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## Appendices

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## Appendices

## I. INTRODUCTION

Network Environmental, Inc. was retained by Hutchinson Antivibration Systems of Grand Rapids, Michigan to conduct compliance emission testing at their Grand Rapids, Michigan facility located at 460 Fuller N.E. The purpose of the study was to determine the capture and destruction efficiency of the regenerative thermal oxidizer (RTO) in accordance with their Permit MI-ROP-E5094-2018 and 40 CFR Part 63, Subpart MMMM.

The sampling was conducted on May 23, 2019 by Stephan K. Byrd and David D. Engelhardt of Network Environmental, Inc. The testing was performed in accordance with EPA Methods 18, 24, 25A and 204 for Destruction and Capture Efficiency. Mr. Jim Niesen and the staff of Hutchinson coordinated source operation and data collection during the testing. Mr. David Patterson and Mr. Dave Morgan of the Michigan Department of Environment, Great Lakes and Energy (EGLE) - Air Quality Division were present to observe the testing and source operation.

## II. PRESENTATION OF RESULTS

**II.1 TABLE 1**
**VOC DESTRUCTION EFFICIENCY RESULTS (as Propane)**
**HUTCHINSON ANTIVIBRATION SYSTEMS, INC.**
**RTO**
**GRAND RAPIDS, MICHIGAN**
**MAY 23, 2019**

| Sample | Time | Concentration PPM(1) | | Mass Emission Rate Lbs./Hr | | %(2) Destruction Efficiency |
|---|---|---|---|---|---|---|
| | | Inlet | Exhaust | Inlet | Exhaust | |
| 1 | 10:25-11:25 | 457.7 | 24.0 | 26.79 | 1.15 | 95.71 |
| 2 | 13:04-14:04 | 553.0 | 28.4 | 31.98 | 1.45 | 95.46 |
| 3 | 14:56-15:56 | 461.7 | 24.4 | 26.37 | 1.21 | 95.37 |
| **Average** | | **502.3** | **25.6** | **28.30** | **1.27** | **95.51** |

(1) PPM = Parts Per Million (v/v) on an actual (wet) basis
(2) Destruction Efficiencies were calculated using the mass emission rates

**II.2 TABLE 2**
**CAPTURE EFFICIENCY RESULTS**
**HUTCHINSON ANTIVIBRATION SYSTEMS, INC.**
**GRAND RAPIDS, MICHIGAN**
**SILVER 1 BOOTH (EUSIL01)**
**MAY 23, 2019**

| Run # | Time | VOC's RM – Lbs. | VOC's Applied - Lbs. | % CE |
|---|---|---|---|---|
| 1 | 09:52-10:52 | 2.87 | 2.29 | 125.40 |
| 2 | 11:09-12:09 | 2.82 | 3.98 | 70.69 |
| 3 | 12:21-13:21 | 3.11 | 2.78 | 111.76 |
| 4 | 13:33-14:33 | 3.55 | 2.77 | 128.27 |
| 5 | 14:45-15:45 | 1.15 | 3.74 | 30.88* |
| 6 | 15:52-16:52 | 4.02 | 4.31 | 93.17 |
| **Average** | | | | **105.84** |

* Sample 5 was not included in the average capture efficiency for the six runs due to the recovery percentages outside of the 100 % $\pm$ 30%. The overall capture efficiency for the nine booths = 100.65%

## III. DISCUSSION OF RESULTS

**Destruction Efficiency -** The results of the destruction efficiency (DE) sampling are presented in Section II, Table 1. The Destruction Efficiencies for the three samples were 95.71% for sample one, 95.46% for sample two and 95.37% for sample three. The average of the three samples was 95.51%. The Destruction Efficiencies were calculated using the mass loadings, as propane, at the inlet and outlet of the RTO.

**Capture Efficiency -** The results of the capture efficiency sampling for the Silver 1 Booth are presented in Section II, Table 2. The capture efficiencies for the six samples were 125.40% for sample one, 70.69% for sample two, 111.76% for sample three, 128.27% for sample four, 30.88% for sample five, and 93.12% for sample six. Sample 5 was not included in the average capture efficiency for the six runs due to the recovery percentages outside of the recommended guidelines of 100% $\pm$ 30%. The average for the capture efficiency was 105.84%. The capture efficiencies were calculated using the mass VOC loading at the exit of Silver 1 Booth compared to the VOC usage for the coatings applied during each test run. The average capture efficiency for the nine booths is 100.65%.

## IV. SOURCE DESCRIPTION

The source sampled was a RTO that controls the coating and adhesive application process located at the Grand Rapids, Michigan facility. The process applies adhesive and coatings to metal parts. The process consists of four adhesive spray booth and five coating booths. The booths are enclosed and vented to the RTO. See Appendix F for process data and coating usage.

## V. SAMPLING AND ANALYTICAL PROTOCOL

The RTO inlet and exhaust sampling was conducted on the 20-inch I.D. RTO inlet duct at a location approximately 5-duct diameters downstream and 1 duct diameter upstream from the nearest disturbances and the 23-inch I.D. RTO outlet stack at a location approximately 8-duct diameters downstream and greater than two duct diameter upstream from the exit.

The following reference test methods were employed to conduct the sampling:

* Destruction Efficiency - U.S. EPA Method 25A
* Capture Efficiency - U.S. EPA Methods 18, 24, and 204

* Exhaust Gas Parameters (flow rate, temperature, moisture and density) - U.S. EPA Methods 1 - 4.

**V.1 Destruction -** The total hydrocarbon (VOC) sampling was conducted in accordance with U.S. EPA Reference Method 25A. The sample gas was extracted from the inlet and outlet of the RTO through heated Teflon sample lines that led to a Thermo Model 51 and a J.U.M Model 3-500 portable flame ionization detectors (FIDs). These analyzers produce instantaneous readouts of the total hydrocarbon concentrations (PPM). Three (3) samples were collected from each of the inlet and outlet of the RTO. Each sample was sixty (60) minutes in duration. The sampling on the RTO inlet and exhaust was conducted simultaneously for the DE.

A systems (from the back of the stack probe to the analyzer) calibration was conducted for the analyzers prior to the testing. Span gases of 151.1 PPM and 2019 PPM propane were used to establish the initial instrument calibration for the analyzers. Propane calibration gases of 50.6 PPM, 96.49 PPM, 491.0 PPM and 959.3 PPM were used to determine the calibration error of the analyzers. After each PPM sample (60 minute sample period), a system zero and system injections of 50.19 PPM and 491.0 PPM propane were performed to establish system drift of the analyzers during the test period. All calibration gases used were EPA Protocol 1 Certified. All the results were calibration corrected using Equation 7E-1 from U.S. EPA Method 7E.

**V.2 Capture Efficiency -** The capture efficiency determination was performed in accordance with EPA Methods 18, 24 and 204. A Teflon sample line was used to extract the samples from the inlet to the oxidizer. Two Anasorb CSC sorbent tubes in series were used to collect the samples. The sampling system was operated at approximately 300 cc/min during the testing. A vacuum pump with a calibrated critical orifice was used to collect the samples. Each sample was sixty (60) minutes in duration. A total of six samples were collected.

The samples were recovered and refrigerated until they were analyzed. The samples were analyzed by Gas Chromatograph with a Flame Ionization Detector (FID) for ethylbenzene, methyl ethyl ketone, methyl isobutyl ketone, toluene, and xylene. A spiked duplicate sample was collected with each of the six test runs. The tubes were spiked with approximately 1000 ug of each compound. The laboratory spiked tube recoveries for five of the six samples ranged from 91.84% to 116.93%. Sample 5 was not included due to the recoveries. All quality assurance and quality control requirements specified in the method were incorporated in the sampling and analysis.

The coating usage was determined by weighing containers of coating to the nearest 0.1 pounds. Weights were recorded at the beginning and end of each one (1) hour run. The booth had coating pots for prime

and top coat sitting on an individual scales. The VOC content of each coating batch used was determined by EPA Method 24. One sample was collected for each different coating used during the testing. The analytical data can be found in Appendix D and the coating usage data can be found in Appendix E.

**V.3 Exhaust Gas Parameters -** The exhaust gas parameters (airflow rate, temperature, moisture and density) were determined in accordance with U.S. EPA Methods 1-4. Moisture was determined by employing the wet bulb/dry bulb measurement technique. Oxygen and carbon dioxide concentrations (%) were determined by collecting a bag sample (grab sample) and Orsat analysis. Twelve (12) sample points were used for the velocity determinations.

The sample points were as follows:

| Point # | Point Location (Inches) | |
|---|---|---|
| | Inlet | Outlet |
| 1 | 1.88 | 1.01 |
| 2 | 2.92 | 3.36 |
| 3 | 5.92 | 6.81 |
| 4 | 14.08 | 16.19 |
| 5 | 17.08 | 16.64 |
| 6 | 19.12 | 21.99 |
| | | |

One velocity traverse was performed at the exhaust of the Silver 1 Booth for each CE sample collected. One velocity traverse was performed at the inlet and outlet of the RTO for each DE test run. All quality assurance and quality control requirements specified in the method were incorporated in the sampling and analysis.

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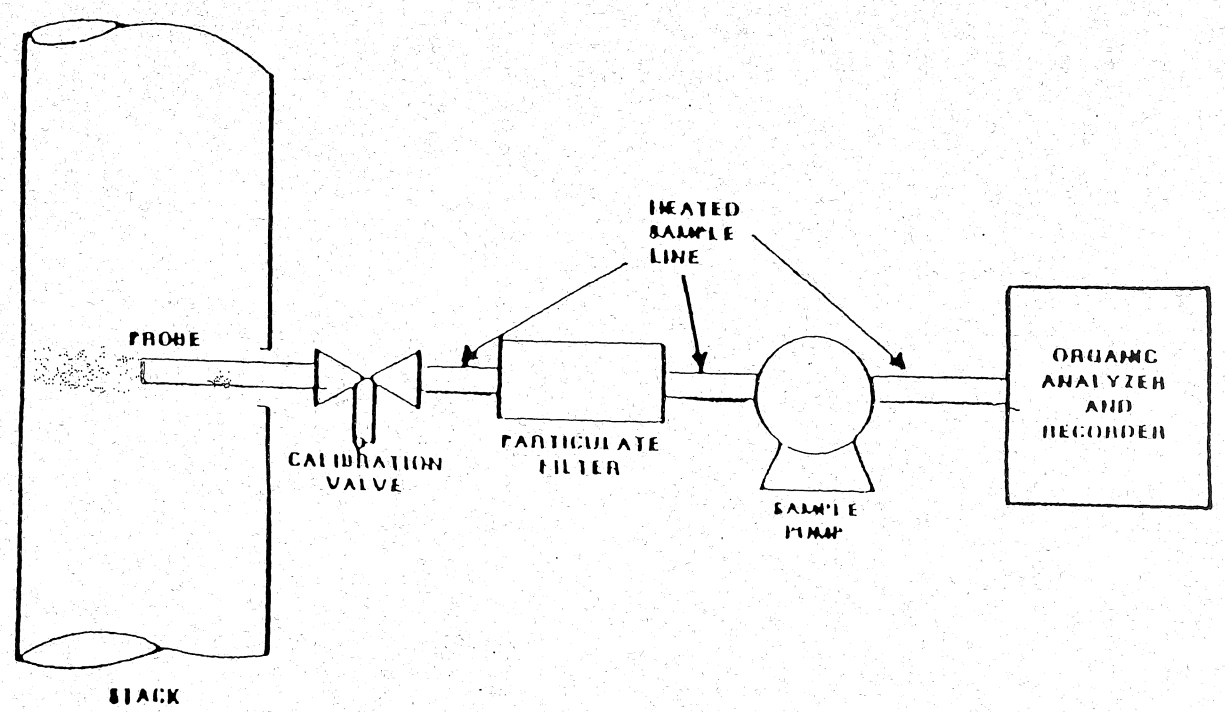


**Figure 1**

**Method 25A Sampling Train**

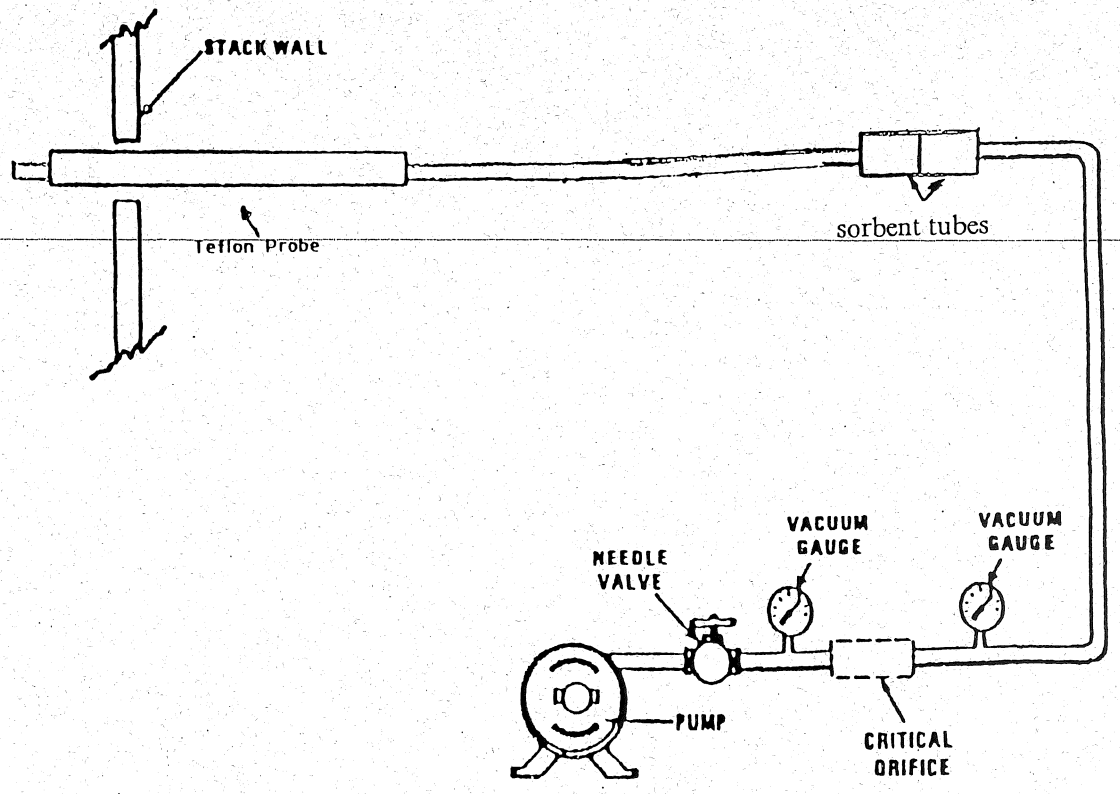


**Figure 2**

**Method 18 Sampling Train**