CEMS Quality Assurance Plan

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Continuous Emissions Monitoring System
Quality Assurance Plan

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Glossary

40 CFR 60, Appendix A, B, and F – These appendices include CEMS standards and test methods of 40 CFR 60 – *Standards of performance for new stationary sources*. These appendices can be found at www.access.gpo.gov/nara/cfr/index.html

AQD – Air Quality Department of MDEQ

Annual – Every fourth quarter

CD – Calibration Drift testing

CE – Calibration Error testing

CERMS – Continuous Emission Rate Monitoring System

CEMS – Continuous Emission Monitoring System

COMS – Continuous Opacity Monitoring System

CGA – Cylinder Gas Audit

CO – Carbon Monoxide

Corrective Action – Repairs or maintenance activities that are not considered 'routine'

Daily – One every 24 hours

DAS – Data Acquisition System

Flow Rate – Emission gas flow rate reported dry at standard conditions

MDEQ – Michigan Department of Environmental Quality

MDEQ Continuous Opacity and Continuous Emission Monitoring Systems Guidance Document – MDEQ publication developed to assist Michigan business with CEMS. This document can be found at http://www.michigan.gov/documents/deq/deq-ead-caap-cems-cems_315946_7.pdf

NO_x – Nitrogen Oxides (NO and NO_2)

O_2 – Oxygen

Out-of-Control – Period of time in which a CEMS is not operating within one or more acceptable data quality criteria. CEMS data during these out-of-control periods are not acceptable for demonstrating compliance with regulatory limits.

PS – Performance Specification (from 40 CFR 60 Appendix B)

PST– Performance Specification Test: The performance specification test includes calibration drift, response time, and relative accuracy.

QA – Quality Assurance

QC – Quality Control

Quarterly – Once every three calendar months

RA – Relative Accuracy

RATA – Relative Accuracy Test Audit

RT – Response Time

SO_2 – Sulfur Dioxide

THC – Total Hydrocarbon

1.0 Introduction

Lafarge Corporation (Lafarge) has developed this CEMS Quality Assurance (QA) Plan to demonstrate compliance with regulatory standards related to continuous emission monitoring systems (CEMS). The objective of this plan is to specify the minimum requirements that are necessary for the control and assessment of the quality of CEMS data. The principles behind this plan consist of periodically assessing CEMS data quality, implementing quality control measures, and taking corrective action when necessary.

This CEMS QA Plan was developed by incorporating the appropriate standards, procedures, and test methodologies presented in

1. MDEQ-AQD's Continuous Opacity and Continuous Emission Monitoring System Guidance Document;
2. 40 CFR 60, Appendices A, B, and F

These documents can be downloaded from the websites provided in the Glossary.

This CEMS QA Plan applies specifically to the CEMS that demonstrate regulatory compliance at Kiln Group 5 (Kilns 19, 20, and 21) and Kiln Group 6 (Kilns 22 and 23). The CEMS have been installed to show continuous compliance for both concentration and emission rate limits established in the plant's Title V permit. Please refer to the last version of the permit to see most up to date limits. Table 1-1 lists the CEMS that are covered in this plan:

Table 1-1. Continuous Emission Monitoring Systems

CEMS	Kiln 19	Kiln 20	Kiln 21	Kiln 22 baghouse	Kiln 23 baghouse	Kiln 22-23 Scrubber
CO	●	●	●	●	●	
O_2	●	●	●	●	●	●
CO_2	●	●	●	●	●	
NO	●	●	●	●	●	
SO_2	●	●	●			●
Flow Rate	●	●	●	●	●	●
Opacity	●	●	●			

Additionally, COMS are installed at the stacks of the following process units:

- Fan 92
- Fan 93
- Kiln 22 clinker cooler
- Kiln 23 clinker cooler

Lafarge personnel will implement the procedures set forth in this plan. Many of the specifications include field calibration and maintenance activities.

As recommended in MDEQ-AQD's CEMS Guidance Document, this CEMS QA Plan was developed as a "living document." As such, this document will be reviewed annually to ensure that the information presented is current and accurate. Furthermore, Lafarge encourages both its own personnel and contractors to make recommendations for improvement of overall CEMS performance and data quality.

1.1 CEMS QA and Communication Responsibilities

Table 1-2 summarizes the personnel that work with the CEMS and their QA function and responsibilities.

Table 1-2. QA and Communication Responsibilities

Plant Position	CEMS QA Function	Responsibilities
Environmental Manager	QA Coordinator, has responsibility for the overall QA program.	The Environmental Manager is ultimately responsible for ensuring that operations are within regulatory compliance and that the proper channels of communication are in place. The Environmental Manager is responsible for communications with MDEQ and EPA.
Electrical & Instrument Supervisor	Assigning CEMS maintenance responsibilities.	Responsible for ensuring that the proper Lafarge personnel know their duties and responsibilities regarding the CEMS calibration and maintenance activities.
CEMS Technicians	Responsible for calibrating and maintaining the CEMS in accordance with this plan.	Responsible for assessing CEMS status and communicating it to the Control Room Operators and the Environmental Manager.
DAS Engineers	Responsible for maintaining the DAS.	Responsible for communicating the DAS status with the Control Room Operators, CEMS Technician, and Environmental Manager.
Control Room Operators	Ensuring that CEMS are collecting data as required by process operations regulatory limits.	Responsible for communicating with the CEMS Technicians in the event of a CEMS problems and operating the process within regulatory limits.

1.2 Training

Lafarge implements a training program where inexperienced CEMS and COMS technicians work in the field with a qualified, experienced technician. The qualified technicians provide hands-on training and ensure the trainees have an adequate working knowledge of the CEMS, the CEMS QA Plan, and the regulatory requirements before they are allowed to work independently.

1.3 Process and Sampling Location Descriptions

The CEMS and flow measurement sampling locations for the three kilns of KG5 are very similar. In each case the stack sampling location is in the breaching duct between each kiln's baghouse and discharge stack. The CEMS port is located on the side of duct breaching at the approximate mid-point. The MIRS sample probes extend approximately 45 inches into the duct.

Kilns 22 and 23 each have a separate CEMS for NO, CO, CO2, and flow located in the duct exiting the bag house before the two ducts combine upstream of the scrubber fan . The KG6 combined stack has a single sampling location for the SO_2, O_2, and flow CEMS.

Figure 1-1 depicts the stack sampling location and the nearest disturbances upstream and downstream. The nearest disturbance upstream is 4.5 E_d and the nearest disturbance downstream is 6 E_d.

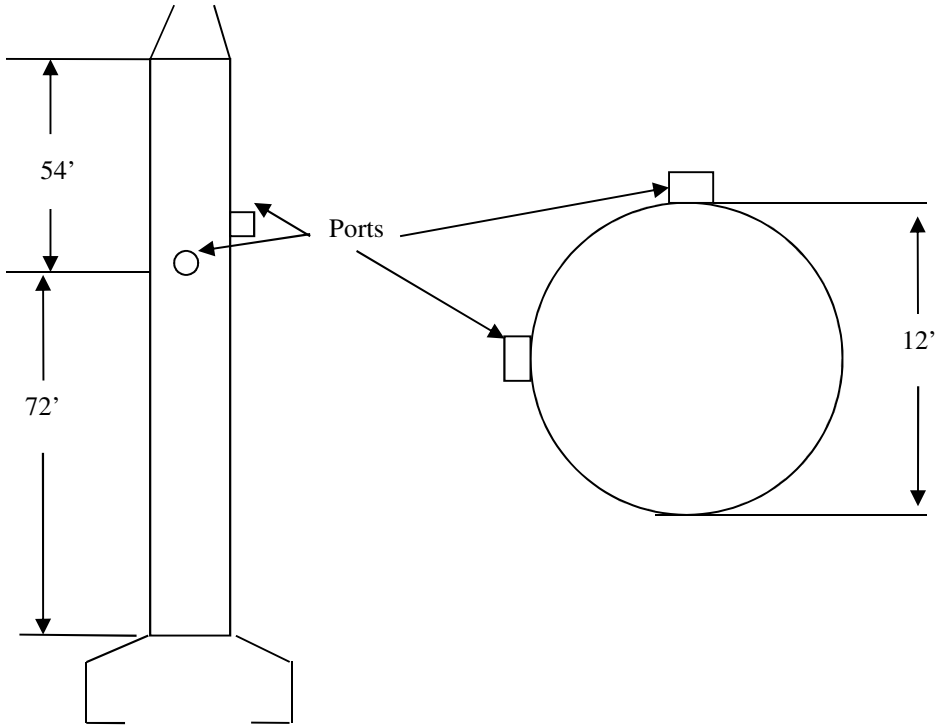

Figure 1-1. Diagram of Stack Sampling Location

2.0 Summary of CEMS Performance Acceptance Criteria

Table 2-1 summarizes the periodic data quality assessments and the corresponding acceptance criteria that need to be performed on Kiln Group 5 (Kilns 19, 20, and 21) according to the regulations. Daily and quarterly acceptance criteria come from 40 CFR 60 Appendix F. The daily acceptance criteria in the table are set to two times the limit in the applicable performance specifications of Appendix B. Annual acceptance criteria come directly from 40 CFR Appendix B. Performance Specification 4A applies to the CO monitors on Kiln Group 5 because the permit limits for CO on the three kilns are all below 200 ppmv at 7% O_2 (dry basis). Concentration based limits for NO_x and SO_2 apply only if the average reference method concentrations are less than 50% of the emission standard. Annual CEMS RATA criteria are shown per Performance Specifications 2, 3, and 4A as referenced in the plant's Title V Permit. MDEQ has requested the annual RATA test on each pollutant monitor be conducted as a continuous emission rate monitoring system (CERMS) per Performance Specification 6. Accordingly, the CERMS RATA criteria from PS-6 are also shown in the table. Monitors for CO_2 were added to the periodic data quality assessment in 2010 for greenhouse gas (GHG) reporting purposes.

Table 2-1. Summary of Data Quality Assessments and Acceptance Criteria
Kiln Group 5 (Kilns 19, 20, and 21)

		Daily	Quarterly	Annual		
CEMS	**Span**	**CD[a]**	**CGA**	**CD**	**RATA**	**CERMS RATA**
CO	300 ppmv 3000 ppmv	≤ 10% span	±15% of the average audit gas value	≤ 5% span for 6 of 7 consecutive days	≤ 10%, or 5% of the emission limit, or 5 ppmv if RA calculated as absolute difference of RM & CEMS plus 2.5% CC	≤ 20%, or 10% of the emission limit, whichever is greater
O_2	25% O_2	≤ 1% O_2	±15% of the average audit gas value	≤ 0.5% O_2 for 7 consecutive days	≤ 1% O_2	NA
CO_2	30% CO_2	≤ 1% CO_2	±15% of the average audit gas value	≤ 0.5% CO_2 for 7 consecutive days	≤ 1% CO_2	NA
NO	1500 ppmv	≤ 5% span	±15% of the average audit gas value	≤ 2.5% span for 7 consecutive days	≤ 20%, or 10% of the emission limit if the RM average is below 50% of limit	≤ 20%, or 10% of the emission limit, whichever is greater
SO_2	170 ppmv 325 ppmv	≤ 5% span	±15% of the average audit gas value	≤ 2.5% span for 7 consecutive days	≤ 20%, or 10% of the emission limit if the RM average is below 50% of limit	≤ 20%, or 10% of the emission limit, whichever is greater
Flow		≤ 6% span	NA	≤ 3% span for 7 consecutive days	NA	NA

[a] The daily acceptance criteria are set to 2× the limit in the applicable 40 CFR 60 App. B PS, per App. F.

Table 2-2 summarizes the periodic data quality assessments and the corresponding acceptance criteria that need to be performed on Kiln Group 6 (Kilns 22 and 23) according to the regulations. Performance Specification 4 applies to the CO monitors on Kiln Group 6 because the permit limits for CO on both kilns are above 200 ppmv at 7% O_2 (dry basis). With the addition of the scrubber, the following CEMS are now located at the baghouse outlet of each kiln to the common scrubber inlet.

Table 2-2. Summary of Data Quality Assessments and Acceptance Criteria
Kiln Group 6 (Kilns 22 and 23) Baghouse Outlets

CEMS	Span	Daily	Quarterly	Annual		
		CD[a]	CGA	CD	RATA	CERMS RATA
CO	300 ppmv 3000 ppmv	≤ 10% span	±15% of the average audit gas value	≤ 5% span for 6 of 7 consecutive days	≤ 10%, or 5% of the emission limit	≤ 20%, or 10% of the emission limit, whichever is greater
O_2	25% O_2	≤ 1% O_2	±15% of the average audit gas value	≤ 0.5% span for 7 consecutive days	≤ 1% O_2	NA
CO_2	30% CO_2	≤ 1% O_2	±15% of the average audit gas value	≤ 0.5% span for 7 consecutive days	≤ 1% O_2	NA
NO	2000 ppmv	≤ 5% span	±15% of the average audit gas value	≤ 2.5% span for 7 consecutive days	≤ 20%, or 10% of the emission limit if the RM average is below 50% of limit	≤ 20%, or 10% of the emission limit, whichever is greater
Flow	0.5" WC (K22) 1.0" WC (K23)	≤ 6% span	NA	≤ 3% span for 7 consecutive days	NA	NA

[a] The daily acceptance criteria are set to 2× the limit in the applicable 40 CFR 60 App. B PS, per App. F.

Table 2-3 summarizes the periodic data quality assessments and the corresponding acceptance criteria that need to be performed on the Kiln Group 6 (Kilns 22 and 23) common scrubber outlet CEMS according to the regulations.

Table 2-3. Summary of Data Quality Assessments and Acceptance Criteria

Kiln Group 6 (Kilns 22 and 23) Scrubber Outlet

CEMS	Span	Daily	Quarterly	Annual		
		CD[a]	CGA	CD	RATA	CERMS RATA
O_2	25% O_2	≤ 1% O_2	±15% of the average audit gas value	≤ 0.5% O_2 for 7 consecutive days	≤ 1% O_2	NA
SO_2	300 ppmv	≤ 5% span	±15% of the average audit gas value	≤ 2.5% span for 7 consecutive days	≤ 20%, or 10% of the emission limit if the RM average is below 50% of limit	≤ 20%, or 10% of the emission limit, whichever is greater
Flow	1.5" WC (K23)	≤ 6% span	NA	≤ 3% span for 7 consecutive days	NA	NA

[a] The daily acceptance criteria are set to 2× the limit in the applicable 40 CFR 60 App. B PS, per App. F.

Table 2-4 summarizes the periodic data quality assessments and the corresponding acceptance criteria that need to be performed on the COMS according to Performance Specification 1 and Procedure 3.

Table 2-4. Summary of Data Quality Assessments and Acceptance Criteria for Continuous Opacity Monitors

Parameter	Frequency	Criterion
Span Value	NA	< 80% opacity
Zero and Upscale Calibration Drift	Daily	≤ 4% opacity
Zero Compensation	Quarterly	≤ 4% opacity
3-Point Calibration Error	Quarterly	≤ 3% opacity
Optical Alignment	Quarterly	≤ 3% opacity
Primary Zero Alignment	Annual	≤ 2% opacity

3.0 Overview of Facility CEMS

Lafarge operates CEMS on all five kilns. All CEMS for KG5 are located at the bag house outlet ducts for each of the three kilns. At KG6, CEMS for NO_x and CO, along with the associated flow and diluent CO_2 monitors are also located at the individual kiln bag house outlet ducts. The two KG6 bag house outlet locations also each have an SO_2 CEMS in place for process control. These SO_2 CEMS are included in this QA plan, but are not part of the CEMS required for regulatory compliance. The equipment used in each bag house outlet system includes an extraction sample probe, heated sample transport line, a dry basis sample conditioning system, analyzers, and the data acquisition system (DAS). The analyzers used for compliance CEMS at the three KG5 kilns are the same as the KG6 CEMS at the bag house outlet ducts. The specific analyzers operating at each location are as follows:

Table 3-1. CEMS and COMS Analyzers

Measured Parameter	Manufacturer	Model
Carbon Monoxide	Environnement S.A.	MIR 9000
Carbon Dioxide	Environnement S.A.	MIR 9000
Sulfur Dioxide	Environnement S.A.	MIR 9000
Oxygen	Ametek	CEMS/IQ
Moisture	MAC Instruments	MAC 155*
Nitric Oxide	Environnement S.A.	MIR 9000
Opacity	Teledyne Monitor Labs, United Sciences	560 Lighthawk, 500C, 550C
Gas Flow Rate	ERMC	Custom Pitot tube with pressure transmitter

* treated as an H_2O process analyzer

Implementation of the Consent Decree has resulted in locating the KG6 compliance CEMS for SO_2, along with flow and diluent O_2 monitors to the combined KG6 stack. The equipment used in this system includes an extraction sample probe, heated sample transport line, a wet basis sample conditioning system, analyzers, and the data acquisition system (DAS). The specific analyzers operating at this location are as follows:

Table 3-2. CEMS and COMS Analyzers

Measured Parameter	Manufacturer	Model
Oxygen	Environnement S.A.	MIR 9000H*
Moisture	Environnement S.A.	MIR 9000H**
Sulfur Dioxide	Environnement S.A.	MIR 9000H
Gas Flow Rate	ERMC	Custom Pitot tube with pressure transmitter

* ZrO_2 sensor integrated into the MIR 9000H

** treated as an H_2O process analyzer

3.1 Operating Principal of Equipment

Lafarge utilizes the MIR 9000 to monitor oxygen, sulfur dioxide, carbon monoxide, carbon dioxide, and nitric oxide continuously. The MIR 9000 is a multi-component Non-Dispersive Infra-Red (ND-IR) analyzer.

The technology uses an optical band pass filter to select an infra-red band and then a cell filled with the gas of interest. This gas is sensed by the beam and blocks the spectral lines where the gas absorbs.

3.2 Data Acquisition System

The individual analyzers provide output in an analog format that corresponds to the concentration of the analyzed constituents. These analog signals are converted to digital format and then averaged, recorded, and monitored in the data acquisition system (DAS). The DAS is provided by Wunderlich-Malec Services and uses Cirrus EIS™ software. In addition to providing data archiving, the DAS also has a number of features to assist in quarterly and annual audits, including automated calibration error testing. The data collected by the DAS are used to evaluate and document compliance status of the regulated kilns.

3.3 Facilities, Equipment, and Spare Part Inventory

The Electrical and Instrument Department has the responsibility for maintaining all CEMS facilities, equipment, and spare part inventory

4.0 Daily Data Quality Assessment

This section discusses the procedures that are used to assess data quality on a daily basis. The technician assigned to the CEMS performs or monitors these procedures.

4.1 Daily CD Test Procedure

The daily test procedure checks the accuracy and stability of the analyzers by comparing their response to a low-level and high-level calibration gas standard. The response is compared to the certified concentration of the gas standard before the instrument is recalibrated, if necessary. Conducting this calibration check after each 24-hour period of operation establishes the daily calibration drift (CD) as specified in Section 4 of 40 CFR 60, Appendix F. The gases are introduced to the CEMS at the probe so the entire system is challenged. The DAS automatically performs the daily CD tests for the various analyzers. The typical starting time is 5:00 a.m. The test cycle takes 15 to 18 minutes for each analyzer. The results of the daily CD testing are stored by the DAS in the 'Calibration Gas Drift Report.' The analyzer will calculate a correction factor based on the difference between the analyzer response and the calibration gas value . This correction factor is applied to all subsequent analyzer readings to generate the reported values. This procedure causes the daily CD to be equal to the total calibration error (CE) on any daily check.

The calibration gases needed to perform the CEMS daily CD tests require an accuracy of 2%. Table 4-1 summarizes acceptable gas concentration ranges for performing the daily calibration drift tests.

Table 4-1. Daily CD Gas Standard Ranges

Location	CEMS	Low-Level Cal Gas	High-Level Cal Gas	Analyzer Span
Kiln Group 5 (Kilns 19, 20, & 21)	CO – low range high range	0-60 ppmv 0-600 ppmv	150-300 ppmv 1500-3000 ppmv	300 ppmv 3000 ppmv
	O_2	0-5% O_2	12.5-25% O_2	25% O_2
	CO_2	0-5% CO_2	15.0-30 % CO_2	30 % CO_2
	NO_x	0-300 ppmv	750-1500 ppmv	1500 ppmv
	SO_2– low range high range	0-200 ppmv 0-600 ppmv	500-1000 ppmv 1500-3000 ppmv	1000 ppmv3000 ppmv
Kiln Group 6 (Kiln 22 & 23 duct)	CO – low range high range	0-60 ppmv 0-600 ppmv	150-300 ppmv 1500-3000 ppmv	300 ppmv 3000 ppmv
	O_2	0-5% O_2	12.5-25% O_2	25% O_2
	CO_2	0-5% CO_2	15.0-30 % CO_2	30 % CO_2
	NO_x	0-400 ppmv	1000-2000 ppmv	2000 ppmv
	SO_2	0-600 ppmv	1500-3000 ppmv	3000 ppmv
Scrubber Stack	SO_2	0-60 ppmv	150-300 ppmv	300 ppmv
	O_2	0-5% O_2	12.5-25% O_2	25% O_2

4.2 Daily System and Data Review

The technician assigned to the CEMS reviews the operating status of the CEMS components and the Calibration Drift Report daily. The daily audit of the CEMS operation status should include, but is not limited to, inspecting and verifying that:

- Periodic blow backs are accomplished;
- Sample conditioning system is operational;
- DAS is functioning properly; and
- Analyzers are not in an alarm state.

4.3 Manual Calibration Drift Check

After reviewing the Calibration Drift Report and the CEMS operation status, the technician may decide to make minor adjustments and manually recalibrate a specific analyzer. Minor adjustments may include, but are not limited to, manually adjusting a specific analyzer or adjusting sample flow rates.

Manual calibrations are accomplished by putting the DAS in manual calibration mode and accomplishing the calibration. After calibrating, the Calibration Drift Report is reviewed to ensure the analyzer is operating with the acceptance limits.

4.4 Out-of-Control Period

Excessive calibration drift data can lead to a CEMS being classified as out of control. If a system is considered out of control, the data may not be used either in calculating emission compliance or toward meeting minimum data availability requirements. A CEMS is defined out of control if:

1. Five consecutive daily calibration drift checks are in excess of the allowable limit shown in Tables 2-1 through 2-4; or
2. One daily calibration drift check is in excess of two times the allowable limit. The out-of-control period begins with the completion of the daily CD check preceding the CD check in excess of two times the allowable limit.

Note that the allowable daily limits shown in tables 2-1 through 2-3 are based on the criteria established in 40 CFR 60 Appendix F, and are expressed as two times the PS limits from Appendix B. If the out-of-control period was caused by exceeding the applicable limit for five consecutive days, the out-of-control period ends with the completion of a CD test that is less than the applicable limit. If the out-of-control period was caused by exceeding two times the applicable limit for one day, the out-of-control period ends with the completion of a CD test that is less than two times the applicable limit.

During the out-of-control period, CEMS data cannot be used for calculating emissions compliance or for meeting minimum data availability requirements.

Table 4-2 summarizes the CD ranges and actions to be taken depending on the extent of the daily CD result. Daily CD testing can identify a problem that would require corrective action to be taken. Section 7 discusses in detail corrective actions and resulting testing requirements.

Table 4-2. CEMS Daily CD Ranges and Action

<table>
<tr><th>CEMS</th><th>Control Level (CL)[a]</th><th>If CD < CL</th><th>If CD > CL and CD < 2x CL</th><th>If CD > 2x CL</th></tr>
<tr><td>CO – low range
high range</td><td>≤10.0% of span
≤10.0% of span</td><td rowspan="6">Inspect the Calibration Drift Report and the components of the CEMS. Perform a manual calibration if necessary.</td><td rowspan="6">Inspect the components of the CEMS and perform a manual calibration. Implement corrective action if needed.

If the CD is ≥ CL for 5 consecutive days then the CEMS is out-of-control until a CD test is < CL.</td><td rowspan="6">The system is out-of-control when a valid CD is > 2× the CL. The appropriate corrective action should be taken.

The CEMS is considered back in control when a CD test result is < 2× CL.</td></tr>
<tr><td>O_2</td><td>≤ 1.0% O_2</td></tr>
<tr><td>CO_2</td><td>≤ 1.0% CO_2</td></tr>
<tr><td>NO_x</td><td>≤ 5% of span</td></tr>
<tr><td>SO_2</td><td>≤ 5% of span</td></tr>
<tr><td>Flow Rate</td><td>≤ 6% of span</td></tr>
<tr><td>Opacity</td><td>≤ 4% opacity</td><td>Inspect the Calibration Drift Report and the components of the COMS. Take corrective action if necessary.</td><td colspan="2">The system is out-of-control; take corrective action. The CEMS is considered back in control when a CD test result is below the CL</td></tr>
</table>

[a] The daily control levels are set to 2× the limit in the applicable 40 CFR 60 App. B PS, per App. F

4.5 Preventive Maintenance

The CEMS Technicians are responsible for performing preventative maintenance activities according to Lafarge Operating Procedures, as needed.

5.0 Quarterly Data Quality Assessment

This section discusses the procedures used to assess data quality on a quarterly basis.

5.1 Quarterly Audit Procedure

The quarterly audit procedure required for the CEMS is called the cylinder gas audit (CGA). The CGA test evaluates the difference between the concentration indicated by the CEMS and the known concentration of the standard calibration gas. The CEMS are challenged with gases certified using the EPA Traceability Protocol to demonstrate that the response is linear. The calibration gases are introduced to the CEMS at the sample probe to check the entire system. The CGA requires a 2-point linearity check, and the acceptance criterion is ±15% of the average audit value, or 5 ppmv (for pollutants), whichever is greater. The annual RATA takes the place of the quarterly CGA for the quarter in which the RATA is performed. A CGA cannot be conducted for more than three consecutive quarters without conducting a RATA.

The DAS contains automated functions to implement the quarterly CGA test. This feature greatly reduces the time commitment necessary for a technician to complete the test. The results are summarized in a DAS report titled Cylinder Gas Audit Report.

At least 60 days prior to a scheduled quarterly test, check the cylinder pressure and the expiration dates of the EPA Protocol 1 standards used for a CGA. If the cylinder pressure is less than 200 psi, or if the cylinder certification will have expired prior to the CGA, a replacement cylinder will be necessary. Table 5-1 lists the appropriate CGA gas ranges for each CEMS.

Table 5-1. CGA Calibration Gas Specifications

Location	CEMS	Analyzer Span	Low Range (20-30% of Span)[a]	High Range (50-60% of Span)[a]
Kiln Group 5 (Kilns 19, 20, & 21)	CO – Low range High range	300 ppmv 3000 ppmv	60-90 ppmv 600-900 ppmv	150-180 ppmv 1500-1800 ppmv
	O_2	25% O_2	4-6% O_2	8-12 % O_2
	CO_2	30 % CO_2	5-8 % CO_2	10-14% CO_2
	NO_x	1500 ppmv	300-450 ppmv	750-900 ppmv
	SO_2 – Low range High range	1000 ppmv 3000 ppmv	200-300 ppmv 600-900 ppmv	500-600 ppmv 1500-1800 ppmv
Kiln Group 6 (Kiln 22 & 23 duct)	CO – Low range High range	300 ppmv 3000 ppmv	60-90 ppmv 600-900 ppmv	150-180 ppmv 1500-1800 ppmv
	O_2	25% O_2	4-6% O_2	8-12% O_2
	CO_2	30 % CO_2	5-8 % CO_2	10-14% CO_2
	NO_x	2000 ppmv	400-600 ppmv	1000-1200 ppmv
	SO_2	3000 ppmv	600-900 ppmv	1500-1800 ppmv
Scrubber Stack	SO_2	300 ppmv	60-90 ppmv	150-180 ppmv
	O_2	25% O_2	4-6% O_2	8-12% O_2

[a] For pollutant monitors only – does not apply to diluent monitors

It is the intent of the rule that a CGA be accomplished during a CD period in which no adjustments or repairs are made to the CEMS other than routine calibration adjustments performed as part of the daily CD determination. Adjustments to the CEMS prior to performing a CE to ensure successful completion of the CCA test shall not be made.

The CGA test will be performed as follows:

1. Connect the two appropriate span gases to the regulators designated for performing the automated CGA function.
2. Notify the operators in the control room that a CGA test is about to start.
3. Click the “CGA” icon on the graphical display.
4. The DAS and PLC are programmed to challenge the CEMS three times at each audit point and average the responses at each audit point. Lafarge follows the practice of not using the same audit bottle for successive challenges.
5. Print out the CGA test results.
6. Notify the control room when testing is complete.

5.2 Data Analysis

At the conclusion of each CGA test event, print out the Cylinder Gas Audit Report and evaluate the CGA test results against the appropriate acceptance criteria. Table 5-2 presents the acceptance criteria, which are specified in Section 5.2.3 of 40 CFR 60, Appendix F. Turn in the report to the Environmental Department. The CEM system is secured by utilizing password protection and only allowing authorized personnel to access the data.

Table 5-2. CGA Acceptance Criteria

CEMS	Acceptance Criterion
CO	15% of Gas Value or 5 ppm, whichever is greater
O_2	15% of Gas Value
CO_2	15% of Gas Value
NO_x	15% of Gas Value or 5 ppm, whichever is greater
SO_2	15% of Gas Value or 5 ppm, whichever is greater

5.3 Out-of-Control Period

If valid CGA test results are outside the acceptable limits then the CEMS is considered out of control. The necessary steps need to be taken to correct the problem and the CGA will need to be repeated. The end of the out-of-control period corresponds to the successful completion of the CGA test.

During the out-of control period, CEMS data cannot be used for calculating emissions compliance or for calculating meeting minimum data availability requirements.

The CGA test could identify a problem that would require corrective action to be taken. Section 7 discusses in detail corrective actions and resulting testing requirements.

5.4.1 Quarterly COMS Data Assessment

Determine the zero compensation for the COMS. Read the compensation value from the front panel display using the procedures found in the instrument manual. The compensation value must meet the criterion shown in Table 2-3.

Check the calibration error. Three neutral density filters meeting the requirements of 40 CFR Part 60, Appendix B, PS–1 must be placed in the COMS light beam path for at least three

nonconsecutive readings. All monitor responses must then be independently recorded from the COMS permanent data recorder. Responses must meet the criterion listed in Table 2-3.

Check the optical alignment. Observe the projected beam image from the alignment eyepiece window at the rear of the optical head assembly. The gun sight reticle should be centered on the beam image and that image should be centered on the retro-reflector. Alignment must conform to the criterion in Table 2-3.

6.0 Annual Data Quality Assessment

In addition to the daily and quarterly testing, the CEMS and COMS are required to undergo comprehensive testing on an annual basis. Table 6-1 summarizes the annual CEMS performance tests requirements for each specific CEMS. Annual testing will be conducted at least once every four calendar quarters. If the unit is off-line in the fourth quarter following the previous RATA, the RATA shall be performed in the quarter the unit commences operation.

Table 6-1. Annual CEMS Performance Test Requirements

Source	CEMS	Rule	Span	Annual Performance Testing		
				CD	RATA	CERMS RATA
Kiln Group 5	CO	40 CFR 60 App. B, PS-4A	300 ppmv 3000 ppmv	≤ 5% span for 6 of 7 consecutive days	≤ 10%, or 5% of the emission limit, or 5 ppmv @ 7% O_2	≤ 20%, or 10% of the emission limit, whichever is greater
	O_2	40 CFR 60 App. B, PS-3	25% O_2	≤ 0.5% span for 7 consecutive days	≤ 1% O_2	NA
	CO_2	40 CFR 60 App. B, PS-3	30% CO_2	≤ 0.5% span for 7 consecutive days	≤ 1% CO_2	NA
	NO_x	40 CFR 60 App. B, PS-2	1500 ppmv	≤ 2.5% span for 7 consecutive days	≤ 20%, or 10% of the emission limit if the RM average is below 50% of limit	≤ 20%, or 10% of the emission limit, whichever is greater
	SO_2		1000 ppmv 3000 ppmv	≤ 2.5% span for 7 consecutive days	≤ 20%, or 10% of the emission limit if the RM average is below 50% of limit	≤ 20%, or 10% of the emission limit, whichever is greater
	Flow	40 CFR 60 App. B, PS-6	0-0.5" WC	≤ 3% span for 7 consecutive days	NA	NA
Kiln Group 6	CO	40 CFR 60 App. B, PS-4	300 ppmv 3000 ppmv	≤ 5% span for 6 of 7 consecutive days	≤ 10%, or 5% of the emission limit, or 5 ppmv @ 7% O_2	≤ 20%, or 10% of the emission limit, whichever is greater
	O_2	40 CFR 60 App. B, PS-3	25%	≤ 0.5% span for 7 consecutive days	≤ 1% O_2	NA
	CO_2	40 CFR 60 App. B, PS-3	30% CO_2	≤ 0.5% span for 7 consecutive days	≤ 1% CO_2	NA
	NO_x	40 CFR 60 App. B, PS-2	2000 ppmv	≤ 2.5% span for 7 consecutive days	≤ 20%, or 10% of the emission limit if the RM average is below 50% of limit	≤ 20%, or 10% of the emission limit, whichever is greater
	SO_2		3000 ppmv (Kilns) 300 ppmv (Scrubber)	≤ 2.5% span for 7 consecutive days	≤ 20%, or 10% of the emission limit if the RM average is below 50% of limit	≤ 20%, or 10% of the emission limit, whichever is greater
	Flow	40 CFR 60 App. B, PS-6	0-0.5" WC	≤ 3% span for 7 consecutive days	NA	NA

6.1 Preliminary Activities

A qualified independent contractor will be required to assist in performing the EPA reference methods for the RATAs. At least 60 days prior to testing, a contractor should be selected and a test date scheduled.

6.2 Calibration Drift Test

The calibration drift test consist of challenging each CEMS for at least seven consecutive days as described in Section 4.0 of this document (Daily Data Quality Assessment) with no adjustments being made during the 24-hour period in between CD determinations except for normal, routine calibration adjustments. No adjustments or repairs may be made to the CEMS other than routine calibration adjustments performed immediately following the daily CD determination.

6.4 Relative Accuracy Test Audit

Page 11 of MDEQ-AQD CEMS Guidance Document states that the only annual testing a facility cannot perform itself is a relative accuracy test audit. A qualified consultant is required to perform a RATA for the CEMS as specified in Table 6-1. Because the RATA are conducted by an independent source, a detailed discussion of this procedure is not provided in this plan.

Ideally, the RATA test date should fall on the seventh day of the CD test period. It is the intent of this requirement to ensure no 'extra' calibrations or adjustments are made before or during a RATA to ensure success. If a RATA is not possible during the CD period, the RATA will be performed (1) after successful completion of the CD test, and (2) during a 24-hour period in which no adjustment or repairs were made other than routine calibration adjustments performed immediately after the daily CD.

6.5 COMS Annual Tests

You must perform the primary zero alignment method annually under clear path conditions. The COMS may be removed from its installation and setup under clear path conditions or, if the process is not operating and the monitor path is free of particulate matter, the zero alignment may be conducted at the installed site. The response difference in percent opacity to the clear path and simulated zero conditions must be recorded as the zero alignment error, and this error must meet the criteria listed in Table 2-3. The monitor must be removed from the stack at least once every three years for the zero alignment audit.

7.0 Corrective Action Program

This section discusses the procedures associated with the CEMS corrective action program. Maintenance and repair activities have been broken down into four categories. Each category is described below and the appropriate testing following corrective action is provided in Section 7.5.

7.1 Cleaning and Routine Maintenance

This category includes maintenance activities that do not require disassembly of components. This includes routine maintenance activities such as changing gas bottles, removing dirt and dust buildup, adjusting zero and span settings, changing peristaltic pump tubing, and other non-invasive procedures where disassembly of components is not required.

7.2 Minor Repair – No Replacement Part

This category includes repairs that are short in duration and require disassembly but no replacement parts are needed other than components normally considered consumable. Included in this category are activities such as replacing filters, removing condensate or particle build-up from inside the CEMS components, replacing pump diaphragms, pulling and inspecting the sample extraction probe from the duct and inspecting, fixing minor leaks, repairing loose or broken wiring, and adjusting DAS signal transmitters.

7.3 Major Repair – Identical Replacement Part

Maintenance and repair activities in this category involve component failure that requires it to be removed from service for repair or replaced. This would include repair or replacement of analyzers, analyzer components, system heaters, pumps, refrigerated condensers, sample probe, sample tubing, filter housings, and DAS components. Also included are situations where the sample distribution or extraction system is reconfigured or modified.

7.4 Major Repair – Non-Identical Replacement Part

This includes maintenance activities that involve a component failure that requires replacement or an upgrade of existing equipment with non-identical parts.

7.5 Corrective Action

Table 7-1 provides the appropriate CEMS testing that should be conducted following the various maintenance and repair activities for the CEMS components described above. The

purpose of the testing is to ensure the CEMS are operating within their regulatory requirements after maintenance has occurred, so that the data generated can continue to be used to demonstrate compliance.

Table 7-1. CEMS Test Requirements following CEMS Repair and Maintenance Activities

CEMS Component	Repair and Maintenance Category			
	Cleaning and Routine Maintenance	**Minor Repairs – No Replacement Parts**	**Major Repair – Identical Replacement Part**	**Major Repair – Non-Identical Replacement Part**
Sample Probe	No action	CD Test	CD Test	CGA
Heated Sample Line	No action	CD Test	CD Test	CGA
Sample Gas Conditioning System	No action	CD Test	CD Test	CGA
Sample and Analyzer Pumps	No action	CD Test	CD Test	CGA
Sample Gas Distribution System	CD Test	CD Test	CGA	CGA
Analyzer (component -- such as a detector or cell)	CD Test	CD Test	CGA	CGA
Analyzers (whole)	CD Test	CD Test	Recertify by appropriate PS	Recertify by appropriate PS
Data Acquisition System (component -- such as a transmitter, circuit board, display, etc.)	No action	CD Test	CD Test	CGA
Data Acquisition System (whole)	No action	CD Test	Recertify by appropriate PS	Recertify by appropriate PS
Opacity Monitor	Optical Alignment, Calibration Check		Optical Alignment Assessment, Clear Path Zero Assessment, Calibration Check	Recertify by PS-1

Note that as a general rule, major repairs will require that the linearity of the CEMS be verified with the notable exception of replacing an analyzer or DAS component with a non-identical replacement. As specified in MDEQ's CEMS Guidance Document, such a replacement requires that the entire performance specification test be performed. Also according to the CEMS Guidance Document, whenever a major component is replaced, the Michigan DEQ, AQD Compliance Support Unit should be contacted for appropriate notification of the change and guidance on possible recertification requirements.

As a general rule, if there were a question regarding which test is required, performing a Quarterly CGA would be a conservative measure. The automated DAS function that generates the Cylinder Gas Audit Report greatly simplifies and expedites a CGA test, so this conservative measure is of minimal burden.

8.0 Documentation and Reporting

All CEMS operations data, including daily emissions logs, calibration drift checks, and performance audits, must be documented and retained by the plant for 5 years. The following section describes the reporting requirements specified in the Renewable Operating Permit (ROP) for the Alpena Plant.

8.1 Conditions Requiring Immediate Reporting

The plant is required by Michigan Administrative Code Rule 912 (R 336.1212) to provide notice of any abnormal condition, start-up, shutdown, or malfunction that results in emissions of the monitored pollutants (CO, NO_x, or SO_2) continuing for more than two hours in excess of the permitted level, to the District Office of the AQD. The notice must be provided not later than two business days after the start-up, shutdown, or discovery of the abnormal conditions or malfunction, and can be made by any reasonable means, including electronic, telephonic, or oral communication. Written reports must be submitted to the District Supervisor within 10 days after the start-up or shutdown occurred, within 10 days after the abnormal conditions or malfunction has been corrected, or within 30 days of discovery of the abnormal conditions or malfunction, whichever is first. The written reports must be certified by a responsible official and include the following:

- The time and date, the probable causes for, and the duration of the event;
- Identification of the source involved and the magnitude of emissions in excess of the permit limit;
- The measures taken to minimize emissions; and
- The actions taken to correct and to prevent a reoccurrence.

8.2 Quarterly Reporting

A quarterly Excess Emissions Report (EER) must be submitted to the District Supervisor within 30 days following the end of each calendar quarter. The EER must include the magnitude and duration of each excursion of SO_2, NO_x, and CO above the permit limit. All concentrations shall be corrected to 7% oxygen on a dry gas basis and based on a 12-month rolling time period, as determined at the end of each calendar month. All mass emissions, expressed as pollutant pounds per ton clinker, shall be based on a 12-month rolling time period, as determined at the end of each calendar month. The EER must also include the cause of the excess emission, periods of CEMS downtime, any corrective action taken, and a

total operating time of the source. If no excess emissions or CEMS downtime occurred, the report must be submitted to indicate that fact.

Additionally, the results of the quarterly CGA or annual RATA for SO_2, NO_x, and CO CEMS must be submitted as a Data Assessment Report with the EER and summary reports.

8.3 Semiannual Reporting

The plant must prepare a semiannual report of the required monitoring to the District Office of the AQD, including identification of any deviations from the permit requirements during the reporting period. The report must be submitted by March 15 for the reporting period July 1 to December 31, and by September 15 for the reporting period January 1 to June 30.

8.4 Annual Reporting

The plant must prepare an annual statement signed by a responsible official certifying that the plant, including the CEMS, is operating in compliance with the ROP. The Report must be submitted to the District Office of the AQD before March 15 of the calendar year after the reporting period.

8.5 Report Distribution

Table 8-1 specifies CEMS report distribution. The Environmental Manager is responsible for Lafarge's internal report distribution and MDEQ report distribution. Annual reports to the MDEQ are due within 60 days of the completion of annual testing.

Table 8-1. Report Distribution

Report	CEMS Technician	Environmental Manager	CEMS Data Archive	MDEQ
Daily CD Reports			1 copy	
Quarterly Excess Emission Report		1 copy	1 copy	1 copy
Quarterly CGA and RATA Reports	1 copy	1 copy	1 copy	1 copy
Semiannual Monitoring Report		1 copy	1 copy	1 copy
Annual Certification of Compliance		1 copy		1 copy

APPENDIX

List of Contacts for CEMS Questions

List of Contacts for CEMS/DAS Questions

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