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I. INTRODUCTION

Network Environmental, Inc. was retained by Emerald Engineered Decorative Solutions (SRN: N3044, Kent County) to conduct VOC (total hydrocarbons) emission sampling at their facility located at 4949 West Greenbrooke S.E., Kentwood, MI. The purpose of the study was to determine the VOC destruction efficiency (DE) of the catalytic oxidizer that services the robot line (EU-ROBOTLINE) at this facility. EGLE Permit To Install No. 401-08 has established a 76% destruction efficiency (DE) limit for the oxidizer and limits VOC emissions to 2,000 Lbs/Month.

The DE of the oxidizer was determined by employing the following reference test methods:

- VOC's – U.S. EPA Method 25A
- Exhaust Gas Parameters (air flow rate, temperature, moisture & density) – U.S. EPA Reference Methods 1 through 4.

The sampling was performed on April 4, 2023 by Richard D. Eerdmans and David D. Engelhardt of Network Environmental, Inc.. Assisting in the study were Mr. Brian Dillon of Emerald Engineered Decorative Solutions and the operating staff of the facility. Ms. April Lazzaro and Ms. Lindsey Wells of the Michigan Department of Environment, Great Lakes and Energy (EGLE) - Air Quality Division were present to observe the sampling and source operation.

II.1 TABLE 1
VOC DESTRUCTION EFFICIENCY (DE) RESULTS
CATALYTIC OXIDIZER
EMERALD ENGINEERED DECORATIVE SOLUTIONS
KENTWOOD, MICHIGAN
APRIL 4, 2023

Sample	Time	Air Flow Rate SCFM (1)		Concentration PPM (2)		Mass Emission Rate Lbs/Hr (3)		Percent Destruction Efficiency (4)
		Inlet	Exhaust	Inlet	Exhaust	Inlet	Exhaust	
1	08:34-09:34	14,845	16,316	220.2	31.5	22.34	3.51	84.29
2	10:01-11:01	14,571	15,625	468.0	55.8	46.59	5.96	87.21
3	11:28-12:28	14,675	15,550	476.8	54.6	47.81	5.80	87.87
Average		**14,697**	**15,830**	**388.3**	**47.3**	**38.91**	**5.09**	**86.46**

(1) SCFM = Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg).
(2) PPM = Parts Per Million (v/v) On An Actual (Wet) Basis As Propane
(3) Lbs/Hr = Pounds Per Hour Calculated As Propane
(4) Destruction Efficiencies were calculated using the mass emission rates (Lbs/Hr)

III. DISCUSSION OF RESULTS

The results of the emission sampling are summarized in Table 1 (Section II.1). The results are presented as follows:

III.1 Total Hydrocarbon (VOC) Destruction Efficiency Results (Table 1)

Table 1 summarizes the VOC DE results for the catalytic oxidizer as follows:

- Sample
- Time
- Air Flow Rate (SCFM) – Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- VOC Concentrations (PPM) – Parts Per Million (v/v) On An Actual (Wet) Basis As Propane
- VOC Mass Emission Rates (Lbs/Hr) – Pounds Of VOC Per Hour As Propane
- VOC Percent Destruction Efficiency (DE)

Both the inlet and exhaust concentrations (PPM) and mass rates (Lbs/Hr) are shown. The DE results were calculated using the mass rate results (Lbs/Hr).

IV. SAMPLING AND ANALYTICAL PROTOCOL

The exhaust sampling was conducted on the 60 inch I.D. exhaust stack at a location approximately 3.5 duct diameters downstream and 2 duct diameters upstream from the nearest disturbances. The inlet sampling was conducted on the 48 inch I.D. inlet duct at a location approximately 6 duct diameters downstream and 3 duct diameters upstream from the nearest disturbances.

IV.1 Total Hydrocarbon (VOC) – The VOC sampling was conducted in accordance with U.S. EPA Method 25A. A J.U.M. Model 3-500 flame ionization detector (FID) analyzer was used to monitor the exhaust. A Thermo Environmental, Inc. Model 51 flame ionization detector (FID) analyzer was used to monitor the inlet. Heated teflon sample lines were used to transport the gases to the analyzers. These analyzers produce instantaneous readouts of the total hydrocarbon concentrations (PPM).

The analyzers were calibrated by system injection (from the back of the stack probe to the analyzer) prior to the testing using propane calibration gases. Span gases of 991.0 PPM (inlet) and 94.9 PPM (exhaust) were used to establish the initial instrument calibrations. Calibration gases of 250.0 PPM & 491.0 PPM (for the inlet) and 30.2 PPM & 50.6 PPM (for the exhaust) propane were used to determine the calibration error

of the analyzers. After each sample, a system zero and system injection of 491.0 PPM (for the inlet) and 50.6 PPM (for the exhaust) propane were performed to establish system drift and system bias during the test period. All calibration gases used were EPA Protocol Calibration Gases. Three (3) samples were collected simultaneously from the inlet and exhaust. Each sample was sixty (60) minutes in duration.

The analyzers were calibrated to the output of the data acquisition system (DAS) used to collect the data from the sources. The analyzer averages were corrected for calibration error and drift using formula EQ.7E-5 from 40 CFR Part 60, Appendix A, Method 7E. Figure 1 is a diagram of the VOC sampling train.

IV.2 Exhaust Gas Parameters – The exhaust gas parameters (air flow rate, temperature, moisture and density) were determined in conjunction with the other sampling by employing U.S. EPA Methods 1 through 4.

Three (3) velocity traverses were conducted at both the inlet and the exhaust. Figure 2 is a diagram of the air flow sampling train.

Moisture on the inlet was determined by employing the wet bulb/dry bulb technique. Moisture on the outlet was determined by running moisture samples in accordance with U.S. EPA Method 4. Samples were withdrawn from the stack and passed through a condensing coil with drop out before being passed through pre-weighed silica gel. The water collected was measured to the nearest 0.5 ml and the silica gel was re-weighed to the nearest 0.5 g. The moisture collected along with the sample volume was used to determine the percent moisture in the exhaust. Each sample was thirty (30) minutes in duration and had a minimum sample volume of twenty-one (21) standard cubic feet. A diagram of the moisture sampling train is shown in Figure 3. Moisture was determined at each location during each sample.

Bag samples were collected from each location and analyzed by Orsat to determine gas density for each sample.

All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis.

This report was prepared by:

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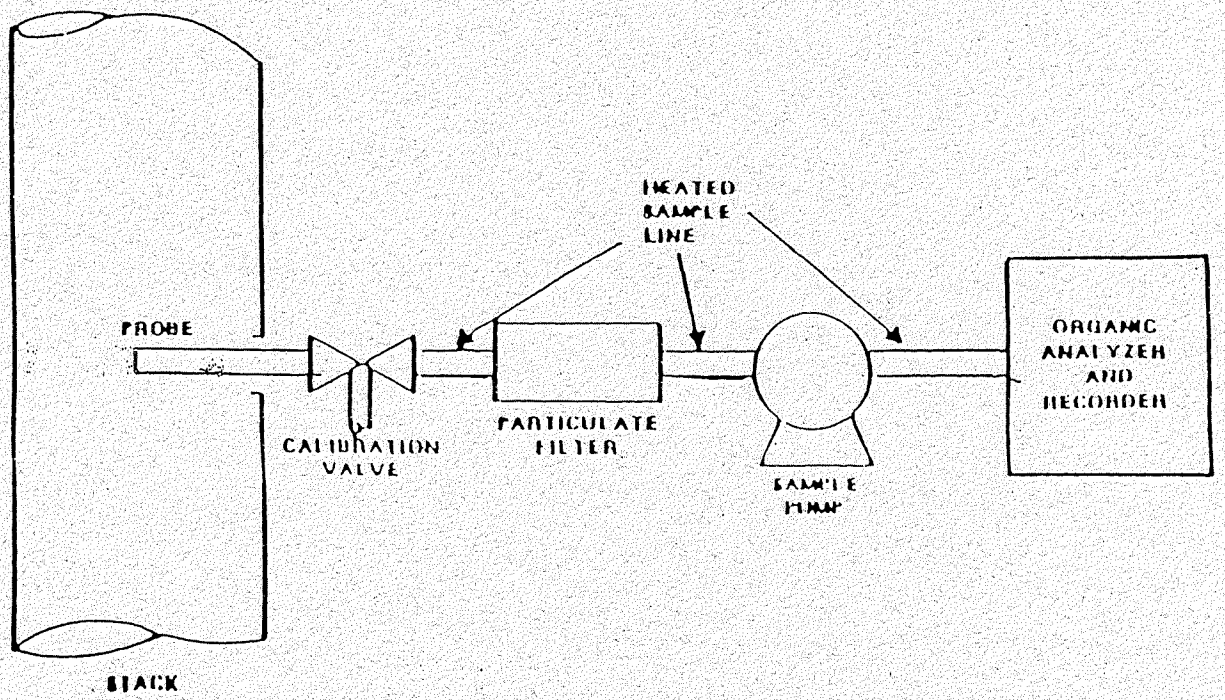

Figure 1

VOC
Sampling Train

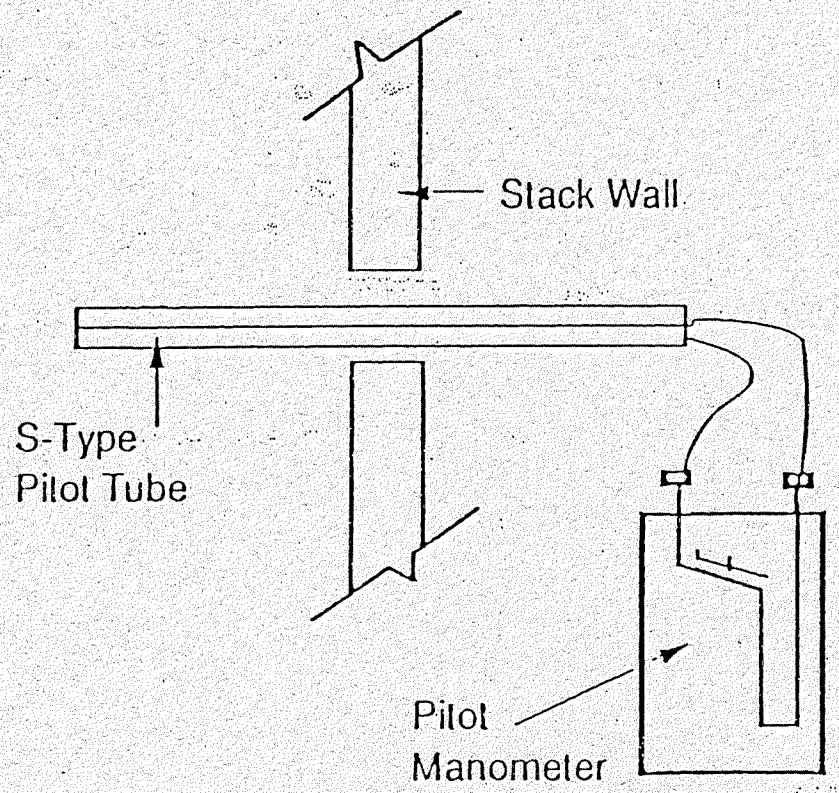

Figure 2

Air Flow
Sampling Train

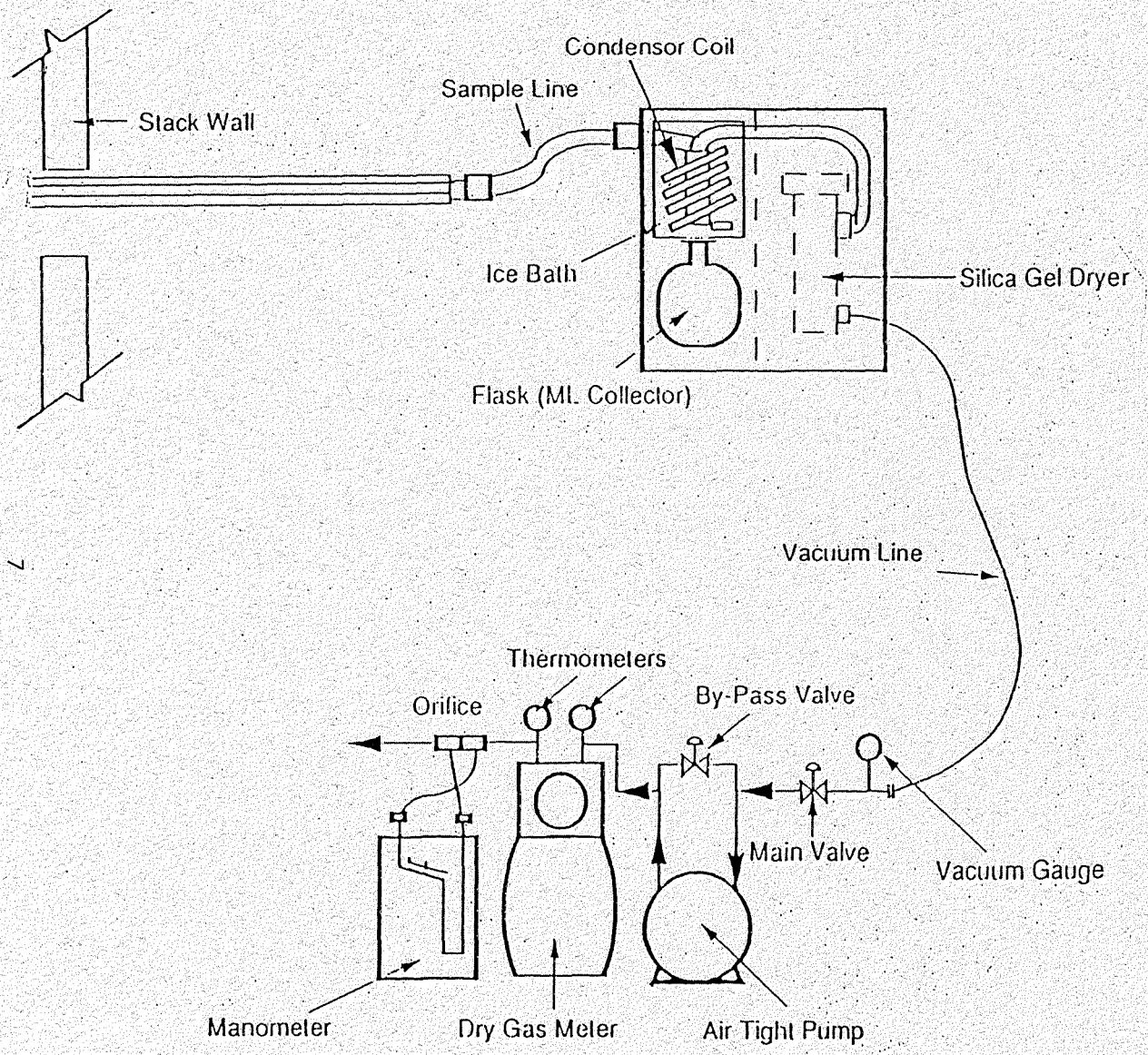

Figure 3

Moisture Sampling Train