

RECEIVED

JAN 24 2018

AIR QUALITY DIVISION



Subject Facility:

Graymont Western Lime
Port Inland Plant
181 W County Road 432
Gulliver, MI 49840

Regulatory Permit No.:

ROP: MI-ROP-N7362-2015
SRN: N7362

Subject Emission Sources:

Lime Kiln Kiln 1
Processed Stone Handling

Test Locations:

Baghouse Exhaust SV-2

Comprehensive Emissions Test Report

Port Inland Plant
Particulate and Opacity
Compliance Testing

Testing Date(s): October 10-11 & 19, 2017

Report Date: November 30, 2017

Revision Date: No revision to date

Report Prepared For:

Keith Miller
Graymont
800 Hill Avenue
Superior, WI 54880

Telephone No.: (715) 394-1719

Report Preparation Supervised By:

Terry Borgerding
Pace Analytical Services, LLC
1700 Elm Street, Suite 200
Minneapolis, MN 55414
Telephone No.: (612) 607-6374
E-mail Address: terry.borgerding@pacelabs.com

Pace Project No. 12-17-1092

Regulatory Summary

Subject Facility: Graymont Western Lime
 Port Inland Plant
Plant Address: 181 W County Road 432
 Gulliver, MI 49840

Air Permit No.: ROP: MI-ROP-N7362-2015
Facility ID No.: SRN: N7362

Emission Unit IDs	Emission Unit Name	Regulated Constituent	Regulatory Citations	Regulatory Limit	Average Test Result
Kiln 1	Lime Kiln	Particulate	40 CFR 63.7090(a)	≤0.10 LB/Ton of stone feed (TSF)	0.011 LB/Ton of stone feed
Process Stone Handling	Screen Enclosure - South Wall	Opacity	40 CFR 63.7090(a)	There must be no visible emissions from the building, except from the vent. Emissions from the vent must have a six-minute average of ≤10%.	0.6% ¹
	Screen Enclosure - East Wall				0% ¹
	Screen Enclosure - West Wall				0% ¹
	Screen Enclosure - North Wall				0.4% ¹
	C118 Conveyor				0% ¹
	C119 Bin Enclosure				0% ¹

¹High six-minute average

RECEIVED

JAN 24 2018

AIR QUALITY DIVISION

Introduction

Pace Analytical Services, LLC personnel conducted particulate emission compliance testing on the Lime Kiln Baghouse exhaust and opacity compliance testing on the process stone handling (PSH) operations at the Graymont Western Lime (Graymont) facility located in Gulliver, Michigan. Mike Walter and Jack Kokkinen performed particulate testing activities on October 10 and 11, 2017 and Dan Luoma performed opacity testing activities on October 19, 2017. Terry Borgerding provided administrative project management. Steve White and Keith Miller with Graymont coordinated plant activities during testing. Robert Dickman with the Michigan Department of Environmental Quality (MDEQ) was on-site to witness particulate testing. Pace Analytical Services, LLC prepared a comprehensive test protocol that was submitted to the MDEQ and approved prior to testing. On-site activities consisted of the following measurements:

- Particulate, three independent one-hour samplings.
- Oxygen and carbon dioxide, monitoring periods concurrent with above.
- Volumetric airflow, measurements collected in conjunction with isokinetic testing.
- Visible emissions, one independent one-hour monitoring period on six sources.

The project objectives were to quantify particulate and visible emission constituents and compare them to applicable air emissions regulations stipulated by MDEQ and the facility permit. Particulate measurements were performed at 89.3% of maximum capacity. Quality protocols comply with regulatory compliance testing requirements.

Subsequent sections summarize the test results and provide descriptions of the process and test methods. Supporting information and raw data are in the appendices.

Results Summary

Results of particulate determinations are summarized in Table 1. The particulate emission rate averaged 0.011 LB/Ton of stone feed (TSF) at 0.00082 GR/DSCF. The particulate emission limit for this source is 0.10 LB/TSF.

Particulate Run 2 was voided due to a failed leak check. Particulate Run 3 was voided due to plant processes going down before the run was completed. Testing resumed on October 11, 2017 and additional runs (Run 4 and Run 5) were performed. Runs 1, 4, and 5 are tabulated for reporting. Raw data for all runs are included in the appendices.

Results of opacity observations are detailed in Tables 4 - 9. The Screen Enclosure - South Wall and Screen Enclosure - North Wall were the only processes with opacity observations over 0%. The Screen Enclosure - South Wall had four readings of 5% in one hour resulting in a high six-minute average of 0.6%. The Screen Enclosure - North Wall had one reading of 10% in one hour resulting in a high six-minute average of 0.4%.

Subsequent tables provide expanded detail of the testing results. The data in this report are indicative of emission characteristics of the measured sources for process conditions at the time of the test. Representations to other sources and test conditions are beyond the scope of this report.

Graymont Western Lime

Port Inland Plant
Gulliver, MI
Pace Project No. 12-17-1092

Table 1 Results Summary Lime Kiln Baghouse Exhaust Test 1

Parameter	Run 1	Run 4	Run 5	Average
Date of Run	10/10/17	10/11/17	10/11/17	
Time of Run	1125-1235	0907-1012	1057-1201	
Stone Feed, TPH	32.375	32.375	32.375	32.375
Volumetric Flow Rate (Rounded to 100 CFM)				
ACFM	87,200	88,300	89,800	88,400
DSCFM	51,300	50,700	51,700	51,200
Gas Temperature, °F	370	390	390	383
Gas Moisture Content, %v/v	6.2	6.3	6.2	6.3
Gas Composition, %v/v, dry				
Carbon Dioxide, CO ₂	26.2	25.9	24.4	25.5
Oxygen, O ₂	6.3	6.3	7.0	6.5
Nitrogen, N ₂ (by difference)	67.5	67.8	68.6	67.9
Particulate Mass Rate, LB/HR				
Filterable Particulate	0.74	0.11	0.24	0.36
Particulate Concentration, GR/DSCF				
Filterable Particulate	0.00168	0.00024	0.00054	0.00082
Regulatory Units, LB/Ton Stone Feed				
Filterable Particulate	0.0229	0.0033	0.0074	0.0112

Graymont Western Lime

Port Inland Plant
Gulliver, MI
Pace Project No. 12-17-1092

Table 2 Major Gases and Moisture Results Lime Kiln Baghouse Exhaust Test 1

Parameter	Run 1	Run 4	Run 5
Date of Run	10/10/17	10/11/17	10/11/17
Time of Run	1125-1235	0907-1012	1057-1201
Major Gas Constituents - Instrumental, % v/v			
Dry Basis (as measured)			
Carbon Dioxide	26.22	25.93	24.45
Oxygen	6.31	6.27	6.99
Nitrogen (by difference)	67.47	67.80	68.56
Wet Basis (calculated)			
Carbon Dioxide	24.58	24.29	22.92
Oxygen	5.92	5.87	6.56
Nitrogen	63.26	63.51	64.28
Portable Oxygen Monitor Result			
Time Weighted Average, %O ₂	6.9	6.5	7.2
Moisture Collected, ml	65.0	66.3	66.2
Moisture Content, %v/v	6.23	6.32	6.24
Moisture Content if Saturated, %v/v	NA (>BP)	NA (>BP)	NA (>BP)
Relative Humidity, % rH	NA (>BP)	NA (>BP)	NA (>BP)
Molecular Weight of Flue Gas, lb/lb-mole			
Dry	32.45	32.40	32.19
Wet	31.55	31.49	31.31

Graymont Western Lime

Port Inland Plant
Gulliver, MI
Pace Project No. 12-17-1092

Table 3 Particulate Results Lime Kiln Baghouse Exhaust Test 1

Parameter	Run 1	Run 4	Run 5
Date of Run	10/10/17	10/11/17	10/11/17
Time of Run	1125-1235	0907-1012	1057-1201
Sample Duration, Minutes	60	60	60
Average Flue Gas Temperature, °F	370.3	390.3	389.8
Moisture Content of Flue Gas, %v/v	6.2	6.3	6.2
Particulate Collected, mg			
Dry Catch	5.0	0.7	1.6
Inorganic Wet Catch	NR	NR	NR
Organic Wet Catch	NR	NR	NR
Volumetric Flow Rate (Rounded to 100 CFM)			
ACFM	87,200	88,300	89,800
SCFM	54,700	54,200	55,100
DSCFM	51,300	50,700	51,700
Sample Volume, Meter Conditions, Ft ³	47.15	47.43	48.14
Sample Volume, Dry Standard, Ft ³	46.02	46.23	46.81
Particulate Concentration, GR/DSCF			
Filterable Particulate	0.0017	0.0002	0.0005
Particulate Emission Rate, LB/HR			
Filterable Particulate	0.74	0.11	0.24

NR=Not required or not requested.

Graymont Western Lime

Port Inland Plant
 Gulliver, MI
 Pace Project No. 12-17-1092

Table 4 Opacity Observations Screen Enclosure - South Wall Test 1

Percent Opacity	Optical Density	Relative Frequency
0	0.000	98.33
5	0.022	1.67
10	0.046	0.00
15	0.071	0.00
20	0.097	0.00
25	0.125	0.00
30	0.155	0.00
35	0.187	0.00
40	0.222	0.00
45	0.260	0.00
50	0.301	0.00
55	0.347	0.00
60	0.398	0.00
65	0.456	0.00
70	0.523	0.00
75	0.602	0.00
80	0.699	0.00
85	0.824	0.00
90	1.000	0.00
95	1.301	0.00
99	2.000	0.00
Average >	0.1	0.000
		Total > 100

Average Opacity Per Sequential Six Minute Period:				High Six Minute Average: 0.6
Period	Opacity	Period	Opacity	Maximum reading: 5.0
1	0.4	6	0.0	Minumum reading: 0.0
2	0.2	7	0.0	Observer: Daniel Luoma
3	0.0	8	0.2	Date of test: 10/19/2017
4	0.0	9	0.0	Time of test: 1350-1450
5	0.0	10	0.0	

NOTE: The high six-minute average opacity is the maximum value for any consecutive 24 readings.

Graymont Western Lime

Port Inland Plant
 Gulliver, MI
 Pace Project No. 12-17-1092

Table 5
Opacity Observations
Screen Enclosure - East Wall
Test 1

Percent Opacity	Optical Density	Relative Frequency
0	0.000	100.00
5	0.022	0.00
10	0.046	0.00
15	0.071	0.00
20	0.097	0.00
25	0.125	0.00
30	0.155	0.00
35	0.187	0.00
40	0.222	0.00
45	0.260	0.00
50	0.301	0.00
55	0.347	0.00
60	0.398	0.00
65	0.456	0.00
70	0.523	0.00
75	0.602	0.00
80	0.699	0.00
85	0.824	0.00
90	1.000	0.00
95	1.301	0.00
99	2.000	0.00
Average >	0.0	Total > 100

Average Opacity Per Sequential Six Minute Period:				High Six Minute Average: 0.0
Period	Opacity	Period	Opacity	Maximum reading: 0.0
1	0.0	6	0.0	Minumum reading: 0.0
2	0.0	7	0.0	Observer: Daniel Luoma
3	0.0	8	0.0	Date of test: 10/19/2017
4	0.0	9	0.0	Time of test: 1350-1450
5	0.0	10	0.0	

NOTE: The high six-minute average opacity is the maximum value for any consecutive 24 readings.

Graymont Western Lime

Port Inland Plant
 Gulliver, MI
 Pace Project No. 12-17-1092

Table 6 Opacity Observations Screen Enclosure - West Wall Test 1

Percent Opacity	Optical Density	Relative Frequency
0	0.000	100.00
5	0.022	0.00
10	0.046	0.00
15	0.071	0.00
20	0.097	0.00
25	0.125	0.00
30	0.155	0.00
35	0.187	0.00
40	0.222	0.00
45	0.260	0.00
50	0.301	0.00
55	0.347	0.00
60	0.398	0.00
65	0.456	0.00
70	0.523	0.00
75	0.602	0.00
80	0.699	0.00
85	0.824	0.00
90	1.000	0.00
95	1.301	0.00
99	2.000	0.00
Average > 0.0	0.000	Total > 100

Average Opacity Per Sequential Six Minute Period:				High Six Minute Average: 0.0
Period	Opacity	Period	Opacity	Maximum reading: 0.0
1	0.0	6	0.0	Minumum reading: 0.0
2	0.0	7	0.0	Observer: Daniel Luoma
3	0.0	8	0.0	Date of test: 10/19/2017
4	0.0	9	0.0	Time of test: 1350-1450
5	0.0	10	0.0	

NOTE: The high six-minute average opacity is the maximum value for any consecutive 24 readings.

Graymont Western Lime

Port Inland Plant
 Gulliver, MI
 Pace Project No. 12-17-1092

Table 7 Opacity Observations Screen Enclosure - North Wall Test 1

Percent Opacity	Optical Density	Relative Frequency
0	0.000	99.58
5	0.022	0.00
10	0.046	0.42
15	0.071	0.00
20	0.097	0.00
25	0.125	0.00
30	0.155	0.00
35	0.187	0.00
40	0.222	0.00
45	0.260	0.00
50	0.301	0.00
55	0.347	0.00
60	0.398	0.00
65	0.456	0.00
70	0.523	0.00
75	0.602	0.00
80	0.699	0.00
85	0.824	0.00
90	1.000	0.00
95	1.301	0.00
99	2.000	0.00
Average >	0.0	Total > 100

Average Opacity Per Sequential Six Minute Period:				High Six Minute Average: 0.4
Period	Opacity	Period	Opacity	Maximum reading: 10.0
1	0.0	6	0.0	Minumum reading: 0.0
2	0.0	7	0.0	Observer: Daniel Luoma
3	0.0	8	0.0	Date of test: 10/19/2017
4	0.4	9	0.0	Time of test: 1455-1555
5	0.0	10	0.0	

NOTE: The high six-minute average opacity is the maximum value for any consecutive 24 readings.

Graymont Western Lime

Port Inland Plant
 Gulliver, MI
 Pace Project No. 12-17-1092

Table 8 Opacity Observations C118 Conveyor Test 1

Percent Opacity	Optical Density	Relative Frequency
0	0.000	100.00
5	0.022	0.00
10	0.046	0.00
15	0.071	0.00
20	0.097	0.00
25	0.125	0.00
30	0.155	0.00
35	0.187	0.00
40	0.222	0.00
45	0.260	0.00
50	0.301	0.00
55	0.347	0.00
60	0.398	0.00
65	0.456	0.00
70	0.523	0.00
75	0.602	0.00
80	0.699	0.00
85	0.824	0.00
90	1.000	0.00
95	1.301	0.00
99	2.000	0.00
Average > 0.0	0.000	Total > 100

Average Opacity Per Sequential Six Minute Period:				High Six Minute Average: 0.0
Period	Opacity	Period	Opacity	Maximum reading: 0.0
1	0.0	6	0.0	Minumum reading: 0.0
2	0.0	7	0.0	Observer: Daniel Luoma
3	0.0	8	0.0	Date of test: 10/19/2017
4	0.0	9	0.0	Time of test: 1455-1555
5	0.0	10	0.0	

NOTE: The high six-minute average opacity is the maximum value for any consecutive 24 readings.

Graymont Western Lime

Port Inland Plant
 Gulliver, MI
 Pace Project No. 12-17-1092

RECEIVED

JAN 24 2018

AIR QUALITY DIVISION

Table 9

Opacity Observations
 C119 Bin Enclosure
 Test 1

Percent Opacity	Optical Density	Relative Frequency
0	0.000	100.00
5	0.022	0.00
10	0.046	0.00
15	0.071	0.00
20	0.097	0.00
25	0.125	0.00
30	0.155	0.00
35	0.187	0.00
40	0.222	0.00
45	0.260	0.00
50	0.301	0.00
55	0.347	0.00
60	0.398	0.00
65	0.456	0.00
70	0.523	0.00
75	0.602	0.00
80	0.699	0.00
85	0.824	0.00
90	1.000	0.00
95	1.301	0.00
99	2.000	0.00
Average > 0.0	0.000	Total > 100

Average Opacity Per Sequential Six Minute Period:				High Six Minute Average: 0.0	
Period	Opacity	Period	Opacity	Maximum reading:	0.0
1	0.0	6	0.0	Mininum reading:	0.0
2	0.0	7	0.0	Observer: Daniel Luoma	
3	0.0	8	0.0	Date of test: 10/19/2017	
4	0.0	9	0.0	Time of test: 1455-1555	
5	0.0	10	0.0		

NOTE: The high six-minute average opacity is the maximum value for any consecutive 24 readings.

Process Description

Graymont operates a rotary lime kiln near Gulliver, Michigan. The operations at this facility are subject to the requirements of air quality operating permit MI-ROP-N7362-2015, issued October 6, 2015. The plant has a maximum lime production rate of 870 tons per day (TPD) and 292,000 tons of lime production per year.

A rotary kiln is a long, cylindrical, refractory-lined furnace that is slightly inclined. The limestone and hot gases pass counter-currently through the kiln. The lime plant consists of a single 235-foot long rotary kiln with a pre-heater and lime cooler. The kiln is fired with coal or a mixture of coal and petroleum coke. Coal and/or petroleum coke is burned near the discharge end of the kiln to provide the necessary heat for the process. The kiln rotates continuously to prevent the drum from sagging, to improve the product contact with the hot gases, and to move the product through the kiln. To maximize fuel efficiency, a product cooler and limestone pre-heater are used to recover heat from the product and the hot gasses. The lime product is discharged from the kiln and then conveyed to various storage silos, where it is screened to size and then shipped to the end user. Lime is used in the metallurgical, pulp and paper, construction, and waste treatment industries.

Emissions from the process consist primarily of particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NO_x), and sulfur dioxide (SO₂) from fuel combustion. Emission controls for the kiln consist of a fabric filter baghouse for PM control, a fuel sulfur content limit and combustion optimization to reduce CO and NO_x emissions. The majority of the SO₂ is collected within the process, owing to reactions with calcium oxide in the kiln.

The kiln production rate during particulate testing is included in Appendix E.