Report of...

VOC Emission Testing

Performed for the...

Sherwin-Williams Company
Holland, Michigan

On...

Lines 1, 9 & 10

October 1-3, 2019

Project #: 176.11

By...

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Grand Rapids, MI

Performed for:

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I. INTRODUCTION

Network Environmental, Inc. was retained by the Sherwin-Williams Company to conduct VOC (total hydrocarbons) emission sampling at their Holland, MI facility. The VOC emissions were determined from Lines 1, 9 & 10. The purpose of the study was to document compliance with EGLE Air Quality Division Renewable Operating Permit (ROP) No. MI-ROP-B7711-2016.

MI-ROP-B7711-2016 has established the following emission limits for these sources:

Line	VOC Emission Limit
1 (EU-LINE-01-AERO)	0.0010 Lb/Can
9 (EU-LINE-09-AERO)	0.001103 Lb/Can
10 (EU-LINE-10-AERO)	0.0010 Lb/Can

The VOC emissions were 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 over the period of October 1-3, 2019 by Stephan K. Byrd, Richard D. Eerdmans and David D. Engelhardt of Network Environmental, Inc.. Assisting in the study were Ms. Trina Moomey and Mr. Steve Eckert of the Sherwin-Williams Company and the operating staff of the facility. Mr. Cody Yazzie and Mr. Tom Gasloli 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 EMISSION RESULTS
LINE 1
SHERWIN-WILLIAMS
HOLLAND, MICHIGAN
OCTOBER 3, 2019

Source	Sample	Time	Air Flow Rate SCFM (1)	Can Count Cans/Hr (2)	VOC Concentration PPM (3)	Mass Emission Rates	
						Lbs/Hr (4)	Lbs/Can (5)
Line 1	1	08:52-09:52	1,789	8,927	452.5	5.53	0.00062
	2	10:16-11:16	1,799	8,823	450.9	5.54	0.00063
	3	12:02-13:02	1,799	9,391	422.9	5.20	0.00055
	Average		**1,796**	**9,047**	**442.1**	**5.42**	**0.00060**

(1) SCFM = Standard Cubic Feet Per Minute (Standard Temperature & Pressure = 29.92 in. Hg & 68 °F)
(2) Can Count was supplied by Sherwin-Williams
(3) PPM = Parts Per Million (v/v) On A "Wet" (Actual) Basis As Propane
(4) Lbs/Hr = Pounds Of VOC Per Hour As Propane
(5) Lbs/Can = Pounds Of VOC Per Can

II.2 TABLE 2
VOC EMISSION RESULTS
LINE 9
SHERWIN-WILLIAMS
HOLLAND, MICHIGAN
OCTOBER 1, 2019

Source	Sample	Time	Air Flow Rate SCFM (1)		Can Count Cans/Hr (2)	VOC Concentration PPM (3)		Mass Emission Rates				
								Lbs/Hr (4)		Lbs/Can (5)		
			Gas House	Floor Vent		Gas House	Floor Vent	Gas House	Floor Vent	Gas House	Floor Vent	**Total**
Line 9	1	09:08-10:49	1,482	604	8,217	452.8	170.1	4.59	0.70	0.00056	0.000085	**0.00065**
	2	11:50-12:54	1,501	599	8,551	385.6	162.6	3.95	0.67	0.00046	0.000078	**0.00054**
	3	13:26-14:34	1,482	594	8,457	365.1	159.1	3.70	0.65	0.00044	0.000077	**0.00052**
	Average		**1,488**	**599**	**8,408**	**401.2**	**163.9**	**4.08**	**0.67**	**0.00049**	**0.000080**	**0.00057**

(1) SCFM = Standard Cubic Feet Per Minute (Standard Temperature & Pressure = 29.92 in. Hg & 68 °F)
(2) Can Count was supplied by Sherwin-Williams
(3) PPM = Parts Per Million (v/v) On A "Wet" (Actual) Basis As Propane
(4) Lbs/Hr = Pounds Of VOC Per Hour As Propane
(5) Lbs/Can = Pounds Of VOC Per Can

II.3 TABLE 3
VOC EMISSION RESULTS
LINE 10
SHERWIN-WILLIAMS
HOLLAND, MICHIGAN
OCTOBER 2, 2019

Source	Sample	Time	Air Flow Rate SCFM (1)		Can Count Cans/Hr (2)	VOC Concentration PPM (3)		Mass Emission Rates				
			Gas House	Floor Vent		Gas House	Floor Vent	Lbs/Hr (4)		Lbs/Can (5)		
								Gas House	Floor Vent	Gas House	Floor Vent	**Total**
Line 10	1	09:01-10:48	1,506	593	7,281	186.0	38.8	1.91	0.16	0.00026	0.000022	**0.00028**
	2	11:14-12:14	1,475	617	8,037	192.9	40.8	1.94	0.17	0.00024	0.000021	**0.00026**
	3	13:33-14:33	1,470	609	8,181	194.9	40.4	1.96	0.17	0.00024	0.000021	**0.00026**
	Average		**1,484**	**606**	**7,833**	**191.3**	**40.0**	**1.94**	**0.17**	**0.00025**	**0.000021**	**0.00027**

(1) SCFM = Standard Cubic Feet Per Minute (Standard Temperature & Pressure = 29.92 in. Hg & 68 °F)
(2) Can Count was supplied by Sherwin-Williams
(3) PPM = Parts Per Million (v/v) On A "Wet" (Actual) Basis As Propane
(4) Lbs/Hr = Pounds Of VOC Per Hour As Propane
(5) Lbs/Can = Pounds Of VOC Per Can

III. DISCUSSION OF RESULTS

The results of the emission sampling are summarized in Table 1 through 3 (Sections II.1 - II.3). The results are presented as follows:

III.1 Total Hydrocarbon (VOC) Emission Results

The tables summarize the VOC emission results as follows:

- Source
- Sample
- Time
- Air Flow Rate (SCFM) – Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Can Count (Cans/Hr) – Cans Per Hour (Supplied By Sherwin-Williams)
- 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 Mass Emission Rates (Lbs/Can) – Pounds Of VOC Per Can

During the first two samples on Line 9 and the first sample on Line 10, the sample runs were suspended because the filling process shut down due to various process equipment failures. These samples were resumed when the filling process was re-started and stable. VOC's were monitored only when the lines were filling cans. Can counts were measured only during the actual sampling periods. The can counts were supplied by Sherwin-Williams Company staff.

III.2 Emission Limits

MI-ROP-B7711-2016 has established the following emission limits for these sources:

Line	VOC Emission Limit
1 (EU-LINE-01-AERO)	0.0010 Lb/Can
9 (EU-LINE-09-AERO)	0.001103 Lb/Can
10 (EU-LINE-10-AERO)	0.0010 Lb/Can

IV. SOURCE DESCRIPTION

Lines 1, 9 and 10 are Aerosol can production lines. Line 1 has one (1) exhaust. Lines 9 and 10 have two

(2) exhausts. The lines fill cans of various capacities with liquid paint or other chemical products. Propellant is then added using a "through the valve" pressure filler. The pressure filling is conducted in the gashouses. Line 1 has its own gashouse, whereas Lines 9 and 10 use the same gashouse. Can counts, during each sampling run, were recorded manually by Sherwin-Williams staff and are displayed in Tabes 1 through 3 (Section II.1 - II.3). The following table summarizes the process operating parameters (supplied by the Sherwin-Williams Company) during the testing:

Line	Product	Propellant	Propellant Fill Weight	Line Speed
1	K01312 Kamar Varnish	NP70	89 Grams	145 Cans/Minute
9	K01305074 Gloss Clear	NP70	80 Grams	135 Cans/Minute
10	K01305074 Gloss Clear	NP70	80 Grams	140 Cans/Minute

V. SAMPLING AND ANALYTICAL PROTOCOL

Line 1 has a 12 inch I.D. exhaust stack. The sampling for Line 1 was conducted at a location that exceeds eight (8) duct diameters downstream and two (2) duct diameters upstream from the nearest disturbances.

Lines 9 and 10 use the same two (2) exhausts. Sampling was conducted the first day with only Line 9 operational and then the next day with only Line 10 operational. Sampling was conducted for both Lines in the exhaust ducts leading to the exhaust stacks simultaneously. The gashouse sampling was conducted on the 18 inch I.D. duct at a location approximately three (3) duct diameters downstream and one (1) duct diameter upstream from the nearest disturbances. The floor vent sampling was conducted on the 24 inch I.D. duct at a location approximately two (2) duct diameters downstream and one (1) duct diameter upstream from the nearest disturbances.

V.1 Total Hydrocarbon (VOC) – The VOC sampling was conducted in accordance with U.S. EPA Method 25A. A J.U.M. Model 3-500 and a Thermo Environmental Model 51 flame ionization detector (FID) analyzers were used to monitor the exhausts. 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 PPM and 491.0 PPM were used to establish the initial instrument calibrations. Calibration gases of 491.0 PPM, 250.0 PPM and 152.0 PPM propane were used to determine the calibration error of the analyzers (depending on which range they were on, either 0-1000 or 0-500 PPM). After each sample, a system zero and system injection of one (1) propane calibration gas 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 from each source. 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 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. The following table is a list of the traverse point dimensions:

Traverse Point	Line 1	Lines 9/10 Gashouse	Lines 9/10 Floor Vent
1	0.53	0.58	0.77
2	1.75	1.89	2.52
3	3.55	3.49	4.66
4	8.45	5.81	7.75
5	10.25	12.19	16.25
6	11.47	14.51	19.34
7	----	16.11	21.48
8	----	17.42	23.23

Three (3) velocity traverses (at each sample location each day) were conducted. Moisture was determined for each velocity traverse by employing the wet bulb/dry bulb technique. Ambient air (20.9 $\%O_2$ and 0.0 $\%CO_2$) was used for the gas density calculations.

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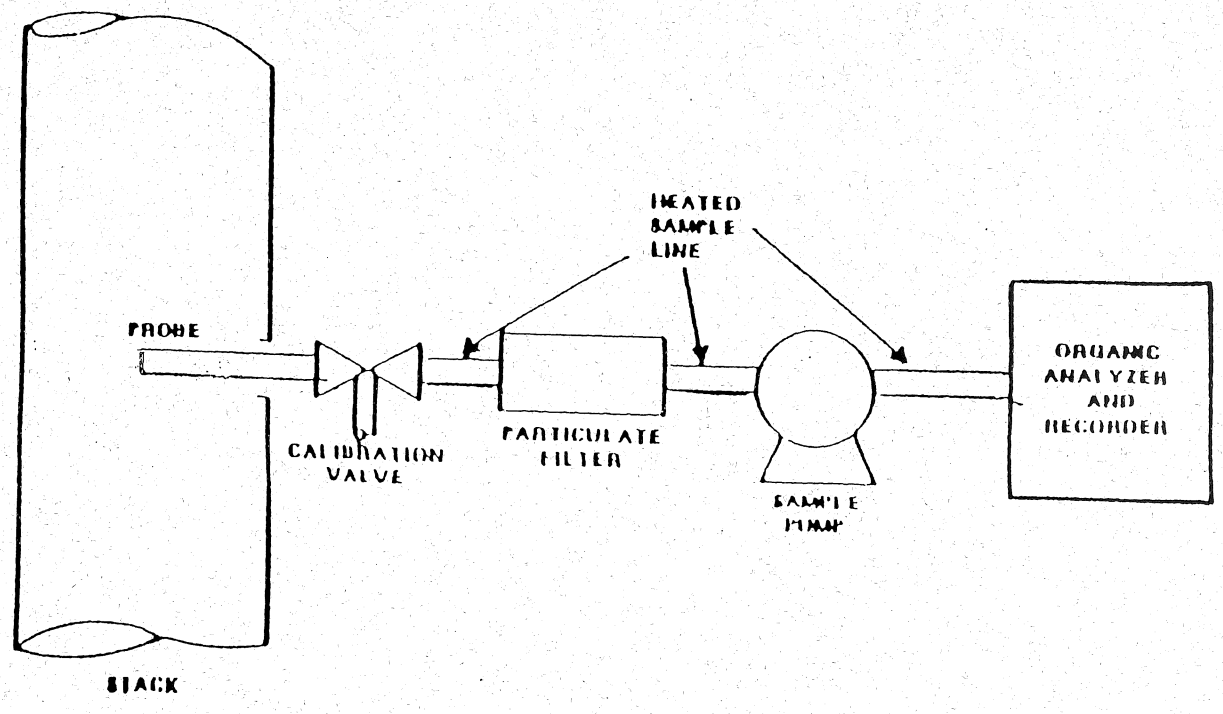

Figure 1

VOC
Sampling Train