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KILN 2 EMISSIONS COMPLIANCE STUDY

Performed At The
Carmeuse Lime & Stone
River Rouge Facility
Kiln 2 Baghouse Exhaust
River Rouge, Michigan

Test Date(s)
November 7, 2017

Report No.
TRC Environmental Corporation Report 280821.KLN2

Report Submittal Date
December 4, 2017

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Report Certification

I certify that to the best of my knowledge:

- Testing data and all corresponding information have been checked for accuracy and completeness.
- Sampling and analysis have been conducted in accordance with the approved protocol and applicable reference methods (as applicable).
- All deviations, method modifications, or sampling and analytical anomalies are summarized in the appropriate report narrative(s).

Christian W. Bartley, QI
Project Manager

December 4, 2017
Date

TRC was operating in conformance with the requirements of ASTM D7036-04 during this test program.

Jeffrey W. Burdette
TRC Air Measurements Technical Director

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KILN 2 EMISSIONS COMPLIANCE STUDY

1.0 INTRODUCTION

TRC Environmental Corporation (TRC) performed a particulate and gaseous emission compliance test program on Kiln 2 Baghouse Exhaust at the River Rouge Facility of Carmeuse in River Rouge, Michigan on November 7, 2017. The tests were authorized by TRC and performed for Carmeuse.

The purpose of this test program was to determine particulate and gaseous emission rates during maximum normal operating conditions (MNOC). The results of the test program will be used in order to determine compliance with Michigan Department of Environmental Quality (MDEQ) permit number MI-ROP-B2169-2013 issued January 15, 2013. The test program was conducted according to the TRC Test Protocol dated July 18, 2017.

1.1 Project Contact Information

Participants		
Test Facility	Carmeuse Lime & Stone River Rouge Facility 25 Marion Avenue River Rouge, Michigan 48218	Kris Milner Area Environmental Manager 859.472.8100 (phone) kris.milner@carmeusena.com
Test Coordinator	TRC Environmental Corporation 2500 Eldo Road, Ste. 2 Monroeville, Pennsylvania 15146	Christian W. Bartley Project Manager 412.357.6499 (phone) cbartley@trcsolutions.com
Air Emissions Testing Body (AETB)	TRC Environmental Corporation 2500 Eldo Road, Suite 2 Monroeville, Pennsylvania 15146	Eric S. White Practice Manager 412.356.3672 (phone) cbartley@trcsolutions.com

The tests were conducted by Christian W. Bartley, QI; Justin G. Bryan, QI; Daniel M. Thiessen; and Rob K. Dornenburg of TRC. Documentation of the on-site ASTM D7036-04 Qualified Individual(s) (QI) can be located in the appendix to this report.

Mark Dziadosz of MDEQ observed the testing.

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1.2 Facility and Process Description

Lime is the product of the high-temperature calcination of limestone. The basic procedures in the production of lime are (1) quarrying the raw limestone, (2) preparing the limestone for the kilns by crushing and sizing, (3) calcining the limestone to quicklime (CaO) and (4) miscellaneous transfer, storage and handling operations.

Carmeuse operates two rotary kilns at their River Rouge facility. Emissions from Rotary Kilns 1 and 2 each duct into separate baghouses. Coal is used as the fuel for both kilns. Each baghouse consists of 1 monovent type discharge; has 12 compartments, 6 per side; and measures 15' deep by 1 O' wide. The inlet of each baghouse must be sampled to determine the gas flow rate entering the baghouse.

2.0 SUMMARY OF RESULTS

The results of this test program are summarized in the table below. Detailed individual run results are presented in Section 6.0.

Unit ID	Pollutant Tested	Measured Emissions	Permitted Emission Limit
EUKILNNUMBER2 Monovent Baghouse	Filterable Particulate Matter (FPM)	0.03 lb/tsf	0.12 lb/tsf
	Opacity (VE)	0%	20% over 6-minute average
		0	One 6-minute average >27%/hr
	Sulfur Dioxide (SO_2)	288.15 ppm	300 ppm corrected to 50% excess Oxygen
		0.657 lb/MMBtu	2.4 lb/MMBtu

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The table below summarizes the test methods used, as well as the number and duration of each at each test location:

Unit ID/ Sample Location	Parameter Measured	USEPA Test Method	No. of Runs	Run Duration (Mins)
EUKILNNUMBER2 Monovent Baghouse	Sample / Velocity Traverses	1	3	N/A
	Velocity – S-type Pitot	2	3	N/A
	CO_2, O_2, and Dry Molecular Weight	3A	3	120
	SO_2	6C	3	120
	Moisture Content	4	3	120
	Particulate Matter	5D	3	120
	Visible Emissions	9	3	120

3.0 DISCUSSION OF RESULTS

No problems were encountered with the testing equipment during the test program. Source operation appeared somewhat normal during the entire test program, however, it was postulated that the coal used in Run 1 was much drier than in the second and third runs. This led to an increased SO2 concentration during the first run, as the coal is fed by weight. No adverse test or environmental conditions were encountered during the length of this test program.

4.0 SAMPLING AND ANALYSIS PROCEDURES

All testing, sampling, analytical, and calibration procedures used for this test program were performed in accordance with the methods presented in the following sections. Where applicable, the Quality Assurance Handbook for Air Pollution Measurement

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Systems, Volume III, Stationary Source Specific Methods, USEPA 600/R-94/038c, September 1994 was used to supplement procedures.

4.1 Determination of Sample Point Locations by USEPA Method 1

This method is applicable to gas streams flowing in ducts, stacks, and flues. It is designed to aid in the representative measurement of pollutant emissions and/or total volumetric flow rates from stationary sources. In order to qualify as an acceptable sample location, it must be located at a position at least two stack or duct equivalent diameters downstream and a half equivalent diameter upstream from any flow disturbance. The location of the ports in relation to upstream and downstream disturbances were measured and recorded.

The cross-section of the measurement site was divided into a number of equal areas, and the traverse points were then located in the center of these areas. The minimum number of points were determined from Figure 1-1 (particulate) of USEPA Method 1.

Prior to performing volumetric flow traverses, a cyclonic flow check was performed in accordance with Section 11.4 of Method 1 and recorded on the data sheet enclosed.

4.2 Volumetric Flow Rate Determination by USEPA Method 2

This method is applicable for the determination of the average velocity and the volumetric flow rate of a gas stream.

The gas velocity head (ΔP) and temperature was measured at traverse points defined by USEPA Method 1. The velocity head was measured with a Type S (Stausscheibe) pitot tube and oil-filled manometer; the gas temperature was measured with a Type K thermocouple. The average gas velocity in the flue is calculated based on: the gas density (as determined by USEPA Methods 3 and 4), the flue gas pressure, the average of the square roots of the velocity heads at each traverse point, and the average flue gas temperature. Flow measurements were be taken at the Baghouse inlet duct (Rectangular) prior to USEPA Method 5D sampling. See stack diagram for sampling points.

4.3 Determination of the Concentration of Gaseous Pollutants Using a Multi-Pollutant Sampling System

Concentrations of the pollutants in the following sub-sections are determined using one sampling system.

A straight-extractive sampling system was used. A data logger continuously records pollutant concentrations and generates one-minute averages of those concentrations. All calibrations and system checks are conducted using USEPA Protocol 1 gases. A calibration gas dilution system certified in accordance with USEPA Method 205 was used to dilute

USEPA Protocol gases to generate the required calibration concentrations. Three-point linearity checks were performed prior to sampling. System bias and drift checks were performed using the low-level gas and the mid-level gas prior to, and following, each test run.

Analyzer interference tests are conducted in accordance with the regulations in effect at the time that TRC places an analyzer model in service.

Sampling for each of the following gaseous pollutants occurred simultaneously with USEPA Method 5D. The sampling probe for gaseous pollutants occupied one of the 2 ports per compartment while the USEPA Method 5D train occupied the other. After each has sampled the appropriate time per port, the systems were switched. Each test run saw 4 compartments sampled as follows:

- Each port had 3 points sampled for 5-minutes = 15-minutes per port = 30-minutes per compartment = 120-minutes per test.
- Compartments 6, 5, 4, and 3 made up Run One
- Compartments 2, 1, 7, and 8 made up Run Two
- Compartments 9, 10, 11, and 12 made up Run Three

4.3.1 CO_2 Determination by USEPA Method 3A

This method is applicable for the determination of CO_2 concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The CO_2 analyzer is equipped with a non-dispersive infrared (IR) detector.

4.3.2 O_2 Determination by USEPA Method 3A

This method is applicable for the determination of O_2 concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The O_2 analyzer is equipped with a paramagnetic-based detector.

4.3.3 SO_2 Determination by USEPA Method 6C

This method is applicable for the determination of SO_2 concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The SO_2 analyzer is equipped with an ultraviolet (UV) detector.

4.4 Moisture Determination by USEPA Method 4

This method is applicable for the determination of the moisture content of stack gas.

A gas sample was extracted at a constant rate from the source. Moisture was removed from the sample stream by a series of pre-weighed impingers immersed in an ice bath. A minimum of 21 dry standard cubic feet of flue gas was collected during each sample run.

4.5 Filterable PM Determination by USEPA Method 5D

This method is applicable for the determination of PM emissions from positive pressure fabric filters. Emissions are determined in terms of concentration (mg/m^3 or gr/ft^3) and emission rate (kg/hr or lb/hr). USEPA Methods 2-4 were performed concurrently with, and as an integral part of, these determinations.

Flue gas were withdrawn isokinetically from the source at traverse points determined per USEPA Method 1, and PM was collected in the nozzle, probe liner, and on a glass fiber filter. The probe liner and filter were maintained at a temperature of a nominal 120 °C (248 ± 25 °F). The PM, which included any material that condensed at or above the filtration temperature was determined gravimetrically after the removal of uncombined water.

4.6 Visible Emissions Determination by USEPA Method 9

This method is applicable for the determination of the opacity of emissions from stationary sources pursuant to § 60.11(b) and for visually determining opacity of emissions.

Opacity observations were made by a qualified observer. Observations were made at the point of greatest opacity in the portion of the plume where condensed water vapor is not present. Observations were made at 15-second intervals for the duration of the test period.

5.0 QUALITY ASSURANCE PROCEDURES

TRC integrates our Quality Management System (QMS) into every aspect of our testing service. We follow the procedures specified in current published versions of the test Method(s) referenced in this report. Any modifications or deviations are specifically identified in the body of the report. We routinely participate in independent, third party audits of our activities, and maintain:

- Accreditation from the Stack Testing Accreditation Council (STAC) and the American Association for Laboratory Accreditation (A2LA) that our operations conform with the requirements of ASTM D 7036 as an Air Emission Testing Body (AETB).

These accreditations demonstrate that our systems for training, equipment maintenance and calibration, document control and project management will fully ensure that project objectives are achieved in a timely and efficient manner with a strict commitment to quality.

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All calibrations are performed in accordance with the test Method(s) identified in this report. If a Method allows for more than one calibration approach, or if approved alternatives are available, the calibration documentation in the appendices specifies which approach was used. All measurement devices are calibrated or verified at set intervals against standards traceable to the National Institute of Standards and Technology (NIST). NIST traceability information is available upon request.

ASTM D7036-04 specifies that: *"AETBs shall have and shall apply procedures for estimating the uncertainty of measurement. Conformance with this section may be demonstrated by the use of approved test protocols for all tests. When such protocols are used, reference shall be made to published literature, when available, where estimates of uncertainty for test methods may be found."* TRC conforms with this section by using approved test protocols for all tests.

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6.0 TEST RESULTS SUMMARY

TRS 1. Emission Test Results; Carmeuse Lime & Stone, River Rouge Facility, River Rouge, Michigan

Source: Kiln 2 Source ID#: EUKILNNUMBER2 Permit ID#: MI-ROP-B2169-2013

Test Data		Run 1	Run 2	Run 3	Average		
Test Date		11/7/2017	11/7/2017	11/7/2017			
Test Run Start Time		8:35 AM	12:15 PM	3:40 PM			
Test Run End Time		10:49 AM	2:45 PM	5:55 PM			
Oxygen (O_2)	(dry volume %)	13.34	12.99	13.29	13.21		
Carbon Dioxide (CO_2)	(dry volume %)	11.51	11.96	11.44	11.64		
Stack Temperature	(°F)	469.1	421.2	421.9	437.40		
Water Vapor (H_2O)	(volume %)	11.18	10.79	11.10	11.02		
Flow Rate	(ACFM)	154,594	147,899	148,821	150,438		
Flow Rate	(SCFM)	87,543	88,395	88,544	88,161		
Flow Rate	(DSCFM)	77,757	78,861	78,711	78,443		
Coal F-Factor (F_d)	(dscf/MMBtu)	9,668	9,668	9,668	9,668		
Heat Input Based on Coal F_d	(MMBtu/hr)	174.6	185.2	177.8	179.2		
Sample Volume	(DSCF)	103.544	108.698	105.720	105.99		
Percent of Isokinetic Sampling	(%)	98.5	102.0	99.1	99.9		
		Plant Supplied Process Data					
Stone Rate	(TPH)	42.0	40.6	38.7	40.46		
Lime Production	(TPH)	19.8	19.2	18.3	19.08		
Coal Rate	(TPH)	6.0	6.0	5.9	5.95		
BH Pressure	("H2O)	2.8	2.9	2.9	2.86		
BH Inlet Temp.	(°F)	427.6	431.4	424.0	427.64		
Kiln Speed	(RPH)	68.0	64.9	65.2	66.02		
		Calculated Results				**Limits**	**Compliant / Non-Compliant**
Filterable PM (Method 5)							
Total Particulate Mass (m_n)	(mg)	16.05	13.15	5.40			
Emission Concentration	(gr/DSCF)	0.0024	0.0019	0.0008			
Emission Rate	(lb/hr)	1.59	1.26	0.53	1.13		
Emission Factor	(lb/tsf)	0.038	0.031	0.014	0.03	0.12	Compliant
Sulfur Dioxide (SO_2)							
Emission Concentration	(ppm_{dv})	189.94	132.08	128.60	150.20		
Emission Concentration	(ppm_{dv} @ 0% $_{excess\ air}$)	525.66	349.55	353.83	409.68		
Emission Concentration *	(ppm_{dv} @ 50% $_{excess\ air}$)	369.72	245.86	248.87	288.15	300	Compliant
Emission Rate	(lb/hr)	147.33	103.90	100.97	117.40		
Emission Factor	(lb/MMBtu)	0.844	0.561	0.568	0.657	2.4	Compliant
Emission Factor	(lb/ton)	7.428	5.422	5.531	6.127		

* Calculation utilizes an agreed upon O_2 @ 50% excess air of 6.20%

TRS 2
USEPA Method 9 Monitoring Results, Kiln 2, EUKILNNUMBER2
Carmeuse Lime and Stone, River Rouge Facility, River Rouge, MI

RUN 1 Date: November 7, 2017

Hour 1	SUMMARY										
	Set Number (6 min average)										
	1	2	3	4	5	6	7	8	9	10	Total
Opacity >20%	0	0	0	0	0	0	0	0	0	0	0
6-minute Avg/hr >27%	0	0	0	0	0	0	0	0	0	0	0
Average Opacity	0	0	0	0	0	0	0	0	0	0	
Hour 2	SUMMARY										
	Set Number (6 min average)										
	11	12	13	14	15	16	17	18	19	20	Total
Opacity >20%	0	0	0	0	0	0	0	0	0	0	0
6-minute Avg/hr >27%	0	0	0	0	0	0	0	0	0	0	0
Average Opacity	0	0	0	0	0	0	0	0	0	0	

RUN 2 Date: November 7, 2017

Hour 1	SUMMARY										
	Set Number (6 min average)										
	1	2	3	4	5	6	7	8	9	10	Total
Opacity >20%	0	0	0	0	0	0	0	0	0	0	0
6-minute Avg/hr >27%	0	0	0	0	0	0	0	0	0	0	0
Average Opacity	0	0	0	0	0	0	0	0	0	0	
Hour 2	SUMMARY										
	Set Number (6 min average)										
	11	12	13	14	15	16	17	18	19	20	Total
Opacity >20%	0	0	0	0	0	0	0	0	0	0	0
6-minute Avg/hr >27%	0	0	0	0	0	0	0	0	0	0	0
Average Opacity	0	0	0	0	0	0	0	0	0	0	

RUN 3 Date: November 7, 2017

Hour 1	SUMMARY										
	Set Number (6 min average)										
	1	2	3	4	5	6	7	8	9	10	Total
Opacity >20%	0	0	0	0	0	0	0	0	0	0	0
6-minute Avg/hr >27%	0	0	0	0	0	0	0	0	0	0	0
Average Opacity	0	0	0	0	0	0	0	0	0	0	
Hour 2	SUMMARY										
	Set Number (6 min average)										
	11	12	13	14	15	16	17	18	19	20	Total
Opacity >20%	0	0	0	0	0	0	0	0	0	0	0
6-minute Avg/hr >27%	0	0	0	0	0	0	0	0	0	0	0
Average Opacity	0	0	0	0	0	0	0	0	0	0	