Report of ...

Emission Testing

performed for ...

Martin Marietta
Magnesia Specialties

Manistee, Michigan

on the

#3 Herreshoff & #3 Rotary Kiln Exhausts

December 4-5, 2013

043.16

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performed for

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I. INTRODUCTION

Network Environmental, Inc. was retained by Martin Marietta Magnesia Specialties of Manistee, Michigan to conduct an emission study at their facility. The purpose of the study was to meet the 2013 emission testing requirements of Renewable Operating Permit (ROP) No. MI-ROP-A3900-2009.

The scope of this project was to determine the particulate emissions from the #3 Herreshoff exhaust and the #3 Rotary Kiln exhaust. Also, the sulfur dioxide (SO_2) emissions were determined from the #3 Rotary Kiln exhaust. Three (3) test runs were conducted for each compound. Each test run was sixty (60) minutes in duration.

The following test methods were employed to conduct the sampling:

- Particulate – U.S. EPA Reference Method 5
- SO_2 – U.S. EPA Reference Method 6C
- Exhaust Gas Parameters – U.S. EPA Reference Methods 1 through 4

The sampling in the study was conducted by Richard D. Eerdmans and David D. Engelhardt of Network Environmental, Inc. over the period of December 4-5, 2013. Assisting in the study was Mr. Robert Gutowski of Martin Marietta Magnesia Specialties. Mr. Rob Dickman and Mr. Jeremy Howe of the MDEQ Air Quality Division were present to observe the testing and source operation.

II.1 TABLE 1
PARTICULATE EMISSION RESULTS SUMMARY
MARTIN MARIETTA MAGNESIA SPECIALTIES
MANISTEE, MICHIGAN
DECEMBER 4-5, 2013

Source	Sample	Date	Time	Air Flow Rate DSCFM (1)	Particulate Concentration		Particulate Mass Rates Lbs/Hr (4)
					Lbs/1000 Lbs (2)	Lbs/1000 Lbs, Dry (3)	
#3 Herreshoff	1	12/4/13	09:58-11:06	39,452	0.042	0.048	8.56
	2	12/4/13	12:01-13:07	38,634	0.048	0.054	9.46
	3	12/4/13	14:19-15:26	38,437	0.044	0.050	8.68
	Average			**38,841**	**0.045**	**0.051**	**8.90**
#3 Rotary Kiln	1	12/5/13	12:40-13:46	19,242	0.0210	0.027	2.39
	2	12/5/13	14:41-15:49	19,194	0.0091	0.012	1.04
	3	12/5/13	16:38-17:45	19,618	0.0087	0.011	1.01
	Average			**19,351**	**0.0129**	**0.016**	**1.48**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
(2) Lbs/1000 Lbs = Pounds of Particulate Per Thousand Pounds of Exhaust Gas On a Actual Basis (Stack Conditions)
(3) Lbs/1000 Lbs, Dry = Pounds of Particulate Per Thousand Pounds of Exhaust Gas On a Dry Basis
(4) Lbs/Hr = Pounds of Particulate Per Hour

II.2 TABLE 2
SULFUR DIOXIDE (SO_2) EMISSION RESULTS
#3 ROTARY KILN EXHAUST
MARTIN MARIETTA MAGNESIA SPECIALTIES
MANISTEE, MICHIGAN
DECEMBER 5, 2013

Sample	Time	Air Flow Rate[1] DSCFM	Concentration[2] PPM	Mass Emission Rate Lbs/Hr[3]
1	09:11-10:11	19,351	752.7	144.22
2	12:22-13:22		768.7	147.29
3	14:10-15:10		746.1	142.96
Average			**755.8**	**144.82**

(1) DSCFM = Dry Standard Cubic Feet Per Minute where STP = 68 °F and 29.92 In. Hg (Average of 3 Air Flows Measured During The Particulate Sampling)
(2) PPM = Parts Per Million (v/v) on a Dry Basis
(3) Lbs/Hr = Pounds of SO_2 Per Hour

III. DISCUSSION OF RESULTS

III.1 Particulate Emission Results

The total particulate emission results are summarized in Table 1 (Section II.1). A more detailed presentation of the particulate sampling can be found in Appendix A. Table 1 consists of the following information:

- Source
- Sample
- Date
- Time
- Air Flow Rates in terms of Dry Standard Cubic Feet Per Minute (DSCFM) (where standard temperature and pressure = 68 °F & 29.92 in. Hg)
- Particulate Concentrations in terms of Pounds of Particulate Per Thousand Pounds of Exhaust Gas On A Actual Basis (Lbs/1000 Lbs)
- Particulate Concentrations in terms of Pounds of Particulate Per Thousand Pounds of Exhaust Gas On A Dry Basis (Lbs/1000 Lbs, Dry)
- Particulate Mass Emission Rates in terms of Pounds of Particulate Per Hour (Lbs/Hr)

III.2 SO_2 Emission Results

The sulfur dioxide (SO_2) emission results are summarized in Table 2 (Section II.2). Table 2 consists of the following information:

- Sample
- Date
- Time
- Air Flow Rates in terms of Dry Standard Cubic Feet Per Minute (DSCFM) (where standard temperature and pressure = 68 °F & 29.92 in. Hg)
- SO_2 Concentrations in terms of Parts Per Million (v/v) On A Dry Basis (PPM)
- SO_2 Mass Emission Rates in terms of Pounds of SO_2 Per Hour (Lbs/Hr)

III.3 Emission Limit

Permit No. MI-ROP-A3900-2009 has established the following emission limits for these sources:

- #3 Herreshoff – Particulate: 0.055 Lbs/1000 Lbs of exhaust gases

- #3 Rotary Kiln – Particulate: 0.13 Lbs/1000 Lbs of exhaust gases (There is also a material limit for the Coke fuel on the #3 Rotary Kiln of 5% sulfur)

IV. SOURCE DESCRIPTION

#3 Herreshoff: Exhaust air from the herreshoff is first passed through an electrostatic precipitator (ESP) before being emitted to the atmosphere through the 77 inch I.D. exhaust stack. Also passing through the ESP and the exhaust stack are the exhausts from the #2 & #3 Shaft Kilns.

#3 Rotary Kiln: Exhaust air from the #3 Rotary Kiln is first passed through an electrostatic precipitator (ESP) before being emitted to the atmosphere through the 42 inch I.D. exhaust stack.

The source operating parameters were monitored by Martin Marietta Magnesia Specialties staff and can be found in Appendix B.

V. SAMPLING AND ANALYTICAL PROTOCOL

The sampling location for the #3 Herreshoff was on the 77 inch I.D. exhaust stack at a location approximately eight (8) duct diameters downstream and five (5) duct diameters upstream from the nearest disturbances. Twelve (12) sampling points (six per port) were used for the particulate and air flow determinations. A diagram of the sampling location can be found in Appendix H.

Prior to the sampling, a preliminary velocity traverse, cyclonic/turbulent flow check and moisture train were conducted. The measurement location and air flows met the criteria established in U.S. EPA Reference Method 1.

The sampling/traverse points were as follows:

Sample Point	Dimension (Inches)
1	3.38
2	11.24
3	22.79
4	54.20
5	65.75
6	73.61

The sampling location for the #3 Rotary Kiln was on the 42 inch I.D. exhaust stack at a location that exceeded the 8 duct diameters downstream and 2 duct diameters upstream requirement of U.S. EPA Method 1. Twelve (12) sampling points were used for the particulate and air flow determinations. A diagram of the sampling location can be found in Appendix H.

Prior to the sampling, a preliminary velocity traverse, cyclonic/turbulent flow check and moisture train were conducted. The measurement location and air flows met the criteria established in U.S. EPA Reference Method 1. Also, prior to the SO_2 sampling, a gas stratification test was conducted. The gas stratification test showed no stratification, so one (1) point was used for the SO_2 sampling.

The sampling/traverse points were as follows:

Sample Point	Dimension (Inches)
1	1.84
2	6.13
3	12.43
4	29.56
5	35.86
6	40.15

V.1 Particulate - The total particulate emission sampling was conducted in accordance with U.S. EPA Reference Method 5. Method 5 is an out of stack filtration method. Three (3) samples were collected from each of the sources. Each sample was sixty (60) minutes in duration, and had a minimum sample volume of thirty (30) dry standard cubic feet. The samples were collected isokinetically from the exhaust through a heated probe and collected on a heated filter (maintained at 250 °F plus or minus 25 °F). The filters and probe/nozzle rinses were analyzed for total particulate by gravimetric analysis. All the quality assurance and quality control procedures listed in the method were incorporated in the sampling and analysis. The particulate sampling train is shown in Figure 1.

V.2 Sulfur Dioxide - The Sulfur Dioxide (SO_2) emission sampling was conducted in accordance with U.S. EPA Reference Method 6C. The sample gas was extracted from the source through a heated teflon sample line which led to a VIA MAK 2 sample gas conditioner and then to a Bovar Model 721M portable stack gas monitor. This analyzer is capable of giving instantaneous readouts of the SO_2 concentrations (PPM). Three

(3) samples were collected from the #3 Rotary Kiln exhaust. Each sample was sixty (60) minutes in duration.

The analyzer was calibrated with EPA protocol SO_2 calibration gases. A span gas of 2,257 PPM was used to establish the initial instrument calibration. Calibration gases of 848.9 PPM and 1,186 PPM were used to determine the calibration error of the analyzer. The sampling system (from the back of the stack probe to the analyzer) was injected using the 1,186 PPM gas to determine the system bias. After each sample, a system zero and system injection of 1,186 PPM were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified.

The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the data from the source. All reference method data was corrected using Equation 7E-5 from U.S. EPA Method 7E. A diagram of the sampling train is shown in Figure 2.

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. Air flow rates, temperatures and moistures were determined using the Method 5 sampling train. Integrated bag samples were collected off of the Method 5 sampling train and analyzed by Orsat analysis in order to determine the oxygen (O_2) and carbon dioxide (CO_2) content of the exhaust gases. All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis.

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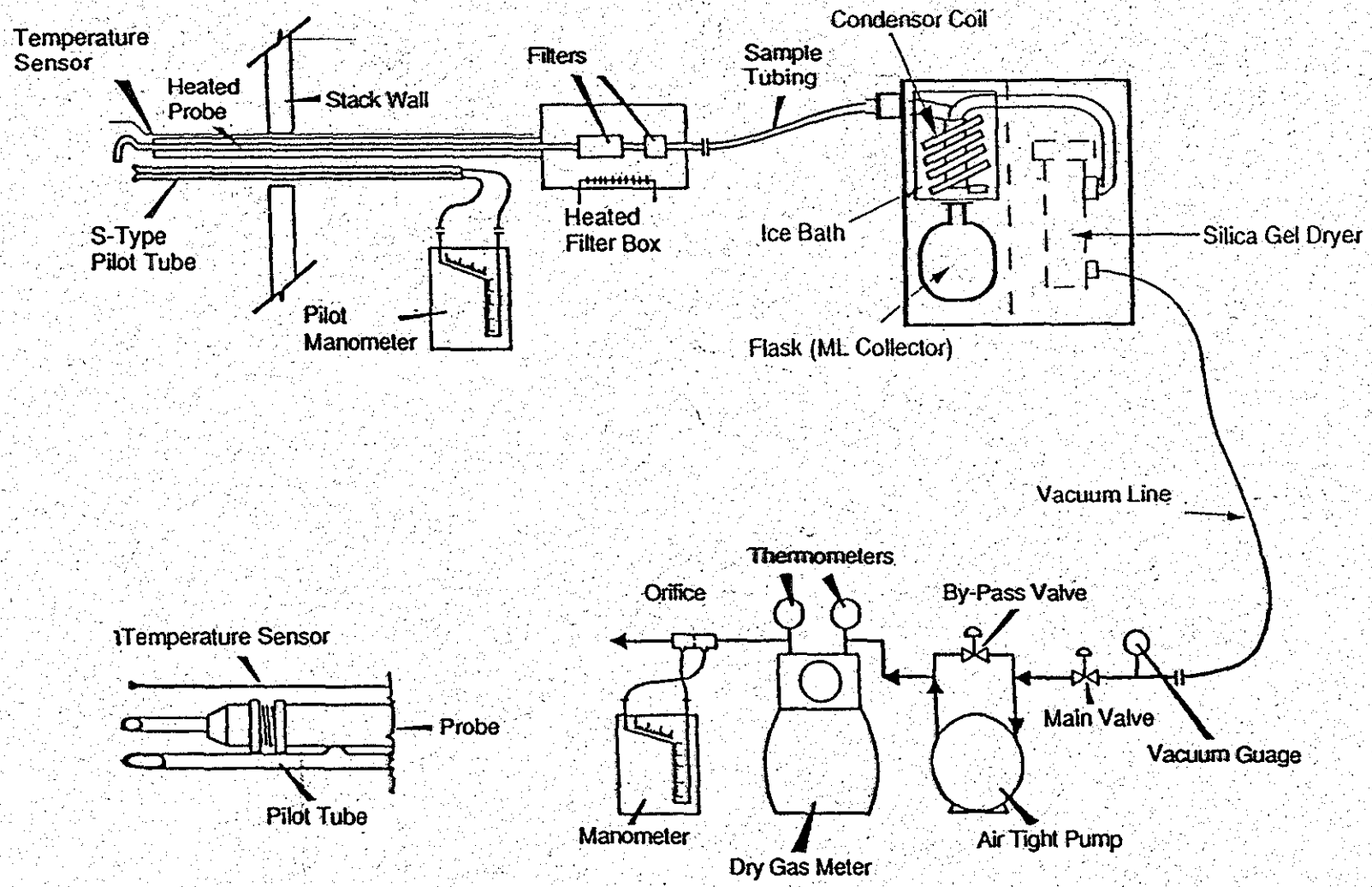

Figure 1

Particulate Sampling Train

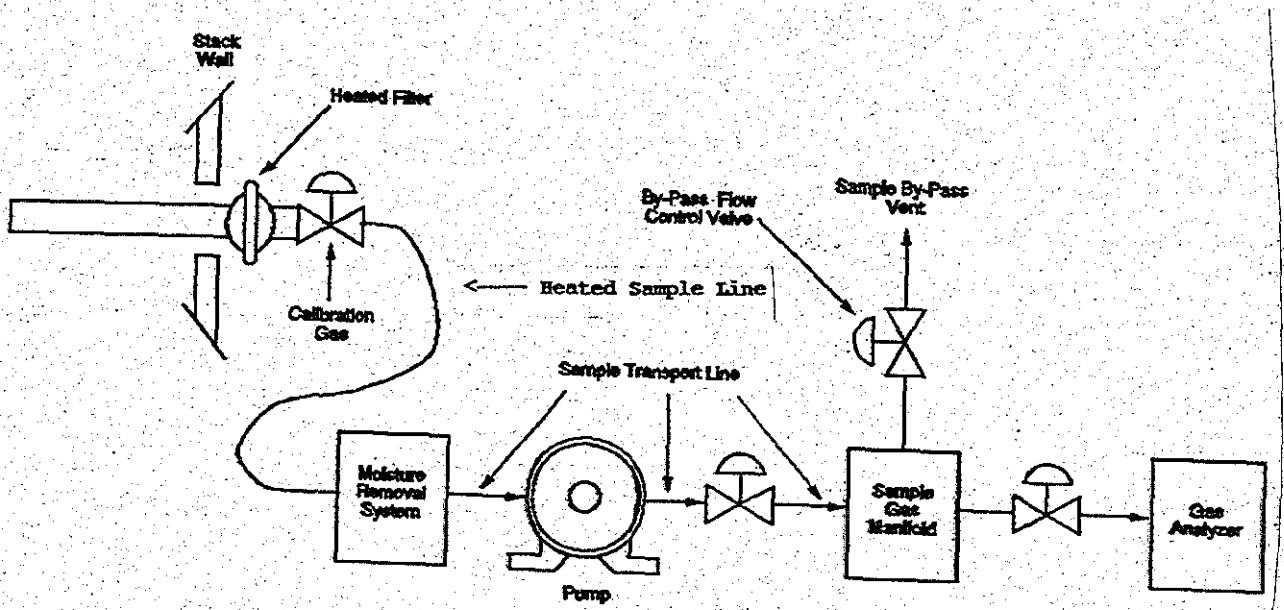

Figure 2

SO_2 Sampling Train