
Regulatory Information

Permit No. Michigan Department of Environment, Great Lakes and Energy (EGLE)
Permit No. MI-ROP-B1559-2014 and PTI 140-15C
Regulatory Citation 40 CFR 60 Performance Specifications 2, 3, 6, 8A and 12A
40 CFR 63, Subpart LLL

Source Information

<i>Source Name</i>	<i>Target Parameters</i>
Main Stack	Flow, SO ₂ , NO _x , CO ₂ , Hg, THC, O ₂
Clinker Cooler Stack	Flow

Contact Information

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Alliance Technical Group, LLC (Alliance) has completed the source testing as described in this report. Results apply only to the source(s) tested and operating condition(s) for the specific test date(s) and time(s) identified within this report. All results are intended to be considered in their entirety, and Alliance is not responsible for use of less than the complete test report without written consent. This report shall not be reproduced in full or in part without written approval from the customer.

To the best of my knowledge and abilities, all information, facts and test data are correct. Data presented in this report has been checked for completeness and is accurate, error-free and legible. Onsite testing was conducted in accordance with approved internal Standard Operating Procedures. Any deviations or problems are detailed in the relevant sections in the test report.

This report is only considered valid once an authorized representative of Alliance has signed in the space provided below; any other version is considered draft. This document was prepared in portable document format (.pdf) and contains pages as identified in the bottom footer of this document.



Walter Gray, QSTI
Alliance Technical Group, LLC

8/15/2023

Date

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1.0 Introduction

Alliance Technical Group, LLC (Alliance) was retained by St Mary's Cement, LLC (St. Mary's) to conduct performance specification testing at the Charlevoix, MI facility. Portions of the facility are subject to provisions of 40 CFR 60, Subpart F and 40 CFR 63, Subpart LLL and EGLE Permit No. MI-ROP-B1559-2014 and PTI 140-15C. Testing was conducted to determine the relative accuracy (RA) of the oxygen (O₂), carbon dioxide (CO₂), nitrogen oxide (NO_x), sulfur dioxide (SO₂), volumetric flow rate (VFR), total hydrocarbon (THC), and mercury (Hg) continuous emission monitoring systems (CEMS) that serve the Main Stack. The RA was also determined on the VFR CEMS that serves the Clinker Cooler Stack.

1.1 Facility Description

St. Mary's Cement, LLC owns and operates a Portland Cement manufacturing plant located near Charlevoix, Michigan. Operations at the plant include raw material quarrying, transportation of raw materials by trucks to the plant, raw feed/material preparation, coal handling and preparation, cement clinker production, finish cement processing, and product storage and shipping. A variety of fuels are burned to supply thermal energy to the cement manufacturing process. Particulate matter emissions are controlled from both the main exhaust stack and the clinker cooler exhaust stack using a fabric filter bag house.

1.2 CEMS Descriptions

Main Stack

	<u>Pollutant</u>	<u>Pollutant</u>	<u>Pollutant</u>	<u>Pollutant</u>	<u>Diluent</u>	<u>Diluent</u>
Parameter:	SO ₂	NO _x	Hg	THC	O ₂	CO ₂
Make:	CAI	CAI	Apex	CAI	Yokogawa	CAI
Model:	700 FTIR	700 FTIR	XC-6000EM	600 HFID	ZR402G	700 FTIR
Serial No.:	1707011	1707011	1605368	E07019	piT629784	1707011
Span:	--	--	--	100 ppm	25%	--

Parameter:	<u>Flow Rate</u>
Make:	EMRC
Model:	RM-185
Serial No.:	RM-183
Span:	0-2" WC

Clinker Cooler Stack

	<u>Flow Rate</u>
Parameter:	--
Make:	EMRC
Model:	RM-185 (Console) RM-183 (Probe)
Serial No.:	97948 (Probe)
Span:	0-2" WC

1.3 Project Team

Personnel involved in this project are identified in the following table.

Table 1-1: Project Team

Facility Personnel	Laurie Leaman
Alliance Personnel	Louis Beauregard Walter Gray Joel Marienau

1.4 Site Specific Test Plan & Notification

Testing was conducted in accordance with the Site Specific Test Plan (SSTP) submitted to EGLE.

1.5 Test Program Notes

During mercury testing, the raw mill shut down during run 10 causing testing to be paused and resumed at 6:00 P.M.

2.0 Summary of Results

Alliance conducted performance specification testing at the St. Mary's facility in Charlevoix, MI on June 13-15, 2023. Testing consisted of determining the RA of the O₂, CO₂, NO_x, SO₂, VFR, THC, and Hg CEMS that serve the Main Stack. The RA was also determined on the VFR CEMS that serves the Clinker Cooler Stack.

Tables 2-1 and 2-2 provide a summary of the emission testing results with comparisons to the applicable federal limits. Any difference between the summary results listed in the following tables and the detailed results contained in appendices is due to rounding for presentation.

Table 2-1: Summary of Performance Specification Test Results – Main Stack

CEMS	Performance Test Data		Relative Accuracy	
	Reference Method Data	CEMS Data	Performance Required	Performance Demonstrated
Nitrogen Oxides Data				
Emission Rate, lb/hr	501.3	517.9	≤ 20 %	4.04 % ¹
Sulfur Dioxide Data				
Emission Rate, lb/hr	383.2	387.4	≤ 20 %	1.80 % ¹
Carbon Dioxide Data				
Concentration, % (wet)	18.3	18.2	≤ 20 %	1.11 % ¹
Oxygen Data				
Concentration, % (dry)	9.15	9.15	≤ 20 %	0.18 % ¹
Total Hydrocarbon Data				
Concentration, ppmvd @ 7% O ₂	51.7	53.8	≤ 20 %	7.60 % ¹
Mercury Data				
Concentration, ug/dscm	0.529	0.634	≤ 0.5 ug/scm	0.14 ug/scm ²
Volumetric Flow Rate				
High Load Flow Rate, scfh (wet)	21,571,848	21,606,829	≤ 20 %	0.82 % ¹

¹ Calculated using the mean reference method.

² Calculated using the MATS alternative performance.

Table 2-2: Summary of Performance Specification Test Results – Clinker Cooler Stack

CEMS	Performance Test Data		Relative Accuracy	
	Reference Method Data	CEMS Data	Performance Required	Performance Demonstrated
Volumetric Flow Rate				
High Load Flow Rate, scfh (wet)	10,060,676	9,925,508	≤ 20 %	2.12 % ¹

¹ Calculated using the mean reference method.

3.0 Testing Methodology

The emission testing program was conducted in accordance with the test methods listed in Table 3-1. Method descriptions are provided below while quality assurance/quality control data is provided in Appendix D.

Table 3-1: Source Testing Methodology

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Volumetric Flow Rate	1 & 2	Full Velocity Traverses
Oxygen/Carbon Dioxide	3A	Instrumental Analysis
Moisture Content	4	Gravimetric Analysis
Sulfur Dioxide	6C	Instrumental Analysis
Nitrogen Oxides	7E	Instrumental Analysis
Total Hydrocarbon	25A	Instrumental Analysis
Mercury	30B	Sorbent Traps
Gas Dilution System Certification	205	--

3.1 U.S. EPA Reference Test Methods 1 and 2 – Sampling/Traverse Points and Volumetric Flow Rate

The sampling location and number of traverse (sampling) points were selected in accordance with U.S. EPA Reference Test Method 1. To determine the minimum number of traverse points, the upstream and downstream distances were equated into equivalent diameters and compared to Figure 1-2 in U.S. EPA Reference Test Method 1.

Full velocity traverses were conducted in accordance with U.S. EPA Reference Test Method 2 to determine the average stack gas velocity pressure, static pressure and temperature. The velocity and static pressure measurement system consisted of a pitot tube and inclined manometer. The stack gas temperature was measured with a K-type thermocouple and pyrometer.

Stack gas velocity pressure and temperature readings were recorded during each test run. The data collected was utilized to calculate the volumetric flow rate in accordance with U.S. EPA Reference Test Method 2. The velocity and static pressure measurement system consisted of a pitot tube and inclined manometer. The stack gas temperature was measured with a K-type thermocouple and pyrometer.

Stack gas velocity pressure and temperature readings were recorded during each test run. The data collected was utilized to calculate the volumetric flow rate for comparison to the continuous emission rate monitoring system (CERMS). The relative accuracy of the CERMS was determined based on procedures found in 40 CFR 60, Performance Specification 6.

3.2 U.S. EPA Reference Test Method 3A – Oxygen/Carbon Dioxide

The oxygen (O₂) and carbon dioxide (CO₂) testing was conducted in accordance with U.S. EPA Reference Test Method 3A. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, Teflon sample line(s), gas conditioning system and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the stack gas. If an unheated

Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.9.

The relative accuracy of the O₂ CEMS was determined based on procedures found in 40 CFR 60, Performance Specification 3.

3.3 U.S. EPA Reference Test Method 4 – Moisture Content

The stack gas moisture content (BWS) was determined in accordance with U.S. EPA Reference Test Method 4. The gas conditioning train consisted of a series of chilled impingers. Prior to testing, each impinger was filled with a known quantity of water or silica gel. Each impinger was analyzed gravimetrically before and after each test run on the same balance to determine the amount of moisture condensed.

3.4 U.S. EPA Reference Test Method 6C – Sulfur Dioxide

The sulfur dioxide (SO₂) testing was conducted in accordance with U.S. EPA Reference Test Method 6C. Data was collected online and reported in one-minute averages. The sampling system consisted of a heated stainless-steel probe, Teflon sample line(s), gas conditioning system and the identified analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the source gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.9.

The relative accuracy of the SO₂ CEMS was determined based on procedures found in 40 CFR 60, Performance Specification 2.

3.5 U.S. EPA Reference Test Method 7E – Nitrogen Oxides

The nitrogen oxides (NO_x) testing was conducted in accordance with U.S. EPA Reference Test Method 7E. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, Teflon sample line(s), gas conditioning system and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the stack gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.9.

The relative accuracy of the NO_x CEMS was determined based on procedures found in 40 CFR 60, Performance Specification 2.

3.6 U.S. EPA Reference Test Method 25A – Total Hydrocarbons

The total hydrocarbons (THC) testing was conducted in accordance with U.S. EPA Reference Test Method 25A. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, heated Teflon sample line(s) and the identified gas analyzer. The quality control measures are described in Section 3.10.

The relative accuracy of the THC CEMS was determined based on procedures found in 40 CFR 60, Performance Specification 8A.

3.7 U.S. EPA Reference Test Method 30B – Mercury

The total vapor phase mercury (Hg) testing was conducted in accordance with U.S. EPA Reference Test Method 30B. The complete sampling system consisted of a heated pair of in-stack sorbent traps, stainless steel-lined probe,

gas conditioning train, pump and calibrated dry gas meter. Sample gas was withdrawn through the paired sorbent traps at a pre-determined sampling rate during each test run. A field recovery test was conducted during five (5) of the test runs in which a known mass of mercury was pre-spiked onto one (1) of the paired sorbent traps.

Prior to starting each test run, the sampling train was leak checked at a vacuum pressure of fifteen inches of mercury. Following the completion of each test run, the sampling train was leak checked at the highest vacuum pressure observed during the test run. Each sorbent trap was removed from the sample probe and sealed to prevent contamination. All samples were sealed and labeled for transport to the identified laboratory for analysis.

Prior to sampling, a multipoint analyzer calibration with certified mercury calibration standards was performed on the Ohio Lumex analyzer. Analysis of an independent calibration standard was performed as a quality check of the multipoint analyzer calibration. Calibration checks were performed during analysis to verify the analyzer calibration had not drifted.

The relative accuracy of the Hg CEMS was determined based on procedures found in 40 CFR 60, Performance Specification 12A.

3.8 U.S. EPA Reference Test Method 205 – Gas Dilution System Certification

A calibration gas dilution system field check was conducted in accordance with U.S. EPA Reference Method 205. Multiple dilution rates and total gas flow rates were utilized to force the dilution system to perform two dilutions on each mass flow controller. The diluted calibration gases were sent directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The analyzer response agreed within 2% of the actual diluted gas concentration. A second Protocol 1 calibration gas, with a cylinder concentration within 10% of one of the gas divider settings described above, was introduced directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The cylinder concentration and the analyzer response agreed within 2%. These steps were repeated three (3) times. Copies of the Method 205 data can be found in the Quality Assurance/Quality Control Appendix.

3.9 Quality Assurance/Quality Control – U.S. EPA Reference Test Methods 3A, 6C and 7E

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Low Level gas was introduced directly to the analyzer. After adjusting the analyzer to the Low-Level gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas. For the Calibration Error Test, Low, Mid, and High Level calibration gases were sequentially introduced directly to the analyzer. All values were within 2.0 percent of the Calibration Span or 0.5 ppmv/% absolute difference.

High or Mid Level gas (whichever was closer to the stack gas concentration) was introduced at the probe and the time required for the analyzer reading to reach 95 percent or 0.5 ppmv/% (whichever was less restrictive) of the gas concentration was recorded. The analyzer reading was observed until it reached a stable value, and this value was recorded. Next, Low Level gas was introduced at the probe and the time required for the analyzer reading to decrease to a value within 5.0 percent or 0.5 ppmv/% (whichever was less restrictive) was recorded. If the Low-Level gas was zero gas, the response was 0.5 ppmv/% or 5.0 percent of the upscale gas concentration (whichever was less restrictive). The analyzer reading was observed until it reached a stable value and this value was recorded.

The measurement system response time and initial system bias were determined from these data. The System Bias was within 5.0 percent of the Calibration Span or 0.5 ppmv/% absolute difference.

High or Mid Level gas (whichever was closer to the stack gas concentration) was introduced at the probe. After the analyzer response was stable, the value was recorded. Next, Low Level gas was introduced at the probe, and the analyzer value recorded once it reached a stable response. The System Bias was within 5.0 percent of the Calibration Span or 0.5 ppmv/% absolute difference or the data was invalidated and the Calibration Error Test and System Bias were repeated.

Drift between pre- and post-run System Bias was within 3 percent of the Calibration Span or 0.5 ppmv/% absolute difference. If the drift exceeded 3 percent or 0.5 ppmv/%, the Calibration Error Test and System Bias were repeated.

Three (3) point sampling was conducted (stacks less than 7.8 feet in diameter - 16.7, 50.0 and 83.3 percent of the measurement line; stacks greater than 7.8 feet in diameter - 0.4, 1.0, and 2.0 meters from the stack wall).

An NO₂ – NO converter check was performed on the analyzer prior to initiating testing and at the completion of testing. An approximately 50 ppm nitrogen dioxide cylinder gas was introduced directly to the NO_x analyzer and the instrument response was recorded in an electronic data sheet. The instrument response was within +/- 10 percent of the cylinder concentration.

A Data Acquisition System with battery backup was used to record the instrument response in one (1) minute averages. The data was continuously stored as a *.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data was also saved to the Alliance server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at Alliance's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.

3.10 Quality Assurance/Quality Control – U.S. EPA Reference Test Method 25A

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Within two (2) hours prior to testing, zero gas was introduced through the sampling system to the analyzer. After adjusting the analyzer to the Zero gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas, and the time required for the analyzer reading to reach 95 percent of the gas concentration was recorded to determine the response time. Next, Low and Mid-Level gases were introduced through the sampling system to the analyzer, and the response was recorded when it was stable. All values were less than +/- 5 percent of the calibration gas concentrations.

Mid Level gas was introduced through the sampling system. After the analyzer response was stable, the value was recorded. Next, Zero gas was introduced through the sampling system, and the analyzer value recorded once it reached a stable response. The Analyzer Drift was less than +/- 3 percent of the span value.

A Data Acquisition System with battery backup was used to record the instrument response in one (1) minute averages. The data was continuously stored as a *.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data was also saved to the Alliance server. All data was reviewed by the Field Team

Leader before leaving the facility. Once arriving at Alliance's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.