

Report of...

VOC Emission Sampling

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Performed for...

AIR QUALITY DIVISION

Albar Industries, Inc.

Lapeer, Michigan

On the...

Thermal Oxidizer & Carbon Adsorber

December 6-7, 2017

Project#: 201.08

By...

Network Environmental, Inc.
Grand Rapids, MI

I. INTRODUCTION

Network Environmental, Inc. was retained by Albar Industries, Inc. to conduct VOC (total hydrocarbons) emission sampling at their facility located in Lapeer, MI. The purpose of the study was to meet a request for testing by the MDEQ Air Quality Division. The sources tested were the RTO (Regenerative Thermal Oxidizer) and the Carbon Adsorber (Concentrator) on Coating Line #3. These sources are regulated under MDEQ ROP No. MI-ROP-N0802-2015. The destruction efficiency (DE) of the RTO and the collection efficiency (CE) of the Concentrator were determined.

The sampling was conducted by employing the following reference test methods:

- VOC's – U.S. EPA Method 25A & 40 CFR 1065.265 (Methane Cutter)
- Exhaust Gas Parameters (air flow rate, temperature, moisture & density) – U.S. EPA Reference Methods 1 through 4.

The sampling was performed over the period of December 6-7, 2017 by Stephan K. Byrd, Richard D. Eerdmans and David D. Engelhardt of Network Environmental, Inc.. Assisting in the study were Mr. Andrew L. Woodruff of Albar Industries, Inc. and the operating staff of the facility. Mr. Robert Byrnes and Mr. David Patterson of the Michigan Department of Environmental Quality (MDEQ) – Air Quality Division were present to observe the sampling and source operation on December 7.

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**II.1 TABLE 1
VOC DESTRUCTION EFFICIENCY (DE) RESULTS
RTO
ALBAR INDUSTRIES, INC.
LAPEER, MICHIGAN
DECEMBER 7, 2017**

Sample	Time	Air Flow Rate SCFM ⁽¹⁾		VOC Concentration PPM ⁽²⁾		Methane Concentration PPM ⁽²⁾	Methane Mass Emission Rate Lbs/Hr ⁽³⁾	VOC Mass Emission Rate Lbs/Hr ⁽³⁾			Percent Destruction Efficiency ⁽⁵⁾
		Inlet	Exhaust	Inlet	Exhaust	Exhaust	Exhaust	Inlet	Exhaust	Exhaust ⁽⁴⁾ Minus Methane	
1	08:56-09:56	4,700	4,814	670.4	49.5	16.63	0.55	21.53	1.63	1.08	94.98
2	10:34-11:34	4,361	4,427	781.6	64.1	15.61	0.47	23.29	1.94	1.47	93.70
3	12:10-13:10	4,548	4,638	873.9	76.6	15.58	0.49	27.16	2.43	1.93	92.88
Average		4,536	4,626	775.3	63.4	15.94	0.50	23.99	2.00	1.49	93.85

(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) Calculated by subtracting the Methane mass emission rate (as propane) from the Total VOC mass emission rate (as propane).

(5) Destruction Efficiencies (DE) were calculated using the mass emission rates (Lbs/Hr). The exhaust mass emission rate with Methane subtracted was used for the DE calculations.

**II.2 TABLE 2
COLLECTION EFFICIENCY (CE) RESULTS
CARBON ADSORBER (CONCENTRATOR)
ALBAR INDUSTRIES, INC.
LAPEER, MICHIGAN
DECEMBER 6, 2017**

Sample	Time	Air Flow Rate SCFM ⁽¹⁾	VOC Concentration PPM ⁽²⁾		Methane Concentration PPM ⁽²⁾	Methane Mass Emission Rate Lbs/Hr ⁽³⁾	VOC Mass Emission Rate Lbs/Hr ⁽³⁾				Percent Collection Efficiency ⁽⁵⁾
			Inlet	Exhaust	Exhaust	Exhaust	Inlet	Exhaust	Inlet ⁽⁴⁾ Minus Methane	Exhaust ⁽⁴⁾ Minus Methane	
1	11:56-12:56	25,290	233.3	63.3	56.33	9.73	40.31	10.94	30.58	1.20	96.06
2	13:09-14:09	25,548	301.1	84.1	73.80	12.88	52.56	14.68	39.68	1.80	95.47
3	15:12-16:12	25,470	227.4	79.5	69.23	12.05	39.58	13.84	27.53	1.79	93.50
Average		25,436	253.9	75.6	66.45	11.55	44.15	13.15	32.60	1.60	95.01

(1) SCFM = Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg) as measured at the carbon adsorber inlet.

(2) PPM = Parts Per Million (v/v) On An Actual (Wet) Basis As Propane.

(3) Lbs/Hr = Pounds Per Hour Calculated As Propane

(4) Calculated by subtracting the Methane mass emission rate (as propane) from the Total VOC mass emission rate (as propane).

(5) Collection Efficiencies (CE) were calculated using the mass emission rates (Lbs/Hr) with methane subtracted.

III. DISCUSSION OF RESULTS

The results of the emission sampling are summarized in Tables 1 and 2 (Sections II.1 & II.2). The results are presented as follows:

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

Table 1 summarizes the VOC DE results for the thermal oxidizer (RTO) 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
- Methane Concentrations (PPM) – Parts Per Million (v/v) On An Actual (Wet) Basis As Propane
- Methane Mass Emission Rates (Lbs/Hr) – Pounds Of Methane Per Hour As Propane
- VOC Mass Emission Rates (Lbs/Hr) – Pounds Of VOC Per Hour As Propane
- VOC Percent Destruction Efficiency (DE) (Calculated using the mass emission rates)

Both the inlet and exhaust concentrations and mass rates are shown.

The DE results were calculated using the mass emission rates (Lbs/Hr). The exhaust mass emission rates with Methane subtracted were used for the DE calculations. The methane concentrations were converted to a propane basis using a response factor (RF) developed for each run by injecting Methane calibration gas into the sampling system (PPM Methane as Propane = PPM Methane/RF).

III.2 Carbon Adsorber (Concentrator) Collection Efficiency (CE) Results (Table 2)

Table 2 summarizes the CE results for the carbon adsorber 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
- Methane Concentrations (PPM) – Parts Per Million (v/v) On An Actual (Wet) Basis As Propane
- Methane Mass Emission Rates (Lbs/Hr) – Pounds Of Methane Per Hour As Propane
- VOC Mass Emission Rates (Lbs/Hr) – Pounds Of VOC Per Hour As Propane
- VOC Percent Collection Efficiency (CE) (Calculated using the mass emission rates minus methane)

Both the inlet and exhaust concentrations and mass rates are shown.

The CE results were calculated using the mass emission rates (Lbs/Hr). The inlet and exhaust mass emission rates with Methane subtracted were used for the CE calculations. The methane concentrations were converted to a propane basis using a response factor (RF) developed for each run by injecting Methane calibration gas into the sampling system ($\text{PPM Methane as Propane} = \text{PPM Methane}/\text{RF}$).

IV. SOURCE DESCRIPTION

The sources sampled were the regenerative thermal oxidizer (RTO) and the Concentrator (carbon adsorber). The RTO controls emissions from the flash off areas, the ovens and the Concentrator. The Concentrator controls emissions from the Base Coat Booths on Coating Line #3.

The RTO is manufactured by Huntington Energy Systems, Inc. and is rated to handle 10,000 SCFM.

The Carbon Adsorber collects VOC emissions from the base coat booths on Line #3. The adsorber is designed to handle 30,000 CFM of exhaust. The gases enter the adsorber at the bottom and pass through fluidized trays of carbon granules that collect the VOC's in the exhaust gas and then exit at the top. The carbon travels over the trays from the top of the adsorber to the bottom. When the carbon reaches the bottom of the adsorber, it is transported to the desorber, where it is desorbed using heat from the RTO. After the carbon is desorbed, it is transported back to the adsorber, where it enters at the top.

Plastic automotive parts are coated on Line #3. The parts are conveyed through a washer and a dryoff oven. The parts then enter the first of four paint booths where the parts are manually coated, pass through a flash off area and then into the next booth. After leaving the fourth booth and flash off area, the parts are conveyed into a bake oven where they spend approximately thirty minutes. The exhaust of the ovens and flash off areas are ducted to the RTO for VOC control.

The parts coated and coatings applied during the testing were considered normal operation for the coating line. Source operating data during the testing can be found in Appendix F.

V. SAMPLING AND ANALYTICAL PROTOCOL

The RTO exhaust sampling was conducted on the 32 inch I.D. exhaust stack at a location approximately six (6) duct diameters downstream and approximately one (1) duct diameter upstream from the nearest disturbances. The RTO inlet sampling was conducted on the 28 inch I.D. inlet duct at a location greater than eight (8) duct diameters downstream and two (2) duct diameters upstream from the nearest disturbances. The Carbon Adsorber was sampled on the inlet and outlet, but velocity traverses were only performed on the inlet. The inlet duct to the adsorber was 48 inch I.D. and the test location was greater than eight (8) duct diameters downstream and greater than two (2) duct diameters upstream from the nearest disturbances.

The sampling was conducted by employing the following reference test methods:

- VOCs – U.S. EPA Method 25A & 40 CFR 1065.265 (Methane Cutter)
- Exhaust Gas Parameters (air flow rate, temperature, moisture & density) – U.S. EPA Reference Methods 1 through 4.

V.1 Total Hydrocarbon (VOC) – The VOC sampling was conducted in accordance with U.S. EPA Method 25A. A J.U.M. Model 109L flame ionization detector (FID) analyzer was used to monitor the exhausts, A J.U.M. Model 3-500 flame ionization detector (FID) analyzer was used to monitor the inlets. 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 959.3 (adsorber & RTO inlets), 453.7 PPM (adsorber exhaust) and 96.49 PPM (RTO exhaust) were used to establish the initial instrument calibrations. Calibration gases of 453.7 PPM & 247.1 PPM (for the inlets), 247.1 PPM & 151.1 PPM (for the adsorber exhaust) and 50.19 PPM & 29.17 PPM (for the RTO exhaust) propane were used to determine the calibration error of the analyzers. After each sample, a system zero and system injection of 247.1 PPM (for the adsorber inlet), 453.7 PPM (for the RTO inlet), 151.1 PPM (for the adsorber exhaust) and 50.19 PPM (for the RTO exhaust) propane were performed to establish system drift and system bias during the test period. During the second RTO test, it was observed that some of the inlet peaks were approaching the upper span gas of 959.3 PPM. After the second and third runs on the RTO a 2,019 PPM propane gas was injected on the RTO inlet to demonstrate response. All calibration gases used were EPA Protocol Calibration Gases. Three (3) samples were collected simultaneously from the inlet and exhaust of each unit. 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.

V.2 Methane – The methane sampling was conducted in accordance U.S. EPA Method 25A & 40 CFR 1065.265 (Methane Cutter). A J.U.M. Model 109L flame ionization detector (FID) analyzer was used to monitor the exhausts. Sample gas was extracted through a heated probe. A heated teflon sample line was used to transport the exhaust gases to the analyzer. The analyzer produces instantaneous readouts of the methane concentrations (PPM).

The analyzer was calibrated by system injection (from the back of the stack probe to the analyzer) prior to the testing. Span gases of 455.0 PPM (adsorber exhaust) and 86.2 (RTO exhaust) were used to establish the initial instrument calibrations. Calibration gases of 250.0 PPM & 86.2 PPM (for the adsorber exhaust) and 44.9 PPM & 25.2 PPM (for the RTO exhaust) were used to determine the calibration error of the analyzer. After each sample, a system zero and system injection of 250.0 PPM (for the adsorber exhaust) and 44.9 PPM (for the RTO exhaust) were performed to establish system drift and system bias during the test period. All calibration gases used were EPA Methane Calibration Gases. Three (3) samples were collected from each exhaust. Each sample was sixty (60) minutes in duration.

The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the data from the exhaust. 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 methane sampling train.

V.3 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. All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis.

Three (3) velocity traverses (at each sample location) were conducted. Moisture (except on the RTO exhaust) was determined for each velocity traverse by employing the wet bulb/dry bulb technique. One (1) moisture train was performed on the RTO exhaust in order to determine moisture content. Also, a grab bag

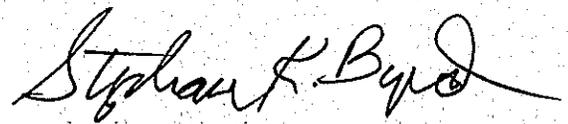
sample was collected on the RTO exhaust and analyzed by Orsat to determine the oxygen (O₂) and carbon dioxide (CO₂) content.

This report was prepared by:

Handwritten signature of David D. Engelhardt in black ink.

David D. Engelhardt
Vice President

This report was reviewed by:

Handwritten signature of Stephan K. Byrd in black ink.

Stephan K. Byrd
President

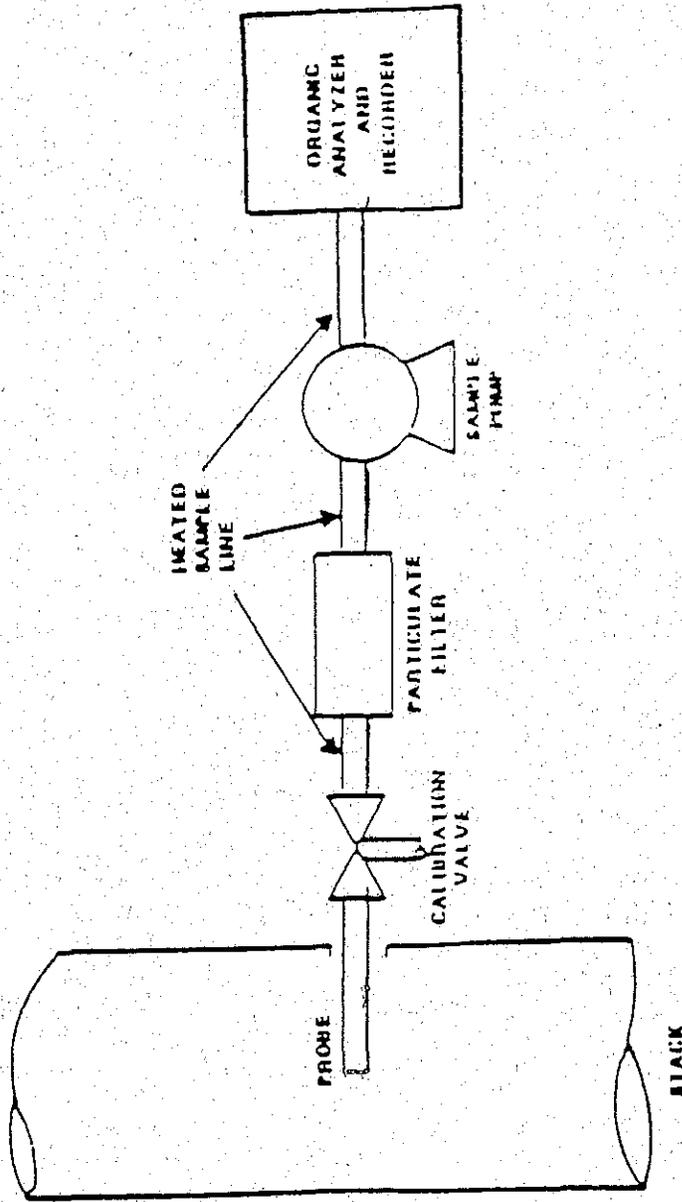


Figure 1
 VOC & Methane Sampling Train