof}	Rectangular	$\sqrt{3}$	2.00
Span drift ⁽²⁾	$u_{d,s}$			0.54
Losses / leakage in the sample system ⁽⁴⁾	u_{loss}			1.68
Temperature dependant span drift ⁽⁵⁾	u_t			2.40
Interferents ⁽¹⁾	u_i			16.67
Effect of Voltage Fluctuation ⁽⁷⁾	u_v			0.50
Effect of Oxygen Synergism ⁽⁷⁾	u_{syn}			4.73

Notes:

For rectangular distributions, $u(x_i) = \frac{u \times R_i}{\sqrt{3}}$

For $u(x_i) = \Delta x_i \sqrt{\frac{(x_{i,max} - x_{i,adj})^2 + (x_{i,min} - x_{i,adj})^2}{3}}$, when $(x_{i,max} - x_{i,adj}) = (x_{i,min} - x_{i,adj})$, then $u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$

Where $u(x_i) = \frac{\sigma}{\sqrt{n}}$ (See note 6 below), $\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$

Performance Characteristics	Uncertainty (Units of final measurement)	Distribution	Divisor	TVOC 0 - 15 mgC/m ³
Lack of fit	u_{lof}	Rectangular	$\sqrt{3}$	0.17
Span drift	$u_{d,s}$			0.047
Temperature dependant span drift	u_t			0.21
Interferents	u_i			1.44
Effect of Voltage Fluctuation (See Note)	u_v			0.043
Effect of Oxygen Synergism (See Note)	u_{syn}			0.41

Recupyl Shredder Exhaust - TVOC - Uncertainty of Measurement Results - Calculations Part 2

Performance Characteristics	Uncertainty (Units of final measurement)	Date & Time	TVOC 0 - 15 mgC/m ³
Losses / leakage in the sample system	u_{loss}	15/02/23 11:00 - 12:00	2.54
Standard Error of Measured Value	u_{SE}	15/02/23 11:00 - 12:00	0.61

Effect on Uncertainty Caused by Oxygen

$$u_{Corr_{O_2}} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})(20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Meas} = 1.00$$

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.0000$$

$$uf_{O_2} = \frac{u_{Corr_{O_2}} \times 100}{f_{O_2}} = 0.00 \%$$

The effect of oxygen on the overall uncertainties (below) is incorporated using the following equation:-

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

Where oxygen or moisture correction is required, uncertainty based on the standard error of the measured peripheral value is converted to units of final measurement using a sensitivity coefficient C,

$$\therefore u(x_i) = C_i u_i \text{ where } C_i = \frac{\partial f}{\partial x_i}$$

Recupyl Shredder Exhaust - TVOC - Uncertainty of Measurement Results - Calculations Part 3

Uncertainty	Date & Time	*TVOC 0 - 15 mgC/m ³
Measured Concentration	15/02/23 11:00 - 12:00	150.87
Expanded Uncertainty as Percentage of Measured Concentration		4 %

Combined Standard Uncertainty

Expanded uncertainty (at 95% confidence) $U_{Exp} = 2 \times u_c$

- Expressed as a percentage of the certified range
- Expressed as a percentage of the certified range as maximum drift per 24hr period
- Expressed as a percentage of the certified range
- Expressed as a percentage of the applied span concentration
- Expressed as a percentage of the certified range per one degree centigrade
- Where the uncertainty of moisture is taken from the manual extract test calculations.
- Expressed as a percentage of the certified range
- Where no uncertainty is presented above, the uncertainty is >100%

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

TVOC Measurement Uncertainty – (Test 3)

Recupyl Shredder Exhaust - TVOC - Measurement Uncertainty - Uncertainty Calculations Table 1

Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Min Certified Ranges
			TVOC 0 - 15 mgC/m ³
Lack of fit ⁽¹⁾	u_{lof}	Rectangular (Divisor = $\sqrt{3}$)	2.00
Span drift ⁽²⁾	$u_{d,s}$	Rectangular (Divisor = $\sqrt{3}$)	0.54
Repeatability Standard Deviation (span) ⁽³⁾	u_r	Normal (Divisor = 1)	40.98
Losses/ leakage in the sample system ⁽⁴⁾	u_{loss}	Rectangular (Divisor = $\sqrt{3}$)	47.47
Temperature dependant span drift ⁽⁵⁾	u_t	Rectangular (Divisor = $\sqrt{3}$)	2.40
Interferents ⁽¹⁾	u_i	Rectangular (Divisor = $\sqrt{3}$)	16.67
Uncertainty of Reference Gas ⁽⁶⁾	u_{ref}	Rectangular (Divisor = $\sqrt{3}$)	25.75
Effect of Voltage Fluctuation ⁽⁷⁾	u_v	Rectangular (Divisor = $\sqrt{3}$)	0.50
Effect of Oxygen Synergism ⁽⁷⁾	u_{syn}	Rectangular (Divisor = $\sqrt{3}$)	4.73

Note:

when $(x_{i,max} - x_{i,adj}) = (x_{i,min} - x_{i,adj})$, then $u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$

- 1 Expressed as a percentage of the certified range
- 2 Expressed as maximum drift per 24hr period as percentage of the certified range
- 3 Expressed as a percentage of the certified range
- 4 Expressed as a percentage of the certified range
- 5 Expressed as a percentage of the certified range per one degree centigrade
- 6 Expressed as standard uncertainty in units of measurement i.e. mg/m³ / %Vol taking account of an additional uncertainty of 2% for gas blending
- 7 Expressed as a percentage of the certified range

Recupyl Shredder Exhaust - TVOC - Measurement Uncertainty - Uncertainty Calculations Table 2

Performance Characteristics	Uncertainty	Value of Standard Uncertainty	* TVOC 0 - 15 mgC/m ³
Lack of fit	u_{lof}	$u(x_i) = \frac{u_{lof} \times R_i}{\sqrt{3}} =$	0.17
Span drift	$u_{d,s}$	$u(x_i) = \frac{u_{d,s} \times R_i}{\sqrt{3}} =$	0.047
Repeatability Standard Deviation (span)	u_r	$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$	6.15
Losses/ leakage in the sample system	u_{loss}	$u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$	4.11
Temperature dependant span drift	u_t	$u(x_i) = \frac{u}{100} \times R_i \times \sqrt{\frac{(x_{i,max} - x_{adj})^2 + (x_{i,min} - x_{adj})(x_{i,max} - x_{adj}) + (x_{i,min} - x_{adj})^2}{3}}$	0.21
Interferents	u_i	$u(x_i) = \frac{u_i \times R_i}{\sqrt{3}} =$	1.44
Uncertainty of Reference Gas	u_{ref}	$u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$	14.87
Effect of Voltage Fluctuation	u_v		0.043
Effect of Oxygen Synergism	u_{syn}		0.41
Combined Standard Uncertainty		$u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$	16.68
Expanded measurement uncertainty (at 95% confidence)		$U_{EXP} = 2 \times u_c$	33.35
Applied Span Concentration			1486.80
Measured Span Concentration, STP Dry Gas			1493.64
Expanded measurement uncertainty as% of Applied Span			2 %

* Sick F3006 FD

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
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 Report Issue Date : 24th April 2023

TVOC Uncertainty of Measurement Results – (Test 3)

Recupyl Shredder Exhaust - TVOC - Uncertainty of Measurement Results - Calculations Part 1

Performance Characteristics	Standard Uncertainty (% of Range)	Distribution	Divisor	Min Certified Range
				TVOC 0 - 15 mgC/m ³
Lack of fit ⁽¹⁾	u_{lof}	Rectangular	$\sqrt{3}$	2.00
Span drift ⁽²⁾	u_{ds}			0.54
Losses / leakage in the sample system ⁽⁴⁾	u_{loss}			0.77
Temperature dependant span drift ⁽⁵⁾	u_t			2.40
Interferents ⁽¹⁾	u_i			16.67
Effect of Voltage Fluctuation ⁽⁷⁾	u_v			0.50
Effect of Oxygen Synergism ⁽⁷⁾	u_{syn}			4.73

Notes:

For rectangular distributions, $u(x_i) = \frac{u \times R_i}{\sqrt{3}}$

For $u(x_i) = \Delta x_i \sqrt{\frac{(x_{i,max} - x_{i,adj})^2 + (x_{i,min} - x_{i,adj})^2 + (x_{i,max} - x_{i,adj})(x_{i,min} - x_{i,adj})}{3}}$, when $|x_{i,max} - x_{i,adj}| = |x_{i,min} - x_{i,adj}|$, then $u(x_i) = \frac{\Delta x_i}{\sqrt{3}}$

Where $u(x_i) = \frac{\sigma}{\sqrt{n}}$ (See note 6 below), $\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$

Performance Characteristics	Uncertainty (Units of final measurement)	Distribution	Divisor	TVOC 0 - 15 mgC/m ³
Lack of fit	u_{lof}	Rectangular	$\sqrt{3}$	0.17
Span drift	u_{ds}			0.047
Temperature dependant span drift	u_t			0.21
Interferents	u_i			1.44
Effect of Voltage Fluctuation (See Note)	u_v			0.043
Effect of Oxygen Synergism (See Note)	u_{syn}			0.41

Recupyl Shredder Exhaust - TVOC - Uncertainty of Measurement Results - Calculations Part 2

Performance Characteristics	Uncertainty (Units of final measurement)	Date & Time	TVOC 0 - 15 mgC/m ³
Losses / leakage in the sample system	u_{loss}	22/02/23 11:00 - 12:00	1.06
Standard Error of Measured Value	u_{SE}	22/02/23 11:00 - 12:00	0.68

Effect on Uncertainty Caused by Oxygen

$$u_{Corr_{O_2}} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})(20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Meas} =$$

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = \frac{1.0000}{1.0000} = 1.00$$

$$uf_{O_2} = \frac{u_{Corr_{O_2}}}{f_{O_2}} \times 100 = \frac{0.00}{1.00} \times 100 = 0.00 \%$$

The effect of oxygen on the overall uncertainties (below) is incorporated using the following equation:-

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

Where oxygen or moisture correction is required, uncertainty based on the standard error of the measured peripheral value is converted to units of final measurement using a sensitivity coefficient C,

$$\therefore u(x_i) = C_i u_i \text{ where } C_i = \frac{\partial f}{\partial x_i}$$

Recupyl Shredder Exhaust - TVOC - Uncertainty of Measurement Results - Calculations Part 3

Uncertainty	Date & Time	* TVOC 0 - 15 mgC/m ³
Measured Concentration	22/02/23 11:00 - 12:00	137.91
Expanded Uncertainty as Percentage of Measured Concentration		3 %

Combined Standard Uncertainty

Expanded uncertainty (at 95% confidence) $U_{Exp} = 2 \times u_c$

- Expressed as a percentage of the certified range
- Expressed as a percentage of the certified range as maximum drift per 24hr period
- Expressed as a percentage of the certified range
- Expressed as a percentage of the applied span concentration
- Expressed as a percentage of the certified range per one degree centigrade
- Where the uncertainty of moisture is taken from the manual extract test calculations
- Expressed as a percentage of the certified range
- Where no uncertainty is presented above, the uncertainty is > 100%

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
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 Report Ref : P5350 : R002

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 Visit Details : Emissions Testing – 2023
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 Report Issue Date : 24th April 2023

Particulates (Test 1), SO2 (Test 1) Uncertainty

Site: Darlaston
 Location: Exhaust Stack

$$u_{mass} = \sqrt{\sum (u_{filter})^2 + (u_{solution})^2}$$

Determinand	Filter mg	Solution mg	Recovered Mass mg	LAB Method Uncert (%) K= 2		Standard Uncertainty		Combined Uncertainty mg
				Filter mg	Solution mg	Filter mg	Solution mg	
TPM 1 & SO2 1								
Particulates	0.10	0.50	0.60	0.10	0.50	0.0500	0.25	0.25
...
Sulphur Dioxide	...	0.25	0.25	...	0.0327	...	0.0163	0.0163
...

TPM 1 & SO2 1			Standard Uncertainty @ 95%		
Sampled Volume (V _m)	0.87	m ³	uV _m	0.001	m ³
Meter Correction Factor (Y _d)	1.05	...	...	...	...
Meter Temperature (T _m)	291.13	k	uT _m	1.5	k
Average Differential Pressure (ΔH)	23.50	mmH ₂ O	uΔH	0.25	mmH ₂ O
Barometric Pressure (p _b)	757.56	mmHg	u _{p_b}	3.8	mmHg
ΔH + ρS (p _m)	101.23	kPa	...	...	...
Oxygen content (O _{2,m})	21.00	% by volume	uO _{2,m} = σ/√n	0.00	% by volume
Moisture Content (H ₂ O)	1.74	% by volume	uH ₂ O	0.18	% 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_iu_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.

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

TPM 1 & SO2 1:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.02$$

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

TPM 1 & SO2 1:

$$f_s = \frac{273}{760} \times \frac{P_b + \Delta H}{T_m} \times Y_d = 0.999$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	1.00	1.00	0.0000967	0.0000242
u _{p_b}	1.00	0.99	0.00132	0.00493
uT _m	1.00	0.99	0.00343	0.00515
H ₂ O	1.00	1.00	0.0102	0.00184

$$u_{f_s} = \sqrt{\left(\frac{u\Delta H}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{(100/(100-H_2O))}\right)^2} = 0.00713$$

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

TPM 1 & SO2 1:

$$V_{std} = V_{measured} \times f_s = 0.871$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty (m ³)
Effect of uV _{std}	0.88	0.86	0.87	0.00622
Effect of uV _m	0.87	0.87	1.00	0.000999

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.00551$$

Uncertainty of Oxygen Correction Factor (%):-

TPM 1 & SO2 1:

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$u_{Corr_{o_2}} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})(20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.00$$

$$u_{f_{o_2}} = \frac{u_{Corr_{o_2}}}{f_{o_2}} \times 100 = 0.00\%$$

Environmental Compliance Limited

Ecobat Solutions
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 Report Ref : P5350 : R002

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

Determinand	TPM 1 & SO2 1:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uM mg/Nm ³
Particulates	0.98	0.40	1.15	0.29
Hydrogen Chloride	...	...	...	...
Sulphur Dioxide	0.31	0.27	1.15	0.0188
Ammonia	...	...	...	...

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

Determinand	TPM 1 & SO2 1:
	uL mg/Nm ³
Particulates	0.00796
Hydrogen Chloride	...
Sulphur Dioxide	0.00333
Ammonia	...

Uncertainty in final measurement @ Reference Conditions due to uVstp

Determinand	TPM 1 & SO2 1:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Particulates	0.69	0.68	0.79	0.00436
Hydrogen Chloride	...	...	...	...
Sulphur Dioxide	0.29	0.29	0.33	0.00183
Ammonia	...	...	...	...

Measurement Uncertainty of Determinand (excluding correction for oxygen)

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

Determinand	TPM 1 & SO2 1:				Uncertainty as Percentage of ELV
	Measurement Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration	
Particulates	0.29	0.59	0.69	85.02	...
Hydrogen Chloride	...	...	...	...	...
Sulphur Dioxide	0.0191	0.0383	0.29	13.26	...
Ammonia	...	...	...	...	...

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

Determinand	TPM 1 & SO2 1:		
	Measurement Uncertainty of Determinand	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ factor (U _{combined})
Particulates	85.02	0.00	85.02
Hydrogen Chloride
Sulphur Dioxide	13.26	0.00	13.26
Ammonia

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Particulates (Test 2) HCl & HF (Test 1) Uncertainty

Site: Darlaston
 Location: Exhaust Stack

$$u_{mass} = \sqrt{\sum (u_{filter})^2 + (u_{solution})^2}$$

Determinand	Filter mg	Solution mg	Recovered Mass mg	LAB Method Uncert (%) K= 2		Standard Uncertainty		Combined Uncertainty mg
				Filter mg	Solution mg	Filter mg	Solution mg	
TPM 2 , HCl & HF 1								
Particulates	0.42	0.50	0.92	0.10	0.50	0.0500	0.25	0.25
Hydrogen Chloride	...	0.0647	0.0647	...	0.00841	...	0.00421	0.00421
Hydrogen Fluoride	...	0.0437	0.0437	...	0.00568	...	0.00284	0.00284
...

TPM 2 , HCl & HF 1			Standard Uncertainty @ 95%		
Sampled Volume (V _m)	0.88	m ³	uV _m	0.001	m ³
Meter Correction Factor (Y _d)	1.05	...	...	...	...
Meter Temperature (T _m)	295.46	k	uT _m	1.5	k
Average Differential Pressure (ΔH)	23.50	mmH ₂ O	uΔH	0.25	mmH ₂ O
Barometric Pressure (p _b)	757.56	mmHg	uP _b	3.8	mmHg
ΔH + ρS (p _m)	101.23	kPa	...	...	...
Oxygen content (O _{2,m})	21.00	% by volume	uO _{2,m} = σ/√n	0.00	% by volume
Moisture Content (H ₂ O)	1.86	% by volume	uH ₂ O	0.18	% 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_iu_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.

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

TPM 2 , HCl & HF 1:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.02$$

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_{mDry})

TPM 2 , HCl & HF 1:

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.985$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.99	0.99	0.0000954	0.0000239
uP _b	0.99	0.98	0.00130	0.00487
uT _m	0.99	0.98	0.00334	0.00500
H ₂ O	0.99	0.98	0.0100	0.00182

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_b)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{(100/(100-H_2O))}\right)^2} = 0.00685$$

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

TPM 2 , HCl & HF 1:

$$V_{std} = V_{measured} \times f_s = 0.871$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty (m ³)
Effect of uV _{ad}	0.88	0.86	0.88	0.00605
Effect of uV _m	0.87	0.87	0.99	0.000985

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.00544$$

Uncertainty of Oxygen Correction Factor (%):-

TPM 2 , HCl & HF 1:

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$uCorr_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})(20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.00$$

$$uf_{o_2} = \frac{uCorr_{o_2}}{f_{o_2}} \times 100 = 0.00\%$$

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

Determinand	TPM 2, HCl & HF 1:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uM mg/Nm ³
Particulates	1.35	0.76	1.15	0.29
Hydrogen Chloride	0.0791	0.0695	1.15	0.00483
Hydrogen Fluoride	0.0534	0.0469	1.15	0.00326
Ammonia	...	...	...	...

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

Determinand	TPM 2, HCl & HF 1:
	uL mg/Nm ³
Particulates	0.0122
Hydrogen Chloride	0.000858
Hydrogen Fluoride	0.000579
Ammonia	...

Uncertainty in final measurement @ Reference Conditions due to uVstp

Determinand	TPM 2, HCl & HF 1:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Particulates	1.06	1.05	1.21	0.00660
Hydrogen Chloride	0.0748	0.0738	0.0853	0.000464
Hydrogen Fluoride	0.0504	0.0498	0.0576	0.000313
Ammonia	...	...	...	...

Measurement Uncertainty of Determinand (excluding correction for oxygen)

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

Determinand	TPM 2, HCl & HF 1:				Uncertainty as Percentage of ELV
	Measurement Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration	
Particulates	0.29	0.59	1.06	55.49	...
Hydrogen Chloride	0.00493	0.00985	0.0743	13.26	...
Hydrogen Fluoride	0.00332	0.00665	0.0501	13.26	...
Ammonia	...	...	...	...	...

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

Determinand	TPM 2, HCl & HF 1:		
	Measurement Uncertainty of Determinand	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ factor (U _{combined})
Particulates	55.49	0.00	55.49
Hydrogen Chloride	13.26	0.00	13.26
Hydrogen Fluoride	13.26	0.00	13.26
Ammonia

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Particulates (Test 3) Uncertainty

Site: Darlaston
 Location: Exhaust Stack

$$u_{mass} = \sqrt{\sum (u_{filter})^2 + (u_{solution})^2}$$

Determinand	Filter mg	Solution mg	Recovered Mass mg	LAB Method Uncert (%) K= 2		Standard Uncertainty		Combined Uncertainty mg
				Filter mg	Solution mg	Filter mg	Solution mg	
TPM 3								
Particulates	0.48	0.80	1.28	0.10	0.50	0.0500	0.25	0.25
...
...
...

TPM 3		Standard Uncertainty @ 95%	
Sampled Volume (V _m)	0.94	m ³	uV _m 0.001 m ³
Meter Correction Factor (Y _d)	1.05	...	...
Meter Temperature (T _m)	296.42	k	uT _m 1.5 k
Average Differential Pressure (ΔH)	23.50	mmH ₂ O	uΔH 0.25 mmH ₂ O
Barometric Pressure (p _b)	757.56	mmHg	u _{p_b} 3.8 mmHg
ΔH + p _s (p _m)	101.23	kPa	...
Oxygen content (O _{2,m})	21.00	% by volume	uO _{2,m} = σ/√n 0.00 % by volume
Moisture Content (H ₂ O)	1.60	% by volume	uH ₂ O 0.17 % 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_iu_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.

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

TPM 3:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.02$$

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

TPM 3:

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.980$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.98	0.98	0.0000949	0.0000237
u _{p_b}	0.98	0.97	0.00129	0.00484
uT _m	0.98	0.97	0.00331	0.00496
H ₂ O	0.98	0.98	0.00996	0.00170

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_b)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{(100/(100-H_2O))}\right)^2} = 0.00672$$

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

TPM 3:

$$V_{std} = V_{measured} \times f_s = 0.923$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty (m ³)
Effect of uV _{std}	0.93	0.92	0.94	0.00633
Effect of uV _m	0.92	0.92	0.98	0.000980

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.00604$$

Uncertainty of Oxygen Correction Factor (%):-

TPM 3:

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$uCorr_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.00$$

$$uf_{o_2} = \frac{uCorr_{o_2}}{f_{o_2}} \times 100 = 0.00\%$$

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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

Determinand	TPM 3:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uM mg/Nm ³
Particulates	1.66	1.11	1.08	0.28
Hydrogen Chloride	...	...	...	...
Sulphur Dioxide	...	...	...	...
Ammonia	...	...	...	...

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

Determinand	TPM 3:
	uL mg/Nm ³
Particulates	0.0160
Hydrogen Chloride	...
Sulphur Dioxide	...
Ammonia	...

Uncertainty in final measurement @ Reference Conditions due to uVstp

Determinand	TPM 3:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Particulates	1.40	1.38	1.50	0.00908
Hydrogen Chloride	...	...	...	...
Sulphur Dioxide	...	...	...	...
Ammonia	...	...	...	...

Measurement Uncertainty of Determinand (excluding correction for oxygen)

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

Determinand	TPM 3:				Uncertainty as Percentage of ELV
	Measurement Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration	
Particulates	0.28	0.55	1.39	39.92	...
Hydrogen Chloride	...	...	...	...	...
Sulphur Dioxide	...	...	...	...	...
Ammonia	...	...	...	...	...

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

Determinand	TPM 3:		
	Measurement Uncertainty of Determinand	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ factor (U _{combined})
Particulates	39.92	0.00	39.92
Hydrogen Chloride	...	...	...
Sulphur Dioxide	...	...	...
Ammonia	...	...	...

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Chlorinated Dioxins & Furans & PCBs Uncertainty (Test 1)

Site: Darlaston
 Location: Exhaust Stack

Dioxin	Recovered Mass ng	LOD ng	LAB Method Uncert (%) K= 2 %age	Standard Uncertainty Symbol	ng
2,3,7,8 - TCDD	0.00219	0.00119	50	u2,3,7,8 - TCDD	0.000548
1,2,3,7,8 - PCDD	0.00225	0.00155	50	u1,2,3,7,8 - PCDD	0.000563
1,2,3,4,7,8 - HxCDD	0.00427	0.00327	50	u1,2,3,4,7,8 - HxCDD	0.00107
1,2,3,6,7,8 - HxCDD	0.00264	0.00264	50	u1,2,3,6,7,8 - HxCDD	0.000660
1,2,3,7,8,9 - HxCDD	0.00274	0.00274	50	u1,2,3,7,8,9 - HxCDD	0.000685
1,2,3,4,6,7,8 - HpCDD	0.00383	0.00383	50	u1,2,3,4,6,7,8 - HpCDD	0.000958
OCDD	0.00715	0.00371	50	uOCDD	0.00179
2,3,7,8 - TCDF	0.00240	0.00170	50	u2,3,7,8 - TCDF	0.000600
1,2,3,7,8 - PCDF	0.00248	0.00170	50	u1,2,3,7,8 - PCDF	0.000620
2,3,4,7,8 - PCDF	0.00326	0.00180	50	u2,3,4,7,8 - PCDF	0.000815
1,2,3,4,7,8 - HxCDF	0.00241	0.00241	50	u1,2,3,4,7,8 - HxCDF	0.000603
1,2,3,6,7,8 - HxCDF	0.00250	0.00250	50	u1,2,3,6,7,8 - HxCDF	0.000625
2,3,4,6,7,8 - HxCDF	0.00340	0.00340	50	u2,3,4,6,7,8 - HxCDF	0.000850
1,2,3,7,8,9 - HxCDF	0.00257	0.00257	50	u1,2,3,7,8,9 - HxCDF	0.000643
1,2,3,4,6,7,8 - HpCDF	0.00394	0.00242	50	u1,2,3,4,6,7,8 - HpCDF	0.000985
1,2,3,4,7,8,9 - HpCDF	0.00255	0.00310	50	u1,2,3,4,7,8,9 - HpCDF	0.000638
OCDF	0.00797	0.00475	50	uOCDF	0.00199

PCB	Recovered Mass ng	LAB Method Uncert (%) K= 2 Percentage	Standard Uncertainty Symbol	ng
PCB BZ#105	0.0547	20	uPCB BZ#105	0.00547
PCB BZ#114	0.0148	20	uPCB BZ#114	0.00148
PCB BZ#118	0.168	20	uPCB BZ#118	0.0168
PCB BZ#123	0.0184	20	uPCB BZ#123	0.00184
PCB BZ#126	0.0175	20	uPCB BZ#126	0.00175
PCB BZ#156	0.0175	20	uPCB BZ#156	0.00175
PCB BZ#157	0.0159	20	uPCB BZ#157	0.00159
PCB BZ#167	0.0168	20	uPCB BZ#167	0.00168
PCB BZ#169	0.0149	20	uPCB BZ#169	0.00149
PCB BZ#189	0.0170	20	uPCB BZ#189	0.00170
PCB BZ#77	0.134	20	uPCB BZ#77	0.0134
PCB BZ#81	0.0104	20	uPCB BZ#81	0.00104

Measured Values			Standard Uncertainty @ 95%		
Sampled Volume (V _m)	4.128	m ³	uV _m	0.001	m ³
Meter Correction Factor (Y _d)	1.048	...	...	...	...
Meter Temperature (T _m)	292.176	K	uT _m	1.5	K
Average Differential Pressure (ΔH)	23.500	mmH ₂ O	uΔH	0.25	mmH ₂ O
Barometric Pressure (P _b)	756.060	mmHg	uP _b	3.8	mmHg
ΔH + ρ _s (P _m)	101.030	kPa	...	...	...
Oxygen content (O _{2,m})	21.000	% by volume	uO _{2,m} = σ/√n	0.00	% by volume
Moisture Content (H ₂ O)	1.305	% by volume	uH ₂ O	0.05	% 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 (uP_b) & measured temperature of dry gas

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.989$$

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

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.013$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.989	0.989	0.0000960	0.0000240
uP _b	0.994	0.984	0.00131	0.00489
uT _m	0.994	0.984	0.00338	0.00508
H ₂ O	0.989	0.988	0.0100	0.000508

$$u_{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_b)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = 0.00677$$

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

$$V_{std} = V_{measured} \times f_s = 4.083$$

	Maximum	Minimum	Sensitivity	Standard Uncertainty
Effect of uV _{std}	4.111	4.055	4.128	0.0280
Effect of uV _m	4.084	4.082	0.989	0.000989

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.1154$$

Uncertainty of oxygen correction factor (uO₂)

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.000 \quad uCorr_{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} =$$

$$\therefore u_{f_{O_2}} = \frac{uCorr_{O_2}}{f_{O_2}} \times 100 = 0\%$$

Environmental Compliance Limited

Ecobat Solutions

Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Roost

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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	0.000671	0.000403	0.245	0.000134
1,2,3,7,8 - PCDD	0.000689	0.000414	0.245	0.000138
1,2,3,4,7,8 - HxCDD	0.00131	0.000785	0.245	0.000262
1,2,3,6,7,8 - HxCDD	0.000809	0.000485	0.245	0.000162
1,2,3,7,8,9 - HxCDD	0.000839	0.000504	0.245	0.000168
1,2,3,4,6,7,8 - HpCDD	0.00117	0.000704	0.245	0.000235
OCDD	0.00219	0.00131	0.245	0.000438
2,3,7,8 - TCDF	0.000735	0.000441	0.245	0.000147
1,2,3,7,8 - PCDF	0.000760	0.000456	0.245	0.000152
2,3,4,7,8 - PCDF	0.000999	0.000599	0.245	0.000200
1,2,3,4,7,8 - HxCDF	0.000738	0.000443	0.245	0.000148
1,2,3,6,7,8 - HxCDF	0.000766	0.000460	0.245	0.000153
2,3,4,6,7,8 - HxCDF	0.00104	0.000625	0.245	0.000208
1,2,3,7,8,9 - HxCDF	0.000787	0.000472	0.245	0.000157
1,2,3,4,6,7,8 - HpCDF	0.00121	0.000724	0.245	0.000241
1,2,3,4,7,8,9 - HpCDF	0.000781	0.000469	0.245	0.000156
OCDF	0.00244	0.00146	0.245	0.000488

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	0.0147	0.0121	0.245	0.00134
PCB BZ#114	0.00399	0.00326	0.245	0.000363
PCB BZ#118	0.0453	0.0371	0.245	0.00412
PCB BZ#123	0.00496	0.00406	0.245	0.000451
PCB BZ#126	0.00472	0.00386	0.245	0.000429
PCB BZ#156	0.00472	0.00386	0.245	0.000429
PCB BZ#157	0.00429	0.00351	0.245	0.000390
PCB BZ#167	0.00453	0.00371	0.245	0.000412
PCB BZ#169	0.00402	0.00329	0.245	0.000365
PCB BZ#189	0.00458	0.00375	0.245	0.000417
PCB BZ#77	0.0361	0.0296	0.245	0.00328
PCB BZ#81	0.00280	0.00229	0.245	0.000255

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	6.197E-06
1,2,3,7,8 - PCDD	6.367E-06
1,2,3,4,7,8 - HxCDD	0.000121
1,2,3,6,7,8 - HxCDD	7.471E-06
1,2,3,7,8,9 - HxCDD	7.754E-06
1,2,3,4,6,7,8 - HpCDD	0.000108
OCDD	0.000202
2,3,7,8 - TCDF	6.792E-06
1,2,3,7,8 - PCDF	7.018E-06
2,3,4,7,8 - PCDF	9.225E-06
1,2,3,6,7,8 - HxCDF	6.820E-06
1,2,3,7,8,9 - HxCDF	7.075E-06
2,3,4,6,7,8 - HxCDF	9.622E-06
1,2,3,7,8,9 - HxCDF	7.273E-06
1,2,3,4,6,7,8 - HpCDF	0.000111
1,2,3,4,7,8,9 - HpCDF	7.216E-06
OCDF	0.000226

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

PCB	uL ng/Nm ³
PCB BZ#105	0.000155
PCB BZ#114	0.0000419
PCB BZ#118	0.000475
PCB BZ#123	0.0000521
PCB BZ#126	0.0000495
PCB BZ#156	0.0000495
PCB BZ#157	0.0000450
PCB BZ#167	0.0000475
PCB BZ#169	0.0000422
PCB BZ#189	0.0000481
PCB BZ#77	0.000379
PCB BZ#81	0.0000294

Uncertainty in final measurement @ Reference Conditions due to uVstp

Dioxin	Maximum ng/Nm ³	Minimum ng/Nm ³	Sensitivity	uVstp ng/Nm ³
2,3,7,8 - TCDD	0.000552	0.000522	0.000132	0.0000152
1,2,3,7,8 - PCDD	0.000567	0.000536	0.000135	0.0000156
1,2,3,4,7,8 - HxCDD	0.00108	0.00102	0.000257	0.0000296
1,2,3,6,7,8 - HxCDD	0.000666	0.000629	0.000159	0.0000183
1,2,3,7,8,9 - HxCDD	0.000691	0.000653	0.000165	0.0000190
1,2,3,4,6,7,8 - HpCDD	0.000966	0.000913	0.000230	0.0000265
OCDD	0.00180	0.00170	0.000430	0.0000495
2,3,7,8 - TCDF	0.000605	0.000572	0.000144	0.0000166
1,2,3,7,8 - PCDF	0.000625	0.000591	0.000149	0.0000172
2,3,4,7,8 - PCDF	0.000822	0.000777	0.000196	0.0000226
1,2,3,4,7,8 - HxCDF	0.000608	0.000574	0.000145	0.0000167
1,2,3,6,7,8 - HxCDF	0.000630	0.000596	0.000150	0.0000173
2,3,4,6,7,8 - HxCDF	0.000857	0.000810	0.000204	0.0000235
1,2,3,7,8,9 - HxCDF	0.000648	0.000613	0.000154	0.0000178
1,2,3,4,6,7,8 - HpCDF	0.000934	0.000899	0.000237	0.0000273
1,2,3,4,7,8,9 - HpCDF	0.000643	0.000608	0.000153	0.0000177
OCDF	0.00201	0.00190	0.000479	0.0000552

Uncertainty in final measurement @ Reference Conditions due to uVstp

PCB	Maximum ng/Nm ³	Minimum ng/Nm ³	Sensitivity	uVstp ng/Nm ³
PCB BZ#105	0.0138	0.0130	0.00329	0.000379
PCB BZ#114	0.00373	0.00353	0.000890	0.000102
PCB BZ#118	0.0424	0.0400	0.0101	0.00116
PCB BZ#123	0.00454	0.00439	0.00111	0.000127
PCB BZ#126	0.00441	0.00417	0.00105	0.000121
PCB BZ#156	0.00441	0.00417	0.00105	0.000121
PCB BZ#157	0.00401	0.00379	0.000956	0.000110
PCB BZ#167	0.00424	0.00400	0.00101	0.000116
PCB BZ#169	0.00376	0.00355	0.000896	0.000103
PCB BZ#189	0.00429	0.00405	0.00102	0.000118
PCB BZ#77	0.0338	0.0319	0.00805	0.000928
PCB BZ#81	0.00262	0.00248	0.000625	0.0000720

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

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

Dioxin	Combined Uncertainty ng/Nm ³	Expanded Uncertainty ng/Nm ³	Measured Concentration ng/Nm ³	% of Measured Concentration
2,3,7,8 - TCDD	0.000135	0.000270	0.000537	50.371
1,2,3,7,8 - PCDD	0.000139	0.000278	0.000551	50.371
1,2,3,4,7,8 - HxCDD	0.000264	0.000527	0.00105	50.371
1,2,3,6,7,8 - HxCDD	0.000163	0.000326	0.000647	50.371
1,2,3,7,8,9 - HxCDD	0.000169	0.000338	0.000672	50.371
1,2,3,4,6,7,8 - HpCDD	0.000236	0.000472	0.000939	50.371
OCDD	0.000441	0.000883	0.00175	50.371
2,3,7,8 - TCDF	0.000148	0.000296	0.000588	50.371
1,2,3,7,8 - PCDF	0.000153	0.000306	0.000608	50.371
2,3,4,7,8 - PCDF	0.000201	0.000402	0.000799	50.371
1,2,3,4,7,8 - HxCDF	0.000149	0.000298	0.000591	50.371
1,2,3,6,7,8 - HxCDF	0.000154	0.000309	0.000613	50.371
2,3,4,6,7,8 - HxCDF	0.000210	0.000420	0.000833	50.371
1,2,3,7,8,9 - HxCDF	0.000159	0.000317	0.000630	50.371
1,2,3,4,6,7,8 - HpCDF	0.000243	0.000486	0.000966	50.371
1,2,3,4,7,8,9 - HpCDF	0.000157	0.000315	0.000625	50.371
OCDF	0.000492	0.000984	0.00195	50.371

PCB	Combined Uncertainty ng/Nm ³	Expanded Uncertainty ng/Nm ³	Measured Concentration ng/Nm ³	% of Measured Concentration
PCB BZ#105	0.00140	0.00280	0.0134	20.911
PCB BZ#114	0.000379	0.000758	0.00363	20.911
PCB BZ#118	0.00430	0.00861	0.0412	20.911
PCB BZ#123	0.000471	0.000943	0.00451	20.911
PCB BZ#126	0.000448	0.000897	0.00429	20.911
PCB BZ#156	0.000448	0.000897	0.00429	20.911
PCB BZ#157	0.000407	0.000815	0.00390	20.911
PCB BZ#167	0.000430	0.000861	0.00412	20.911
PCB BZ#169	0.000382	0.000764	0.00365	20.911
PCB BZ#189	0.000436	0.000872	0.00417	20.911
PCB BZ#77	0.00343	0.00687	0.0328	20.911
PCB BZ#81	0.000266	0.000533	0.00255	20.911

Total (ng/Nm³) 0.12 9.5

Total (ng/Nm³) 0.014 13.5

$$u_{combined} = \sqrt{\sum (u_{f_{i_1}})^2 + (\text{Uncertainty of Measurement of Determinand})^2}$$

$$u_{combined} = \sqrt{\sum (u_{f_{i_1}})^2 + (\text{Uncertainty of Measurement of Determinand})^2}$$

Dioxin	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ² Factor	Overall Measurement Uncertainty inc O ₂ Corr ² Factor (Uncombined)	New Combined Uncertainty ng/Nm ³
2,3,7,8 - TCDD	50.371	0.00	50.371	0.000135
1,2,3,7,8 - PCDD	50.371	0.00	50.371	0.000139
1,2,3,4,7,8 - HxCDD	50.371	0.00	50.371	0.000264
1,2,3,6,7,8 - HxCDD	50.371	0.00	50.371	0.000163
1,2,3,7,8,9 - HxCDD	50.371	0.00	50.371	0.000169
1,2,3,4,6,7,8 - HpCDD	50.371	0.00	50.371	0.000236
OCDD	50.371	0.00	50.371	0.000441
2,3,7,8 - TCDF	50.371	0.00	50.371	0.000148
1,2,3,7,8 - PCDF	50.371	0.00	50.371	0.000153
2,3,4,7,8 - PCDF	50.371	0.00	50.371	0.000201
1,2,3,4,7,8 - HxCDF	50.371	0.00	50.371	0.000149
1,2,3,6,7,8 - HxCDF	50.371	0.00	50.371	0.000154
2,3,4,6,7,8 - HxCDF	50.371	0.00	50.371	0.000210
1,2,3,7,8,9 - HxCDF	50.371	0.00	50.371	0.000159
1,2,3,4,6,7,8 - HpCDF	50.371	0.00	50.371	0.000243
1,2,3,4,7,8,9 - HpCDF	50.371	0.00	50.371	0.000157
OCDF	50.371	0.00	50.371	0.000492

PCB	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ² Factor	Overall Measurement Uncertainty inc O ₂ Corr ² Factor (Uncombined)	New Combined Uncertainty ng/m ³
PCB BZ#105	20.911	0.00	20.911	0.00140
PCB BZ#114	20.911	0.00	20.911	0.000379
PCB BZ#118	20.911	0.00	20.911	0.00430
PCB BZ#123	20.911	0.00	20.911	0.000471
PCB BZ#126	20.911	0.00	20.911	0.000448
PCB BZ#156	20.911	0.00	20.911	0.000448
PCB BZ#157	20.911	0.00	20.911	0.000407
PCB BZ#167	20.911	0.00	20.911	0.000430
PCB BZ#169	20.911	0.00	20.911	0.000382
PCB BZ#189	20.911	0.00	20.911	0.000436
PCB BZ#77	20.911	0.00	20.911	0.00343
PCB BZ#81	20.911	0.00	20.911	0.000266

Environmental Compliance Limited

Ecobat Solutions

Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust

Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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	0.000270	0.000536	1	0.000270	0.000536	1	0.000270	0.000536	1	0.000270	0.000536
1,2,3,7,8 - PCDD	0.5	0.000139	0.000276	1	0.000278	0.000551	1	0.000278	0.000551	1	0.000278	0.000551
1,2,3,4,7,8 - HxCDD	0.1	0.0000527	0.000105	0.1	0.0000527	0.000105	0.5	0.000263	0.000523	0.05	0.0000263	0.0000523
1,2,3,6,7,8 - HxCDD	0.1	0.0000326	0.0000647	0.1	0.0000326	0.0000647	0.01	3.257E-06	6.466E-06	0.01	3.257E-06	6.466E-06
1,2,3,7,8,9 - HxCDD	0.1	0.0000338	0.0000671	0.1	0.0000338	0.0000671	0.01	3.380E-06	6.711E-06	0.1	0.0000338	0.0000671
1,2,3,4,6,7,8 - HpCDD	0.01	4.725E-06	9.381E-06	0.01	4.725E-06	9.381E-06	0.001	4.725E-07	9.381E-07	0.001	4.725E-07	9.381E-07
OCDD	0.001	8.821E-07	1.751E-06	0.0001	8.821E-08	1.751E-07	...	...	...	...	...	...
2,3,7,8 - TCDF	0.1	0.0000296	0.0000588	0.1	0.0000296	0.0000588	0.05	0.0000148	0.0000294	1	0.0000296	0.0000588
1,2,3,7,8 - PCDF	0.05	0.0000153	0.0000304	0.05	0.0000153	0.0000304	0.05	0.0000153	0.0000304	0.1	0.0000306	0.0000607
2,3,4,7,8 - PCDF	0.5	0.000201	0.000399	0.5	0.000201	0.000399	0.5	0.000201	0.000399	1	0.000402	0.000798
1,2,3,4,7,8 - HxCDF	0.1	0.0000297	0.0000590	0.1	0.0000297	0.0000590	0.1	0.0000297	0.0000590	0.1	0.0000297	0.0000590
1,2,3,6,7,8 - HxCDF	0.1	0.0000308	0.0000612	0.1	0.0000308	0.0000612	0.1	0.0000308	0.0000612	0.1	0.0000308	0.0000612
2,3,4,6,7,8 - HxCDF	0.1	0.0000419	0.0000833	0.1	0.0000419	0.0000833	0.1	0.0000419	0.0000833	0.1	0.0000419	0.0000833
1,2,3,7,8,9 - HxCDF	0.1	0.0000317	0.0000629	0.1	0.0000317	0.0000629	0.1	0.0000317	0.0000629	0.1	0.0000317	0.0000629
1,2,3,4,6,7,8 - HpCDF	0.01	4.861E-06	9.650E-06	0.01	4.861E-06	9.650E-06	0.01	4.861E-06	9.650E-06	0.01	4.861E-06	9.650E-06
1,2,3,4,7,8,9 - HpCDF	0.001	3.146E-06	6.246E-06	0.01	3.146E-06	6.246E-06	0.01	3.146E-06	6.246E-06	0.001	3.146E-06	6.246E-06
OCDF	0.001	9.833E-07	1.952E-06	0.0001	9.833E-08	1.952E-07	0.0001	9.833E-08	1.952E-07	0.0001	9.833E-08	1.952E-07
TOTAL	...	0.000	0.002	...	0.000	0.002	...	0.001	0.002	...	0.001	0.003
% Uncertainty	...	...	20.673	...	...	21.318	...	...	21.757	...	...	21.7

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	2.803E-07	1.341E-06	0.000005	1.402E-08	6.703E-08	0.0001	2.803E-07	1.341E-06
PCB BZ#114	0.0005	3.792E-07	1.814E-06	0.000005	3.792E-09	1.814E-08	0.0001	7.585E-08	3.627E-07
PCB BZ#118	0.0001	8.609E-07	4.117E-06	0.000005	4.305E-08	2.059E-07	0.00001	8.609E-08	4.117E-07
PCB BZ#123	0.0001	9.429E-08	4.509E-07	0.000005	4.715E-09	2.255E-08	0.00001	9.429E-09	4.509E-08
PCB BZ#126	0.1	0.0000897	0.000429	0.005	4.484E-06	0.0000214	0.1	0.0000897	0.000429
PCB BZ#156	0.0005	4.484E-07	2.144E-06	0.000005	4.484E-09	2.144E-08	0.0001	8.968E-08	4.289E-07
PCB BZ#157	0.0005	4.074E-07	1.948E-06	0.000005	4.074E-09	1.948E-08	0.0001	8.148E-08	3.897E-07
PCB BZ#167	0.00001	8.609E-09	4.117E-08	0.000005	4.305E-09	2.059E-08	0.00001	8.609E-09	4.117E-08
PCB BZ#169	0.01	7.636E-06	0.0000365	0.00005	3.818E-08	1.826E-07	0.001	7.636E-07	3.652E-06
PCB BZ#189	0.0001	8.712E-08	4.166E-07	0.000005	4.356E-09	2.083E-08	0.00001	8.712E-09	4.166E-08
PCB BZ#77	0.0001	6.867E-07	3.284E-06	0.0001	6.867E-07	3.284E-06	0.05	0.000343	0.00164
PCB BZ#81	0.0001	5.330E-08	2.549E-07	0.0005	2.665E-07	1.274E-06	0.1	0.0000533	0.000255
TOTAL	...	0.000090	0.00048	...	0.000045	0.000027	...	0.00036	0.0023
% Uncertainty	...	...	18.7	...	...	17.1	...	...	15.4

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Roo2

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Brominated Dioxins & Furans Uncertainty (Test 1)

Site: Darlaston Location: Exhaust Stack						
Dioxin	Recovered Mass ng	LOD ng	LAB Method Uncert (%) %age	K= 2 as Mass (ng)	Standard Uncertainty Symbol	ng
2,3,7,8 - TBDD	0.001520	0.001830	50	0.000760	u _{2,3,7,8 - TBDD}	0.0003800
1,2,3,7,8 - PBDD	0.002150	0.002150	50	0.001075	u _{1,2,3,7,8 - PBDD}	0.000538
1,2,3,4,7,8 - HxBDD	0.031900	0.032700	50	0.015950	u _{1,2,3,4,7,8 - HxBDD}	0.007975
1,2,3,6,7,8 - HxBDD					u _{1,2,3,6,7,8 - HxBDD}	
1,2,3,7,8,9 - HxBDD	0.036500	0.037400	50	0.018250	u _{1,2,3,7,8,9 - HxBDD}	0.009125
1,2,3,4,6,7,8 - HpBDD	0.009150	0.023000	50	0.00458	u _{1,2,3,4,6,7,8 - HpBDD}	0.00229
OBDD	0.024400	0.040300	50	0.0122	u _{OBDD}	0.00610
2,3,7,8 - TBDF	0.00184	0.002220	50	0.000920	u _{2,3,7,8 - TBDF}	0.000460
1,2,3,7,8 - PBDF	0.00324	0.003240	50	0.001620	u _{1,2,3,7,8 - PBDF}	0.000810
2,3,4,7,8 - PBDF	0.00298	0.002990	50	0.00149	u _{2,3,4,7,8 - PBDF}	0.000745
1,2,3,4,7,8 - HxBDF	0.00455	0.011300	50	0.00228	u _{1,2,3,4,7,8 - HxBDF}	0.001138
1,2,3,6,7,8 - HxBDF					u _{1,2,3,6,7,8 - HxBDF}	
2,3,4,6,7,8 - HxBDF					u _{2,3,4,6,7,8 - HxBDF}	
1,2,3,7,8,9 - HxBDF					u _{1,2,3,7,8,9 - HxBDF}	
1,2,3,4,6,7,8 - HpBDF	0.06270	0.009060	50	0.03135	u _{1,2,3,4,6,7,8 - HpBDF}	0.01568
1,2,3,4,7,8,9 - HpBDF					u _{1,2,3,4,7,8,9 - HpBDF}	
OCBF	0.28600	0.306000	50	0.14300	u _{OCBF}	0.071500

Measured Values		Standard Uncertainty @ 95%	
Sampled Volume (V _m)	4.128 m ³	u _{V_m}	0.001 m ³
Meter Correction Factor (Y _d)	1.048		...
Meter Temperature (T _m)	292.176 k	u _{T_m}	1.5 k
Average Differential Pressure (ΔH)	23.500 mmH ₂ O	u _{ΔH}	0.25 mmH ₂ O
Barometric Pressure (p _b)	756.060 mmHg	u _{p_b}	3.8 mmHg
ΔH + p _s (p _m)	101.030 kPa		...
Oxygen content (O _{2,m})	21.000 % by volume	u _{O_{2,m}} = σ/√n	0.00 % by volume
Moisture Content (H ₂ O)	1.305 % by volume	u _{H₂O}	0.05 % 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 (u_{ΔH}), measured stack pressure uncertainty component (u_{p_b}) & measured temperature of dry gas

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.989$$

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

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.013$$

	Maximum	Minimum	Sensitivity	u _{fstp}
u _{ΔH}	0.989	0.989	0.0000960	0.0000240
u _{p_b}	0.994	0.984	0.00131	0.00489
u _{T_m}	0.994	0.984	0.00338	0.00508
H ₂ O	0.989	0.988	0.010	0.001

$$u_{f_s} = \sqrt{\left(\frac{u_{\Delta H}}{(P_m/101.3)}\right)^2 + \left(\frac{u_{T_m}}{(T_m/273.15)}\right)^2 + \left(\frac{u_{H_2O}}{(100/(100 - H_2O))}\right)^2} = 0.00677$$

Uncertainty in volume @ reference conditions due to volume correction factor uncertainty component (u_{V_{std}}) & volume uncertainty component (u_{V_m})

$$V_{std} = V_{measured} \times f_s = 4.083$$

	Maximum	Minimum	Sensitivity	Standard Uncertainty
	m ³	m ³		m ³
Effect of u _{V_{std}}	4.111	4.055	4.128	0.0280
Effect of u _{V_m}	4.084	4.082	0.989	0.000989

Combined Standard Uncertainty

$$\frac{u_{V_{std}}}{V_{std}} = \sqrt{\left(\frac{u_{V_{std}}}{f_s}\right)^2 + \left(\frac{u_{V_m}}{V_m}\right)^2} = 0.1154$$

Uncertainty of oxygen correction factor (u_{f_{O₂}})

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.000 \quad u_{Corr_{O_2}} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})(20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.000$$

$$\therefore u_{f_{O_2}} = \frac{u_{Corr_{O_2}}}{f_{O_2}} \times 100 = 0\%$$

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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 - TBDD	0.004654	0.002792	0.245	9.307E-05
1,2,3,7,8 - PBDD	0.000658	0.0003949	0.245	0.0001316
1,2,3,4,7,8 - HxBDD	0.009786	0.005860	0.245	0.0019533
1,2,3,7,8,9 - HxBDD	0.011175	0.006705	0.245	0.0022349
1,2,3,4,6,7,8 - HpBDD	0.00280	0.00168	0.245	0.000560
OBDD	0.00747	0.00448	0.245	0.001494
2,3,7,8 - TBDF	0.000563	0.000338	0.245	0.0001127
1,2,3,7,8 - PBDF	0.000392	0.000295	0.245	0.0001984
2,3,4,7,8 - PBDF	0.000912	0.000547	0.245	0.000182
1,2,3,4,7,8 - HxBDF	0.001393	0.000836	0.245	0.0002786
1,2,3,4,6,7,8 - HpBDF	0.01920	0.01152	0.245	0.003839
OCBF	0.087560	0.052536	0.245	0.017512

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 - TBDD	4.292E-06
1,2,3,7,8 - PBDD	6.080E-06
1,2,3,4,7,8 - HxBDD	9.022E-05
1,2,3,7,8,9 - HxBDD	1.032E-04
1,2,3,4,6,7,8 - HpBDD	0.0000259
OBDD	0.000690
2,3,7,8 - TBDF	5.204E-06
1,2,3,7,8 - PBDF	9.163E-06
2,3,4,7,8 - PBDF	8.428E-06
1,2,3,4,7,8 - HxBDF	1.287E-05
1,2,3,4,6,7,8 - HpBDF	0.0001773
OCBF	8.088E-04

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 - TBDD	0.0003531	0.0003620	9.125E-05	1.053E-05
1,2,3,7,8 - PBDD	0.000542	0.0005121	0.0001291	1.488E-05
1,2,3,4,7,8 - HxBDD	0.008040	0.007598	0.0019151	2.210E-04
1,2,3,7,8,9 - HxBDD	0.005200	0.006894	0.0021913	2.529E-04
1,2,3,4,6,7,8 - HpBDD	0.00231	0.00219	0.000549	0.000363
OBDD	0.00615	0.00581	0.001465	0.000169
2,3,7,8 - TBDF	0.000464	0.000438	0.0001105	0.0000127
1,2,3,7,8 - PBDF	0.000817	0.000772	0.0001945	0.0000224
2,3,4,7,8 - PBDF	0.000751	0.000710	0.000179	0.0000206
1,2,3,4,7,8 - HxBDF	0.001147	0.001084	0.0002732	0.0000315
1,2,3,4,6,7,8 - HpBDF	0.01580	0.01493	0.003764	0.0004344
OCBF	0.072085	0.068122	0.017170	0.0019813

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

Dioxin	Combined Uncertainty ng/Nm ³	Expanded Uncertainty ng/Nm ³	Measured Concentration ng/Nm ³	% of Measured Concentration
2,3,7,8 - TBDD	9.376E-05	0.0001875	0.0003723	50.372
1,2,3,7,8 - PBDD	0.0001326	0.0002652	0.000527	50.372
1,2,3,4,7,8 - HxBDD	0.0019678	0.0039356	0.007913	50.372
1,2,3,7,8,9 - HxBDD	0.0022515	0.0045031	0.008940	50.372
1,2,3,4,6,7,8 - HpBDD	0.000564	0.001129	0.00224	50.372
OBDD	0.001505	0.00301	0.00598	50.372
2,3,7,8 - TBDF	0.0001135	0.000227	0.000451	50.372
1,2,3,7,8 - PBDF	0.0001999	0.0003997	0.000794	50.372
2,3,4,7,8 - PBDF	0.000184	0.000368	0.000730	50.372
1,2,3,4,7,8 - HxBDF	0.0002807	0.000561	0.001114	50.372
1,2,3,4,6,7,8 - HpBDF	0.003868	0.007735	0.01536	50.372
OCBF	0.017642	0.035284	0.070048	50.372
Total (ng/Nm³)		0.114	32.1	

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

Dioxin	% of Measured Concentration	Measurement Uncertainty of Origin Cor ² Factor	Overall Measurement Uncertainty of Cor ² Factor (Uncombined)	New Combined Uncertainty ng/Nm ³
2,3,7,8 - TBDD	50.372	0.000	50.372	9.376E-05
1,2,3,7,8 - PBDD	50.372	0.000	50.372	0.0001326
1,2,3,4,7,8 - HxBDD	50.372	0.000	50.372	0.0019678
1,2,3,7,8,9 - HxBDD	50.372	0.000	50.372	0.0022515
1,2,3,4,6,7,8 - HpBDD	50.372	0.000	50.372	0.000564
OBDD	50.372	0.000	50.372	0.001505
2,3,7,8 - TBDF	50.372	0.000	50.372	0.0001135
1,2,3,7,8 - PBDF	50.372	0.000	50.372	0.0001999
2,3,4,7,8 - PBDF	50.372	0.000	50.372	0.000184
1,2,3,4,7,8 - HxBDF	50.372	0.000	50.372	0.0002807
1,2,3,4,6,7,8 - HpBDF	50.372	0.000	50.372	0.003868
OCBF	50.372	0.000	50.372	0.017642

Uncertainty - Adjusted for TEQ / TEF			
Dioxin	TEQ ng/Nm ³	Uncertainty ng/Nm ³	Conc ng/Nm ³
2,3,7,8 - TBDD	1	0.0001875	0.0003723
1,2,3,7,8 - PBDD	0.5	0.0001326	0.0002633
1,2,3,4,7,8 - HxBDD	0.1	3.936E-04	0.0007813
1,2,3,7,8,9 - HxBDD	0.1	4.503E-04	0.0008940
1,2,3,4,6,7,8 - HpBDD	0.01	1.129E-05	0.0000224
OBDD	0.001	3.010E-06	5.976E-06
2,3,7,8 - TBDF	0.1	0.0000227	0.0000451
1,2,3,7,8 - PBDF	0.05	1.999E-05	0.0000397
2,3,4,7,8 - PBDF	0.5	0.000184	0.000365
1,2,3,4,7,8 - HxBDF	0.1	0.0000561	0.0001114
1,2,3,4,6,7,8 - HpBDF	0.01	7.735E-05	0.0001536
OCBF	0.001	3.528E-05	7.056E-05
TOTAL	...	0.001	0.003
% Uncertainty	...	...	21.608

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Cadmium & Nickel (Test 1) Heavy Metals Uncertainty (Test 1)

Site: Darlaston
 Location: Exhaust Stack

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

Metal	Particulate mg	Vapour mg	LAB Method Uncert (%) K= 2		Standard Uncertainty		Combined Standard Uncertainty of Measured Mass	
			Particulate Phase	Vapour Phase	Particulate Phase mg/m ³	Vapour Phase mg/m ³	Symbol	mg/m ³
Antimony	0.600	0.126	15	16	0.0000450	0.0000101	uMSb	0.0000461
Arsenic	0.500	0.189	11	12	0.0000275	0.0000113	uMAs	0.0000297
Cadmium	0.500	0.126	12	10	0.0000300	6.300E-06	uMCd	0.0000307
Chromium	14.300	13.075	12	10	0.000858	0.000654	uMCr	0.00108
Cobalt	0.700	0.708	12	10	0.0000420	0.0000354	uMCo	0.0000549
Copper	2.000	3.923	12	10	0.000120	0.000196	uMCu	0.000230
Lead	4.500	6.255	13	16	0.000293	0.000500	uMPb	0.000580
Manganese	2.100	3.860	16	10	0.000168	0.000193	uMMn	0.000256
Nickel	7.400	4.607	12	9	0.000444	0.000207	uMNI	0.000490
Selenium	0.700	0.378	14	14	0.0000490	0.0000265	uMSe	0.0000557
Thallium	0.400	0.126	14	14	0.0000280	8.820E-06	uMTl	0.0000294
Vanadium	0.400	0.0630	12	9	0.0000240	2.835E-06	uMV	0.0000242

			Standard Uncertainty @ 95%		
Sampled Volume (V _m)	0.946	m ³	uV _m	0.001	m ³
Meter Correction Factor (Y _d)	1.048	...	...	...	...
Meter Temperature (T _m)	295.00	k	uT _m	1.5	k
Average Differential Pressure (ΔH)	23.50	mmH ₂ O	uΔH	0.25	mmH ₂ O
Barometric Pressure (p _s)	758.31	mmHg	u _{p_s}	3.8	mmHg
ΔH + ρs (p _m)	101.33	kPa	...	...	...
Oxygen content (O _{2,m})	21.00	% by volume	uO _{2,m} = σ/√n	0.00	% by volume
Moisture Content (H ₂ O)	1.63	% by volume	uH ₂ O	0.17	% 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_s}) & measured temperature of (uT_m)

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

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.986$$

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.017$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.986	0.986	0.0000954	0.0000238
u _{p_s}	0.991	0.981	0.00130	0.00486
uT _m	0.991	0.981	0.00334	0.00501
H ₂ O	0.987	0.984	0.0100	0.0017

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = 0.00683$$

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

$$V_{std} = V_{measured} \times f_s = 0.932$$

	Maximum	Minimum	Sensitivity	Standard Uncertainty
	m ³	m ³		m ³
Effect of uV _{ad}	0.939	0.926	0.946	0.00646
Effect of uV _m	0.933	0.931	0.986	0.000986

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.00618$$

Uncertainty of oxygen correction factor (u_{f_{o₂}})

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$u_{Corr_{o_2}} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times \text{Uncertainty of } O_2 \text{ Measurement}} = 1.00$$

$$\therefore u_{f_{o_2}} = \frac{u_{Corr_{o_2}}}{f_{o_2}} \times 100 = 0\%$$

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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	0.000828	0.000729	1.073	0.0000495
Arsenic	0.000771	0.000707	1.073	0.0000319
Cadmium	0.000704	0.000639	1.073	0.0000329
Chromium	0.0305	0.0282	1.073	0.00116
Cobalt	0.00157	0.00145	1.073	0.0000589
Copper	0.00660	0.00611	1.073	0.000247
Lead	0.0122	0.0109	1.073	0.000622
Manganese	0.00667	0.00612	1.073	0.000274
Nickel	0.0134	0.0124	1.073	0.000526
Selenium	0.00122	0.00110	1.073	0.0000597
Thallium	0.000596	0.000533	1.073	0.0000315
Vanadium	0.000523	0.000471	1.073	0.0000259

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	8.992E-06
Arsenic	8.534E-06
Cadmium	7.754E-06
Chromium	0.000339
Cobalt	0.0000174
Copper	0.0000734
Lead	0.000133
Manganese	0.0000738
Nickel	0.000149
Selenium	0.0000134
Thallium	6.515E-06
Vanadium	5.735E-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	0.000784	0.000774	0.000835	5.165E-06
Arsenic	0.000744	0.000734	0.000793	4.901E-06
Cadmium	0.000676	0.000667	0.000720	4.453E-06
Chromium	0.0296	0.0292	0.0315	0.000195
Cobalt	0.00152	0.00150	0.00162	0.0000100
Copper	0.00640	0.00631	0.00681	0.0000421
Lead	0.0116	0.0115	0.0124	0.0000765
Manganese	0.00644	0.00635	0.00686	0.0000424
Nickel	0.0130	0.0128	0.0138	0.0000854
Selenium	0.00116	0.00115	0.00124	7.669E-06
Thallium	0.000568	0.000561	0.000605	3.742E-06
Vanadium	0.000500	0.000493	0.000533	3.294E-06

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

Metal	Combined Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration
Antimony	0.0000505	0.000101	0.000779	12.980
Arsenic	0.0000334	0.0000668	0.000739	9.036
Cadmium	0.0000341	0.0000682	0.000671	10.149
Chromium	0.00122	0.00244	0.0294	8.319
Cobalt	0.0000623	0.000125	0.00151	8.244
Copper	0.000261	0.000521	0.00635	8.208
Lead	0.000640	0.00128	0.0115	11.103
Manganese	0.000287	0.000575	0.00639	8.990
Nickel	0.000553	0.00111	0.0129	8.586
Selenium	0.0000617	0.000123	0.00116	10.669
Thallium	0.0000324	0.0000647	0.000564	11.475
Vanadium	0.0000268	0.0000535	0.000497	10.774

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

Metal	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr* Factor	Overall Measurement Uncertainty inc O ₂ Corr* factor (Ucombined)	New Combined Uncertainty mg/Nm ³
Antimony	12.980	0.00	12.980	0.000051
Arsenic	9.036	0.00	9.036	0.000033
Cadmium	10.149	0.00	10.149	0.000034
Chromium	8.319	0.00	8.319	0.001221
Cobalt	8.244	0.00	8.244	0.000062
Copper	8.208	0.00	8.208	0.000261
Lead	11.103	0.00	11.103	0.000640
Manganese	8.990	0.00	8.990	0.000287
Nickel	8.586	0.00	8.586	0.000553
Selenium	10.669	0.00	10.669	0.000062
Thallium	11.475	0.00	11.475	0.000032
Vanadium	10.774	0.00	10.774	0.000027

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.

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Cadmium & Nickel (Test 2) Uncertainty

Site: Darlaston
 Location: Exhaust Stack

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

Metal	Particulate mg	Vapour mg	LAB Method Uncert (%) K= 2		Standard Uncertainty		Combined Standard Uncertainty of Measured Mass	
			Particulate Phase	Vapour Phase	Particulate Phase mg/m ³	Vapour Phase mg/m ³	Symbol	mg/m ³
Cadmium	0.500	0.105	12	10	0.0000300	5.250E-06	uMCd	0.0000305
Nickel	5.500	3.045	12	9	0.000330	0.000137	uMNI	0.000357

			Standard Uncertainty @ 95%		
Sampled Volume (V _m)	0.972	m ³	uV _m	0.001	m ³
Meter Correction Factor (Yd)	1.048	...	...	...	...
Meter Temperature (T _m)	295.92	K	uT _m	1.5	K
Average Differential Pressure (ΔH)	23.50	mmH ₂ O	uDH	0.25	mmH ₂ O
Barometric Pressure (p _s)	758.31	mmHg	u _{p_s}	3.8	mmHg
ΔH + p _s (p _m)	101.33	KPa	...	...	...
Oxygen content (O _{2,m})	21.00	% by volume	uO _{2,m} = σ/√n	0.00	% by volume
Moisture Content (H ₂ O)	2.13	% by volume	uH ₂ O	0.17	% 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_s}) & measured temperature of (uT_m)

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

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{T_m}}{T_m} \times Y_d = 0.988$$

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.022$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.988	0.988	0.0000955	0.0000239
u _{p_s}	0.992	0.983	0.00130	0.00487
uT _m	0.993	0.983	0.00334	0.00501
H ₂ O	0.989	0.986	0.0101	0.0017

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{(100/(100 - H_2O))}\right)^2} = 0.00683$$

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

$$V_{std} = V_{measured} \times f_s = 0.960$$

	Maximum	Minimum	Sensitivity	Standard Uncertainty
	m ³	m ³		m ³
Effect of uV _{std}	0.967	0.953	0.972	0.00664
Effect of uV _m	0.961	0.959	0.988	0.000988

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.00653$$

Uncertainty of oxygen correction factor (uf_{o₂})

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$u_{Corr_{o_2}} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times \text{Uncertainty of } O_2 \text{ Measurement}} = 1.00$$

$$\therefore uf_{o_2} = \frac{u_{Corr_{o_2}}}{f_{o_2}} \times 100 = 0\%$$

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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
Cadmium	0.000662	0.000599	1.042	0.0000317
Nickel	0.00927	0.00853	1.042	0.000372

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
Cadmium	7.277E-06
Nickel	0.000103

Uncertainty in final measurement @ Reference Conditions due to uVstp

Metal	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Cadmium	0.000635	0.000626	0.000657	4.286E-06
Nickel	0.00896	0.00884	0.00927	0.0000605

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

Metal	Combined Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration
Cadmium	0.0000328	0.0000657	0.000630	10.419
Nickel	0.000391	0.000782	0.00890	8.782

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

Metal	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ factor (U _{combined})	New Combined Uncertainty mg/Nm ³
Cadmium	10.419	0.00	10.419	0.000033
Nickel	8.782	0.00	8.782	0.000391

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.

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Cadmium & Nickel (Test 3) Uncertainty

Site: Darlaston
 Location: Exhaust Stack

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

Metal	Particulate mg	Vapour mg	LAB Method Uncert (%) K= 2		Standard Uncertainty		Combined Standard Uncertainty of Measured Mass	
			Particulate Phase	Vapour Phase	Particulate Phase mg/m ³	Vapour Phase mg/m ³	Symbol	mg/m ³
Cadmium	0.500	0.133	12	10	0.0000300	6.650E-06	uMCd	0.0000307
Nickel	4.600	3.725	12	9	0.000276	0.000168	uMNI	0.000323

			Standard Uncertainty @ 95%		
Sampled Volume (V _m)	0.967	m ³	uV _m	0.001	m ³
Meter Correction Factor (Yd)	1.048	...	...	...	...
Meter Temperature (T _m)	295.83	k	uT _m	1.5	k
Average Differential Pressure (ΔH)	23.50	mmH ₂ O	uDH	0.25	mmH ₂ O
Barometric Pressure (P _b)	758.31	mmHg	uP _s	3.8	mmHg
ΔH + P _s (P _m)	101.33	kPa	...	...	...
Oxygen content (O _{2,m})	21.00	% by volume	uO _{2,m} = σ/√n	0.00	% by volume
Moisture Content (H ₂ O)	1.14	% by volume	uH ₂ O	0.16	% 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 (uP_s) & measured temperature of (uT_m)

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

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{T_m}}{T_m} \times Y_d = 0.978$$

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.012$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.978	0.978	0.0000946	0.0000237
uP _s	0.983	0.973	0.00129	0.00483
uT _m	0.983	0.973	0.00331	0.00496
H ₂ O	0.980	0.976	0.0099	0.0016

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = 0.00669$$

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

$$V_{std} = V_{measured} \times f_s = 0.946$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty m ³
Effect of uV _{std}	0.952	0.939	0.967	0.00647
Effect of uV _m	0.947	0.945	0.978	0.000978

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.00633$$

Uncertainty of oxygen correction factor (uf_{o2})

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$u_{Corr_{o_2}} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.00$$

$$\therefore uf_{o_2} = \frac{u_{Corr_{o_2}}}{f_{o_2}} \times 100 = 0\%$$

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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
Cadmium	0.000702	0.000637	1.058	0.0000325
Nickel	0.00915	0.00846	1.058	0.000341

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
Cadmium	7.730E-06
Nickel	0.000102

Uncertainty in final measurement @ Reference Conditions due to uVstp

Metal	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Cadmium	0.000674	0.000665	0.000708	4.480E-06
Nickel	0.00886	0.00875	0.00931	0.0000589

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

Metal	Combined Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration
Cadmium	0.0000337	0.0000674	0.000669	10.069
Nickel	0.000361	0.000722	0.00880	8.204

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

Metal	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ factor (U _{combined})	New Combined Uncertainty mg/Nm ³
Cadmium	10.069	0.00	10.069	0.000034
Nickel	8.204	0.00	8.204	0.000361

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.

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Roo2

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Particulates (Test 4) Uncertainty

Site: Darlaston
 Location: Exhaust Stack

$$u_{mass} = \sqrt{\sum (u_{filter})^2 + (u_{solution})^2}$$

Determinand	Filter mg	Solution mg	Recovered Mass mg	LAB Method Uncert (%) K= 2 Filter mg	Solution mg	Standard Uncertainty Filter mg	Solution mg	Combined Uncertainty mg
TPM 4								
Particulates	0.10	0.50	0.60	0.10	0.50	0.0500	0.25	0.25
...
...
...

	TPM 4		Standard Uncertainty @ 95%
Sampled Volume (V _m)	1.34	m ³	uV _m 0.001 m ³
Meter Correction Factor (Y _d)	1.05	...	...
Meter Temperature (T _m)	297.38	k	uT _m 1.5 k
Average Differential Pressure (ΔH)	48.40	mmH ₂ O	uΔH 0.25 mmH ₂ O
Barometric Pressure (p _b)	752.31	mmHg	u _{p_b} 3.8 mmHg
ΔH + ρS (ρ _m)	100.77	kPa	...
Oxygen content (O _{2,m})	21.00	% by volume	uO _{2,m} = σ/√N 0.00 % by volume
Moisture Content (H ₂ O)	0.88	% by volume	uH ₂ O 0.12 % 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_iu_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.

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

TPM 4:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.01$$

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

TPM 4:

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.965$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.97	0.97	0.0000939	0.0000235
u _{p_b}	0.97	0.96	0.00128	0.00479
uT _m	0.97	0.96	0.00325	0.00487
H ₂ O	0.97	0.96	0.00974	0.00117

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_b)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100(100-H_2O)}\right)^2} = 0.00644$$

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

TPM 4:

$$V_{std} = V_{measured} \times f_s = 1.290$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty (m ³)
Effect of uV _{std}	1.30	1.28	1.34	0.00860
Effect of uV _m	1.29	1.29	0.97	0.000965

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.0115$$

Uncertainty of Oxygen Correction Factor (%):-

TPM 4:

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$uCorr_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.00$$

$$uf_{o_2} = \frac{uCorr_{o_2}}{f_{o_2}} \times 100 = 0.00\%$$

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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

Determinand	TPM 4:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uM mg/Nm ³
Particulates	0.66	0.27	0.78	0.20
Hydrogen Chloride	...	...	...	...
Sulphur Dioxide	...	...	...	...
Ammonia	...	...	...	...

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

Determinand	TPM 4:
	uL mg/Nm ³
Particulates	0.00537
Hydrogen Chloride	...
Sulphur Dioxide	...
Ammonia	...

Uncertainty in final measurement @ Reference Conditions due to uVstp

Determinand	TPM 4:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Particulates	0.47	0.46	0.36	0.00416
Hydrogen Chloride	...	...	...	...
Sulphur Dioxide	...	...	...	...
Ammonia	...	...	...	...

Measurement Uncertainty of Determinand (excluding correction for oxygen)

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

Determinand	TPM 4:				Uncertainty as Percentage of ELV
	Measurement Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration	
Particulates	0.20	0.40	0.47	85.03	...
Hydrogen Chloride	...	...	...	...	...
Sulphur Dioxide	...	...	...	...	...
Ammonia	...	...	...	...	...

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

Determinand	TPM 4:		
	Measurement Uncertainty of Determinand	Measurement Uncertainty of Oxygen Corr ^d Factor	Overall Measurement Uncertainty inc O ₂ Corr ^d factor (U _{combined})
Particulates	85.03	0.00	85.03
Hydrogen Chloride	...	...	...
Sulphur Dioxide	...	...	...
Ammonia	...	...	...

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Particulates (Test 5), HCl & HF (Test 2) Uncertainty

Site: Darlaston
 Location: Exhaust Stack

$$u_{mass} = \sqrt{\sum (u_{filter})^2 + (u_{solution})^2}$$

Determinand	Filter mg	Solution mg	Recovered Mass mg	LAB Method Uncert (%) K= 2		Standard Uncertainty		Combined Uncertainty mg
				Filter mg	Solution mg	Filter mg	Solution mg	
TPM 5, HCl & HF 2								
Particulates	1.34	0.50	1.84	0.10	0.50	0.0500	0.25	0.25
Hydrogen Chloride	...	0.0293	0.0293	...	0.00381	...	0.00190	0.00190
Hydrogen Fluoride	...	0.0293	0.0293	...	0.00381	...	0.00190	0.00190
...

TPM 5, HCl & HF 2			Standard Uncertainty @ 95%		
Sampled Volume (V _m)	1.34	m ³	uV _m	0.001	m ³
Meter Correction Factor (Y _d)	1.05	...	...	...	...
Meter Temperature (T _m)	296.33	k	uT _m	1.5	k
Average Differential Pressure (ΔH)	48.40	mmH ₂ O	uΔH	0.25	mmH ₂ O
Barometric Pressure (p _b)	752.31	mmHg	u _{p_b}	3.8	mmHg
ΔH + p _s (p _m)	100.77	kPa	...	...	...
Oxygen content (O _{2,m})	21.00	% by volume	uO _{2,m} = σ/√n	0.00	% by volume
Moisture Content (H ₂ O)	1.07	% by volume	uH ₂ O	0.12	% 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_iu_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.

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

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.01$$

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

TPM 5, HCl & HF 2:

$$f_s = \frac{273}{760} \times \frac{P_b + \Delta H}{T_m} \times Y_d = 0.970$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.97	0.97	0.0000944	0.0000236
u _{p_b}	0.98	0.97	0.00128	0.00481
uT _m	0.98	0.97	0.00327	0.00491
H ₂ O	0.97	0.97	0.00981	0.00118

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_b)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{(100(100-H_2O))}\right)^2} = 0.00653$$

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

TPM 5, HCl & HF 2:

$$V_{std} = V_{measured} \times f_s = 1.304$$

	Maximum	Minimum	Sensitivity	Standard Uncertainty (m ³)
Effect of uV _{std}	1.31	1.30	1.34	0.00878
Effect of uV _m	1.31	1.30	0.97	0.000970

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.0118$$

Uncertainty of Oxygen Correction Factor (%):-

TPM 5, HCl & HF 2:

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$uCorr_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times \text{Uncertainty of } O_2 \text{ Measurement}} = 1.00$$

$$uf_{o_2} = \frac{uCorr_{o_2}}{f_{o_2}} \times 100 = 0.00\%$$

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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

Determinand	TPM 5, HCl & HF2:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uM mg/Nm ³
Particulates	1.61	1.22	0.77	0.20
Hydrogen Chloride	0.0239	0.0210	0.77	0.00146
Hydrogen Fluoride	0.0239	0.0210	0.77	0.00146
Ammonia	...	...	...	...

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

Determinand	TPM 5, HCl & HF2:
	uL mg/Nm ³
Particulates	0.0163
Hydrogen Chloride	0.000259
Hydrogen Fluoride	0.000259
Ammonia	...

Uncertainty in final measurement @ Reference Conditions due to uVstp

Determinand	TPM 5, HCl & HF2:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Particulates	1.42	1.40	1.08	0.0128
Hydrogen Chloride	0.0227	0.0223	0.0172	0.000204
Hydrogen Fluoride	0.0227	0.0223	0.0172	0.000204
Ammonia	...	...	...	...

Measurement Uncertainty of Determinand (excluding correction for oxygen)

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

Determinand	TPM 5, HCl & HF2:				Uncertainty as Percentage of ELV
	Measurement Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration	
Particulates	0.20	0.39	1.41	27.87	...
Hydrogen Chloride	0.00150	0.00299	0.0225	13.33	...
Hydrogen Fluoride	0.00150	0.00299	0.0225	13.33	...
Ammonia	...	...	...	...	...

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

Determinand	TPM 5, HCl & HF2:		
	Measurement Uncertainty of Determinand	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ factor (U _{combined})
Particulates	27.87	0.00	27.87
Hydrogen Chloride	13.33	0.00	13.33
Hydrogen Fluoride	13.33	0.00	13.33
Ammonia

Environmental Compliance Limited

Ecobat Solutions
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 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Particulates (Test 6), SO2 (Test 2) Uncertainty

Site: Darlaston
 Location: Exhaust Stack

$$u_{mass} = \sqrt{\sum (u_{filter})^2 + (u_{solution})^2}$$

Determinand	Filter mg	Solution mg	Recovered Mass mg	LAB Method Uncert (%) K= 2		Standard Uncertainty		Combined Uncertainty mg
				Filter mg	Solution mg	Filter mg	Solution mg	
TPM 6 & SO2 2								
Particulates	0.10	0.50	0.60	0.10	0.50	0.0500	0.25	0.25
...
Sulphur Dioxide	...	0.0949	0.0949	...	0.0123	...	0.00617	0.00617
...

TPM 6 & SO2 2			Standard Uncertainty @ 95%		
Sampled Volume (V _m)	1.37	m ³	uV _m	0.001	m ³
Meter Correction Factor (Y _d)	1.05	...	...	...	...
Meter Temperature (T _m)	297.04	k	uT _m	1.5	k
Average Differential Pressure (ΔH)	48.50	mmH ₂ O	uΔH	0.25	mmH ₂ O
Barometric Pressure (p _b)	752.31	mmHg	u _{p_b}	3.8	mmHg
ΔH + ρ _s (p _m)	100.78	kPa	...	...	...
Oxygen content (O _{2,m})	21.00	% by volume	uO _{2,m} = σ/√n	0.00	% by volume
Moisture Content (H ₂ O)	0.77	% by volume	uH ₂ O	0.12	% 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_iu_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.

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

TPM 6 & SO2 2:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.01$$

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

TPM 6 & SO2 2:

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.965$$

	Maximum	Minimum	Sensitivity	uf _{stp}
uΔH	0.97	0.97	0.0000939	0.0000235
u _{p_b}	0.97	0.96	0.00128	0.00479
uT _m	0.97	0.96	0.00325	0.00487
H ₂ O	0.97	0.96	0.00973	0.00114

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_b)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100(100-H_2O)}\right)^2} = 0.00644$$

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

TPM 6 & SO2 2:

$$V_{std} = V_{measured} \times f_s = 1.317$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty (m ³)
Effect of uV _{sd}	1.33	1.31	1.37	0.00879
Effect of uV _m	1.32	1.32	0.97	0.000965

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.0120$$

Uncertainty of Oxygen Correction Factor (%):-

TPM 6 & SO2 2:

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$uCorr_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})(20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.00$$

$$uf_{o_2} = \frac{uCorr_{o_2}}{f_{o_2}} \times 100 = 0.00\%$$

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
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 Report Issue Date : 24th April 2023

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

Determinand	TPM 6 & SO2 2:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uM mg/Nm ³
Particulates	0.65	0.26	0.76	0.19
Hydrogen Chloride	...	...	...	...
Sulphur Dioxide	0.0767	0.0674	0.76	0.00468
Ammonia	...	...	...	...

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

Determinand	TPM 6 & SO2 2:
	uL mg/Nm ³
Particulates	0.00526
Hydrogen Chloride	...
Sulphur Dioxide	0.000832
Ammonia	...

Uncertainty in final measurement @ Reference Conditions due to uVstp

Determinand	TPM 6 & SO2 2:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Particulates	0.46	0.45	0.35	0.00416
Hydrogen Chloride	...	...	...	...
Sulphur Dioxide	0.0727	0.0714	0.0547	0.000658
Ammonia	...	...	...	...

Measurement Uncertainty of Determinand (excluding correction for oxygen)

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

Determinand	TPM 6 & SO2 2:				Uncertainty as Percentage of ELV
	Measurement Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration	
Particulates	0.19	0.39	0.46	85.03	...
Hydrogen Chloride	...	...	...	...	...
Sulphur Dioxide	0.00480	0.00960	0.0720	13.33	...
Ammonia	...	...	...	...	...

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

Determinand	TPM 6 & SO2 2:		
	Measurement Uncertainty of Determinand	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ factor (U _{combined})
Particulates	85.03	0.00	85.03
Hydrogen Chloride
Sulphur Dioxide	13.33	0.00	13.33
Ammonia

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Chlorinated Dioxins & Furans & PCBs Uncertainty (Test 2)

Site: Darlaston
 Location: Exhaust Stack

Dioxin	Recovered Mass ng	LOD ng	LAB Method Uncert (%) %age	K= 2 as Mass (ng)	Standard Uncertainty Symbol	ng
2,3,7,8 - TCDD	0.000280	0.000330	50	0.000140	u2,3,7,8 - TCDD	0.0000700
1,2,3,7,8 - PCDD	0.000480	0.000560	50	0.000240	u1,2,3,7,8 - PCDD	0.000120
1,2,3,4,7,8 - HxCDD	0.000690	0.000480	50	0.000345	u1,2,3,4,7,8 - HxCDD	0.000173
1,2,3,6,7,8 - HxCDD	0.00382	0.000500	50	0.00191	u1,2,3,6,7,8 - HxCDD	0.000955
1,2,3,7,8,9 - HxCDD	0.00177	0.000520	50	0.000885	u1,2,3,7,8,9 - HxCDD	0.000443
1,2,3,4,6,7,8 - HpCDD	0.0177	0.000370	30	0.00531	u1,2,3,4,6,7,8 - HpCDD	0.00266
OCDD	0.0644	0.000350	30	0.0193	uOCDD	0.00966
2,3,7,8 - TCDF	0.00572	0.000710	50	0.00286	u2,3,7,8 - TCDF	0.00143
1,2,3,7,8 - PCDF	0.00388	0.000760	50	0.00194	u1,2,3,7,8 - PCDF	0.000970
2,3,4,7,8 - PCDF	0.00483	0.000680	50	0.00242	u2,3,4,7,8 - PCDF	0.00121
1,2,3,4,7,8 - HxCDF	0.00559	0.000360	30	0.00168	u1,2,3,4,7,8 - HxCDF	0.000839
1,2,3,6,7,8 - HxCDF	0.00491	0.000350	30	0.00147	u1,2,3,6,7,8 - HxCDF	0.000737
2,3,4,6,7,8 - HxCDF	0.00547	0.000300	30	0.00164	u2,3,4,6,7,8 - HxCDF	0.000821
1,2,3,7,8,9 - HxCDF	0.000430	0.000310	50	0.000215	u1,2,3,7,8,9 - HxCDF	0.000108
1,2,3,4,6,7,8 - HpCDF	0.0217	0.000240	30	0.00651	u1,2,3,4,6,7,8 - HpCDF	0.00326
1,2,3,4,7,8,9 - HpCDF	0.00312	0.000290	30	0.000936	u1,2,3,4,7,8,9 - HpCDF	0.000468
OCDF	0.0131	0.000190	30	0.00393	uOCDF	0.00197

PCB	Recovered Mass ng	LAB Method Uncert (%) Percentage	K= 2 as Mass (ng)	Standard Uncertainty Symbol	ng
PCB BZ#105	0.373	20	0.0746	uPCB BZ#105	0.0373
PCB BZ#114	0.0365	20	0.00730	uPCB BZ#114	0.00365
PCB BZ#118	1.070	20	0.214	uPCB BZ#118	0.107
PCB BZ#123	0.0313	20	0.00626	uPCB BZ#123	0.00313
PCB BZ#126	0.0136	20	0.00272	uPCB BZ#126	0.00136
PCB BZ#156	0.0380	20	0.00760	uPCB BZ#156	0.00380
PCB BZ#157	0.00699	20	0.00140	uPCB BZ#157	0.000699
PCB BZ#167	0.0161	20	0.00322	uPCB BZ#167	0.00161
PCB BZ#169	0.000900	20	0.000180	uPCB BZ#169	9.000E-06
PCB BZ#189	0.00730	20	0.00146	uPCB BZ#189	0.000730
PCB BZ#77	1.050	20	0.210	uPCB BZ#77	0.105
PCB BZ#81	0.0751	20	0.0150	uPCB BZ#81	0.00751

Measured Values			Standard Uncertainty @ 95%		
Sampled Volume (V _m)	5.624	m ³	uV _m	0.001	m ³
Meter Correction Factor (Y _d)	1.048	...	...	...	...
Meter Temperature (T _m)	295.667	K	uT _m	1.5	K
Average Differential Pressure (ΔH)	23.500	mmH ₂ O	uΔH	0.25	mmH ₂ O
Barometric Pressure (p _b)	755.309	mmHg	u _{p_b}	3.8	mmHg
ΔH + p _s (p _m)	100.930	kPa	...	...	...
Oxygen content (O _{2,m})	21.000	% by volume	uO _{2,m} = σ/√n	0.00	% by volume
Moisture Content (H ₂ O)	0.609	% by volume	uH ₂ O	0.03	% 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 dry gas

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.970$$

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

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.006$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.970	0.969	0.0000942	0.0000235
u _{p_b}	0.974	0.965	0.00128	0.00480
uT _m	0.974	0.965	0.00328	0.00492
H ₂ O	0.970	0.969	0.00975	0.000314

$$u_{f_s} = \sqrt{\left(\frac{u(\Delta H)}{P_m/101.3}\right)^2 + \left(\frac{uT_m}{T_m/273.15}\right)^2 + \left(\frac{uH_2O}{100/(100-H_2O)}\right)^2} = 0.00643$$

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

$$V_{std} = V_{measured} \times f_s = 5.452$$

	Maximum	Minimum	Sensitivity	Standard Uncertainty
	m ³	m ³		m ³
Effect of uV _{std}	5.488	5.416	5.624	0.0362
Effect of uV _m	5.453	5.451	0.970	0.000970

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.2033$$

Uncertainty of oxygen correction factor (uO₂)

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.000 \quad u_{Corr_{O_2}} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} =$$

$$\therefore u_{f_{O_2}} = \frac{u_{Corr_{O_2}}}{f_{O_2}} \times 100 = 0\%$$

Environmental Compliance Limited

Ecobat Solutions

Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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	0.0000642	0.0000385	0.183	0.0000128
1,2,3,7,8 - PCDD	0.000110	0.0000660	0.183	0.0000220
1,2,3,4,7,8 - HxCDD	0.000158	0.0000949	0.183	0.0000316
1,2,3,6,7,8 - HxCDD	0.000876	0.000525	0.183	0.000175
1,2,3,7,8,9 - HxCDD	0.000406	0.000243	0.183	0.0000812
1,2,3,4,6,7,8 - HpCDD	0.00373	0.00276	0.183	0.000487
OCDD	0.0136	0.0100	0.183	0.00177
2,3,7,8 - TCDF	0.00131	0.000787	0.183	0.000262
1,2,3,7,8 - PCDF	0.000890	0.000534	0.183	0.000178
2,3,4,7,8 - PCDF	0.00111	0.000664	0.183	0.000221
1,2,3,4,7,8 - HxCDF	0.00118	0.000871	0.183	0.000154
1,2,3,6,7,8 - HxCDF	0.00104	0.000765	0.183	0.000135
2,3,4,6,7,8 - HxCDF	0.00115	0.000853	0.183	0.000150
1,2,3,7,8,9 - HxCDF	0.000986	0.000592	0.183	0.000197
1,2,3,4,6,7,8 - HpCDF	0.00458	0.00338	0.183	0.000597
1,2,3,4,7,8,9 - HpCDF	0.00658	0.00486	0.183	0.000858
OCDF	0.00276	0.00204	0.183	0.000360

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	0.0753	0.0616	0.183	0.00684
PCB BZ#114	0.00736	0.00603	0.183	0.000669
PCB BZ#118	0.216	0.177	0.183	0.0196
PCB BZ#123	0.00631	0.00517	0.183	0.000574
PCB BZ#126	0.00274	0.00224	0.183	0.000249
PCB BZ#156	0.00767	0.00627	0.183	0.000697
PCB BZ#157	0.00141	0.00115	0.183	0.000128
PCB BZ#167	0.00325	0.00266	0.183	0.000295
PCB BZ#169	0.000182	0.000149	0.183	1.651E-06
PCB BZ#189	0.00147	0.00121	0.183	0.000134
PCB BZ#77	0.212	0.173	0.183	0.0193
PCB BZ#81	0.0152	0.0124	0.183	0.00138

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	5.930E-07
1,2,3,7,8 - PCDD	1.017E-06
1,2,3,4,7,8 - HxCDD	1.461E-06
1,2,3,6,7,8 - HxCDD	8.089E-06
1,2,3,7,8,9 - HxCDD	3.749E-06
1,2,3,4,6,7,8 - HpCDD	0.000375
OCDD	0.000136
2,3,7,8 - TCDF	0.0000121
1,2,3,7,8 - PCDF	8.217E-06
2,3,4,7,8 - PCDF	0.0000102
1,2,3,4,7,8 - HxCDF	0.0000118
1,2,3,6,7,8 - HxCDF	0.0000104
2,3,4,6,7,8 - HxCDF	0.0000116
1,2,3,7,8,9 - HxCDF	9.107E-07
1,2,3,4,6,7,8 - HpCDF	0.0000460
1,2,3,4,7,8,9 - HpCDF	6.608E-06
OCDF	0.0000277

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

PCB	uL ng/Nm ³
PCB BZ#105	0.000790
PCB BZ#114	0.0000773
PCB BZ#118	0.00227
PCB BZ#123	0.0000663
PCB BZ#126	0.0000288
PCB BZ#156	0.0000805
PCB BZ#157	0.0000148
PCB BZ#167	0.0000341
PCB BZ#169	1.906E-07
PCB BZ#189	0.0000155
PCB BZ#77	0.00222
PCB BZ#81	0.000159

Uncertainty in final measurement @ Reference Conditions due to uVstp

Dioxin	Maximum ng/Nm ³	Minimum ng/Nm ³	Sensitivity	uVstp mg/Nm ³
2,3,7,8 - TCDD	0.0000533	0.0000495	9.432E-06	1.918E-06
1,2,3,7,8 - PCDD	0.0000914	0.0000849	0.000162	3.288E-06
1,2,3,4,7,8 - HxCDD	0.000131	0.000122	0.000232	4.726E-06
1,2,3,6,7,8 - HxCDD	0.000728	0.000675	0.00129	0.000262
1,2,3,7,8,9 - HxCDD	0.000337	0.000313	0.000596	0.000121
1,2,3,4,6,7,8 - HpCDD	0.00337	0.00313	0.00596	0.000121
OCDD	0.0123	0.0114	0.0217	0.000441
2,3,7,8 - TCDF	0.00109	0.00101	0.000193	0.0000392
1,2,3,7,8 - PCDF	0.000739	0.000686	0.000131	0.0000266
2,3,4,7,8 - PCDF	0.000920	0.000854	0.000163	0.0000331
1,2,3,4,7,8 - HxCDF	0.00106	0.000988	0.000188	0.0000383
2,3,4,6,7,8 - HxCDF	0.000935	0.000868	0.000165	0.0000336
1,2,3,6,7,8 - HxCDF	0.00104	0.000967	0.000184	0.0000375
1,2,3,7,8,9 - HxCDF	0.000819	0.000760	0.000145	2.945E-06
1,2,3,4,6,7,8 - HpCDF	0.00413	0.00384	0.000731	0.000149
1,2,3,4,7,8,9 - HpCDF	0.000594	0.000552	0.000105	0.0000214
OCDF	0.00250	0.00232	0.000441	0.0000897

Uncertainty in final measurement @ Reference Conditions due to uVstp

PCB	Maximum ng/Nm ³	Minimum ng/Nm ³	Sensitivity	uVstp mg/Nm ³
PCB BZ#105	0.0711	0.0660	0.0126	0.00256
PCB BZ#114	0.00695	0.00645	0.00123	0.000250
PCB BZ#118	0.204	0.189	0.0360	0.00733
PCB BZ#123	0.00586	0.00553	0.0105	0.00214
PCB BZ#126	0.00259	0.00240	0.000458	0.0000932
PCB BZ#156	0.00724	0.00672	0.00128	0.000260
PCB BZ#157	0.00133	0.00124	0.000235	0.0000479
PCB BZ#167	0.00307	0.00285	0.000542	0.000110
PCB BZ#169	0.0000171	0.0000159	3.032E-06	6.165E-07
PCB BZ#189	0.00139	0.00129	0.000246	0.0000500
PCB BZ#77	0.200	0.186	0.0354	0.00719
PCB BZ#81	0.0143	0.0133	0.00253	0.000514

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

Dioxin	Combined Uncertainty ng/Nm ³	Expanded Uncertainty ng/Nm ³	Measured Concentration ng/Nm ³	% of Measured Concentration
2,3,7,8 - TCDD	0.0000130	0.0000260	0.0000514	50.608
1,2,3,7,8 - PCDD	0.0000223	0.0000446	0.0000880	50.608
1,2,3,4,7,8 - HxCDD	0.0000320	0.0000640	0.000127	50.608
1,2,3,6,7,8 - HxCDD	0.000177	0.000355	0.000701	50.608
1,2,3,7,8,9 - HxCDD	0.0000821	0.000164	0.000325	50.608
1,2,3,4,6,7,8 - HpCDD	0.000503	0.00101	0.00205	31.002
OCDD	0.00183	0.00366	0.00731	31.002
2,3,7,8 - TCDF	0.000285	0.000571	0.00114	50.608
1,2,3,7,8 - PCDF	0.000180	0.000360	0.000712	50.608
2,3,4,7,8 - PCDF	0.000224	0.000448	0.000886	50.608
1,2,3,4,7,8 - HxCDF	0.000159	0.000318	0.000636	31.002
1,2,3,6,7,8 - HxCDF	0.000140	0.000280	0.000560	31.002
2,3,4,6,7,8 - HxCDF	0.000156	0.000312	0.000612	31.002
1,2,3,7,8,9 - HxCDF	0.000200	0.000400	0.000799	50.608
1,2,3,4,6,7,8 - HpCDF	0.000617	0.00123	0.00246	31.002
1,2,3,4,7,8,9 - HpCDF	0.000887	0.00177	0.00354	31.002
OCDF	0.000372	0.000745	0.00149	31.002

Total (ng/Nm³) 0.029 14.5

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

Dioxin	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ Factor (Uncombined)	New Combined Uncertainty ng/Nm ³
2,3,7,8 - TCDD	50.608	0.00	50.608	0.0000130
1,2,3,7,8 - PCDD	50.608	0.00	50.608	0.0000223
1,2,3,4,7,8 - HxCDD	50.608	0.00	50.608	0.0000320
1,2,3,6,7,8 - HxCDD	50.608	0.00	50.608	0.000177
1,2,3,7,8,9 - HxCDD	50.608	0.00	50.608	0.0000821
1,2,3,4,6,7,8 - HpCDD	31.002	0.00	31.002	0.000503
OCDD	31.002	0.00	31.002	0.00183
2,3,7,8 - TCDF	50.608	0.00	50.608	0.000285
1,2,3,7,8 - PCDF	50.608	0.00	50.608	0.000180
2,3,4,7,8 - PCDF	50.608	0.00	50.608	0.000224
1,2,3,4,7,8 - HxCDF	31.002	0.00	31.002	0.000159
1,2,3,6,7,8 - HxCDF	31.002	0.00	31.002	0.000140
2,3,4,6,7,8 - HxCDF	31.002	0.00	31.002	0.000156
1,2,3,7,8,9 - HxCDF	50.608	0.00	50.608	0.000200
1,2,3,4,6,7,8 - HpCDF	31.002	0.00	31.002	0.000617
1,2,3,4,7,8,9 - HpCDF	31.002	0.00	31.002	0.000887
OCDF	31.002	0.00	31.002	0.000372

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

PCB	Combined Uncertainty ng/Nm ³	Expanded Uncertainty ng/Nm ³	Measured Concentration ng/Nm ³	% of Measured Concentration
PCB BZ#105	0.00735	0.0147	0.0684	21.474
PCB BZ#114	0.000719	0.00144	0.00669	21.474
PCB BZ#118	0.0211	0.0421	0.196	21.474
PCB BZ#123	0.000616	0.00123	0.00574	21.474
PCB BZ#126	0.000268	0.000536	0.00249	21.474
PCB BZ#156	0.000748	0.00150	0.00697	21.474
PCB BZ#157	0.000138	0.000275	0.00128	21.474
PCB BZ#167	0.000317	0.000634	0.00295	21.474
PCB BZ#169	1.772E-06	3.545E-06	0.0000165	21.474
PCB BZ#189	0.000144	0.000288	0.00134	21.474
PCB BZ#77	0.0207	0.0414	0.193	21.474
PCB BZ#81	0.00148	0.00296	0.0138	21.474

Total (ng/Nm³) 0.50 12.2

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

PCB	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ Factor (Uncombined)	New Combined Uncertainty ng/Nm ³
PCB BZ#105	21.474	0.00	21.474	0.00735
PCB BZ#114	21.474	0.00	21.474	0.000719
PCB BZ#118	21.474	0.00	21.474	0.0211
PCB BZ#123	21.474	0.00	21.474	0.000616
PCB BZ#126	21.474	0.00	21.474	0.000268
PCB BZ#156	21.474	0.00	21.474	0.000748
PCB BZ#157	21.474	0.00	21.474	0.000138
PCB BZ#167	21.474	0.00	21.474	0.000317
PCB BZ#169	21.474	0.00	21.474	1.772E-06
PCB BZ#189	21.474	0.00	21.474	0.000144
PCB BZ#77	21.474	0.00	21.474	0.0207
PCB BZ#81	21.474	0.00	21.474	0.00148

Environmental Compliance Limited

Ecobat Solutions

Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust

Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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	0.0000260	0.0000514	1	0.0000260	0.0000514	1	0.0000260	0.0000514	1	0.0000260	0.0000514
1,2,3,7,8 - PCDD	0.5	0.0000223	0.0000440	1	0.0000446	0.0000880	1	0.0000446	0.0000880	1	0.0000446	0.0000880
1,2,3,4,7,8 - HxCDD	0.1	6.405E-06	0.0000127	0.1	6.405E-06	0.0000127	0.5	0.0000320	0.0000633	0.05	3.202E-06	6.328E-06
1,2,3,6,7,8 - HxCDD	0.1	0.0000355	0.0000701	0.1	0.0000355	0.0000701	0.01	3.546E-06	7.006E-06	0.01	3.546E-06	7.006E-06
1,2,3,7,8,9 - HxCDD	0.1	0.0000164	0.0000325	0.1	0.0000164	0.0000325	0.01	1.643E-06	3.246E-06	0.1	0.0000164	0.0000325
1,2,3,4,6,7,8 - HpCDD	0.01	0.0000101	0.0000325	0.01	0.0000101	0.0000325	0.001	1.006E-06	3.246E-06	0.001	1.006E-06	3.246E-06
OCDD	0.001	3.662E-06	0.0000118	0.0001	3.662E-07	1.181E-06	...	...	...	...	...	...
2,3,7,8 - TCDF	0.1	0.0000531	0.000105	0.1	0.0000531	0.000105	0.05	0.0000265	0.0000525	1	0.000531	0.00105
1,2,3,7,8 - PCDF	0.05	0.0000180	0.0000356	0.05	0.0000180	0.0000356	0.05	0.0000180	0.0000356	0.1	0.0000360	0.0000712
2,3,4,7,8 - PCDF	0.5	0.000224	0.000443	0.5	0.000224	0.000443	0.5	0.000224	0.000443	1	0.000448	0.000886
1,2,3,4,7,8 - HxCDF	0.1	0.0000318	0.000103	0.1	0.0000318	0.000103	0.1	0.0000318	0.000103	0.1	0.0000318	0.000103
1,2,3,6,7,8 - HxCDF	0.1	0.0000279	0.0000901	0.1	0.0000279	0.0000901	0.1	0.0000279	0.0000901	0.1	0.0000279	0.0000901
2,3,4,6,7,8 - HxCDF	0.1	0.0000311	0.000100	0.1	0.0000311	0.000100	0.1	0.0000311	0.000100	0.1	0.0000311	0.000100
1,2,3,7,8,9 - HxCDF	0.1	3.991E-06	7.887E-06	0.1	3.991E-06	7.887E-06	0.1	3.991E-06	7.887E-06	0.1	3.991E-06	7.887E-06
1,2,3,4,6,7,8 - HpCDF	0.01	0.0000123	0.0000398	0.01	0.0000123	0.0000398	0.01	0.0000123	0.0000398	0.01	0.0000123	0.0000398
1,2,3,4,7,8,9 - HpCDF	0.01	1.774E-06	5.722E-06	0.01	1.774E-06	5.722E-06	0.001	1.774E-06	5.722E-06	0.001	1.774E-06	5.722E-06
OCDF	0.001	7.449E-07	2.403E-06	0.0001	7.449E-08	2.403E-07	0.0001	7.449E-08	2.403E-07	0.0001	7.449E-08	2.403E-07
TOTAL	...	0.000	0.001	...	0.000	0.001	...	0.000	0.001	...	0.001	0.003
% Uncertainty	...	...	20.494	...	...	20.216	...	...	22.002	...	...	27.5

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	1.469E-06	6.841E-06	0.000005	7.345E-08	3.421E-07	0.0001	1.469E-06	6.841E-06
PCB BZ#114	0.0005	7.188E-07	3.347E-06	0.000005	7.188E-09	3.347E-08	0.0001	1.438E-07	6.695E-07
PCB BZ#118	0.0001	4.214E-06	0.0000196	0.000005	2.107E-07	9.813E-07	0.00001	4.214E-07	1.963E-06
PCB BZ#123	0.0001	1.233E-07	5.741E-07	0.000005	6.164E-09	2.870E-08	0.00001	1.233E-08	5.741E-08
PCB BZ#126	0.1	0.0000536	0.000249	0.005	2.678E-06	0.0000125	0.1	0.0000536	0.000249
PCB BZ#156	0.0005	7.483E-07	3.485E-06	0.000005	7.483E-09	3.485E-08	0.0001	1.497E-07	6.970E-07
PCB BZ#157	0.0005	1.377E-07	6.410E-07	0.000005	1.377E-09	6.410E-09	0.0001	2.753E-08	1.282E-07
PCB BZ#167	0.00001	6.341E-09	2.953E-08	0.000005	3.171E-09	1.476E-08	0.00001	6.341E-09	2.953E-08
PCB BZ#169	0.01	3.545E-08	1.651E-07	0.00005	1.772E-10	8.254E-10	0.001	3.545E-09	1.651E-08
PCB BZ#189	0.0001	2.875E-08	1.339E-07	0.000005	1.438E-09	6.695E-09	0.00001	2.875E-09	1.339E-08
PCB BZ#77	0.0001	4.136E-06	0.0000193	0.0001	4.136E-06	0.0000193	0.05	0.00207	0.00963
PCB BZ#81	0.0001	2.958E-07	1.377E-06	0.0005	1.479E-06	6.887E-06	0.1	0.000296	0.00138
TOTAL	...	0.000054	0.00030	...	0.0000051	0.000040	...	0.00209	0.0113
% Uncertainty	...	...	17.7	...	...	12.9	...	...	18.5

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Roo2

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Brominated Dioxins & Furans & PCBs Uncertainty (Test 2)

Site: Darlaston Location: Exhaust Stack						
Dioxin	Recovered Mass ng	LOD ng	LAB Method Uncert (%) %age	K= 2 as Mass (ng)	Standard Uncertainty Symbol	ng
2,3,7,8 - TBDD	0.004250	0.001280	50	0.002125	u2,3,7,8 - TBDD	0.0010625
1,2,3,7,8 - PBDD	0.003920	0.003040	50	0.001960	u1,2,3,7,8 - PBDD	0.000980
1,2,3,4,7,8 - HxBDD	0.029700	0.022300	50	0.014850	u1,2,3,4,7,8 - HxBDD	0.007425
1,2,3,6,7,8 - HxBDD					u1,2,3,6,7,8 - HxBDD	
1,2,3,7,8,9 - HxBDD	0.030700	0.023000	50	0.015350	u1,2,3,7,8,9 - HxBDD	0.007675
1,2,3,4,6,7,8 - HpBDD	0.082700	0.028800	50	0.04135	u1,2,3,4,6,7,8 - HpBDD	0.02068
OBDD	0.788000	0.473000	50	0.3940	uOBDD	0.19700
2,3,7,8 - TBDF	0.00150	0.001380	50	0.000750	u2,3,7,8 - TBDF	0.000375
1,2,3,7,8 - PBDF	0.00215	0.003240	50	0.001075	u1,2,3,7,8 - PBDF	0.000538
2,3,4,7,8 - PBDF	0.00226	0.003400	50	0.00113	u2,3,4,7,8 - PBDF	0.000565
1,2,3,4,7,8 - HxBDF	0.02750	0.012100	50	0.01375	u1,2,3,4,7,8 - HxBDF	0.006875
1,2,3,6,7,8 - HxBDF					u1,2,3,6,7,8 - HxBDF	
2,3,4,6,7,8 - HxBDF					u2,3,4,6,7,8 - HxBDF	
1,2,3,7,8,9 - HxBDF					u1,2,3,7,8,9 - HxBDF	
1,2,3,4,6,7,8 - HpBDF	0.06230	0.010100	50	0.03115	u1,2,3,4,6,7,8 - HpBDF	0.01558
1,2,3,4,7,8,9 - HpBDF					u1,2,3,4,7,8,9 - HpBDF	
O CBF	0.19600	0.064300	50	0.09800	uOCBF	0.049000

Measured Values		Standard Uncertainty @ 95%	
Sampled Volume (V _m)	5.624 m ³	uV _m	0.001 m ³
Meter Correction Factor (Y _d)	1.048		
Meter Temperature (T _m)	295.667 K	uT _m	1.5 K
Average Differential Pressure (ΔH)	23.500 mmH ₂ O	uΔH	0.25 mmH ₂ O
Barometric Pressure (p _b)	755.309 mmHg	uP _b	3.8 mmHg
ΔH + pS (p _m)	100.930 kPa		
Oxygen content (O _{2,m})	21.000 % by volume	uO _{2,m} = σ/√n	0.00 % by volume
Moisture Content (H ₂ O)	0.609 % by volume	uH ₂ O	0.03 % 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 (uP_b) & measured temperature of dry gas

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.970$$

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

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.006$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.970	0.969	0.0000942	0.0000235
uP _b	0.974	0.965	0.00128	0.00480
uT _m	0.974	0.965	0.00328	0.00492
H ₂ O	0.970	0.969	0.010	0.000

$$uf_s = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_b)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{(100/(100 - H_2O))}\right)^2} = 0.00643$$

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

$$V_{std} = V_{measured} \times f_s = 5.452$$

	Maximum	Minimum	Sensitivity	Standard Uncertainty
	m ³	m ³		m ³
Effect of uV _{std}	5.488	5.416	5.624	0.0362
Effect of uV _m	5.453	5.451	0.970	0.000970

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.2033$$

Uncertainty of oxygen correction factor (ufO₂)

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.000 \quad uCorr_{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.000$$

$$\therefore uf_{O_2} = \frac{uCorr_{O_2}}{f_{O_2}} \times 100 = 0\%$$

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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 - TBDD	0.0009744	0.0005846	0.183	1.948E-04
1,2,3,7,8 - PBDD	0.000899	0.0005392	0.183	0.0001797
1,2,3,4,7,8 - HxBDD	0.006809	0.004086	0.183	0.0013618
1,2,3,7,8,9 - HxBDD	0.007038	0.004223	0.183	0.0014077
1,2,3,4,6,7,8 - HpBDD	0.01896	0.01138	0.183	0.003792
OBDD	0.18066	0.10840	0.183	0.036132
2,3,7,8 - TPDF	0.000344	0.000206	0.183	0.0000688
1,2,3,7,8 - PBDF	0.000493	0.000296	0.183	0.0000986
2,3,4,7,8 - PBDF	0.000518	0.000311	0.183	0.000104
1,2,3,4,7,8 - HxBDF	0.006305	0.003783	0.183	0.0012610
1,2,3,4,6,7,8 - HpBDF	0.01428	0.00857	0.183	0.002857
OCBF	0.044936	0.026962	0.183	0.008987

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 - TBDD	9.001E-06			
1,2,3,7,8 - PBDD	8.302E-06			
1,2,3,4,7,8 - HxBDD	6.290E-05			
1,2,3,7,8,9 - HxBDD	6.502E-05			
1,2,3,4,6,7,8 - HpBDD	0.0001751			
OBDD	0.0016689			
2,3,7,8 - TPDF	3.177E-06			
1,2,3,7,8 - PBDF	4.553E-06			
2,3,4,7,8 - PBDF	4.786E-06			
1,2,3,4,7,8 - HxBDF	5.824E-05			
1,2,3,4,6,7,8 - HpBDF	0.0001319			
OCBF	4.151E-04			

Uncertainty in final measurement @ Reference Conditions due to uVsp				
Dioxin	Maximum ng/Nm ³	Minimum ng/Nm ³	Sensitivity	uVsp ng/Nm ³
2,3,7,8 - TBDD	0.003097	0.0007515	1.432E-04	2.911E-05
1,2,3,7,8 - PBDD	0.000747	0.0006931	0.0001321	2.685E-05
1,2,3,4,7,8 - HxBDD	0.006658	0.005252	0.0010005	2.034E-04
1,2,3,7,8,9 - HxBDD	0.005849	0.005428	0.0010342	2.103E-04
1,2,3,4,6,7,8 - HpBDD	0.01576	0.01462	0.002786	0.000566
OBDD	0.15013	0.13933	0.026545	0.005388
2,3,7,8 - TPDF	0.000286	0.000265	0.0000505	0.0000103
1,2,3,7,8 - PBDF	0.000410	0.000380	0.0000724	0.0000147
2,3,4,7,8 - PBDF	0.000431	0.000400	0.000076	0.0000155
1,2,3,4,7,8 - HxBDF	0.005239	0.004863	0.0009284	0.0001884
1,2,3,4,6,7,8 - HpBDF	0.01187	0.01102	0.002099	0.0004268
OCBF	0.037342	0.034656	0.006603	0.0013426

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

Dioxin	Combined Uncertainty ng/Nm ³	Expanded Uncertainty ng/Nm ³	Measured Concentration ng/Nm ³	% of Measured Concentration
2,3,7,8 - TBDD	1.972E-04	0.0003945	0.0007795	50.608
1,2,3,7,8 - PBDD	0.0001819	0.0003639	0.000719	50.608
1,2,3,4,7,8 - HxBDD	0.0013784	0.0027568	0.005447	50.608
1,2,3,7,8,9 - HxBDD	0.0014248	0.0028496	0.005631	50.608
1,2,3,4,6,7,8 - HpBDD	0.003838	0.007676	0.01517	50.608
OBDD	0.036571	0.07314	0.14453	50.608
2,3,7,8 - TPDF	0.0000696	0.000139	0.000275	50.608
1,2,3,7,8 - PBDF	0.0000998	0.0001996	0.000394	50.608
2,3,4,7,8 - PBDF	0.000105	0.000210	0.000415	50.608
1,2,3,4,7,8 - HxBDF	0.0012763	0.002553	0.005044	50.608
1,2,3,4,6,7,8 - HpBDF	0.002891	0.005783	0.01143	50.608
OCBF	0.009096	0.018193	0.035949	50.608
Total (ng/Nm³)		0.226		33.7

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

Dioxin	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr. Factor	Overall Measurement Uncertainty incl. O ₂ Corr. Factor (Uncorrected)	New Combined Uncertainty ng/Nm ³
2,3,7,8 - TBDD	50.608	0.000	50.608	1.972E-04
1,2,3,7,8 - PBDD	50.608	0.000	50.608	0.0001819
1,2,3,4,7,8 - HxBDD	50.608	0.000	50.608	0.0013784
1,2,3,7,8,9 - HxBDD	50.608	0.000	50.608	0.0014248
1,2,3,4,6,7,8 - HpBDD	50.608	0.000	50.608	0.003838
OBDD	50.608	0.000	50.608	0.036571
2,3,7,8 - TPDF	50.608	0.000	50.608	0.0000696
1,2,3,7,8 - PBDF	50.608	0.000	50.608	0.0000998
2,3,4,7,8 - PBDF	50.608	0.000	50.608	0.000105
1,2,3,4,7,8 - HxBDF	50.608	0.000	50.608	0.0012763
1,2,3,4,6,7,8 - HpBDF	50.608	0.000	50.608	0.002891
OCBF	50.608	0.000	50.608	0.009096

Uncertainty - Adjusted for TEQ / TEF				
Dioxin	TEQ ng/m ³	Uncertainty ng/Nm ³	Conc ng/Nm ³	
2,3,7,8 - TBDD	1	0.0003945	0.0007795	
1,2,3,7,8 - PBDD	0.5	0.0001819	0.0003639	
1,2,3,4,7,8 - HxBDD	0.1	2.757E-04	0.0005447	
1,2,3,7,8,9 - HxBDD	0.1	2.850E-04	0.0005631	
1,2,3,4,6,7,8 - HpBDD	0.01	7.676E-05	0.0001517	
OBDD	0.001	7.314E-05	1.445E-04	
2,3,7,8 - TPDF	0.1	0.0000139	0.0000275	
1,2,3,7,8 - PBDF	0.05	9.976E-06	0.0000197	
2,3,4,7,8 - PBDF	0.5	0.000105	0.000207	
1,2,3,4,7,8 - HxBDF	0.1	0.0002553	0.0005044	
1,2,3,4,6,7,8 - HpBDF	0.1	0.1	0.1	
OCBF	0.01	5.783E-05	0.0001143	
TOTAL	0.001	1.819E-05	3.595E-05	
% Uncertainty	...	0.001	0.003	19.156

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Roo2

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Cadmium & Nickel (Test 4) Heavy Metals Uncertainty (Test 2)

Site: Darlaston
 Location: Exhaust Stack

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

Metal	Particulate mg	Vapour mg	LAB Method Uncert (%) K=2		Standard Uncertainty		Combined Standard Uncertainty of Measured	
			Particulate Phase	Vapour Phase	Particulate Phase mg/m ³	Vapour Phase mg/m ³	Symbol	mg/m ³
Antimony	0.600	0.147	15	16	0.0000450	0.0000118	uMSb	0.0000465
Arsenic	0.500	0.221	11	12	0.0000275	0.0000132	uMAs	0.0000305
Cadmium	0.500	0.147	12	10	0.0000300	7.350E-06	uMCd	0.0000309
Chromium	4.900	14.399	12	10	0.000294	0.000720	uMCr	0.000778
Cobalt	0.500	0.194	12	10	0.0000300	9.700E-06	uMCo	0.0000315
Copper	1.600	13.424	12	10	0.0000960	0.000671	uMCu	0.000678
Lead	5.000	6.507	13	16	0.000325	0.000521	uMpb	0.000614
Manganese	4.300	2.416	16	10	0.000344	0.000121	uMMn	0.000365
Nickel	6.500	1.226	12	9	0.000390	0.0000551	uMNI	0.000394
Selenium	0.700	0.441	14	14	0.0000490	0.0000309	uMSe	0.0000579
Thallium	0.400	0.147	14	14	0.0000280	0.0000103	uMTI	0.0000298
Vanadium	0.600	0.0735	12	9	0.0000360	3.308E-06	uMV	0.0000362

		Standard Uncertainty @ 95%	
Sampled Volume (V _m)	0.997 m ³	uV _m	0.001 m ³
Meter Correction Factor (Y _d)	0.929 ...		...
Meter Temperature (T _m)	287.58 k	uT _m	1.5 k
Average Differential Pressure (ΔH)	27.30 mmHg _O	uDH	0.25 mmHg _O
Barometric Pressure (p _b)	747.06 mmHg	uP _b	3.8 mmHg
ΔH + p _s (p _m)	99.87 kPa		...
Oxygen content (O _{2,m})	21.00 % by volume	uO _{2,m} = σ/√n	0.00 % by volume
Moisture Content (H ₂ O)	1.09 % by volume	uH ₂ O	0.18 % 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 (uP_s) & measured

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

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.879$$

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.011$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.879	0.879	0.0000863	0.0000216
uP _s	0.883	0.875	0.00117	0.00440
uT _m	0.884	0.874	0.00306	0.00458
H ₂ O	0.881	0.877	0.0089	0.0016

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = 0.00565$$

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

$$V_{std} = V_{measured} \times f_s = 0.876$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty m ³
Effect of uV _{std}	0.882	0.871	0.997	0.00563
Effect of uV _m	0.877	0.875	0.879	0.000879

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.00567$$

Uncertainty of oxygen correction factor (uf_{O2})

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$u_{Corr_{O_2}} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.00$$

$$\therefore uf_{O_2} = \frac{u_{Corr_{O_2}}}{f_{O_2}} \times 100 = 0\%$$

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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	0.000905	0.000799	1.141	0.0000531
Arsenic	0.000857	0.000787	1.141	0.0000348
Cadmium	0.000774	0.000703	1.141	0.0000352
Chromium	0.0229	0.0211	1.141	0.000887
Cobalt	0.000828	0.000756	1.141	0.0000360
Copper	0.0179	0.0164	1.141	0.000774
Lead	0.0138	0.0124	1.141	0.000700
Manganese	0.00808	0.00725	1.141	0.000416
Nickel	0.00926	0.00837	1.141	0.000449
Selenium	0.00137	0.00124	1.141	0.0000661
Thallium	0.000658	0.000590	1.141	0.0000340
Vanadium	0.000810	0.000727	1.141	0.0000413

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

Metal	uL mg/Nm ³
Antimony	9.842E-06
Arsenic	9.493E-06
Cadmium	8.525E-06
Chromium	0.000254
Cobalt	9.144E-06
Copper	0.000198
Lead	0.000152
Manganese	0.0000885
Nickel	0.000102
Selenium	0.0000150
Thallium	7.207E-06
Vanadium	8.874E-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	0.000858	0.000847	0.000973	5.512E-06
Arsenic	0.000827	0.000817	0.000938	5.317E-06
Cadmium	0.000743	0.000734	0.000842	4.774E-06
Chromium	0.0222	0.0219	0.0251	0.000142
Cobalt	0.000797	0.000787	0.000904	5.121E-06
Copper	0.0173	0.0170	0.0196	0.000111
Lead	0.0132	0.0130	0.0150	0.0000849
Manganese	0.00771	0.00761	0.00874	0.0000496
Nickel	0.00887	0.00876	0.0101	0.0000570
Selenium	0.00131	0.00129	0.00149	8.420E-06
Thallium	0.000628	0.000620	0.000712	4.037E-06
Vanadium	0.000774	0.000764	0.000877	4.970E-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	0.0000543	0.000109	0.000852	12.731
Arsenic	0.0000365	0.0000730	0.000822	8.875
Cadmium	0.0000366	0.0000731	0.000738	9.908
Chromium	0.000934	0.00187	0.0220	8.483
Cobalt	0.0000375	0.0000749	0.000792	9.464
Copper	0.000806	0.00161	0.0171	9.406
Lead	0.000722	0.00144	0.0131	10.990
Manganese	0.000428	0.000856	0.00766	11.175
Nickel	0.000464	0.000929	0.00882	10.535
Selenium	0.0000683	0.000137	0.00130	10.491
Thallium	0.0000350	0.0000701	0.000624	11.224
Vanadium	0.0000425	0.0000850	0.000769	11.057

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

Metal	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ⁺ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁺ factor (U _{combined})	New Combined Uncertainty mg/Nm ³
Antimony	12.731	0.00	12.731	0.000054
Arsenic	8.875	0.00	8.875	0.000036
Cadmium	9.908	0.00	9.908	0.000037
Chromium	8.483	0.00	8.483	0.000934
Cobalt	9.464	0.00	9.464	0.000037
Copper	9.406	0.00	9.406	0.000806
Lead	10.990	0.00	10.990	0.000722
Manganese	11.175	0.00	11.175	0.000428
Nickel	10.535	0.00	10.535	0.000464
Selenium	10.491	0.00	10.491	0.000068
Thallium	11.224	0.00	11.224	0.000035
Vanadium	11.057	0.00	11.057	0.000042

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.

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Roo2

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing - 2023
 Survey Dates : 31st January - 2nd February, 15th - 16th & 21st - 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Cadmium & Nickel (Test 5) Uncertainty

Site: Darlaston
 Location: Exhaust Stack

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

Metal	Particulate mg	Vapour mg	LAB Method Uncert (%) K=2		Standard Uncertainty		Combined Standard Uncertainty of Measured	
			Particulate Phase	Vapour Phase	Particulate Phase mg/m ³	Vapour Phase mg/m ³	Symbol	mg/m ³
Cadmium	0.500	0.148	12	10	0.0000300	7.400E-06	uMcd	0.0000309
Nickel	11.800	2.350	12	9	0.000708	0.000106	uMNI	0.000716

				Standard Uncertainty @ 95%			
Sampled Volume (V _m)	1.003	m ³		uV _m	0.001	m ³	
Meter Correction Factor (Y _d)	0.929	...			...	...
Meter Temperature (T _m)	294.00	k		uT _m	1.5	k	
Average Differential Pressure (ΔH)	27.30	mmH ₂ O		uDH	0.25	mmH ₂ O	
Barometric Pressure (p _b)	747.06	mmHg		uP _s	3.8	mmHg	
ΔH + p _s (p _m)	99.87	kPa			...	...
Oxygen content (O _{2,m})	21.00	% by volume		uO _{2,m} = σ/√n	0.00	% by volume	
Moisture Content (H ₂ O)	1.88	% by volume		uH ₂ O	0.18	% 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 (uP_s) & measured

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

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{T_m}}{T_m} \times Y_d = 0.867$$

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.019$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.867	0.867	0.0000851	0.0000213
uP _s	0.871	0.862	0.00116	0.00434
uT _m	0.871	0.862	0.00295	0.00442
H ₂ O	0.868	0.865	0.0088	0.0016

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = 0.00539$$

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

$$V_{std} = V_{measured} \times f_s = 0.869$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty m ³
Effect of uV _{std}	0.875	0.864	1.003	0.00541
Effect of uV _m	0.870	0.868	0.867	0.000867

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.00548$$

Uncertainty of oxygen correction factor (uf_{O2})

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$uCorr_{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.00$$

$$\therefore uf_{O_2} = \frac{uCorr_{O_2}}{f_{O_2}} \times 100 = 0\%$$

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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
Cadmium	0.000781	0.000710	1.150	0.0000355
Nickel	0.0171	0.0155	1.150	0.000824

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

Metal	uL mg/Nm ³
Cadmium	8.608E-06
Nickel	0.000188

Uncertainty in final measurement @ Reference Conditions due to uVstp

Metal	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Cadmium	0.000750	0.000741	0.000858	4.698E-06
Nickel	0.0164	0.0162	0.0187	0.000103

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

Metal	Combined Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration
Cadmium	0.0000369	0.0000737	0.000745	9.893
Nickel	0.000851	0.00170	0.0163	10.455

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

Metal	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ factor (U _{combined})	New Combined Uncertainty mg/Nm ³
Cadmium	9.893	0.00	9.893	0.000037
Nickel	10.455	0.00	10.455	0.000851

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.

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Roo2

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing - 2023
 Survey Dates : 31st January - 2nd February, 15th - 16th & 21st - 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Cadmium & Nickel (Test 6) Uncertainty

Site: Darlaston
 Location: Exhaust Stack

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

Metal	Particulate mg	Vapour mg	LAB Method Uncert (%) K=2		Standard Uncertainty		Combined Standard Uncertainty of Measured	
			Particulate Phase	Vapour Phase	Particulate Phase mg/m ³	Vapour Phase mg/m ³	Symbol	mg/m ³
Cadmium	0.500	0.146	12	10	0.0000300	7.290E-06	uMcd	0.0000309
Nickel	5.900	1.677	12	9	0.000354	0.0000755	uMNI	0.000362

				Standard Uncertainty @ 95%			
Sampled Volume (V _m)	1.016	m ³		uV _m	0.001	m ³	
Meter Correction Factor (Y _d)	0.929	...			...	...
Meter Temperature (T _m)	304.58	k		uT _m	1.5	k	
Average Differential Pressure (ΔH)	27.30	mmH ₂ O		uDH	0.25	mmH ₂ O	
Barometric Pressure (p _b)	747.06	mmHg		uP _s	3.8	mmHg	
ΔH + p _s (p _m)	99.87	kPa			...	...
Oxygen content (O _{2,m})	21.00	% by volume		uO _{2,m} = σ/√n	0.00	% by volume	
Moisture Content (H ₂ O)	3.39	% by volume		uH ₂ O	0.22	% 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 (uP_s) & measured

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

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{T_m}}{T_m} \times Y_d = 0.850$$

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.035$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.850	0.850	0.0000834	0.0000209
uP _s	0.854	0.845	0.00113	0.00425
uT _m	0.854	0.845	0.00279	0.00418
H ₂ O	0.852	0.848	0.0088	0.0019

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = 0.00511$$

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

$$V_{std} = V_{measured} \times f_s = 0.863$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty m ³
Effect of uV _{std}	0.868	0.858	1.016	0.00519
Effect of uV _m	0.864	0.862	0.850	0.000850

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.00532$$

Uncertainty of oxygen correction factor (uf_{O₂})

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$uCorr_{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.00$$

$$\therefore uf_{O_2} = \frac{uCorr_{O_2}}{f_{O_2}} \times 100 = 0\%$$

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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
Cadmium	0.000784	0.000712	1.158	0.0000358
Nickel	0.00920	0.00836	1.158	0.000419

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

Metal	uL mg/Nm ³
Cadmium	8.638E-06
Nickel	0.000101

Uncertainty in final measurement @ Reference Conditions due to uVstp

Metal	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Cadmium	0.000753	0.000744	0.000867	4.612E-06
Nickel	0.00883	0.00872	0.0102	0.0000541

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

Metal	Combined Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration
Cadmium	0.0000371	0.0000742	0.000748	9.913
Nickel	0.000435	0.000870	0.00878	9.906

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

Metal	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ factor (U _{combined})	New Combined Uncertainty mg/Nm ³
Cadmium	9.913	0.00	9.913	0.000037
Nickel	9.906	0.00	9.906	0.000435

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.

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Particulates (Test 7), SO2 (Test 3) Uncertainty

Site: Darlaston
 Location: Exhaust Stack

$$u_{mass} = \sqrt{\sum (u_{filter})^2 + (u_{solution})^2}$$

Determinand	Filter mg	Solution mg	Recovered Mass mg	LAB Method Uncert (%) K= 2		Standard Uncertainty		Combined Uncertainty mg
				Filter mg	Solution mg	Filter mg	Solution mg	
TPM 7 & SO2 3								
Particulates	0.10	0.50	0.60	0.10	0.50	0.0500	0.25	0.25
...
Sulphur Dioxide	...	0.13	0.13	...	0.0168	...	0.00839	0.00839
...

TPM 7 & SO2 3			Standard Uncertainty @ 95%		
Sampled Volume (V _m)	1.32	m ³	uV _m	0.001	m ³
Meter Correction Factor (Y _d)	1.05	...	...	...	...
Meter Temperature (T _m)	292.50	k	uT _m	1.5	k
Average Differential Pressure (ΔH)	48.40	mmH ₂ O	uΔH	0.25	mmH ₂ O
Barometric Pressure (p _b)	756.06	mmHg	u _{p_b}	3.8	mmHg
ΔH + ρS (ρ _m)	101.27	kPa	...	...	...
Oxygen content (O _{2,m})	21.00	% by volume	uO _{2,m} = σ/√n	0.00	% by volume
Moisture Content (H ₂ O)	1.23	% by volume	uH ₂ O	0.12	% 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_iu_i, where C is the sensitivity coefficient, u_i is the standard uncertainty and i is the index identifying the contributing factor e.g. i = uV_m, uT_m, etc.

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

TPM 7 & SO2 3:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.01$$

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

TPM 7 & SO2 3:

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.989$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.99	0.99	0.0000958	0.0000239
u _{p_b}	0.99	0.98	0.00130	0.00488
uT _m	0.99	0.98	0.00338	0.00507
H ₂ O	0.99	0.99	0.0100	0.00121

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_b)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{(100/(100-H_2O))}\right)^2} = 0.00684$$

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

TPM 7 & SO2 3:

$$V_{std} = V_{measured} \times f_s = 1.309$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty (m ³)
Effect of uV _{sd}	1.32	1.30	1.32	0.00905
Effect of uV _m	1.31	1.31	0.99	0.000989

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.0120$$

Uncertainty of Oxygen Correction Factor (%):-

TPM 7 & SO2 3:

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$uCorr_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})(20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.00$$

$$uf_{o_2} = \frac{uCorr_{o_2}}{f_{o_2}} \times 100 = 0.00\%$$

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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

Determinand	TPM 7 & SO2 3:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uM mg/Nm ³
Particulates	0.65	0.26	0.76	0.19
Hydrogen Chloride	...	...	...	...
Sulphur Dioxide	0.10	0.0921	0.76	0.00641
Ammonia	...	...	...	...

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

Determinand	TPM 7 & SO2 3:
	uL mg/Nm ³
Particulates	0.00529
Hydrogen Chloride	...
Sulphur Dioxide	0.00114
Ammonia	...

Uncertainty in final measurement @ Reference Conditions due to uVstp

Determinand	TPM 7 & SO2 3:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Particulates	0.46	0.45	0.35	0.00420
Hydrogen Chloride	...	...	...	...
Sulphur Dioxide	0.0995	0.0977	0.0753	0.000904
Ammonia	...	...	...	...

Measurement Uncertainty of Determinand (excluding correction for oxygen)

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

Determinand	TPM 7 & SO2 3:				Uncertainty as Percentage of ELV
	Measurement Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration	
Particulates	0.19	0.39	0.46	85.03	...
Hydrogen Chloride	...	...	...	...	...
Sulphur Dioxide	0.00657	0.0131	0.0985	13.33	...
Ammonia	...	...	...	...	...

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

Determinand	TPM 7 & SO2 3:		
	Measurement Uncertainty of Determinand	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ factor (U _{combined})
Particulates	85.03	0.00	85.03
Hydrogen Chloride	...	...	...
Sulphur Dioxide	13.33	0.00	13.33
Ammonia

Environmental Compliance Limited

Ecobat Solutions
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 Report Issue Date : 24th April 2023

Particulates (Test 8), HCl & HF (Test 3) Uncertainty

Site: Darlaston
 Location: Exhaust Stack

$$u_{mass} = \sqrt{\sum (u_{filter})^2 + (u_{solution})^2}$$

Determinand	Filter mg	Solution mg	Recovered Mass mg	LAB Method Uncert (%) K= 2		Standard Uncertainty		Combined Uncertainty mg
				Filter mg	Solution mg	Filter mg	Solution mg	
TPM 8, HCl & HF 3								
Particulates	0.10	0.50	0.60	0.10	0.50	0.0500	0.25	0.25
Hydrogen Chloride	...	0.0346	0.0346	...	0.00450	...	0.00225	0.00225
Hydrogen Fluoride	...	0.0270	0.0270	...	0.00350	...	0.00175	0.00175
...

TPM 8, HCl & HF 3			Standard Uncertainty @ 95%		
Sampled Volume (V _m)	1.32	m ³	uV _m	0.001	m ³
Meter Correction Factor (Y _d)	1.05	...	...	...	...
Meter Temperature (T _m)	294.13	k	uT _m	1.5	k
Average Differential Pressure (ΔH)	48.40	mmH ₂ O	uΔH	0.25	mmH ₂ O
Barometric Pressure (p _b)	756.06	mmHg	u _{p_b}	3.8	mmHg
ΔH + ρS (ρ _m)	101.27	kPa	...	...	...
Oxygen content (O _{2,m})	21.00	% by volume	uO _{2,m} = σ/√n	0.00	% by volume
Moisture Content (H ₂ O)	1.35	% by volume	uH ₂ O	0.12	% 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_iu_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.

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

TPM 8, HCl & HF 3:

$$f_{s,wet} = \frac{100}{100 - H_2O} = 1.01$$

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

TPM 8, HCl & HF 3:

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.985$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.99	0.99	0.0000954	0.0000238
u _{p_b}	0.99	0.98	0.00130	0.00486
uT _m	0.99	0.98	0.00335	0.00502
H ₂ O	0.99	0.98	0.00999	0.00122

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_b)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100(100-H_2O)}\right)^2} = 0.00675$$

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

TPM 8, HCl & HF 3:

$$V_{std} = V_{measured} \times f_s = 1.300$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty (m ³)
Effect of uV _{std}	1.31	1.29	1.32	0.00890
Effect of uV _m	1.30	1.30	0.99	0.000985

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.0118$$

Uncertainty of Oxygen Correction Factor (%):-

TPM 8, HCl & HF 3:

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$uCorr_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times \text{Uncertainty of } O_2 \text{ Measurement}} = 1.00$$

$$uf_{o_2} = \frac{uCorr_{o_2}}{f_{o_2}} \times 100 = 0.00\%$$

Environmental Compliance Limited

Ecobat Solutions
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 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

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 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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

Determinand	TPM 8, HCl & HF3:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uM mg/Nm ³
Particulates	0.66	0.27	0.77	0.20
Hydrogen Chloride	0.0283	0.0249	0.77	0.00173
Hydrogen Fluoride	0.0221	0.0194	0.77	0.00135
Ammonia	...	...	...	...

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

Determinand	TPM 8, HCl & HF3:
	uL mg/Nm ³
Particulates	0.00533
Hydrogen Chloride	0.000307
Hydrogen Fluoride	0.000239
Ammonia	...

Uncertainty in final measurement @ Reference Conditions due to uVstp

Determinand	TPM 8, HCl & HF3:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Particulates	0.47	0.46	0.36	0.00419
Hydrogen Chloride	0.0269	0.0264	0.0205	0.000241
Hydrogen Fluoride	0.0209	0.0206	0.0160	0.000188
Ammonia	...	...	...	...

Measurement Uncertainty of Determinand (excluding correction for oxygen)

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

Determinand	TPM 8, HCl & HF3:				Uncertainty as Percentage of ELV
	Measurement Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration	
Particulates	0.20	0.39	0.46	85.03	...
Hydrogen Chloride	0.00177	0.00355	0.0266	13.33	...
Hydrogen Fluoride	0.00138	0.00276	0.0207	13.33	...
Ammonia	...	...	...	...	...

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

Determinand	TPM 8, HCl & HF3:		
	Measurement Uncertainty of Determinand	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ factor (U _{combined})
Particulates	85.03	0.00	85.03
Hydrogen Chloride	13.33	0.00	13.33
Hydrogen Fluoride	13.33	0.00	13.33
Ammonia	...	...	...

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Particulates (Test 9) Uncertainty

Site: Darlaston
 Location: Exhaust Stack

$$u_{mass} = \sqrt{\sum (u_{filter})^2 + (u_{solution})^2}$$

Determinand	Filter mg	Solution mg	Recovered Mass mg	LAB Method Uncert (%) K= 2		Standard Uncertainty		Combined Uncertainty mg
				Filter mg	Solution mg	Filter mg	Solution mg	
TPM 9								
Particulates	0.10	0.50	0.60	0.10	0.50	0.0500	0.25	0.25
...
...
...

	TPM 9		Standard Uncertainty @ 95%	
Sampled Volume (V _m)	1.30	m ³	uV _m	0.001 m ³
Meter Correction Factor (Y _d)	1.05	...	...	...
Meter Temperature (T _m)	294.67	k	uT _m	1.5 k
Average Differential Pressure (ΔH)	48.40	mmH ₂ O	uΔH	0.25 mmH ₂ O
Barometric Pressure (p _b)	756.06	mmHg	u _{p_b}	3.8 mmHg
ΔH + p _s (p _m)	101.27	kPa	...	...
Oxygen content (O _{2,m})	21.00	% by volume	uO _{2,m} = σ/√n	0.00 % by volume
Moisture Content (H ₂ O)	1.32	% by volume	uH ₂ O	0.12 % 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_iu_i where C is the sensitivity coefficient, u_i is the standard uncertainty and i is the index identifying the contributing factor e.g. i = uV_m, uT_m etc.

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

TPM 9:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.01$$

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

TPM 9:

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.983$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.98	0.98	0.0000952	0.0000238
u _{p_b}	0.99	0.98	0.00129	0.00485
uT _m	0.99	0.98	0.00334	0.00500
H ₂ O	0.98	0.98	0.00996	0.00123

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_b)^2}}{(P_b/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{(100/(100 - H_2O))}\right)^2} = 0.00671$$

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

TPM 9:

$$V_{std} = V_{measured} \times f_s = 1.282$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty (m ³)
Effect of uV _{sd}	1.29	1.27	1.30	0.00875
Effect of uV _m	1.28	1.28	0.98	0.000983

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.0115$$

Uncertainty of Oxygen Correction Factor (%):-

TPM 9:

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$uCorr_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured})(20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.00$$

$$uf_{o_2} = \frac{uCorr_{o_2}}{f_{o_2}} \times 100 = 0.00\%$$

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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

Determinand	TPM 9:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uM mg/Nm ³
Particulates	0.67	0.27	0.78	0.20
Hydrogen Chloride	...	...	...	...
Sulphur Dioxide	...	...	...	...
Ammonia	...	...	...	...

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

Determinand	TPM 9:
	uL mg/Nm ³
Particulates	0.00540
Hydrogen Chloride	...
Sulphur Dioxide	...
Ammonia	...

Uncertainty in final measurement @ Reference Conditions due to uVstp

Determinand	TPM 9:			
	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Particulates	0.47	0.46	0.37	0.00418
Hydrogen Chloride	...	...	...	...
Sulphur Dioxide	...	...	...	...
Ammonia	...	...	...	...

Measurement Uncertainty of Determinand (excluding correction for oxygen)

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

Determinand	TPM 9:				Uncertainty as Percentage of ELV
	Measurement Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration	
Particulates	0.20	0.40	0.47	85.03	...
Hydrogen Chloride	...	...	...	...	...
Sulphur Dioxide	...	...	...	...	...
Ammonia	...	...	...	...	...

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

Determinand	TPM 9:		
	Measurement Uncertainty of Determinand	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ factor (U _{combined})
Particulates	85.03	0.00	85.03
Hydrogen Chloride	...	...	...
Sulphur Dioxide	...	...	...
Ammonia	...	...	...

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Chlorinated Dioxins & Furans & PCBs Uncertainty (Test 3)

Site: Darlaston
 Location: Exhaust Stack

Dioxin	Recovered Mass ng	LOD ng	LAB Method Uncert (%) K= 2 %age	as Mass (ng)	Standard Uncertainty Symbol	ng
2,3,7,8 - TCDD	0.000290	0.0000800	50	0.000145	u2,3,7,8 - TCDD	0.0000725
1,2,3,7,8 - PCDD	0.000860	0.000140	50	0.000430	u1,2,3,7,8 - PCDD	0.000215
1,2,3,4,7,8 - HxCDD	0.000670	0.000120	50	0.000335	u1,2,3,4,7,8 - HxCDD	0.000168
1,2,3,6,7,8 - HxCDD	0.00173	0.000120	30	0.000519	u1,2,3,6,7,8 - HxCDD	0.000260
1,2,3,7,8,9 - HxCDD	0.000830	0.000130	50	0.000415	u1,2,3,7,8,9 - HxCDD	0.000208
1,2,3,4,6,7,8 - HpCDD	0.0115	0.000100	30	0.00345	u1,2,3,4,6,7,8 - HpCDD	0.00173
OCDD	0.0430	0.000260	30	0.0129	uOCDD	0.00645
2,3,7,8 - TCDF	0.00439	0.000120	30	0.00132	u2,3,7,8 - TCDF	0.000659
1,2,3,7,8 - PCDF	0.00196	0.000100	30	0.000588	u1,2,3,7,8 - PCDF	0.000294
2,3,4,7,8 - PCDF	0.00496	0.000900	30	0.00149	u2,3,4,7,8 - PCDF	0.000744
2,3,4,7,8 - HxCDF	0.00259	0.0000800	30	0.000777	u1,2,3,4,7,8 - HxCDF	0.000389
1,2,3,6,7,8 - HxCDF	0.00252	0.0000700	30	0.000756	u1,2,3,6,7,8 - HxCDF	0.000378
2,3,4,6,7,8 - HxCDF	0.00275	0.0000700	30	0.000825	u2,3,4,6,7,8 - HxCDF	0.000413
1,2,3,7,8,9 - HxCDF	0.000210	0.0000700	50	0.000105	u1,2,3,7,8,9 - HxCDF	0.0000525
1,2,3,4,6,7,8 - HpCDF	0.00743	0.0000500	30	0.00223	u1,2,3,4,6,7,8 - HpCDF	0.00111
1,2,3,4,7,8,9 - HpCDF	0.000840	0.0000500	30	0.000252	u1,2,3,4,7,8,9 - HpCDF	0.000126
OCDF	0.00580	0.000120	30	0.00174	uOCDF	0.000870

PCB	Recovered Mass ng	LAB Method Uncert (%) K= 2 Percentage	as Mass (ng)	Standard Uncertainty Symbol	ng
PCB BZ#105	0.228	20	0.0456	uPCB BZ#105	0.0228
PCB BZ#114	0.0227	20	0.00454	uPCB BZ#114	0.00227
PCB BZ#118	0.620	20	0.124	uPCB BZ#118	0.0620
PCB BZ#123	0.0170	20	0.00340	uPCB BZ#123	0.00170
PCB BZ#126	0.0117	20	0.00234	uPCB BZ#126	0.00117
PCB BZ#156	0.0427	20	0.00854	uPCB BZ#156	0.00427
PCB BZ#157	0.00760	20	0.00152	uPCB BZ#157	0.000760
PCB BZ#167	0.0165	20	0.00330	uPCB BZ#167	0.00165
PCB BZ#169	0.00214	20	0.000428	uPCB BZ#169	0.000214
PCB BZ#189	0.00475	20	0.000950	uPCB BZ#189	0.000475
PCB BZ#77	0.436	20	0.0872	uPCB BZ#77	0.0436
PCB BZ#81	0.0341	20	0.00682	uPCB BZ#81	0.00341

Measured Values			Standard Uncertainty @ 95%		
Sampled Volume (V _m)	7.681	m ³	uV _m	0.001	m ³
Meter Correction Factor (Y _d)	1.048	...	...	...	...
Meter Temperature (T _m)	294.708	K	uT _m	1.5	K
Average Differential Pressure (ΔH)	48.400	mmH ₂ O	uΔH	0.25	mmH ₂ O
Barometric Pressure (P _b)	746.309	mmHg	uP _b	3.8	mmHg
ΔH + P _s (P _m)	99.974	kPa	...	...	...
Oxygen content (O _{2,m})	21.000	% by volume	uO _{2,m} = σ/√n	0.00	% by volume
Moisture Content (H ₂ O)	1.355	% by volume	uH ₂ O	0.04	% 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 (uP_b) & measured temperature of dry gas

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{T_m}}{13.6} \times Y_d = 0.971$$

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

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.014$$

	Maximum	Minimum	Sensitivity	ufsp
uΔH	0.971	0.971	0.0000952	0.0000238
uP _b	0.976	0.966	0.00129	0.00485
uT _m	0.976	0.966	0.00329	0.00494
H ₂ O	0.971	0.970	0.00984	0.000403

$$u_{f_s} = \sqrt{\left(\frac{u\Delta H}{P_m/101.3}\right)^2 + \left(\frac{uT_m}{T_m/273.15}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = 0.00654$$

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

$$V_{std} = V_{measured} \times f_s = 7.456$$

	Maximum	Minimum	Sensitivity	Standard Uncertainty
Effect of uV _{std}	7.506	7.406	7.681	0.0502
Effect of uV _m	7.457	7.455	0.971	0.000971

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{V_{std}}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.3856$$

Uncertainty of oxygen correction factor (uO₂)

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.000 \quad uCorr_{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} =$$

$$\therefore u_{f_{O_2}} = \frac{uCorr_{O_2}}{f_{O_2}} \times 100 = 0\%$$

Environmental Compliance Limited

Ecobat Solutions

Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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	0.0000486	0.0000292	0.134	9.723E-06
1,2,3,7,8 - PCDD	0.000144	0.0000865	0.134	0.0000288
1,2,3,4,7,8 - HxCDD	0.000112	0.0000674	0.134	0.0000225
1,2,3,6,7,8 - HxCDD	0.000267	0.000197	0.134	0.0000348
1,2,3,7,8,9 - HxCDD	0.00139	0.000835	0.134	0.0000278
1,2,3,4,6,7,8 - HpCDD	0.00177	0.00131	0.134	0.000231
OCDD	0.00663	0.00490	0.134	0.000865
2,3,7,8 - TCDF	0.000677	0.000500	0.134	0.0000883
1,2,3,7,8 - PCDF	0.000302	0.000223	0.134	0.0000394
2,3,4,7,8 - PCDF	0.000765	0.000565	0.134	0.0000998
1,2,3,4,7,8 - HxCDF	0.000399	0.000295	0.134	0.0000521
1,2,3,6,7,8 - HxCDF	0.000389	0.000287	0.134	0.0000507
2,3,4,6,7,8 - HxCDF	0.000424	0.000313	0.134	0.0000553
1,2,3,7,8,9 - HxCDF	0.0000352	0.0000211	0.134	7.041E-06
1,2,3,4,6,7,8 - HpCDF	0.00115	0.000847	0.134	0.000149
1,2,3,4,7,8,9 - HpCDF	0.00193	0.00130	0.134	0.000169
OCDF	0.00895	0.00661	0.134	0.000117

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	0.0336	0.0275	0.134	0.00306
PCB BZ#114	0.00335	0.00274	0.134	0.000304
PCB BZ#118	0.0915	0.0748	0.134	0.00832
PCB BZ#123	0.00251	0.00205	0.134	0.000228
PCB BZ#126	0.00173	0.00141	0.134	0.000157
PCB BZ#156	0.00630	0.00515	0.134	0.000573
PCB BZ#157	0.00112	0.000917	0.134	0.000102
PCB BZ#167	0.00243	0.00199	0.134	0.000221
PCB BZ#169	0.000316	0.000258	0.134	0.0000287
PCB BZ#189	0.000701	0.000573	0.134	0.0000637
PCB BZ#77	0.0643	0.0526	0.134	0.00585
PCB BZ#81	0.00503	0.00412	0.134	0.000457

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	4.491E-07
1,2,3,7,8 - PCDD	1.332E-06
1,2,3,4,7,8 - HxCDD	1.038E-06
1,2,3,6,7,8 - HxCDD	2.679E-06
1,2,3,7,8,9 - HxCDD	1.285E-06
1,2,3,4,6,7,8 - HpCDD	0.0000178
OCDD	0.0000666
2,3,7,8 - TCDF	6.798E-06
1,2,3,7,8 - PCDF	3.035E-06
2,3,4,7,8 - PCDF	7.681E-06
1,2,3,4,7,8 - HxCDF	4.011E-06
1,2,3,6,7,8 - HxCDF	3.903E-06
2,3,4,6,7,8 - HxCDF	4.259E-06
1,2,3,7,8,9 - HxCDF	3.252E-07
1,2,3,4,6,7,8 - HpCDF	0.0000115
1,2,3,4,7,8,9 - HpCDF	1.301E-06
OCDF	8.982E-06

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	0.0000353
PCB BZ#114	0.0000352
PCB BZ#118	0.000960
PCB BZ#123	0.0000263
PCB BZ#126	0.0000181
PCB BZ#156	0.0000661
PCB BZ#157	0.0000118
PCB BZ#167	0.0000256
PCB BZ#169	3.314E-06
PCB BZ#189	7.356E-06
PCB BZ#77	0.000675
PCB BZ#81	0.0000528

Uncertainty in final measurement @ Reference Conditions due to u/Stp

Dioxin	Maximum ng/Nm ³	Minimum ng/Nm ³	Sensitivity	u/Stp mg/Nm ³
2,3,7,8 - TCDD	0.0000410	0.0000370	5.230E-06	2.017E-06
1,2,3,7,8 - PCDD	0.000122	0.000110	0.0000155	5.980E-06
1,2,3,4,7,8 - HxCDD	0.0000948	0.0000854	0.0000121	4.659E-06
1,2,3,6,7,8 - HxCDD	0.000245	0.000221	0.0000312	0.0000120
1,2,3,7,8,9 - HxCDD	0.00117	0.00106	0.000115	5.772E-06
1,2,3,4,6,7,8 - HpCDD	0.00163	0.00147	0.000207	0.0000800
OCDD	0.00608	0.00548	0.000776	0.000299
2,3,7,8 - TCDF	0.000621	0.000560	0.0000792	0.0000305
1,2,3,7,8 - PCDF	0.000277	0.000250	0.0000353	0.0000136
2,3,4,7,8 - PCDF	0.000710	0.000633	0.0000895	0.0000345
1,2,3,4,7,8 - HxCDF	0.000366	0.000330	0.0000467	0.0000180
1,2,3,6,7,8 - HxCDF	0.000356	0.000321	0.0000454	0.0000175
2,3,4,6,7,8 - HxCDF	0.000389	0.000351	0.0000496	0.0000191
1,2,3,7,8,9 - HxCDF	0.0000297	0.0000268	3.787E-06	1.460E-06
1,2,3,4,6,7,8 - HpCDF	0.00105	0.000947	0.000134	0.0000517
1,2,3,4,7,8,9 - HpCDF	0.00119	0.00107	0.000151	5.841E-06
OCDF	0.00820	0.00740	0.000105	0.0000403

Uncertainty in final measurement @ Reference Conditions due to u/Stp

PCB	Maximum ng/Nm ³	Minimum ng/Nm ³	Sensitivity	u/Stp mg/Nm ³
PCB BZ#105	0.0322	0.0291	0.00411	0.00159
PCB BZ#114	0.00321	0.00289	0.000409	0.000158
PCB BZ#118	0.0877	0.0791	0.0112	0.00431
PCB BZ#123	0.00240	0.00217	0.000307	0.000118
PCB BZ#126	0.00165	0.00149	0.000211	0.0000814
PCB BZ#156	0.00630	0.00545	0.000770	0.000287
PCB BZ#157	0.00107	0.000969	0.000137	0.0000529
PCB BZ#167	0.00233	0.00210	0.000298	0.000115
PCB BZ#169	0.000303	0.000273	0.0000386	0.0000149
PCB BZ#189	0.000672	0.000606	0.0000857	0.0000330
PCB BZ#77	0.0617	0.0556	0.00786	0.00303
PCB BZ#81	0.00482	0.00435	0.000615	0.000237

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

Dioxin	Combined Uncertainty ng/Nm ³	Expanded Uncertainty ng/Nm ³	Measured Concentration ng/Nm ³	% of Measured Concentration
2,3,7,8 - TCDD	9.940E-06	0.0000199	0.0000389	51.116
1,2,3,7,8 - PCDD	0.0000295	0.0000590	0.000115	51.116
1,2,3,4,7,8 - HxCDD	0.0000230	0.0000459	0.0000899	51.116
1,2,3,6,7,8 - HxCDD	0.0000369	0.0000738	0.000232	31.826
1,2,3,7,8,9 - HxCDD	0.0000285	0.0000569	0.000111	51.116
1,2,3,4,6,7,8 - HpCDD	0.000245	0.000491	0.00154	31.826
OCDD	0.000918	0.00184	0.00577	31.826
2,3,7,8 - TCDF	0.0000937	0.000187	0.000589	31.826
1,2,3,7,8 - PCDF	0.0000418	0.0000837	0.000263	31.826
2,3,4,7,8 - PCDF	0.000106	0.000212	0.000665	31.826
1,2,3,4,7,8 - HxCDF	0.0000553	0.000111	0.000347	31.826
1,2,3,6,7,8 - HxCDF	0.0000538	0.000108	0.000338	31.826
2,3,4,6,7,8 - HxCDF	0.0000587	0.000117	0.000389	31.826
1,2,3,7,8,9 - HxCDF	7.198E-06	0.0000144	0.0000282	51.116
1,2,3,4,6,7,8 - HpCDF	0.000159	0.000317	0.000996	31.826
1,2,3,4,7,8,9 - HpCDF	0.0000179	0.0000359	0.000113	31.826
OCDF	0.000124	0.000248	0.000778	31.826
Total (ng/Nm³)		0.012	16.0	

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

PCB	Combined Uncertainty ng/Nm ³	Expanded Uncertainty ng/Nm ³	Measured Concentration ng/Nm ³	% of Measured Concentration
PCB BZ#105	0.00346	0.00692	0.0306	22.647
PCB BZ#114	0.000345	0.00069	0.00304	22.647
PCB BZ#118	0.00942	0.0188	0.0832	22.647
PCB BZ#123	0.000258	0.000516	0.00228	22.647
PCB BZ#126	0.000178	0.000356	0.00157	22.647
PCB BZ#156	0.000648	0.001296	0.00573	22.647
PCB BZ#157	0.000115	0.000231	0.00102	22.647
PCB BZ#167	0.000251	0.000501	0.00221	22.647
PCB BZ#169	0.0000325	0.000065	0.000287	22.647
PCB BZ#189	0.0000721	0.000144	0.000637	22.647
PCB BZ#77	0.00662	0.0132	0.0585	22.647
PCB BZ#81	0.000518	0.001036	0.00457	22.647
Total (ng/Nm³)		0.19	12.5	

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

Dioxin	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ³ Factor	Overall Measurement Uncertainty inc O ₂ Corr ³ Factor (Ucombined)	New Combined Uncertainty ng/Nm ³
2,3,7,8 - TCDD	51.116	0.00	51.116	9.940E-06
1,2,3,7,8 - PCDD	51.116	0.00	51.116	0.0000295
1,2,3,4,7,8 - HxCDD	51.116	0.00	51.116	0.0000230
1,2,3,6,7,8 - HxCDD	31.826	0.00	31.826	0.0000369
1,2,3,7,8,9 - HxCDD	51.116	0.00	51.116	0.0000285
1,2,3,4,6,7,8 - HpCDD	31.826	0.00	31.826	0.000245
OCDD	31.826	0.00	31.826	0.000918
2,3,7,8 - TCDF	31.826	0.00	31.826	0.0000937
1,2,3,7,8 - PCDF	31.826	0.00	31.826	0.0000418
2,3,4,7,8 - PCDF	31.826	0.00	31.826	0.000106
1,2,3,4,7,8 - HxCDF	31.826	0.00	31.826	0.0000553
1,2,3,6,7,8 - HxCDF	31.826	0.00	31.826	0.0000538
2,3,4,6,7,8 - HxCDF	31.826	0.00	31.826	0.0000587
1,2,3,7,8,9 - HxCDF	51.116	0.00	51.116	7.198E-06
1,2,3,4,6,7,8 - HpCDF	31.826	0.00	31.826	0.000159
1,2,3,4,7,8,9 - HpCDF	31.826	0.00	31.826	0.0000179
OCDF	31.826	0.00	31.826	0.000124

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

PCB	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ³ Factor	Overall Measurement Uncertainty inc O ₂ Corr ³ Factor (Ucombined)	New Combined Uncertainty ng/Nm ³
PCB BZ#105	22.647	0.00	22.647	0.00346
PCB BZ#114	22.647	0.00	22.647	0.000345
PCB BZ#118	22.647	0.00	22.647	0.00942
PCB BZ#123	22.647	0.00	22.647	0.000258
PCB BZ#126	22.647	0.00	22.647	0.000178
PCB BZ#156	22.647	0.00	22.647	0.000648
PCB BZ#157	22.647	0.00	22.647	0.000115
PCB BZ#167	22.647	0.00	22.647	0.000251
PCB BZ#169	22.647	0.00	22.647	0.0000325
PCB BZ#189	22.647	0.00	22.647	0.0000721
PCB BZ#77	22.647	0.00	22.647	0.00662
PCB BZ#81	22.647	0.00	22.647	0.000518

Environmental Compliance Limited

Ecobat Solutions

Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Roo2

Installation Name : Recupyl Shredder Exhaust

Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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	0.000199	0.000389	1	0.000199	0.000389	1	0.000199	0.000389	1	0.000199	0.000389
1,2,3,7,8 - PCDD	0.5	0.000295	0.000577	1	0.000590	0.00115	1	0.000590	0.00115	1	0.000590	0.00115
1,2,3,4,7,8 - HxCDD	0.1	4.593E-06	8.986E-06	0.1	4.593E-06	8.986E-06	0.5	0.000230	0.000449	0.05	2.297E-06	4.493E-06
1,2,3,6,7,8 - HxCDD	0.1	7.384E-06	0.000232	0.1	7.384E-06	0.000232	0.01	7.384E-07	2.320E-06	0.01	7.384E-07	2.320E-06
1,2,3,7,8,9 - HxCDD	0.1	5.690E-06	0.000111	0.1	5.690E-06	0.000111	0.01	5.690E-07	1.135E-06	0.1	5.690E-06	0.000111
1,2,3,4,6,7,8 - HpCDD	0.01	4.909E-06	0.000154	0.01	4.909E-06	0.000154	0.001	4.909E-07	1.542E-06	0.001	4.909E-07	1.542E-06
OCDD	0.001	1.835E-06	5.767E-06	0.0001	1.835E-07	5.767E-07	...	...	...	...	...	...
2,3,7,8 - TCDF	0.1	0.000187	0.000589	0.1	0.000187	0.000589	0.05	9.369E-06	0.000294	1	0.000187	0.000589
1,2,3,7,8 - PCDF	0.05	4.183E-06	0.000131	0.05	4.183E-06	0.000131	0.05	4.183E-06	0.000131	0.1	8.366E-06	0.000263
2,3,4,7,8 - PCDF	0.5	0.000106	0.000333	0.5	0.000106	0.000333	0.5	0.000106	0.000333	1	0.000212	0.000665
1,2,3,4,7,8 - HxCDF	0.1	0.0000111	0.0000347	0.1	0.0000111	0.0000347	0.1	0.0000111	0.0000347	0.1	0.0000111	0.0000347
1,2,3,6,7,8 - HxCDF	0.1	0.0000108	0.0000338	0.1	0.0000108	0.0000338	0.1	0.0000108	0.0000338	0.1	0.0000108	0.0000338
2,3,4,6,7,8 - HxCDF	0.1	0.0000117	0.0000369	0.1	0.0000117	0.0000369	0.1	0.0000117	0.0000369	0.1	0.0000117	0.0000369
1,2,3,7,8,9 - HxCDF	0.1	1.440E-06	2.816E-06	0.1	1.440E-06	2.816E-06	0.1	1.440E-06	2.816E-06	0.1	1.440E-06	2.816E-06
1,2,3,4,6,7,8 - HpCDF	0.01	3.171E-06	9.965E-06	0.01	3.171E-06	9.965E-06	0.01	3.171E-06	9.965E-06	0.01	3.171E-06	9.965E-06
1,2,3,4,7,8,9 - HpCDF	0.001	3.585E-07	1.127E-06	0.001	3.585E-07	1.127E-06	0.001	3.585E-07	1.127E-06	0.001	3.585E-07	1.127E-06
OCDF	0.001	2.476E-07	7.779E-07	0.0001	2.476E-08	7.779E-08	0.0001	2.476E-08	7.779E-08	0.0001	2.476E-08	7.779E-08
TOTAL	...	0.000	0.001	...	0.000	0.001	...	0.000	0.001	...	0.000	0.002
% Uncertainty	...	...	16.855	...	...	17.131	...	...	18.159	...	...	18.5

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	6.925E-07	3.058E-06	0.000005	3.462E-08	1.529E-07	0.0001	6.925E-07	3.058E-06
PCB BZ#114	0.0005	3.447E-07	1.522E-06	0.000005	3.447E-09	1.522E-08	0.0001	6.895E-08	3.044E-07
PCB BZ#118	0.0001	1.883E-06	8.315E-06	0.000005	9.416E-08	4.158E-07	0.00001	1.883E-07	8.315E-07
PCB BZ#123	0.0001	5.163E-08	2.280E-07	0.000005	2.582E-09	1.140E-08	0.00001	5.163E-09	2.280E-08
PCB BZ#126	0.1	0.0000355	0.000157	0.005	1.777E-06	7.846E-06	0.1	0.0000355	0.000157
PCB BZ#156	0.0005	6.485E-07	2.863E-06	0.000005	6.485E-09	2.863E-08	0.0001	1.297E-07	5.727E-07
PCB BZ#157	0.0005	1.154E-07	5.096E-07	0.000005	1.154E-09	5.096E-09	0.0001	2.308E-08	1.019E-07
PCB BZ#167	0.00001	5.012E-09	2.213E-08	0.000005	2.506E-09	1.106E-08	0.00001	5.012E-09	2.213E-08
PCB BZ#169	0.01	6.500E-07	2.870E-06	0.00005	3.250E-09	1.435E-08	0.001	6.500E-08	2.870E-07
PCB BZ#189	0.0001	1.443E-08	6.370E-08	0.000005	7.214E-10	3.185E-09	0.00001	1.443E-09	6.370E-09
PCB BZ#77	0.0001	1.324E-06	5.847E-06	0.0001	1.324E-06	5.847E-06	0.05	0.000662	0.00292
PCB BZ#81	0.0001	1.036E-07	4.573E-07	0.0005	5.179E-07	2.287E-06	0.1	0.000104	0.000457
TOTAL	...	0.000036	0.00018	...	0.000023	0.000017	...	0.00067	0.0035
% Uncertainty	...	...	19.5	...	...	13.7	...	...	18.9

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Brominated Dioxins & Furans & PCBs Uncertainty (Test 3)

Site: Darlaston Location: Exhaust Stack						
Dioxin	Recovered Mass ng	LOD ng	LAB Method Uncert (%) %age	K= 2 as Mass (ng)	Standard Uncertainty Symbol	ng
2,3,7,8 - TBDD	0.001090	0.001690	50	0.000545	u2,3,7,8 - TBDD	0.0002725
1,2,3,7,8 - PBDD	0.002030	0.002430	50	0.001015	u1,2,3,7,8 - PBDD	0.000508
1,2,3,4,7,8 - HxBDD	0.038600	0.025000	50	0.019300	u1,2,3,4,7,8 - HxBDD	0.009650
1,2,3,6,7,8 - HxBDD					u1,2,3,6,7,8 - HxBDD	
1,2,3,7,8,9 - HxBDD	0.040000	0.025900	50	0.020000	u1,2,3,7,8,9 - HxBDD	0.010000
1,2,3,4,6,7,8 - HpBDD	0.079000	0.035200	50	0.03950	u1,2,3,4,6,7,8 - HpBDD	0.01975
OBDD	0.823000	0.199000	50	0.4115	uOBDD	0.20575
2,3,7,8 - TBDF	0.00136	0.001610	50	0.000680	u2,3,7,8 - TBDF	0.000340
1,2,3,7,8 - PBDF	0.00332	0.002100	50	0.001660	u1,2,3,7,8 - PBDF	0.000830
2,3,4,7,8 - PBDF	0.00348	0.002200	50	0.00174	u2,3,4,7,8 - PBDF	0.000870
1,2,3,4,7,8 - HxBDF	0.00850	0.002860	50	0.00425	u1,2,3,4,7,8 - HxBDF	0.002125
1,2,3,6,7,8 - HxBDF					u1,2,3,6,7,8 - HxBDF	
2,3,4,6,7,8 - HxBDF					u2,3,4,6,7,8 - HxBDF	
1,2,3,7,8,9 - HxBDF					u1,2,3,7,8,9 - HxBDF	
1,2,3,4,6,7,8 - HpBDF	0.06140	0.012900	50	0.03070	u1,2,3,4,6,7,8 - HpBDF	0.01535
1,2,3,4,7,8,9 - HpBDF					u1,2,3,4,7,8,9 - HpBDF	
OCEB	0.12900	0.080700	50	0.06450	uOCEB	0.032250

Measured Values		Standard Uncertainty @ 95%	
Sampled Volume (V _m)	7.681 m ³	uV _m	0.001 m ³
Meter Correction Factor (Y _d)	1.048		
Meter Temperature (T _m)	294.708 K	uT _m	1.5 K
Average Differential Pressure (ΔH)	48.400 mmH ₂ O	uΔH	0.25 mmH ₂ O
Barometric Pressure (p _b)	746.309 mmHg	u _{p_b}	3.8 mmHg
ΔH + p _s (p _m)	99.974 kPa		
Oxygen content (O _{2,m})	21.000 % by volume	uO _{2,m} = σ/√n	0.00 % by volume
Moisture Content (H ₂ O)	1.355 % by volume	uH ₂ O	0.04 % 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_b}) & measured temperature of dry gas

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.971$$

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

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.014$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.971	0.971	0.0000952	0.0000238
u _{p_b}	0.976	0.966	0.00129	0.00485
uT _m	0.976	0.966	0.00329	0.00494
H ₂ O	0.971	0.970	0.010	0.000

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_b)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{(100/(100 - H_2O))}\right)^2} = 0.00654$$

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

$$V_{std} = V_{measured} \times f_s = 7.456$$

	Maximum	Minimum	Sensitivity	Standard Uncertainty
	m ³	m ³		m ³
Effect of uV _{std}	7.506	7.406	7.681	0.0502
Effect of uV _m	7.457	7.455	0.971	0.000971

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.3856$$

Uncertainty of oxygen correction factor (ufO₂)

$$f_{O_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.000 \quad uCorr^{O_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.000$$

$$\therefore uf_{O_2} = \frac{uCorr^{O_2}}{f_{O_2}} \times 100 = 0\%$$

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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 - TBDD	0.0001827	0.0001096	0.134	3.655E-05
1,2,3,7,8 - PBDD	0.000340	0.0002042	0.134	0.0000881
1,2,3,4,7,8 - HxBDD	0.006471	0.003883	0.134	0.0012942
1,2,3,7,8,9 - HxBDD	0.006706	0.004023	0.134	0.0013412
1,2,3,4,6,7,8 - HpBDD	0.01324	0.00795	0.134	0.002649
OBDD	0.13797	0.08278	0.134	0.027594
2,3,7,8 - TPDF	0.000228	0.000137	0.134	0.0000455
1,2,3,7,8 - PPDF	0.000557	0.000334	0.134	0.0001113
2,3,4,7,8 - PPDF	0.000583	0.000350	0.134	0.000117
1,2,3,4,7,8 - HxPDF	0.001425	0.000855	0.134	0.0002850
1,2,3,4,6,7,8 - HpPDF	0.01029	0.00618	0.134	0.002059
OCBF	0.021626	0.012976	0.134	0.004325

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 - TBDD	1.688E-06			
1,2,3,7,8 - PBDD	3.144E-06			
1,2,3,4,7,8 - HxBDD	5.978E-05			
1,2,3,7,8,9 - HxBDD	6.195E-05			
1,2,3,4,6,7,8 - HpBDD	0.0001223			
OBDD	0.0012745			
2,3,7,8 - TPDF	2.106E-06			
1,2,3,7,8 - PPDF	5.141E-06			
2,3,4,7,8 - PPDF	5.389E-06			
1,2,3,4,7,8 - HxPDF	1.316E-05			
1,2,3,4,6,7,8 - HpPDF	0.0000951			
OCBF	1.998E-04			

Uncertainty in final measurement @ Reference Conditions due to uVsp				
Dioxin	Maximum ng/Nm ³	Minimum ng/Nm ³	Sensitivity	uVsp ng/Nm ³
2,3,7,8 - TBDD	0.0001642	0.0001390	1.966E-05	7.580E-06
1,2,3,7,8 - PBDD	0.000287	0.0002589	0.0000366	1.412E-05
1,2,3,4,7,8 - HxBDD	0.005459	0.004922	0.0006962	2.684E-04
1,2,3,7,8,9 - HxBDD	0.005657	0.005101	0.0007214	2.782E-04
1,2,3,4,6,7,8 - HpBDD	0.01117	0.01007	0.001425	0.000549
OBDD	0.11640	0.10495	0.014843	0.005723
2,3,7,8 - TPDF	0.000192	0.000173	0.0000245	0.0000095
1,2,3,7,8 - PPDF	0.000470	0.000423	0.0000599	0.0000231
2,3,4,7,8 - PPDF	0.000492	0.000444	0.000063	0.0000242
1,2,3,4,7,8 - HxPDF	0.001202	0.001084	0.0001533	0.0000591
1,2,3,4,6,7,8 - HpPDF	0.00868	0.00783	0.001107	0.0004270
OCBF	0.018244	0.016450	0.002327	0.0008971

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

Dioxin	Combined Uncertainty ng/Nm ³	Expanded Uncertainty ng/Nm ³	Measured Concentration ng/Nm ³	% of Measured Concentration
2,3,7,8 - TBDD	3.736E-05	0.0000747	0.0001462	51.116
1,2,3,7,8 - PBDD	0.0000696	0.0001382	0.000272	51.116
1,2,3,4,7,8 - HxBDD	0.0013231	0.0026462	0.005177	51.116
1,2,3,7,8,9 - HxBDD	0.0013711	0.0027422	0.005365	51.116
1,2,3,4,6,7,8 - HpBDD	0.002708	0.005416	0.01060	51.116
OBDD	0.028210	0.05642	0.11038	51.116
2,3,7,8 - TPDF	0.0000466	0.000093	0.000182	51.116
1,2,3,7,8 - PPDF	0.0001138	0.0002276	0.000445	51.116
2,3,4,7,8 - PPDF	0.000119	0.000239	0.000467	51.116
1,2,3,4,7,8 - HxPDF	0.0002914	0.000583	0.001140	51.116
1,2,3,4,6,7,8 - HpPDF	0.002105	0.004209	0.00823	51.116
OCBF	0.004422	0.008844	0.017301	51.116
Total (ng/Nm³)	0.160	0.316	0.316	36.1

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

Dioxin	% of Measured Concentration	Measurement Uncertainty of Oxygen Cor ⁿ Factor	Overall Measurement Uncertainty Co ⁿ Factor (Uncombined)	New Combined Uncertainty ng/Nm ³
2,3,7,8 - TBDD	51.116	0.000	51.116	3.736E-05
1,2,3,7,8 - PBDD	51.116	0.000	51.116	0.0000696
1,2,3,4,7,8 - HxBDD	51.116	0.000	51.116	0.0013231
1,2,3,7,8,9 - HxBDD	51.116	0.000	51.116	0.0013711
1,2,3,4,6,7,8 - HpBDD	51.116	0.000	51.116	0.002708
OBDD	51.116	0.000	51.116	0.028210
2,3,7,8 - TPDF	51.116	0.000	51.116	0.0000466
1,2,3,7,8 - PPDF	51.116	0.000	51.116	0.0001138
2,3,4,7,8 - PPDF	51.116	0.000	51.116	0.000119
1,2,3,4,7,8 - HxPDF	51.116	0.000	51.116	0.0002914
1,2,3,4,6,7,8 - HpPDF	51.116	0.000	51.116	0.002105
OCBF	51.116	0.000	51.116	0.004422

Uncertainty - Adjusted for TEQ / TEF				
Dioxin	TEQ ng/Nm ³	Uncertainty ng/Nm ³	Conc ng/Nm ³	
2,3,7,8 - TBDD	0.0000747	0.0001462	1	
1,2,3,7,8 - PBDD	0.5	0.0000696	0.0001361	
1,2,3,4,7,8 - HxBDD	0.1	2.646E-04	0.0005177	
1,2,3,7,8,9 - HxBDD	0.1	2.742E-04	0.0005365	
1,2,3,4,6,7,8 - HpBDD	0.01	5.416E-05	0.0001060	
OBDD	0.001	5.642E-05	1.104E-04	
2,3,7,8 - TPDF	0.1	0.000093	0.0000182	
1,2,3,7,8 - PPDF	0.05	1.138E-05	0.0000223	
2,3,4,7,8 - PPDF	0.5	0.000119	0.000233	
1,2,3,4,7,8 - HxPDF	0.1	0.0000583	0.0001140	
1,2,3,4,6,7,8 - HpPDF	0.01	4.209E-05	0.0000823	
OCBF	0.001	8.844E-06	1.730E-05	
TOTAL	...	0.000	0.002	
% Uncertainty	...	...	20.878	

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Roo2

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Cadmium & Nickel (Test 7) Heavy Metals Uncertainty (Test 3)

Site: Darlaston
 Location: Exhaust Stack

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

Metal	Particulate mg	Vapour mg	LAB Method Uncert (%) K=2		Standard Uncertainty		Combined Standard Uncertainty of Measured	
			Particulate Phase	Vapour Phase	Particulate Phase mg/m ³	Vapour Phase mg/m ³	Symbol	mg/m ³
Antimony	0.600	0.246	15	16	0.0000450	0.0000197	uMSb	0.0000491
Arsenic	0.500	0.209	11	12	0.0000275	0.0000125	uMAs	0.0000302
Cadmium	0.500	0.193	12	10	0.0000300	9.645E-06	uMCd	0.0000315
Chromium	2.800	3.393	12	10	0.000168	0.000170	uMCr	0.000239
Cobalt	5.900	60.163	12	10	0.000354	0.00301	uMCo	0.00303
Copper	1.700	7.492	12	10	0.000102	0.000375	uMCu	0.000388
Lead	2.200	27.038	13	16	0.000143	0.00216	uMPb	0.00217
Manganese	8.500	46.976	16	10	0.000680	0.00235	uMMn	0.00245
Nickel	15.900	69.047	12	9	0.000954	0.00311	uMNI	0.00325
Selenium	0.700	0.418	14	14	0.0000490	0.0000293	uMSe	0.0000571
Thallium	0.400	0.139	14	14	0.0000280	9.758E-06	uMTl	0.0000297
Vanadium	0.400	0.123	12	9	0.0000240	5.544E-06	uMV	0.0000246

		Standard Uncertainty @ 95%	
Sampled Volume (V _m)	1.308	m ³	uV _m 0.001
Meter Correction Factor (Y _d)	1.048	...	...
Meter Temperature (T _m)	293.75	k	uT _m 1.5
Average Differential Pressure (ΔH)	48.40	mmH ₂ O	uDH 0.25
Barometric Pressure (p _b)	753.06	mmHg	uP _s 3.8
ΔH + p _s (p _m)	100.87	kPa	...
Oxygen content (O _{2,m})	21.00	% by volume	uO _{2,m} = σ/√n 0.00
Moisture Content (H ₂ O)	1.63	% by volume	uH ₂ O 0.13

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 (uP_s) & measured

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.985$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.985	0.985	0.0000958	0.0000239
uP _s	0.990	0.981	0.00130	0.00488
uT _m	0.990	0.980	0.00335	0.00503
H ₂ O	0.987	0.984	0.0100	0.0013

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

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.017$$

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = 0.00679$$

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

$$V_{std} = V_{measured} \times f_s = 1.289$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty m ³
Effect of uV _{std}	1.298	1.280	1.308	0.00888
Effect of uV _m	1.290	1.288	0.985	0.000985

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.0117$$

Uncertainty of oxygen correction factor (uf_{o2})

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$u_{Corr_{o_2}} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.00$$

$$\therefore uf_{o_2} = \frac{u_{Corr_{o_2}}}{f_{o_2}} \times 100 = 0\%$$

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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	0.000695	0.000619	0.776	0.0000381
Arsenic	0.000574	0.000527	0.776	0.0000235
Cadmium	0.000562	0.000513	0.776	0.0000244
Chromium	0.00499	0.00462	0.776	0.000185
Cobalt	0.0536	0.0489	0.776	0.00235
Copper	0.00743	0.00683	0.776	0.000301
Lead	0.0244	0.0210	0.776	0.00168
Manganese	0.0449	0.0411	0.776	0.00190
Nickel	0.0684	0.0634	0.776	0.00252
Selenium	0.000912	0.000823	0.776	0.0000443
Thallium	0.000441	0.000395	0.776	0.0000230
Vanadium	0.000425	0.000387	0.776	0.0000191

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

Metal	uL mg/Nm ³
Antimony	7.582E-06
Arsenic	6.352E-06
Cadmium	6.207E-06
Chromium	0.0000555
Cobalt	0.000592
Copper	0.0000823
Lead	0.000262
Manganese	0.000497
Nickel	0.000761
Selenium	0.0000100
Thallium	4.832E-06
Vanadium	4.687E-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	0.000663	0.000651	0.000509	5.940E-06
Arsenic	0.000555	0.000545	0.000427	4.976E-06
Cadmium	0.000542	0.000533	0.000417	4.863E-06
Chromium	0.00485	0.00476	0.00373	0.0000435
Cobalt	0.0517	0.0508	0.0398	0.000464
Copper	0.00720	0.00707	0.00553	0.0000645
Lead	0.0229	0.0225	0.0176	0.000205
Manganese	0.0434	0.0427	0.0334	0.000389
Nickel	0.0665	0.0653	0.0511	0.000596
Selenium	0.000875	0.000860	0.000673	7.848E-06
Thallium	0.000422	0.000415	0.000325	3.786E-06
Vanadium	0.000410	0.000402	0.000315	3.672E-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	0.0000393	0.0000786	0.000657	11.974
Arsenic	0.0000248	0.0000496	0.000550	9.016
Cadmium	0.0000257	0.0000514	0.000538	9.557
Chromium	0.000198	0.000396	0.00480	8.250
Cobalt	0.00247	0.00493	0.0513	9.628
Copper	0.000319	0.000638	0.00713	8.942
Lead	0.00171	0.00343	0.0227	15.116
Manganese	0.00200	0.00400	0.0430	9.291
Nickel	0.00270	0.00540	0.0659	8.196
Selenium	0.0000461	0.0000922	0.000868	10.622
Thallium	0.0000238	0.0000476	0.000418	11.379
Vanadium	0.0000200	0.0000400	0.000406	9.862

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

Metal	% of Measured Concentration	Measurement Uncertainty of Oxygen Cor ² Factor	Overall Measurement Uncertainty inc O ₂ Cor ² factor (Ucombined)	New Combined Uncertainty mg/Nm ³
Antimony	11.974	0.00	11.974	0.000039
Arsenic	9.016	0.00	9.016	0.000025
Cadmium	9.557	0.00	9.557	0.000026
Chromium	8.250	0.00	8.250	0.000198
Cobalt	9.628	0.00	9.628	0.002467
Copper	8.942	0.00	8.942	0.000319
Lead	15.116	0.00	15.116	0.001714
Manganese	9.291	0.00	9.291	0.001999
Nickel	8.196	0.00	8.196	0.002701
Selenium	10.622	0.00	10.622	0.000046
Thallium	11.379	0.00	11.379	0.000024
Vanadium	9.862	0.00	9.862	0.000020

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.

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Roo2

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Cadmium & Nickel (Test 8) Heavy Metals Uncertainty

Site: Darlaston
 Location: Exhaust Stack

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

Metal	Particulate mg	Vapour mg	LAB Method Uncert (%) K=2		Standard Uncertainty		Combined Standard Uncertainty of Measured	
			Particulate Phase	Vapour Phase	Particulate Phase mg/m ³	Vapour Phase mg/m ³	Symbol	mg/m ³
Cadmium	0.500	0.136	12	10	0.0000300	6.800E-06	uMcd	0.0000308
Nickel	9.600	8.206	12	9	0.000576	0.000369	uMNI	0.000684

				Standard Uncertainty @ 95%			
Sampled Volume (V _m)	1.333	m ³		uV _m	0.001	m ³	
Meter Correction Factor (Y _d)	1.048	...			...	...
Meter Temperature (T _m)	297.29	k		uT _m	1.5	k	
Average Differential Pressure (ΔH)	48.40	mmH ₂ O		uDH	0.25	mmH ₂ O	
Barometric Pressure (ρ _b)	753.06	mmHg		uρ _s	3.8	mmHg	
ΔH + ρ _s (ρ _m)	100.87	kPa			...	...
Oxygen content (O _{2,m})	21.00	% by volume		uO _{2,m} = σ/√n	0.00	% by volume	
Moisture Content (H ₂ O)	1.82	% by volume		uH ₂ O	0.13	% 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 (uρ_s) & measured

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

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{T_m}}{T_m} \times Y_d = 0.976$$

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.019$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.976	0.976	0.0000948	0.0000237
uρ _s	0.980	0.971	0.00129	0.00484
uT _m	0.980	0.971	0.00328	0.00492
H ₂ O	0.977	0.974	0.0099	0.0013

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = 0.00658$$

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

$$V_{std} = V_{measured} \times f_s = 1.300$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty m ³
Effect of uV _{std}	1.309	1.292	1.333	0.00878
Effect of uV _m	1.301	1.299	0.976	0.000976

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.0117$$

Uncertainty of oxygen correction factor (uf_{o2})

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$uCorr_{o_2} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times (20.9\% - O_{2,measured})} \times \text{Uncertainty of } O_2 \text{ Measurement} = 1.00$$

$$\therefore uf_{o_2} = \frac{uCorr_{o_2}}{f_{o_2}} \times 100 = 0\%$$

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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
Cadmium	0.000513	0.000465	0.769	0.0000237
Nickel	0.0142	0.0132	0.769	0.000526

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

Metal	uL mg/Nm ³
Cadmium	5.647E-06
Nickel	0.000158

Uncertainty in final measurement @ Reference Conditions due to uVstp

Metal	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Cadmium	0.000494	0.000485	0.000376	4.415E-06
Nickel	0.0138	0.0136	0.0105	0.000124

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

Metal	Combined Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration
Cadmium	0.0000247	0.0000494	0.000489	10.108
Nickel	0.000563	0.00113	0.0137	8.225

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

Metal	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ factor (U _{combined})	New Combined Uncertainty mg/Nm ³
Cadmium	10.108	0.00	10.108	0.000025
Nickel	8.225	0.00	8.225	0.000563

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.

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : Ro02

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

Cadmium & Nickel (Test 9) Heavy Metals Uncertainty

Site: Darlaston
 Location: Exhaust Stack

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

Metal	Particulate mg	Vapour mg	LAB Method Uncert (%) K= 2		Standard Uncertainty		Combined Standard Uncertainty of Measured Mass	
			Particulate Phase	Vapour Phase	Particulate Phase mg/m ³	Vapour Phase mg/m ³	Symbol	mg/m ³
Cadmium	0.500	0.136	12	10	0.0000300	6.800E-06	uMcd	0.0000308
Nickel	9.600	8.206	12	9	0.000576	0.000369	uMni	0.000684

				Standard Uncertainty @ 95%		
Sampled Volume (V _m)	1.333	m ³		uV _m	0.001	m ³
Meter Correction Factor (Yd)	1.048	...		...	...	...
Meter Temperature (T _m)	297.29	k		uT _m	1.5	k
Average Differential Pressure (ΔH)	48.40	mmH ₂ O		uDH	0.25	mmH ₂ O
Barometric Pressure (p _s)	753.06	mmHg		u _{p_s}	3.8	mmHg
ΔH + p _s (p _m)	100.87	kPa		...	...	...
Oxygen content (O _{2,m})	21.00	% by volume		uO _{2,m} = σ/√n	0.00	% by volume
Moisture Content (H ₂ O)	1.82	% by volume		uH ₂ O	0.13	% 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_s}) & measured temperature of (uT_m)

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

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{T_m}}{T_m} \times Y_d = 0.976 \quad f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.019$$

	Maximum	Minimum	Sensitivity	ufstp
uΔH	0.976	0.976	0.0000948	0.0000237
u _{p_s}	0.980	0.971	0.00129	0.00484
uT _m	0.980	0.971	0.00328	0.00492
H ₂ O	0.977	0.974	0.0099	0.0013

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = 0.00658$$

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

$$V_{std} = V_{measured} \times f_s = 1.300$$

	Maximum m ³	Minimum m ³	Sensitivity	Standard Uncertainty m ³
Effect of uV _{std}	1.309	1.292	1.333	0.00878
Effect of uV _m	1.301	1.299	0.976	0.000976

Combined Standard Uncertainty

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.0117$$

Uncertainty of oxygen correction factor (uf_{o₂})

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

$$u_{Corr_{o_2}} = \frac{20.9\% - O_{2,ref}}{(20.9\% - O_{2,measured}) \times \text{Uncertainty of } O_2 \text{ Measurement}} = 1.00$$

$$\therefore uf_{o_2} = \frac{u_{Corr_{o_2}}}{f_{o_2}} \times 100 = 0\%$$

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5350 : R002

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions Testing – 2023
 Survey Dates : 31st January – 2nd February, 15th – 16th & 21st – 23rd February & 17th March 2023
 Report Issue Date : 24th April 2023

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
Cadmium	0.000513	0.000465	0.769	0.0000237
Nickel	0.0142	0.0132	0.769	0.000526

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
Cadmium	5.647E-06
Nickel	0.000158

Uncertainty in final measurement @ Reference Conditions due to uVstp

Metal	Maximum mg/Nm ³	Minimum mg/Nm ³	Sensitivity	uVstp mg/Nm ³
Cadmium	0.000494	0.000485	0.000376	4.415E-06
Nickel	0.0138	0.0136	0.0105	0.000124

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

Metal	Combined Uncertainty mg/Nm ³	Expanded Uncertainty mg/Nm ³	Measured Concentration mg/Nm ³	Percent of Measured Concentration
Cadmium	0.0000247	0.0000494	0.000489	10.108
Nickel	0.000563	0.00113	0.0137	8.225

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

Metal	% of Measured Concentration	Measurement Uncertainty of Oxygen Corr ⁿ Factor	Overall Measurement Uncertainty inc O ₂ Corr ⁿ factor (U _{combined})	New Combined Uncertainty mg/Nm ³
Cadmium	10.108	0.00	10.108	0.000025
Nickel	8.225	0.00	8.225	0.000563

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.

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Stack Reference Exhaust Stack

Measurement Uncertainty Calculations - Velocity at Stack Conditions

Contribution From	Standard u/c (mm H ₂ O)	
Pitot Calibration Uncertainty Contribution	0.005	A
Manometer Calibration Uncertainty Contribution	0.005	B
Variation in Actual Pitot reading at sample points	0.00	C
Combined u/c (mm H ₂ O) =	Combined u/c (mm H₂O)	
SQRT (A/√3) ² + (B/√3) ² + (C/√3) ²	0.00	
Expanded Uncertainty of Flow Measurements (mm H₂O)	0.01	
	Standard u/c (K)	
Temperature Calibration (K)	1.43	D
Variation in Actual Temp reading at sample points	0.00	E
Combined u/c of Temp (K)	Combined u/c (K)	
SQRT ((D/√3) ² + (E/√3) ²)	0.82	
Expanded Uncertainty of Temp Measurements (K)	1.65	
Measured Average Velocity (m/s) at Stack Conds	3.21	
Maximum Average Velocity (m/s) at Stack Conds	3.23	
Standard Uncertainty Velocity at Stack Conditions (%)	0.70	
Expanded Uncertainty Velocity (at Stack Conditions)	1.39 (%)	

Measurement Uncertainty Calculations - Flowrate at Stack Conditions

Contribution From	Standard u/c (m ²)
Area (m ²)	0.00047
Measured Average Flowrate (m ³ /s) at Stack Conds	0.15
Maximum Average Flowrate (m ³ /s) at Stack Conds	0.15
Standard Uncertainty Flowrate (m ³ /s) at Stack Conditions (%)	1.70
Expanded Uncertainty Flowrate (m³/s) at Stack Conditions	3.41 (%)

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	0.14
Maximum Average Flowrate (m ³ /s) at STP Wet	0.15
Standard Uncertainty Flowrate (m ³ /s) at STP Wet	2.19
Expanded Uncertainty Flowrate (m³/s) at STP Wet	4.38 (%)