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# KILN 1 EMISSIONS COMPLIANCE STUDY

*Performed At The*
**Carmeuse Lime & Stone**
**River Rouge Facility**
**Kiln 1 Baghouse Exhaust**
**River Rouge, Michigan**

*Test Date(s)*
**December 7, 2017**

*Report No.*
**TRC Environmental Corporation Report 280821.KLN1**

*Report Submittal Date*
**January 8, 2018**

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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

January 8, 2018
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 1 EMISSIONS COMPLIANCE STUDY

## 1.0 INTRODUCTION

TRC Environmental Corporation (TRC) performed a particulate and gaseous emission compliance test program on Kiln 1 Baghouse Exhaust at the River Rouge Facility of Carmeuse Lime & Stone (Carmeuse) in River Rouge, Michigan on December 7, 2017. The tests were authorized by 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<br>River Rouge Facility<br>25 Marion Avenue<br>River Rouge, Michigan 48218 | Kris Milner<br>Area Environmental Manager<br>859.472.8100 (phone)<br>kris.milner@carmeusena.com |
| Test Coordinator | TRC Environmental Corporation<br>2500 Eldo Road, Ste. 2<br>Monroeville, Pennsylvania 15146 | Christian W. Bartley<br>Project Manager<br>412.357.6499 (phone)<br>cbartley@trcsolutions.com |
| Air Emissions Testing Body (AETB) | TRC Environmental Corporation<br>2500 Eldo Road, Suite 2<br>Monroeville, Pennsylvania 15146 | Eric S. White<br>Practice Manager<br>412.789.4569 (phone)<br>ewhite@trcsolutions.com |

The tests were conducted by Craig L. Grunden, QI; Justin G. Bryan, QI; Eric J. Thiessen; and Robert 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 |
|---|---|---|---|
| EUKILNNUMBER1 Monovent Baghouse | Filterable Particulate Matter (FPM) | 0.02 lb/tsf | 0.12 lb/tsf |
| | Opacity (VE) | 0% | 20% over 6-minute average |
| | | 0 | One 6-minute average >27%/hr |

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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) |
|---|---|---|---|---|
| EUKILNNUMBER1 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 |
| | 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 normal during the entire test program. 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 Systems, Volume III, Stationary Source Specific Methods, USEPA 600/R-94/038c, September 1994 was used to supplement procedures.

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### 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 ($\Delta P$) 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 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. 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 1, 2, 3, and 4 made up Run One
- Compartments 5, 6, 12, and 11 made up Run Two
- Compartments 10, 9, 8, and 7 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.

### 4.4 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.

Sampling for USEPA Method 5D occurred simultaneously with gaseous pollutant sampling. The USEPA Method 5D train occupied one of the 2 ports per compartment while the sampling probe for gaseous pollutants other. After each had 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 1, 2, 3, and 4 made up Run One
- Compartments 5, 6, 12, and 11 made up Run Two
- Compartments 10, 9, 8, and 7 made up Run Three

### 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 to 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 1 Source ID#: EUKILNNUMBER1 Permit ID#: MI-ROP-B2169-2013

| Test Data | | Run 1 | Run 2 | Run 3 | Average | | |
|---|---|---|---|---|---|---|---|
| Test Date | | 12/7/2017 | 12/7/2017 | 12/7/2017 | | | |
| Test Run Start Time | | 9:25 AM | 12:23 PM | 3:05 PM | | | |
| Test Run End Time | | 11:44 AM | 2:48 PM | 5:19 PM | | | |
| Oxygen ($O_2$) | (dry volume %) | 9.33 | 8.83 | 8.11 | 8.76 | | |
| Carbon Dioxide ($CO_2$) | (dry volume %) | 17.44 | 18.19 | 19.27 | 18.30 | | |
| Stack Temperature | (°F) | 460.7 | 459.7 | 464.2 | 461.53 | | |
| Water Vapor ($H_2O$) | (volume %) | 21.97 | 20.85 | 22.64 | 21.82 | | |
| Flow Rate | (ACFM) | 102,635 | 104,427 | 105,290 | 104,117 | | |
| Flow Rate | (SCFM) | 58,125 | 59,204 | 59,402 | 58,910 | | |
| Flow Rate | (DSCFM) | 45,356 | 46,862 | 45,952 | 46,057 | | |
| Coal F-Factor ($F_d$) | (dscf/MMBtu) | 9,668 | 9,668 | 9,668 | 9,668 | | |
| Heat Input Based on Coal $F_d$ | (MMBtu/hr) | 155.8 | 167.9 | 174.5 | 166.1 | | |
| Sample Volume | (DSCF) | 66.740 | 63.143 | 62.711 | 64.20 | | |
| Percent of Isokinetic Sampling | (%) | 108.5 | 99.4 | 100.7 | 102.9 | | |
| | | **Plant Supplied Process Data** | | | | | |
| Stone Rate | (TPH) | 36.9 | 36.8 | 36.4 | 36.69 | | |
| Lime Production | (TPH) | 17.4 | 17.3 | 17.2 | 17.31 | | |
| Coal Rate | (TPH) | 5.3 | 5.7 | 5.7 | 5.55 | | |
| BH Pressure | ("H2O) | 1.4 | 1.5 | 1.5 | 1.50 | | |
| BH Inlet Temp. | (°F) | 471.3 | 480.7 | 474.3 | 475.43 | | |
| Kiln Speed | (RPH) | 68.9 | 68.8 | 68.0 | 68.56 | | |
| | | **Calculated Results** | | | | **Limits** | **Compliant / Non-Compliant** |
| **Filterable PM (Method 5)** | | | | | | | |
| Total Particulate Mass ($m_n$) | (mg) | 4.29 | 10.01 | 6.27 | | | |
| Emission Concentration | (gr/DSCF) | 0.0010 | 0.0024 | 0.0015 | | | |
| Emission Rate | (lb/hr) | 0.38 | 0.98 | 0.61 | 0.66 | | |
| Emission Factor | (lb/tsf) | 0.010 | 0.027 | 0.017 | 0.02 | 0.12 | Compliant |

TRS 2

USEPA Method 9 Monitoring Results, Kiln 1, EUKILNNUMBER1

Carmeuse Lime and Stone, River Rouge Facility, River Rouge, MI

RUN 1 Date: December 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: December 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: December 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 | |