



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 – August 2023 |
| Job Number | : P5558 |
| Report Number | : R001 |
| Report Issue Date | : 18th September 2023 |
| Survey Dates | : 16th August 2023 |

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| Report Issue: | | FINAL | |
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| | | Signature: | |
| Date: | 13 th September 2023 | Date: | 18 th September 2023 |

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Ecobat Solutions
Permit No : EPR/DB3704FG
Variation No : EPR/DB3704FG/V006
Report Ref : P5558 : R001

Installation Name : Recupyl Shredder Exhaust
Visit Details : Emissions – August 2023
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Opinions and Interpretation expressed within this report are outside the scope of the UKAS accreditation.

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

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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/P5558/Q001**, 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 |
| Total Organic Carbon (TVOC) | ● U |
| Speciated VOC | ● U |
| Acetaldehyde | ● 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 | Volumetric Flowrate | ... | 0.16549 | m³/sec | 12 | Stack Conditions | 16/08/2023 | 09:50 – 10:00 | BS EN 16911-1:2013 & MID | UKAS / MCERTS | | Normal |
| | Volumetric Flowrate | ... | 0.15335 | m³/sec | 13 | & Wet Gas | | | BS EN 16911-1:2013 & MID | UKAS / MCERTS | | Normal |
| | TVOC as Carbon (Total) | ... | 316.91 | mgC/m³ | 3 | & Wet Gas | | 10:27 – 12:40 | BS EN 12619:2013 | UKAS / MCERTS | | Normal |
| | TVOC as Carbon (Test 1) | ... | 258.55 | mgC/m³ | 3 | & Wet Gas | | 10:27 – 11:27 | BS EN 12619:2013 | UKAS / MCERTS | | Normal |
| | TVOC as Carbon (Test 2) | ... | 366.06 | mgC/m³ | 3 | & Wet Gas | | 11:35 – 12:35 | BS EN 12619:2013 | UKAS / MCERTS | | Normal |
| | Acetaldehyde – Test 1 § | ... | 0.11 | mg/m³ | 11 | & Wet Gas | | 10:27 – 11:27 | CEN/TS 13649:2014 | UKAS / MCERTS | | Normal |
| | Acetaldehyde – Test 2 § | ... | 0.11 | mg/m³ | 11 | & Wet Gas | | 11:35 – 12:35 | CEN/TS 13649:2014 | UKAS / MCERTS | | Normal |
| | Speciated VOC – Test 1 § | ... | 146.18* | mg/m³ | 11 | & Wet Gas | | 10:27 – 11:27 | CEN/TS 13649:2014 | NU | ✓ | Normal |
| | Speciated VOC – Test 1 § | ... | 238.97* | mg/m³ | 11 | & Wet Gas | | 11:35 – 12:35 | CEN/TS 13649:2014 | NU | ✓ | Normal |

*Only a single species was identified during the GC-MS scan for both of the speciated VOC tests. This was “Carbonic acid, ethyl-, methyl ester”

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

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

Speciated VOC – These tests are non-conforming, (and reported results are not accredited), although the sampling method is UKAS/MCERTS accredited, UKAS accreditation is not and cannot be available for the laboratory analysis.

Homogeneity tests have not been completed for pollutants at the following locations: **Recupyl Shredder Exhaust**. Such tests are not applicable to this location (as the duct area is <math><1\text{m}^2</math>).

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PART 2 – SUPPORTING INFORMATION

3 SAMPLING STAFF DETAILS

Site Sampling Team

| Names of Site Team | Dates on Site | MCERTS No. | LEVEL | Technical Endorsements |
|--------------------|------------------------------|------------|-------|------------------------|
| Adam May | 16 th August 2023 | MM 05 626 | 2 | TE1, TE2, TE3, TE4 |
| Andrew Barnes | | MM 18 1507 | 1 | ... |

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.

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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 |
| TVOC (Signal 3030PM) | BS EN 12619: 2013 | ECL / TPD / 032A |
| Speciated VOC | CEN/TS 13649:2014 | ECL / TPD / 084 |

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5 SAMPLE POINT DESCRIPTIONS

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

Homogeneity testing has not been completed at this location.

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

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

The sample location that was monitored is detailed below:

Recupyl Shredder Exhaust

The stack diameter is 0.245m and the sample platform width back from the sample port is circa 5m. The sample port was at a height of circa 0.45m above the sample platform.

Access to the sampling location was via temporary platform.

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EQUIPMENT IDs
(Pre site checklist from SSP)

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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 | | | | | | | | |
| MST Nozzle set | | | | | | | | | |
| MST “S” Type Pitot | | | | | | | | | |
| MST Probe | | | | | | | | | |
| MST Hot Box | | | | | | | | | |
| MST Impinger Arm | | | | | | | | | |
| Barometer | | 351 | | | | | | | |
| Site Balance | | | | | | | | | |
| Site Check weights | | | | | | | | | |
| Horiba | | E002 | | | | | | | |
| Heated Probe / Filter | | | | | | | | | |
| Chiller | | | | | | | | | |
| MFC | | | | | | | | | |
| Heated Line | | | | | | | | | |
| FID | E003 | 301 | | | | | | | |
| Heated Line | | 1013 | 1014 | | | | | | |
| Heated Probe / Filter | | 572 | | | | | | | |
| Testo | E004 | | | | | | | | |
| FTIR | E005 | | | | | | | | |
| Heated Probe / Filter | | | | | | | | | |
| Heated Line | | | | | | | | | |
| Stackmite | E006 | | | | | | | | |
| “L” Type Pitot | | 603 | | | | | | | |
| Digital Manometer | | 1249 | | | | | | | |
| Stack Thermocouple | | 1247 | | | | | | | |
| Thermocouple Reader | | 1251 | | | | | | | |
| Nozzle Set | | | | | | | | | |
| Workhorse Pumps | E007 | 1366 | 162 | | | | | | |
| Stack Thermocouple | | 1247 | | | | | | | |
| Tube Thermocouple | | 1039 | 1031 | | | | | | |
| Meter Thermocouple | | 1038 | 1028 | | | | | | |
| High Vac Gauge | | | | | | | | | |
| Dioxin Thermocouple | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

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

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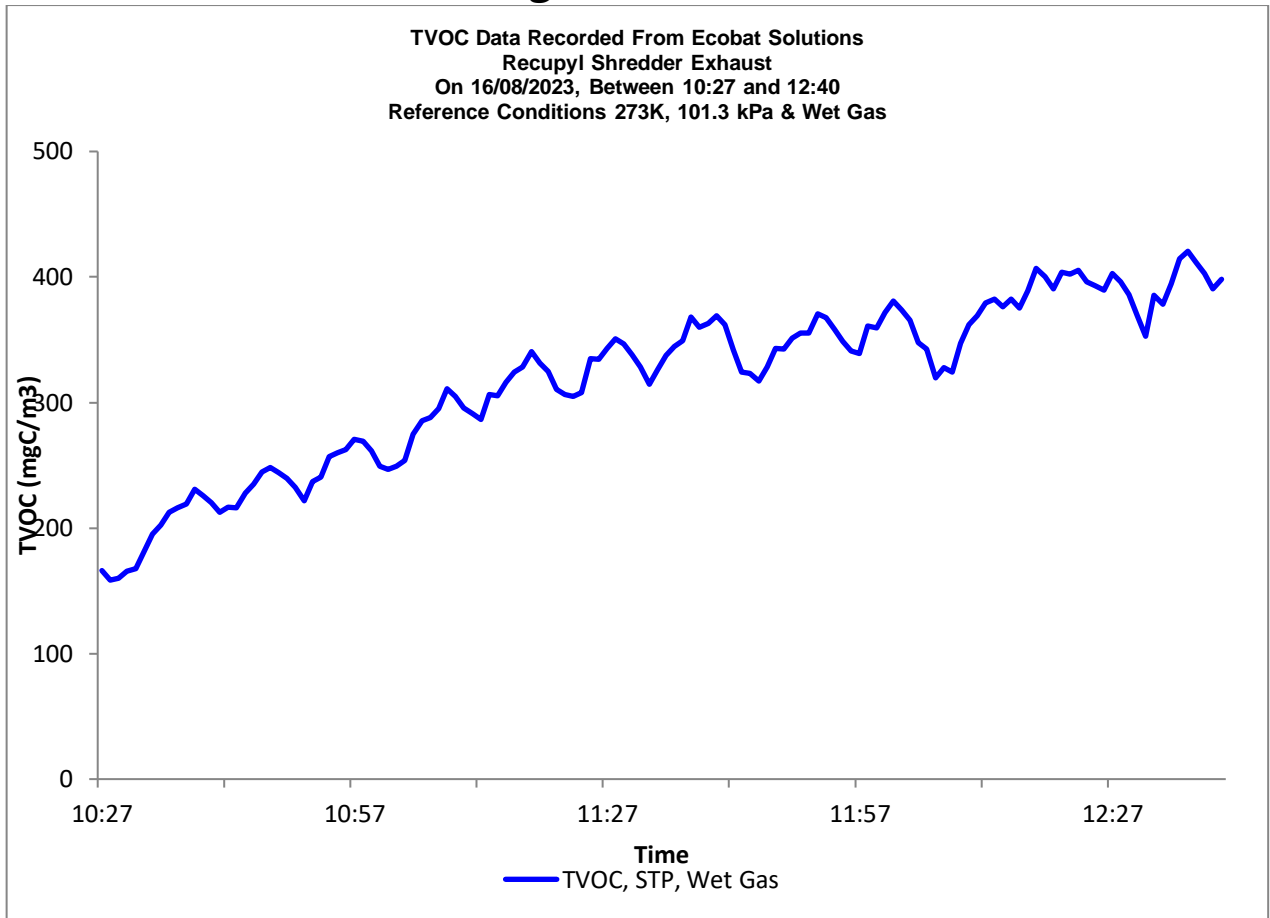
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FIGURES

Ecobat Solutions
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Figure 1 – TVOC



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TABLES

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Table 1 – TVOC
Data Recorded from Recupyl Shredder Exhaust
Sample Period: 10:27 – 12:40 on the 16th August 2023
Volumetric Flowrate (Reference Conditions) = 0.15335 m³/sec *

| | Average | Emission Rate |
|---------------------------------|-------------------------|----------------------|
| | mg/m³ | Kg/hr |
| TVOC (as carbon)* 10:27 – 12:40 | 316.91 | 0.1750 |
| TVOC (as carbon)* 10:27 – 11:27 | 258.55 | 0.1427 |
| TVOC (as carbon)* 11:35 – 12:35 | 366.06 | 0.2021 |

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

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Table 2 – Acetaldehyde- Test 1
Ecobat Solutions
Darlaston Recupyl Shredder Exhaust Stack

| Emission Parameter | Units | Value | | |
|--------------------------------------|-------------------|-----------------------|-------------|---------------|
| Stack Diameter | mm | 245 | | |
| Area of Sample Plane | m ² | 0.047 | | |
| Measured Oxygen (Dry) | %Vol | 20.90 | | |
| Meter Temperature | °C | 20.67 | | |
| Stack Temperature | °C | 20.00 | | |
| Sample Date | ... | 16/08/2023 | | |
| Sample Period | ... | 10:27 - 11:27 | | |
| Sample Volume (as Measured) | m ³ | 0.0060 | | |
| Sample Volume (reference Conditions) | m ^{3*} | 0.0055 | | |
| Sample Tube Results | | Acetaldehyde 1 | | Blank |
| Sample Reference ECL/23/4625 | Units | Concentration* | Uncertainty | Concentration |
| Concentration of Acetaldehyde | mg/m ³ | 0.11 | 11.29% | 0.018 |

*Reference Conditions: 273 K, 101.3 kPa, Wet Gas

Table 3 – Acetaldehyde – Test 2
Ecobat Solutions
Darlaston Recupyl Shredder Exhaust Stack

| Emission Parameter | Units | Value | | |
|--------------------------------------|-------------------|-----------------------|-------------|---------------|
| Stack Diameter | mm | 245 | | |
| Area of Sample Plane | m ² | 0.047 | | |
| Measured Oxygen (Dry) | %Vol | 20.90 | | |
| Meter Temperature | °C | 21.50 | | |
| Stack Temperature | °C | 20.50 | | |
| Sample Date | ... | 16/08/2023 | | |
| Sample Period | ... | 11:35 - 12:35 | | |
| Sample Volume (as Measured) | m ³ | 0.0059 | | |
| Sample Volume (reference Conditions) | m ^{3*} | 0.0054 | | |
| Sample Tube Results | | Acetaldehyde 2 | | Blank |
| Sample Reference ECL/23/4626 | Units | Concentration* | Uncertainty | Concentration |
| Concentration of Acetaldehyde | mg/m ³ | 0.11 | 11.28% | 0.018 |

*Reference Conditions: 273 K, 101.3 kPa, Wet Gas

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Table 4 – Speciated VOC – Test 1
Ecobat Solutions
Darlaston Recupyl Shredder Exhaust Stack

| Emission Parameter | Units | Value | | |
|--|-------------------|-------------------------|--------------------|----------------------|
| Stack Diameter | mm | 245 | | |
| Area of Sample Plane | m ² | 0.047 | | |
| Measured Oxygen (Dry) | %Vol | 20.90 | | |
| Meter Temperature | °C | 21.83 | | |
| Stack Temperature | °C | 20.00 | | |
| Sample Date | ... | 16/08/2023 | | |
| Sample Period | ... | 10:27 - 11:27 | | |
| Sample Volume (as Measured) | m ³ | 0.0063 | | |
| Sample Volume (reference Conditions) | m ^{3*} | 0.0058 | | |
| Sample Tube Results | | Speciated VOCs 1 | | Blank |
| Sample Reference ECL/23/4628 | Units | Concentration* | Uncertainty | Concentration |
| Concentration of Carbonic acid, ethyl-, methyl ester | mg/m ³ | 146.18 | 10.54% | 0.87 |

*Reference Conditions: 273 K, 101.3 kPa, Wet Gas

Table 5 – Speciated VOC – Test 2
Ecobat Solutions
Darlaston Recupyl Shredder Exhaust Stack

| Emission Parameter | Units | Value | | |
|--|-------------------|-------------------------|--------------------|----------------------|
| Stack Diameter | mm | 245 | | |
| Area of Sample Plane | m ² | 0.047 | | |
| Measured Oxygen (Dry) | %Vol | 20.90 | | |
| Meter Temperature | °C | 23.17 | | |
| Stack Temperature | °C | 20.50 | | |
| Sample Date | ... | 16/08/2023 | | |
| Sample Period | ... | 11:35 - 12:35 | | |
| Sample Volume (as Measured) | m ³ | 0.0063 | | |
| Sample Volume (reference Conditions) | m ^{3*} | 0.0057 | | |
| Sample Tube Results | | Speciated VOCs 2 | | Blank |
| Sample Reference ECL/23/4629 | Units | Concentration* | Uncertainty | Concentration |
| Concentration of Carbonic acid, ethyl-, methyl ester | mg/m ³ | 238.97 | 10.59% | 0.88 |

*Reference Conditions: 273 K, 101.3 kPa, Wet Gas

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VELOCITY TRAVERSE PROFILES

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FIELD CALIBRATION AND SAMPLING DATA

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TVOC Calibration Site Log

TVOC - FIELD DATA SHEET

| | | | | | | |
|-------------------------|--------------------------|--------|--------|----------------------------|---------------------|-----|
| Client | Ecobat Solutions | | | Barometric Pressure mb | 1004 | |
| Site | Darlaston | | | Barometer ID | ECL/ID/ 351 | |
| Date | 16/08/2023 | | | Analyser ID | ECL/ID/ 301 | |
| Location | Recupyl Shredder Exhaust | | | Sonimix/ MFC ID | ECL/ID/ n/a | |
| Stack ID | Recupyl Shredder Exhaust | | | Heated Line/ Controller ID | ECL/ID/ 1013 & 1014 | |
| Stack Temp °C | 20 | | | Heated Line Set Temp °C | 180 | YES |
| Ambient Temp (sampling) | 1=18.4 | 2=19.6 | 3=20.1 | Heated Line Length | 10 | m |
| Ambient Temp (sampling) | 4=20.4 | 5=20.6 | 6=20.7 | Heated Probe Filter ID | ECL/ID/ 572 | |
| Job No | P5558 | | | Heated Filter Set Temp °C | 180 | YES |
| Operators | AM & AB2 | | | Logger ID | 930 | |

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/ 2942 | ... | ... | Propane | 400 ppm |
| Hydrogen / Helium | Gas/ 2892 | ... | ... | | 91.69 ppm |
| Propane (In Air) | Gas/ 2936 | 91.69 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 | 09:31 | 09:34 | 09:37 | 09:40 | 09:42 | 09:45 |

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 SYSTEM Span Gas Cal | | |
|-------------------------|-----|---|----------|------------|----------|-----------------------------------|----------|----------------------|
| Max | Min | Zero Check | | Span Check | | Start Time | 90% Time | less than 200s (Y/N) |
| 18 | 17 | Start Time | End Time | Start Time | End Time | 09:51:00 | 09:51:30 | Y |
| ZERO / SPAN | | 09:47 | 09:50 | 09:52 | 09:55 | | | |

| | Start Time | End Time | Location | Production Details | |
|---------------|------------|----------|---------------|--------------------|--|
| Sample Period | 10:27 | 12:40 | Exhaust Stack | Normal | |
| Sample Period | | | | | |
| 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 | |
| 21 | 21 | Start Time | End Time | Start Time | End Time |
| ZERO / SPAN | | 12:41 | 12:44 | 12:46 | 12:49 |

Process Details / Comments

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5558 : R001

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions – August 2023
 Survey Dates : 16th August 2023
 Report Issue Date : 18th September 2023

TVOC Calibration Summary

**TVOC
ppm**

| | | |
|---|-------------|--------------|
| Analyser Range | | 400 |
| Repeatability at Zero | | 2 |
| Span Gas Concentration Applied | | 91.69 |
| Zero Gas Concentration Applied | | 0 |
| Direct Cal | Zero | 0.00 |
| | Span | 91.7 |
| | Zero | 0.42 |
| Difference (Zero) | | 0.4159 |
| < 2× Repeatability @ Zero? | | YES |
| Pre Test (System) | | |
| | Zero | 0.00 |
| | Span | 91.2 |
| Difference (Zero) | | 0.0000 |
| < 2% Relative to Direct Span | | YES |
| Difference (Span) | | 0.4991 |
| < 2% Relative to Direct Span | | YES |
| Post Test (System) | | |
| | Zero | 0.25 |
| | Span | 91.7 |
| Difference (Zero) | | 0.2496 |
| Zero Drift < 2% of Applied Span? | | YES |
| Difference (Span) | | 0.4783 |
| 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 : P5558 : R001

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions – August 2023
 Survey Dates : 16th August 2023
 Report Issue Date : 18th September 2023

| Environmental Compliance Limited | | | | SAMPLE TUBE DATA SAMPLING PROFORMA (VAPEX ONLY) | | | |
|----------------------------------|------------------|---|------------------------------|---|---|--------------------|------------|
| Client | Ecobat Solutions | <input checked="" type="radio"/> Circular <input type="radio"/> Rectangular <input type="radio"/> Ellipse | Vapex Pump ID | 1366 | | Date of Test | 16/08/2023 |
| Site | Darlston | Stack Diameter (mm) | 245 | | Sample Start Time | 10:27 | |
| Location | Recupyl Shredder | Stack Area (m ²) | 0.047 | | Sample End Time | 11:27 | |
| Stack ID | Exhaust Stack | Barometric Pressure (mb) | 1004 | | Duration | 60 | |
| Test No | Acetaldehyde 1 | Stack Thermocouple ID | 1247 | | Measured O ₂ | 20.90 | |
| Job No | P5558 | Tube Thermocouple ID | 1039 | | O ₂ Uncertainty %Vol | 1.25 | |
| ECL Site Staff | AM, AB2 | Meter Thermocouple ID | 1038 | | Meter Start Time | 10:27 | |
| Barometer ID | 351 | In-Stack Sinter Used (Y/N) | Y | | Meter End Time | 11:27 | |
| | | | Vapex Sampling Rate (ml/min) | 100 | | Meter Elapsed Time | 1:00:00 |
| | | | | | Impinger 1 | None Used | |
| | | | | | Start Weight (g) | | |
| | | | | | End Weight (g) | | |
| | | | | | Total weight (g) | 0 | |
| | | | | | Impinger 2 | | |
| | | | | | Start Weight (g) | | |
| | | | | | End Weight (g) | | |
| | | | | | Total weight (g) | 0 | |
| | | | | | Impinger3 | | |
| | | | | | Start Weight (g) | | |
| | | | | | End Weight (g) | | |
| | | | | | Total weight (g) | 0 | |
| | | | | | Silica | (IF USED) | |
| | | | | | <50% Spent at end Y/N? | Yes | |
| | | | | | Sample train upstream of solvent tube condensation free for entire sample (Y/N) | Yes | |

| Environmental Compliance Limited | | | | SAMPLE TUBE DATA SAMPLING PROFORMA (VAPEX ONLY) | | | |
|----------------------------------|------------------|---|------------------------------|---|---|--------------------|------------|
| Client | Ecobat Solutions | <input checked="" type="radio"/> Circular <input type="radio"/> Rectangular <input type="radio"/> Ellipse | Vapex Pump ID | 1366 | | Date of Test | 16/08/2023 |
| Site | Darlston | Stack Diameter (mm) | 245 | | Sample Start Time | 11:35 | |
| Location | Recupyl Shredder | Stack Area (m ²) | 0.047 | | Sample End Time | 12:35 | |
| Stack ID | Exhaust Stack | Barometric Pressure (mb) | 1004 | | Duration | 60 | |
| Test No | Acetaldehyde 2 | Stack Thermocouple ID | 1247 | | Measured O ₂ | 20.90 | |
| Job No | P5558 | Tube Thermocouple ID | 1039 | | O ₂ Uncertainty %Vol | 1.25 | |
| ECL Site Staff | AM, AB2 | Meter Thermocouple ID | 1038 | | Meter Start Time | 11:35 | |
| Barometer ID | 351 | In-Stack Sinter Used (Y/N) | Y | | Meter End Time | 12:35 | |
| | | | Vapex Sampling Rate (ml/min) | 100 | | Meter Elapsed Time | 1:00:00 |
| | | | | | Impinger 1 | None Used | |
| | | | | | Start Weight (g) | | |
| | | | | | End Weight (g) | | |
| | | | | | Total weight (g) | 0 | |
| | | | | | Impinger 2 | | |
| | | | | | Start Weight (g) | | |
| | | | | | End Weight (g) | | |
| | | | | | Total weight (g) | 0 | |
| | | | | | Impinger3 | | |
| | | | | | Start Weight (g) | | |
| | | | | | End Weight (g) | | |
| | | | | | Total weight (g) | 0 | |
| | | | | | Silica | (IF USED) | |
| | | | | | <50% Spent at end Y/N? | Yes | |
| | | | | | Sample train upstream of solvent tube condensation free for entire sample (Y/N) | Yes | |

Environmental Compliance Limited

Ecobat Solutions

Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5558 : R001

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions – August 2023
 Survey Dates : 16th August 2023
 Report Issue Date : 18th September 2023

| Environmental Compliance Limited | | | | SAMPLE TUBE DATA SAMPLING PROFORMA (Workhorse or MST) | | | | | |
|---|------------------|---|--|---|--------------|-------------------------------------|--------|-------------------------------------|-------|
| Client | Ecobat Solutions | <input checked="" type="radio"/> Circular <input type="radio"/> Rectangular <input type="radio"/> Ellipse | Pump ID | 162 | Date of Test | 16/08/2023 | | | |
| Site | Darlaston | Stack Diameter (mm) | 245 | Meter ID | ... | Sample Start Time | 10:27 | | |
| Location | Recupyl Shredder | Stack Area (m ²) | 0.047 | MST Probe ID | ... | Sample End Time | 11:27 | | |
| Stack ID | Exhaust Stack | Barometric Pressure (mb) | 1004 | MST Probe Heating Temp (C) | ... | Duration | 60 | | |
| Test No | Speciated VOCs 1 | Stack Thermocouple ID | 1247 | DGM Yd or ml/count | 0.5 | Measured O2 | 20.90 | | |
| Job No | P5558 | Tube Thermocouple ID | 1031 | MST Hot Box ID | ... | O2 Uncertainty %Vol | 1.25 | | |
| ECL Site Staff | AM, AB2 | Meter Thermocouple ID | 1028 | MST Hot Box Heating Temp (C) | ... | | | | |
| Barometer ID | 351 | In-Stack Sinter Used (Y/N) | Y | Workhorse Set Sample Rate (%) | 40 | | | | |
| | | | | MST Delta H Sampling Rate | ... | | | | |
| Meter Units <input checked="" type="radio"/> ml <input type="radio"/> litres | | | | Sample | Leak 1 | Time (start/end) (minimum 1 minute) | Leak 2 | Time (start/end) (minimum 1 minute) | Total |
| Start Volume | 697233.0 | 697198.0 | 09:23:00 | 709812.0 | 11:29:00 | | | | |
| Final Volume | 709789.0 | 697198.0 | 09:24:00 | 709812.0 | 11:30:00 | | | | |
| Total Volume | 12538.4 | 0.0 | | 0.0 | | | | 12538.4 | |
| Sample Train Internal Volume | 17.5924 | ml | Pre and post test leak checks are mandatory - in order to pass, the meter must stop fully for 1 minute. (Total volume in leak check is therefore zero) | | | | | | |
| Sample Point | A1 | A1 | A1 | A1 | A1 | | | | |
| Time/ point (mins) | 0-10 | 10-20 | 20-30 | 30-40 | | | | | |
| Tube Temp °C | 20 | 20 | 20 | 21 | | | | | |
| Stack Temp °C | 20 | 20 | 20 | 20 | | | | | |
| Meter Temp In °C | 21 | 21 | 22 | 22 | | | | | |
| Meter Temp Out °C | 21 | 21 | 22 | 22 | | | | | |
| Impinger 1 | None Used | | | | | | | | |
| Start Weight (g) | | | | | | | | | |
| End Weight (g) | | | | | | | | | |
| Total weight (g) | 0 | | | | | | | | |
| Impinger 2 | | | | | | | | | |
| Start Weight (g) | | | | | | | | | |
| End Weight (g) | | | | | | | | | |
| Total weight (g) | 0 | | | | | | | | |
| Impinger 3 | | | | | | | | | |
| Start Weight (g) | | | | | | | | | |
| End Weight (g) | | | | | | | | | |
| Total weight (g) | 0 | | | | | | | | |
| Sample Point | A1 | A1 | | | | | | | |
| Time/ point (mins) | 40-50 | 50-60 | | | | | | | |
| Tube Temp °C | 21 | 21 | | | | | | | |
| Stack Temp °C | 20 | 20 | | | | | | | |
| Meter Temp In °C | 22 | 23 | | | | | | | |
| Meter Temp Out °C | 22 | 23 | | | | | | | |
| Sample Point | | | | | | | | | |
| Time/ point (mins) | | | | | | | | | |
| Tube Temp °C | | | | | | | | | |
| Stack Temp °C | | | | | | | | | |
| Meter Temp In °C | | | | | | | | | |
| Meter Temp Out °C | | | | | | | | | |
| Silica | | | | | | (IF USED) | | | |
| <50% Spent at end Y/N? | | | | | | Yes | | | |
| Sample train upstream of solvent tube condensation free for entire sample (Y/N) | | | | | | Yes | | | |

| Environmental Compliance Limited | | | | SAMPLE TUBE DATA SAMPLING PROFORMA (Workhorse or MST) | | | | | |
|---|------------------|---|--|---|--------------|-------------------------------------|--------|-------------------------------------|-------|
| Client | Ecobat Solutions | <input checked="" type="radio"/> Circular <input type="radio"/> Rectangular <input type="radio"/> Ellipse | Pump ID | 162 | Date of Test | 16/08/2023 | | | |
| Site | Darlaston | Stack Diameter (mm) | 245 | Meter ID | ... | Sample Start Time | 11:35 | | |
| Location | Recupyl Shredder | Stack Area (m ²) | 0.047 | MST Probe ID | ... | Sample End Time | 12:35 | | |
| Stack ID | Exhaust Stack | Barometric Pressure (mb) | 1004 | MST Probe Heating Temp (C) | ... | Duration | 60 | | |
| Test No | Speciated VOCs 2 | Stack Thermocouple ID | 1247 | DGM Yd or ml/count | 0.5 | Measured O2 | 20.90 | | |
| Job No | P5558 | Tube Thermocouple ID | 1031 | MST Hot Box ID | ... | O2 Uncertainty %Vol | 1.25 | | |
| ECL Site Staff | AM, AB2 | Meter Thermocouple ID | 1028 | MST Hot Box Heating Temp (C) | ... | | | | |
| Barometer ID | 351 | In-Stack Sinter Used (Y/N) | Y | Workhorse Set Sample Rate (%) | 40 | | | | |
| | | | | MST Delta H Sampling Rate | ... | | | | |
| Meter Units <input checked="" type="radio"/> ml <input type="radio"/> litres | | | | Sample | Leak 1 | Time (start/end) (minimum 1 minute) | Leak 2 | Time (start/end) (minimum 1 minute) | Total |
| Start Volume | 709921.0 | 709885.0 | 11:33:00 | 722473.0 | 12:38:00 | | | | |
| Final Volume | 722443.0 | 709885.0 | 11:34:00 | 722473.0 | 12:39:00 | | | | |
| Total Volume | 12504.4 | 0.0 | | 0.0 | | | | 12504.4 | |
| Sample Train Internal Volume | 17.5924 | ml | Pre and post test leak checks are mandatory - in order to pass, the meter must stop fully for 1 minute. (Total volume in leak check is therefore zero) | | | | | | |
| Sample Point | A1 | A1 | A1 | A1 | A1 | | | | |
| Time/ point (mins) | 0-10 | 10-20 | 20-30 | 30-40 | | | | | |
| Tube Temp °C | 21 | 21 | 22 | 22 | | | | | |
| Stack Temp °C | 20 | 20 | 20 | 21 | | | | | |
| Meter Temp In °C | 22 | 23 | 23 | 23 | | | | | |
| Meter Temp Out °C | 22 | 23 | 23 | 23 | | | | | |
| Impinger 1 | None Used | | | | | | | | |
| Start Weight (g) | | | | | | | | | |
| End Weight (g) | | | | | | | | | |
| Total weight (g) | 0 | | | | | | | | |
| Impinger 2 | | | | | | | | | |
| Start Weight (g) | | | | | | | | | |
| End Weight (g) | | | | | | | | | |
| Total weight (g) | 0 | | | | | | | | |
| Impinger 3 | | | | | | | | | |
| Start Weight (g) | | | | | | | | | |
| End Weight (g) | | | | | | | | | |
| Total weight (g) | 0 | | | | | | | | |
| Sample Point | A1 | A1 | | | | | | | |
| Time/ point (mins) | 40-50 | 50-60 | | | | | | | |
| Tube Temp °C | 22 | 22 | | | | | | | |
| Stack Temp °C | 21 | 21 | | | | | | | |
| Meter Temp In °C | 24 | 24 | | | | | | | |
| Meter Temp Out °C | 24 | 24 | | | | | | | |
| Sample Point | | | | | | | | | |
| Time/ point (mins) | | | | | | | | | |
| Tube Temp °C | | | | | | | | | |
| Stack Temp °C | | | | | | | | | |
| Meter Temp In °C | | | | | | | | | |
| Meter Temp Out °C | | | | | | | | | |
| Silica | | | | | | (IF USED) | | | |
| <50% Spent at end Y/N? | | | | | | Yes | | | |
| Sample train upstream of solvent tube condensation free for entire sample (Y/N) | | | | | | Yes | | | |

Ecobat Solutions
Permit No : EPR/DB3704FG
Variation No : EPR/DB3704FG/V006
Report Ref : P5558 : R001

Installation Name : Recupyl Shredder Exhaust
Visit Details : Emissions – August 2023
Survey Dates : 16th August 2023
Report Issue Date : 18th September 2023

LABORATORY ANALYSIS RESULTS

Laboratory analysis for Speciated VOC was subcontracted to RPS laboratories, a UKAS Accredited Testing Laboratory, Number 0605.

RPS DO NOT 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 Acetaldehyde 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.

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5558 : Root

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions – August 2023
 Survey Dates : 16th August 2023
 Report Issue Date : 18th September 2023

Comments

Report No.: 23-09288-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0862 P5558

| RPS Sample Number | Customer Number | Sample Comments |
|-------------------|-----------------|--|
| 199505 | ECL/23/4628 | Front: Carbonic acid, ethyl-, methyl ester 836µg Back VOC <5µg |
| 199506 | ECL/23/4629 | Front: Carbonic acid, ethyl-, methyl ester 1365µg Back VOC <5µg |
| 199507 | ECL/23/4630 | Front: VOC <5µg Back VOC <5µg |

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5558 : R001

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions – August 2023
 Survey Dates : 16th August 2023
 Report Issue Date : 18th September 2023

Results Summary

Report No.: 23-09274-1

Customer Reference: 2023 Stack Preferential Rates

Customer Order No: E0862 P5558

| Customer Sample No | ECL/23/4625 | ECL/23/4626 | ECL/23/4627 |
|--------------------|-------------|-------------|-------------|
| RPS Sample No | 199478 | 199479 | 199480 |
| Sample Matrix | TUBE | TUBE | TUBE |
| Sampling Date | 16/08/2023 | 16/08/2023 | 16/08/2023 |

| Determinand | CAS No | Codes | SOP | RL | Units | | | |
|--------------------|---------|-------|-----|-----|-------|-------|-------|-------|
| acetaldehyde FRONT | 75-07-0 | UM | A40 | 0.1 | ug | 0.6 | 0.6 | < 0.1 |
| acetaldehyde BACK | 75-07-0 | UM | A40 | 0.1 | ug | < 0.1 | < 0.1 | < 0.1 |

Environmental Compliance Limited

Ecobat Solutions
Permit No : EPR/DB3704FG
Variation No : EPR/DB3704FG/V006
Report Ref : P5558 : R001

Installation Name : Recupyl Shredder Exhaust
Visit Details : Emissions – August 2023
Survey Dates : 16th August 2023
Report Issue Date : 18th September 2023

UNCERTAINTY CALCULATIONS

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5558 : R001

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions – August 2023
 Survey Dates : 16th August 2023
 Report Issue Date : 18th September 2023

TVOC Measurement Uncertainty

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 = $\sqrt{3}$) | 0.73 |
| Span drift ⁽²⁾ | $u_{d,s}$ | Rectangular (Divisor = $\sqrt{3}$) | 0.35 |
| Repeatability Standard Deviation (span) ⁽³⁾ | u_r | Normal (Divisor = 1) | 8.87 |
| Losses/ leakage in the sample system ⁽⁴⁾ | u_{loss} | Rectangular (Divisor = $\sqrt{3}$) | 3.33 |
| Temperature dependant span drift ⁽⁵⁾ | u_t | Rectangular (Divisor = $\sqrt{3}$) | 0.30 |
| Interferents ⁽¹⁾ | u_i | Rectangular (Divisor = $\sqrt{3}$) | 4.39 |
| Uncertainty of Reference Gas ⁽⁶⁾ | u_{ref} | Rectangular (Divisor = $\sqrt{3}$) | 2.55 |
| Effect of Voltage Fluctuation ⁽⁷⁾ | u_v | Rectangular (Divisor = $\sqrt{3}$) | 1.80 |
| Effect of Oxygen Synergism ⁽⁷⁾ | u_{syn} | Rectangular (Divisor = $\sqrt{3}$) | 4.60 |

Note:

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

- 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} | $u(x_i) = \frac{u_{lof} \times R_i}{\sqrt{3}} =$ | 0.064 |
| Span drift | $u_{d,s}$ | $u(x_i) = \frac{u_{d,s} \times R_i}{\sqrt{3}} =$ | 0.031 |
| Repeatability Standard Deviation (span) | u_r | $\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}} =$ | 1.33 |
| Losses/ leakage in the sample system | u_{loss} | $u(x_i) = \frac{u_{loss} \times R_i}{\sqrt{3}} =$ | 0.29 |
| Temperature dependant span drift | u_t | $u(x_i) = \frac{u_t}{100} \times R_i \times \sqrt{\frac{(x_{i,max} - x_{i,adj})^2 + (x_{i,min} - x_{i,adj})(x_{i,max} - x_{i,adj}) + (x_{i,min} - x_{i,adj})^2}{3}}$ | 0.052 |
| Interferents | u_i | $u(x_i) = \frac{u_i \times R_i}{\sqrt{3}} =$ | 0.38 |
| Uncertainty of Reference Gas | u_{ref} | $u(x_i) = \frac{u_{ref}}{\sqrt{3}} =$ | 1.47 |
| Effect of Voltage Fluctuation | u_v | $u(x_i) = \frac{u_v \times R_i}{\sqrt{3}} =$ | 0.16 |
| Effect of Oxygen Synergism | u_{syn} | $u(x_i) = \frac{u_{syn} \times R_i}{\sqrt{3}} =$ | 0.40 |
| Combined Standard Uncertainty | | $u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2}$ | 2.09 |
| Expanded measurement uncertainty (at 95% confidence) | | $U_{EXP} = 2 \times u_c$ | 4.18 |
| Applied Span Concentration | | | 147.35 |
| Measured Span Concentration, STP Dry Gas | | | 147.07 |
| Expanded measurement uncertainty as % of Applied Span | | | 3 % |

* Signal 3030 FID

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5558 : Ro01

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions – August 2023
 Survey Dates : 16th August 2023
 Report Issue Date : 18th September 2023

TVOC Uncertainty of Measurement Result

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 | $\sqrt{3}$ | 0.73 |
| Span drift ⁽²⁾ | $u_{d,s}$ | | | 0.35 |
| Losses / leakage in the sample system ⁽⁴⁾ | u_{loss} | | | 0.54 |
| Temperature dependant span drift ⁽⁵⁾ | u_t | | | 0.30 |
| Interferents ⁽¹⁾ | u_i | | | 4.39 |
| Effect of Voltage Fluctuation ⁽⁷⁾ | u_v | | | 1.80 |
| Effect of Oxygen Synergism ⁽⁷⁾ | u_{syn} | | | 4.60 |

Notes:

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

For $u(x_i) = \Delta x_i \sqrt{\frac{(x_{i,max} - x_{i,adj})^2 + (x_{i,min} - x_{i,adj})(x_{i,max} - x_{i,adj}) + (x_{i,min} - x_{i,adj})^2}{3}}$, 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 | $\sqrt{3}$ | 0.064 |
| Span drift | $u_{d,s}$ | | | 0.031 |
| Temperature dependant span drift | u_t | | | 0.039 |
| Interferents | u_i | | | 0.38 |
| Effect of Voltage Fluctuation (See Note) | u_v | | | 0.16 |
| Effect of Oxygen Synergism (See Note) | u_{syn} | | | 0.40 |

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} | 16/08/23 10:27 - 12:40 | 1.73 |
| Standard Error of Measured Value | u_{SE} | 16/08/23 10:27 - 12:40 | 5.73 |

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 | 16/08/23 10:27 - 12:40 | 316.91 |
| Expanded Uncertainty as Percentage of Measured Concentration | | 4 % |

Combined Standard Uncertainty $u_c = \sqrt{u_{lof}^2 + u_{d,s}^2 + u_r^2 + u_{loss}^2 + u_t^2 + u_i^2 + u_{ref}^2 + u_v^2 + u_{syn}^2}$

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/Voo6
 Report Ref : P5558 : R001

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions – August 2023
 Survey Dates : 16th August 2023
 Report Issue Date : 18th September 2023

Note:
 Results based on Charcoal Tubes Only!

Site: Ecobat Solutions, Darlaston
 Location: Recupyl Shredder , Stack ID:Exhaust Stack

| | | | | Standard Uncertainty @ 95% | |
|-------------------------------------|-----------|---------|----------------|----------------------------|-----------------------|
| Sampled Volume | V_m | 0.00610 | m ³ | uV_m | 0.0002 m ³ |
| Meter Correction Factor or ml/count | Y_d | 0.986 | ... | ... | ... |
| Meter Temperature | T_m | 293.67 | k | uT_m | 1.5 k |
| Barometric Pressure | P_b | 1004.00 | mBar | 10.0 | mBar |
| Oxygen content | $O_{2,m}$ | 20.90 | %Vol | $uO_{2,m}$ | 1.25 %Vol |
| Moisture | H_2O | 0.00 | %Vol | uH_2O | %Vol |

| Tubes | | |
|--------------|----------------|----------------------|
| Determinand | Recovered Mass | Standard Uncertainty |
| Acetaldehyde | 0.60 µg | uM 0.0300 µg |

Note: In the following calculations, the sensitivity coefficient (C) is estimated using $C_i = \frac{\partial f}{\partial x_i}$
 For each factor, uncertainty is then calculated by $C_i u_i$ where C is the sensitivity coefficient, u is the standard uncertainty and i is the index identifying the contributing factor e.g. i= uV_m , uT_m etc.

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

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

Uncertainty in correction factor to STP due to measured barometric pressure uncertainty component (upb), measured temperature of dry gas uncertainty component (uTm) & measured moisture (uH2O) where required

$$f_s = \frac{273}{T_m} \times \frac{P}{101.3} = 0.92$$

| | Maximum | Minimum | Sensitivity | ufsp |
|---------|---------|---------|-------------|---------|
| uP_b | 0.48 | 0.47 | 0.000476 | 0.00476 |
| uT_m | 0.93 | 0.92 | 0.00314 | 0.00471 |
| uH_2O | ... | ... | ... | ... |

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{uP_b}{(P_b/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{(100/(100 - H_2O))}\right)^2} = 0.00598$$

Uncertainty in volume @ STP due to volume correction factor uncertainty component (uVstd) & volume uncertainty component (uVm)

$$V_{std} = V_{measured} \times f_s = 0.00554$$

| | Maximum | Minimum | Sensitivity | Standard Uncertainty |
|----------------------|---------|---------|-------------|----------------------|
| Effect of uV_m | 0.00558 | 0.00550 | 0.00601 | 0.000360 |
| Effect of uV_{std} | 0.00568 | 0.00540 | 0.91 | 0.000138 |

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uf_s}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.000130$$

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

$$uL = \frac{Conc \times 2}{\sqrt{3}}$$

| | Tubes | Condensate |
|--------------|--------------------|--------------------|
| | uL | uL |
| | mg/Nm ³ | mg/Nm ³ |
| Acetaldehyde | 0.00125 | ... |

$$Conc = \frac{M_{Recovered}}{V_m \times f_s \times f_{O_2}}$$

Uncertainty in final measurement @ Reference Conditions due to uM_{Recovered}

| Charcoal Tube Results | | | | |
|-----------------------|--------------------|--------------------|-------------|----------------------|
| | Maximum | Minimum | Sensitivity | Standard Uncertainty |
| | mg/Nm ³ | mg/Nm ³ | | mg/Nm ³ |
| Acetaldehyde | 0.11 | 0.10 | 180.51 | 0.00542 |
| Condensate Results | | | | |
| | Maximum | Minimum | Sensitivity | Standard Uncertainty |
| | mg/Nm ³ | mg/Nm ³ | | mg/Nm ³ |
| Acetaldehyde | | | | |

Uncertainty in final measurement @ Reference Conditions due to uV_{std}

| Charcoal Tube Results | | | | |
|-----------------------|--------------------|--------------------|-------------|----------------------|
| | Maximum | Minimum | Sensitivity | Standard Uncertainty |
| | mg/Nm ³ | mg/Nm ³ | | mg/Nm ³ |
| Acetaldehyde | 0.11 | 0.11 | 19.56 | 0.00255 |

Combined Uncertainty (excluding Oxygen contribution)

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

| Charcoal Tubes | Combined Uncertainty | Expanded Uncertainty | Measured Concentration | Percent of Measured Concentration |
|----------------|----------------------|----------------------|------------------------|-----------------------------------|
| Determinand | mg/Nm ³ | mg/Nm ³ | mg/Nm ³ | |
| Acetaldehyde | 0.00611 | 0.0122 | 0.11 | 11.29 |

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5558 : R001

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions – August 2023
 Survey Dates : 16th August 2023
 Report Issue Date : 18th September 2023

Note:
 Results based on Charcoal Tubes Only!

Site: Ecobat Solutions, Darlaston
 Location: Recypyl Shredder, Stack ID: Exhaust Stack

| | | | Standard Uncertainty @ 95% | | |
|-------------------------------------|-----------|------------------------|----------------------------|--------|----------------|
| Sampled Volume | V_m | 0.00600 m ³ | uV_m | 0.0002 | m ³ |
| Meter Correction Factor or ml/count | Y_d | 0.966 | ... | ... | ... |
| Meter Temperature | T_m | 294.50 k | uT_m | 1.5 | k |
| Barometric Pressure | P_b | 1004.00 mBar | | 10.0 | mBar |
| Oxygen content | $O_{2,m}$ | 20.90 %Vol | $uO_{2,m}$ | 1.25 | %Vol |
| Moisture | H_2O | 0.00 %Vol | uH_2O | | %Vol |

| Tubes | | | Standard Uncertainty | | |
|--------------|----------------|----|----------------------|--------|----|
| Determinand | Recovered Mass | | | | |
| Acetaldehyde | 0.60 | µg | uM | 0.0300 | µg |

Note: In the following calculations, the sensitivity coefficient (C) is estimated using: $C_i = \frac{\partial f}{\partial x_i}$
 For each factor, uncertainty is then calculated by $C_i u_i$ where C_i is the sensitivity coefficient, u_i is the standard uncertainty and i is the index identifying the contributing factor e.e. $i = uV_m, uT_m$ etc.

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

$$f_{s,wd} = \frac{100}{100 - H_2O} = 1.00$$

Uncertainty in correction factor to STP due to measured barometric pressure uncertainty component (upb), measured temperature of dry gas uncertainty component (uTm) & measured moisture (uH2O) where required

| | | | | |
|---|--------------|--------------|----------------------|---------------|
| $f_s = \frac{273}{T_m} \times \frac{p}{101.3} =$ | 0.92 | | | |
| upb | Maximum 0.48 | Minimum 0.47 | Sensitivity 0.000475 | ufstp 0.00475 |
| uTm | 0.92 | 0.91 | 0.00312 | 0.00468 |
| uH2O | ... | ... | ... | ... |
| $\frac{uf_s}{f_s} = \sqrt{\left(\frac{uP_b}{(P_b/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100(100-H_2O)}\right)^2}$ | = 0.00594 | | | |

Uncertainty in volume @ STP due to volume correction factor uncertainty component (uVstd) & volume uncertainty component (uVm)

| | | | | |
|---|------------------------|------------------------|-------------|-------------------------------------|
| $V_{std} = V_{measured} \times f_s =$ | 0.00544 | 0.00515 | | |
| | Maximum m ³ | Minimum m ³ | Sensitivity | Standard Uncertainty m ³ |
| Effect of u_f | 0.00547 | 0.00540 | 0.00592 | 0.000352 |
| Effect of uV_m | 0.00557 | 0.00530 | 0.91 | 0.000136 |
| $\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uf_s}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2}$ | = 0.000127 | | | |

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

| | | |
|--|--------------------|--------------------|
| $uL = \frac{Conc \times 2}{\sqrt{3}}$ | Tube ul | Condensate ul |
| | mg/Nm ³ | mg/Nm ³ |
| Acetaldehyde | 0.00127 | ... |
| $Conc = \frac{M_{Recoverd}}{V_m \times f_s \times f_{d1}}$ | | |

Uncertainty in final measurement @ Reference Conditions due to $uM_{measured}$

| Charcoal Tube Results | | | | |
|-----------------------|----------------------------|----------------------------|-------------|---|
| | Maximum | Minimum | Sensitivity | Standard Uncertainty |
| Acetaldehyde | mg/Nm ³ | mg/Nm ³ | | mg/Nm ³ |
| | 0.12 | 0.10 | 183.88 | 0.00552 |
| Condensate Results | | | | |
| Acetaldehyde | Maximum mg/Nm ³ | Minimum mg/Nm ³ | Sensitivity | Standard Uncertainty mg/Nm ³ |

Uncertainty in final measurement @ Reference Conditions due to uV_{20}

| Charcoal Tube Results | | | | |
|-----------------------|--------------------|--------------------|-------------|----------------------|
| | Maximum | Minimum | Sensitivity | Standard Uncertainty |
| Acetaldehyde | mg/Nm ³ | mg/Nm ³ | | mg/Nm ³ |
| | 0.11 | 0.11 | 20.30 | 0.00258 |

Combined Uncertainty (excluding Oxygen contribution)

$$u_{combined} = \sqrt{\sum (u_{M})^2 + (u_L)^2 + (uV_{20})^2}$$

| Charcoal Tubes: | Combined Uncertainty | Expanded Uncertainty | Measured Concentration | Percent of Measured Concentration |
|-----------------|----------------------|----------------------|------------------------|-----------------------------------|
| Determinand | mg/Nm ³ | mg/Nm ³ | mg/Nm ³ | |
| Acetaldehyde | 0.00622 | 0.0124 | 0.11 | 11.28 |

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5558 : R001

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions – August 2023
 Survey Dates : 16th August 2023
 Report Issue Date : 18th September 2023

Note:
 Results based on Charcoal Tubes Only!

Site: Ecobat Solutions, Darlaston
 Location: Recupyl Shredder , Stack ID:Exhaust Stack

| | | | | Standard Uncertainty @ 95% | |
|-------------------------------------|------------------|---------|----------------|----------------------------|----------------------|
| Sampled Volume | V _m | 0.01254 | m ³ | uV _m | 0.000 m ³ |
| Meter Correction Factor or ml/count | Yd | 0.5 | ... | ... | ... |
| Meter Temperature | T _m | 294.83 | k | uT _m | 1.5 k |
| Barometric Pressure | P _b | 1004.00 | mBar | | 10.0 mBar |
| Oxygen content | O _{2,m} | 20.90 | %Vol | uO _{2,m} | 1.25 %Vol |
| Moisture | H ₂ O | 0.00 | %Vol | uH ₂ O | %Vol |

| Tubes | | |
|-------------------------------------|----------------|----------------------|
| Determinand | Recovered Mass | Standard Uncertainty |
| Carbonic acid, ethyl-, methyl ester | 841.00 µg | uM 41.82 µg |

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 $u_i = C_i \times u_{x_i}$ 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:

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

Uncertainty in correction factor to STP due to measured barometric pressure uncertainty component (up_b), measured temperature of dry gas uncertainty component (uT_m) & measured moisture (uH₂O)

$$f_s = \frac{273}{T_m} \times \frac{P}{101.3} = 0.92$$

| | Maximum | Minimum | Sensitivity | ufstp |
|-------------------|---------|---------|-------------|---------|
| up _b | 0.48 | 0.47 | 0.000475 | 0.00475 |
| uT _m | 0.92 | 0.91 | 0.00311 | 0.00467 |
| uH ₂ O | ... | ... | ... | ... |

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{uP_b}{P_b/101.3}\right)^2 + \left(\frac{uT_m}{T_m/273.15}\right)^2 + \left(\frac{uH_2O}{100/(100-H_2O)}\right)^2} = 0.00592$$

Uncertainty in volume @ STP due to volume correction factor uncertainty component (uVstd) & volume uncertainty component (uVm)

$$V_{std} = V_{measured} \times f_s = 0.00575$$

| | Maximum | Minimum | Sensitivity | Standard Uncertainty |
|---------------------------|----------------|----------------|-------------|----------------------|
| | m ³ | m ³ | | m ³ |
| Effect of uf _s | 0.00579 | 0.00572 | 0.00627 | 0.0000371 |
| Effect of uV _m | 0.00590 | 0.00561 | 0.46 | 0.000144 |

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uf_s}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.0000752$$

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

$$uL = \frac{Conc \times \frac{2}{100}}{\sqrt{3}}$$

| | Tubes uL | Condensate uL |
|-------------------------------------|--------------------|--------------------|
| | mg/Nm ³ | mg/Nm ³ |
| Carbonic acid, ethyl-, methyl ester | 1.69 | ... |

$$Conc = \frac{M_{Recovered}}{V_m \times f_s \times f_{O_2}}$$

Uncertainty in final measurement @ Reference Conditions due to uM_{Recovered}

| Charcoal Tube Results | | | | |
|-------------------------------------|--------------------|--------------------|-------------|----------------------|
| | Maximum | Minimum | Sensitivity | Standard Uncertainty |
| | mg/Nm ³ | mg/Nm ³ | | mg/Nm ³ |
| Carbonic acid, ethyl-, methyl ester | 153.44 | 138.91 | 173.81 | 7.27 |

| Condensate Results | | | | |
|-------------------------------------|--------------------|--------------------|-------------|----------------------|
| | Maximum | Minimum | Sensitivity | Standard Uncertainty |
| | mg/Nm ³ | mg/Nm ³ | | mg/Nm ³ |
| Carbonic acid, ethyl-, methyl ester | | | | |

Uncertainty in final measurement @ Reference Conditions due to uV_{STD}

| Charcoal Tube Results | | | | |
|-------------------------------------|--------------------|--------------------|-------------|----------------------|
| | Maximum | Minimum | Sensitivity | Standard Uncertainty |
| | mg/Nm ³ | mg/Nm ³ | | mg/Nm ³ |
| Carbonic acid, ethyl-, methyl ester | 148.11 | 144.29 | 25411.18 | 1.91 |

Combined Uncertainty (excluding Oxygen contribution)

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

| Charcoal Tubes: | Combined Uncertainty | Expanded Uncertainty | Measured Concentration | Percent of Measured Concentration |
|-------------------------------------|----------------------|----------------------|------------------------|-----------------------------------|
| Determinand | mg/Nm ³ | mg/Nm ³ | mg/Nm ³ | |
| Carbonic acid, ethyl-, methyl ester | 7.70 | 15.41 | 146.18 | 10.54 |

Environmental Compliance Limited

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5558 : R001

Installation Name : Recupyl Shredder Exhaust
 Visit Details : Emissions – August 2023
 Survey Dates : 16th August 2023
 Report Issue Date : 18th September 2023

Note:
 Results based on Charcoal Tubes Only!

Site: Ecobat Solutions, Darlaston
 Location: Recupyl Shredder , Stack ID:Exhaust Stack

| | | | | Standard Uncertainty @ 95% | |
|-------------------------------------|------------------|---------|----------------|----------------------------|----------------------|
| Sampled Volume | V _m | 0.01250 | m ³ | uV _m | 0.000 m ³ |
| Meter Correction Factor or ml/count | Y _d | 0.5 | ... | ... | ... |
| Meter Temperature | T _m | 296.17 | k | uT _m | 1.5 k |
| Barometric Pressure | P _b | 1004.00 | mBar | | 10.0 mBar |
| Oxygen content | O _{2,m} | 20.90 | %Vol | uO _{2,m} | 1.25 %Vol |
| Moisture | H ₂ O | 0.00 | %Vol | uH ₂ O | %Vol |

| Tubes | | |
|-------------------------------------|----------------|----------------------|
| Determinand | Recovered Mass | Standard Uncertainty |
| Carbonic acid, ethyl-, methyl ester | 1365.00 µg | uM 68.25 µg |

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 u_i where C is the sensitivity coefficient, u is the standard uncertainty and i is the index identifying the contributing factor e.g. i=uV_m, uT_m, etc.

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

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

Uncertainty in correction factor to STP due to measured barometric pressure uncertainty component (uP_b), measured temperature of dry gas uncertainty component (uT_m) & measured moisture (uH₂O)

$$f_s = \frac{273}{T_m} \times \frac{P}{101.3} = 0.91$$

| | Maximum | Minimum | Sensitivity | ufstp |
|-------------------|---------|---------|-------------|---------|
| uP _b | 0.48 | 0.47 | 0.000473 | 0.00473 |
| uT _m | 0.92 | 0.91 | 0.00308 | 0.00463 |
| uH ₂ O | ... | ... | ... | ... |

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{uP_b}{P_b/101.3}\right)^2 + \left(\frac{uT_m}{T_m/273.15}\right)^2 + \left(\frac{uH_2O}{100/(100-H_2O)}\right)^2} = 0.00585$$

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

$$V_{std} = V_{measured} \times f_s = 0.00571$$

| | Maximum | Minimum | Sensitivity | Standard Uncertainty |
|---------------------------|---------|---------|-------------|----------------------|
| Effect of uP _b | 0.00575 | 0.00568 | 0.00625 | 0.0000366 |
| Effect of uV _m | 0.00585 | 0.00557 | 0.46 | 0.000143 |

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uf_s}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.0000744$$

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

$$uL = \frac{Conc \times 2}{\sqrt{3} \times 100}$$

| | Tubes | Condensate |
|-------------------------------------|--------------------|--------------------|
| Carbonic acid, ethyl-, methyl ester | mg/Nm ³ | mg/Nm ³ |
| | 2.76 | ... |

$$Conc = \frac{M_{recovered}}{V_m \times f_s \times f_{O_2}}$$

Uncertainty in final measurement @ Reference Conditions due to uM_{recovered}

| Charcoal Tube Results | | | | |
|-------------------------------------|--------------------|--------------------|-------------|----------------------|
| | Maximum | Minimum | Sensitivity | Standard Uncertainty |
| Carbonic acid, ethyl-, methyl ester | mg/Nm ³ | mg/Nm ³ | | mg/Nm ³ |
| | 250.92 | 227.02 | 175.07 | 11.95 |
| Condensate Results | | | | |
| | Maximum | Minimum | Sensitivity | Standard Uncertainty |
| Carbonic acid, ethyl-, methyl ester | mg/Nm ³ | mg/Nm ³ | | mg/Nm ³ |

Uncertainty in final measurement @ Reference Conditions due to uV_{std}

| Charcoal Tube Results | | | | |
|-------------------------------------|--------------------|--------------------|-------------|----------------------|
| | Maximum | Minimum | Sensitivity | Standard Uncertainty |
| Carbonic acid, ethyl-, methyl ester | mg/Nm ³ | mg/Nm ³ | | mg/Nm ³ |
| | 242.13 | 235.90 | 41844.52 | 3.11 |

Combined Uncertainty (excluding Oxygen contribution)

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

| Charcoal Tubes: | Combined Uncertainty | Expanded Uncertainty | Measured Concentration | Percent of Measured Concentration |
|-------------------------------------|----------------------|----------------------|------------------------|-----------------------------------|
| Determinand | mg/Nm ³ | mg/Nm ³ | mg/Nm ³ | |
| Carbonic acid, ethyl-, methyl ester | 12.65 | 25.30 | 238.97 | 10.59 |

Ecobat Solutions
 Permit No : EPR/DB3704FG
 Variation No : EPR/DB3704FG/V006
 Report Ref : P5558 : Ro01

Installation Name : Recypyl Shredder Exhaust
 Visit Details : Emissions – August 2023
 Survey Dates : 16th August 2023
 Report Issue Date : 18th September 2023

Stack Reference Exhaust Stack

Measurement Uncertainty Calculations - Velocity at Stack Conditions

| Contribution From | Standard u/c (Pa) | |
|---|----------------------------------|---|
| Pitot Calibration Uncertainty Contribution | 0.04 | A |
| Manometer Calibration Uncertainty Contribution | 0.037666667 | B |
| Variation in Actual Pitot reading at sample points | 0.60 | C |
| Combined u/c (Pa) = SQRT $(A/\sqrt{3})^2 + (B/\sqrt{3})^2 + (C/\sqrt{3})^2$ | Combined u/c (Pa) 0.35 | |
| Expanded Uncertainty of Flow Measurements Pa | 0.70 | |
| | Standard u/c (K) | |
| Temperature Calibration (K) | 1.46 | D |
| Variation in Actual Temp reading at sample points | 0.00 | E |
| Combined u/c of Temp (K) SQRT $((D/\sqrt{3})^2 + (E/\sqrt{3})^2)$ | Combined u/c (K) 0.84 | |
| Expanded Uncertainty of Temp Measurements (K) | 1.69 | |
| Measured Average Velocity (m/s) at Stack Conds | 3.53 | |
| Maximum Average Velocity (m/s) at Stack Conds | 3.70 | |
| Standard Uncertainty Velocity at Stack Conditions (%) | 4.82 | |
| Expanded Uncertainty Velocity (at Stack Conditions) | 9.63 (%) | |

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 | 0.17 |
| Maximum Average Flowrate (m ³ /s) at Stack Conds | 0.18 |
| Standard Uncertainty Flowrate (m ³ /s) at Stack Conditions (%) | 5.86 |
| Expanded Uncertainty Flowrate (m³/s) at Stack Conditions | 11.73 (%) |

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 | 0.15 |
| Maximum Average Flowrate (m ³ /s) at STP Wet | 0.16 |
| Standard Uncertainty Flowrate (m ³ /s) at STP Wet | 6.36 |
| Expanded Uncertainty Flowrate (m³/s) at STP Wet | 12.72 (%) |