Quality Assurance/ Quality Control Plan

For

Graymont
Port Inland Plant
Gulliver, Michigan

Plan Prepared By

6960 Aviation Boulevard • Suite G
Glen Burnie, MD 21061 • (410) 859-5455 • FAX (410) 859-5457
e-mail: viminfo@vimtechnologies.com

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Quality Assurance / Quality Control Plan
Revisions History

Revision Number	Date of Revision	Reason(s) for Revision	Revised Pages
0	Nov 19	Original Edition	Original Pages

Central Document Control List

Document Number	Location
1	CEMS Shelter
2	HSE Specialist
3	Shared (408 R-Drive)

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1. Overview

Introduction

This plan was created to satisfy the requirements of 40 CFR 60, Subpart HH, 40 CFR 60 Appendix B and F, 40 CFR Part 63 Subpart AAAAA and Michigan Department of Environment, Great Lakes and Energy (EGLE) Permit Number MI-ROP-N7362-2015. The goal of the plan is to specify the operating and quality assurance and quality control (QA/QC) practices used by this facility that will ensure the integrity of the data collected by the CEMS for the purposes of demonstrating compliance with applicable emission limits for Kiln 1.

Objectives

A quality assurance/quality control (QA/QC) plan is an important component of any monitoring system. When integrated into the day-to-day operations, a QA/QC plan will accomplish the following:

1. Ensure that good QA/QC practices are being followed,
2. Reduce monitor downtime and long-term maintenance costs,
3. Improve data accuracy, and
4. Identify data quality issues so they may be resolved in a timely manner.

The purpose of this plan is to:

1. Identify quality assurance activities,
2. Identify responsibilities for the various elements of operating and maintaining a CEMS,
3. Ensure compliance with emissions limits, and
4. Ensure a successful agency audit of the CEMS.

Policy Statement

It is the policy of Graymont to fully comply with all aspects of the air emissions monitoring programs governing this facility. Each employee that has been assigned a responsibility for the CEMS shall carry out that responsibility fully. If the task cannot be completed according to the

procedures described in this manual, that person is responsible for notifying his supervisor of the problem.

Identification of Responsibilities

Quality assurance activities are those that verify the accuracy of the data being collected. These activities include system audits, quarterly testing, and relative accuracy test audits.

Quality control activities are the routine tasks that ensure the proper functioning of the system components. Such activities include daily calibration error checks, preventive maintenance, and corrective maintenance.

In addition to the QA and QC activities, a successful CEMS program requires planning, assessment of QA/QC results as well as of the data obtained from the CEMS, and a plan for implementing corrective actions.

Specific responsibilities have been assigned as detailed below. An organization chart depicting the relationships between the CEMS team members may be found in Figure 1.

Figure 1

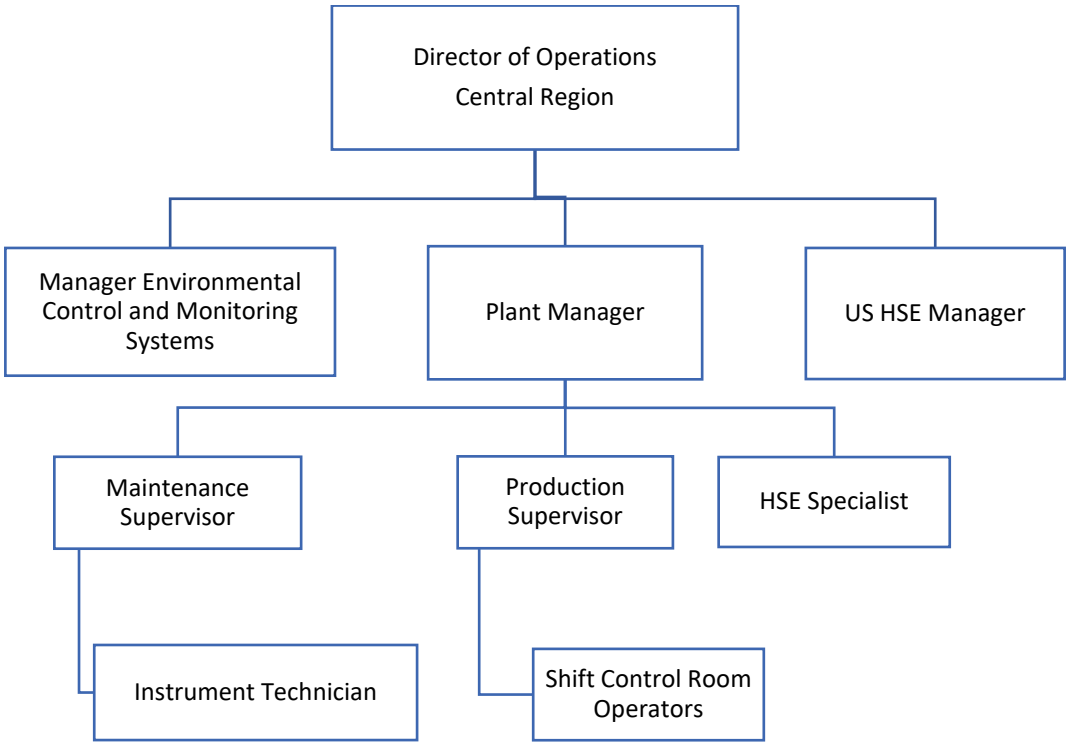

Table 1.1 – CEMS Responsibilities by Position

Position Title	*Responsibilities*
Central Region Director of Operations	• Directs and integrates activities of facility staff • Ensures that Port Inland is operated and maintained
Plant Manager	• Is responsible to the Central Region Director of Operations • Directs and integrates activities of Port Inland staff • Ensures that the plant is operated and maintained as intended • Ensures that operations conform to laws and regulations, contracts, policies, and prudent utility practices
US HSE Manager	• Is responsible to the Central Region Director of Operations • Serves as a liaison between Graymont and EPA, as well as between Graymont and EGLE
Manager, Environmental Control and Monitoring Systems	• Is responsible to the Central Region Director of Operations and US HSE Manager • Oversees CEMS data collection at Port Inland • Oversees monitoring program QA/QC across Graymont • Standardizes QA/QC Plans across Graymont
Production Supervisor	• Is responsible to the Plant Manager • Oversees the Shift Control Room Operators • Notifies the HSE Specialist of excess emissions due to an operational problem
Maintenance Supervisor	• Is responsible to the Plant Manager • Oversees the Instrumentation Technician and Electricians • Notifies the HSE Specialist of any malfunction or maintenance activities of the CEMS system.
HSE Specialist	• Is responsible to the Plant Manager • Oversees CEMS data collections at Port Inland • Manages the CEMS operations and maintenance activities • Advises the Plant Manager on the condition of the CEMS equipment • Enters reason codes for excess emissions into the plant logbook and DAHS • Provides emissions reports to Plant Manager for signature and submission to EGLE • Contacts the vendor/contractor for service assistance

	• Acknowledges CEMS downtime events that deal with maintenance or QA activities • Advises Instrumentation Technician of CEMS problems detected • Reduces, validates, and evaluates CEMS data • Edits Data Acquisition and Handling System (DAHS) data • Ensures that files of information concerning the operation of the CEMSs are maintained for five years • Provides CEMS and DAHS training as needed • Conducts quarterly cylinder gas audits with assistance from Instrumentation Technician and Electricians • Approves recommendations of consultants and staff regarding equipment, personnel, and training needs • Develops and implements CEMS procedures • Ensures that the requirements of this document are carried out in a timely manner • Initiates and coordinates revisions to the QA plan • Once signed by the Plant Manager, submits data reports to the state and federal regulatory agencies • Acts as Port Inland contact for EGLE • Coordinates and schedules relative accuracy test audits (RATAs) • Submits quarterly excess emissions reports to EPA and EGLE • Notifies management that emissions reports have been sent to regulatory agencies • Notifies EGLE of conditions that are expected to create excess emissions • Submits quarterly excess emissions reports to EPA and EGLE • Supports the activities of Instrumentation Technician and Electrician involved with the CEMS • Maintains the CEMS Logbook • Conducts a routine visual inspection of the CEMS components located in the CEMS enclosure • Ensures that a supply of certified calibration gas is always available • Ensures that the field operation requirements of this document are carried out in a timely manner

Instrumentation Technician	• Is responsible to the Maintenance Supervisor • Maintains the calibration gas bottle certificates of analysis • Maintains CEMS spare parts and calibration gas inventories • Conduct the QC Activities (e.g. calibration checks, calibrations, corrective actions, routine preventative maintenance, and corrective maintenance as needed • Maintains the CEMS Logbook along with the HSE Specialist • Performs corrective maintenance in response to CEMS alarms • Checks daily monitor calibrations and notifies HSE Specialist of calibration exceedances and impending maintenance activities • Support CEMS Consultant/Technical Advisor for any testing
Electrician	• Perform routine or emergency maintenance when Instrumentation Technician is unavailable. • Work with Instrumentation Technician and HSE Specialist on routine tests such as; quarterly audits, analyzer maintenance and troubleshooting
Control Room Operators (CRO)	• Is responsible to the Production Supervisor • Notifies the Production Supervisor and/or initiates actions to reduce excess emissions if they are due to an operational problem • Notifies Instrumentation Technician of monitor malfunctions and alarms
CEMS Consultant/Technical Advisor	• Provides CEMS training as needed • Advises the HSE Specialist on the interpretation of EPA and EGLE regulations and policies • Conducts RATAs • Conducts compliance testing • Prepares reports for all auditing and testing activities performed by CEMS consultant/Technical Advisor

QA/QC Plan Document Control

This QA/QC Plan will be reviewed annually, and any changes and revisions will be provided to all appropriate parties. In the event a major revision to the QA/QC Plan is required, each copy will be reissued to the appropriate person. All revisions to this plan, or any section(s) within, will be clearly documented in the Central Document Control List.

When modifications to the QA/QC plan become necessary, the Graymont Port Inland HSE Specialist is responsible for ensuring that all revisions in the new QA/QC plan update, and distribution of these revisions are provided to all applicable parties.

The QA/QC Plan will be sent to the EGLE Air Quality Division for their review and comment. Any changes or revisions to the Plan will also be forwarded to the EGLE.

Maintenance of the QA/QC Plan

The HSE Specialist maintains the original master copy online as a read-only document. Hard copies of the entire plan or only pertinent sections are available to be updated at any time.

To properly maintain the QA/QC Plan, the following activities are monitored:

- Maintain a current list of QA/QC plan holders.
- Prepare revisions and updates of the QA/QC Plan as a result of the following:
    - Changes in regulations
    - Modifications or improvements of QA/QC procedures.
    - Changes in personnel or organization.
    - Replacement of CEMS components.
    - Modifications to operating permit.

The current revision of each section of the QA/QC plan is documented in the Central Document Control List section. The revision number and date for the plan will be notated on the Revisions History table at the front of the plan.

2. System Details

Facility Description

The Graymont Port Inland Plant is in the upper peninsula of Michigan in Schoolcraft County. The facility is a lime plant with a maximum daily production of 870 tons of lime. There is one 200-foot long rotary kiln (Kiln 1) with a pre-heater and lime cooler. Kiln 1 mainly combusts coal to produce lime. Diesel fuel may be used as a secondary fuel during startups and for flame stabilization during startup and shutdown of the kiln. The kiln, fuels combusted, and control devices are summarized in Table 2.1 below:

Table 2.1 – Listing of Kilns

Kiln	*Capacity*	*Type*	*Fuels*	*Controls*
1	870 tons/day	Kiln	Coal, Diesel and Propane	Modular Baghouse

Summary of Systems

The plant is subject to these regulatory programs that require CEMS:

- 40 CFR Part 60
- 40 CFR Part 60, Subpart HH
- 40 CFR Part 63, Subpart AAAAA
- EGLE Air Quality Operating Permit #MI-ROP-N7362-2015

In order to accomplish this reporting, the following systems are used to monitor emissions, as well as various other parameters that must also be reported:

Table 2.2 – Listing of Monitoring Systems Used at Facility

Pollutant	*Kiln #1*
Opacity	×
NOx	×
CO	×
Stack flow	×

CEMS-Related Emissions Limitations

Several regulatory sources govern the installation and operation of CEMS for this kiln. An overview of these sources is presented below:

Table 2.3 – Listing of Applicable Regulatory Sources

Limits	*Regulation Source*
NO_x Emissions	• 40 CFR 60 • EGLE Air Quality Operating Permit #MI-ROP-N7362-2015
CO Emissions	• 40 CFR 60 • EGLE Air Quality Operating Permit #MI-ROP-N7362-2015
Opacity Emissions	• 40 CFR 60 and 63 • EGLE Air Quality Operating Permit #MI-ROP-N7362-2015

A listing of the CEMS-related regulatory requirements that exist for this facility is presented below:

Table 2.4 – Listing of Specific Limits

Kiln	*Parameter*	*Average*	*Limit*
1	NOx (lb/hr)	24-hour rolling	132.6
1	NOx (tons)	12-month rolling	532
1	CO (lb/hr)	24-hour rolling	113.2
1	CO (tons)	12-month rolling	456
1	Opacity (%)	6-minute	10

Monitoring Equipment Details

The CEMS analyzer components for Kiln 1consists of two pollutant monitors (NOx, CO), an opacity monitor, and a stack flow monitor. The CEMS uses a wet dilution extractive sampling system. The stack flow

measurements are in-situ (wet) measurements utilizing a differential pressure system.

The table below details the components currently in use:

Table 2.5 – Listing of Components

Monitor	*Kiln 1*
NOx Monitor	Thermo Scientific 42i S/N 117860003
CO Monitor	Thermo Scientific 48i S/N 1170860004
Opacity Monitor	Teledyne Lighthawk 560 S/N 5602914
PLC	Allen Bradley Compact Logix 1769-L33ER S/N 4531
DAHS	VIM Technologies CEMLink 6 S/N 4531
Sample Probe	M&C SP 2006-DIL S/N 24922/2085038

Analyzers

- NOx Monitor

The Thermo Scientific Model 42i analyzer uses the chemiluminescent method of detection to analyze the stack gas sample for concentrations of NOx. A chemiluminescent analyzer is based on the principle that nitric oxide (NO) and ozone (O3) react to produce a characteristic luminescence having an intensity that is linearly proportional to the NO concentration. The stack sample is drawn into the analyzer, where it is filtered for particulate, then to the NO2-to-NO converter, followed by the reaction chamber. Ozone that is generated from dry air is reacted with the NO in the sample to produce electronically excited NO2 molecules. When excited NO2 molecules decay to lower energy states, they emit infrared light, the intensity of which can be measured. A photomultiplier tube detects the intensity of the NO2 luminescence.

- CO Monitor

The Thermo Scientific Model 48i dual range analyzer operates on the principle that carbon monoxide (CO) absorbs infrared radiation at a wavelength of 4.6 microns. The sample is drawn into the analyzers through the sample bulkhead. The sample flows through the optical bench. Radiation from an infrared source is chopped and then passes through a gas filter alternating between CO and dinitrogen (N2). The radiation then passes through a narrow bandpass interference filter and enters the optical bench where absorption by the sample gas occurs. The infrared radiation then exits the optical bench and falls on an infrared detector.

The CO gas filter acts to produce a reference beam which cannot be further attenuated by CO in the sample cell. The N2 side of the filter wheel is transparent to the infrared radiation and therefore produces a measurement beam which can be absorbed by CO in the cell. The chopped detector signal is modulated by the alternation between the two gas filters with an amplitude related to the concentration of CO in the sample cell. Other gases do not cause modulation of the detector signal since they absorb the reference and measure beams equally. Thus, the GFC system responds specifically to CO.

- Flow Monitor

The EMRC stack volumetric flow monitoring system is a differential pressure system utilizing a Type-S pitot tube. The velocity pressure is measured using a pressure transducer. The average stack gas velocity is the product of a velocity constant, the pitot calibration coefficient, and the square root of the stack temperature multiplied by the delta p divided by the stack pressure and the molecular weight of the stack gas. The stack gas velocity and the stack cross-sectional area are used to calculate stack flow rate.

- Opacity Monitor

The Teledyne/Monitor Labs Lighthawk 560 opacity analyzer uses the principle of transmissometry to measure the visibility reduction known as opacity. In the analyzer, a beam of light is generated in the optical heat and directed across the stack to a reflector that returns the beam back on itself. The amount of transmitted light is subtracted from one to yield the amount of light obscured, or the opacity.

If the stack diameter at the location of the transmissometer is different from that at the stack exit, the opacity reading must be corrected. This is

done by simply applying a correction factor that is based on the ratio between the two internal stack diameters. Port Inland does not have a tapered stack.

The continuous opacity monitoring system (COMS) sensing units (i.e. transceiver and reflector) on Kiln 1 is bolted to flanges across the centerline of the stack on 82-inches diameter vertical stack downstream of the baghouse and ID fan. Kiln 1 stack height is 120.1 feet tall. This meets all Performance Specification 1, Section 8.1 monitor location and light path placements.

- Sampling System

Kiln 1 has its own exhaust stack. The CEMS has an M&C Products SP 2006 dilution extractive probe installed in the kiln exhaust stack. The dilution ratio is 50:1. The Kiln 1 sample probe located 64 feet from the top of the stack. There is a dilution extractive sample probe, heated umbilical line, NO_x/CO/Opacity, and flow rate analyzer on the kiln stack.

- Data Acquisition and Handling System

The VIM Technologies CEMLink 6 Data Acquisition and Handling System (DAHS) receives, processes, stores, displays, and reports emissions data from the CEMS equipment. The DAHS is designed such that the system control and the data acquisition are independent hardware systems. The DAHS consists of an Allen Bradley programmable logic controller (PLC) and a polling computer. The DAHS performs algorithms for data validation, generates reports, stores data on the hard drive, and provides operator interface.

The PLC controls the system with all the input/output ports required to operate the CEMS and interface with any plant parameters, including such tasks as:

- Automatic calibration of the analyzers at selected time intervals
- Automatic control of sample system purging
- Provision of status outputs and failure alarms for the sample conditioning system and analyzers
- Short- data collection and alarming
- Raw data validation and first-level averaging
- Performs calibration correction of analyzer outputs

Note that all CEMS, including the DAHS, must always use Eastern Standard time for data recording throughout the year.

Analyzer Span and Range Values

The values for each instrument span are shown in the table below.

Table 2.6 – Instrument Values

Kiln 1 Analyzer Ranges

Parameter	*K1 Span*
NOx	800 ppmw
CO (dual range)	2000 ppmw (low) 20000 ppmw (high)
Flow	1 inch of H_2O wscfh
Opacity	40 %

DAHS Configuration Details

Each DAHS is configured differently according to the programs to which the source is subject, and the requirements of the source's operating permit. This section will detail various aspects of the configuration that are unique to this installation.

Determination of the Process Status

A status bit will be used to indicate the kiln operating status. A kiln offline digital input will be used to define the operational status of each kiln. Data Validation will be based on the kiln operating status.

The status bits used in this configuration are:

- Online. Fuel flow initiates with Kiln Offline digital input changes from false to true and the Kiln Startup/Shutdown digital input is true.
- Offline. Kiln Offline Digital Input is false
- Data validation procedures are applied to all CEMS averages while the kiln is online (Online).
- A Part 60 operating hour requires the lime be generated for 1 minute in an hour. The hourly kiln status bit for an operating hour will be set to online if any 1-minute in the hour.

Data Validation and Averaging

The following data validation rules will be used by the DAHS to generate averages. Only valid readings will be used to build an average. All analyzer readings are assigned a status bit. All invalid averages will be assigned a status bit which can be used to determine CEMS downtimes. Typical reasons to invalidate CEMS data are: Process down, failed a daily calibration check, analyzer malfunction, sample conditioning malfunction, maintenance, QA/QC tests, etc. The source must be operating for a reading to be considered valid.

- 1-minute average. This parameter will consist of six readings taken at 10-second intervals. If any one of these six 10-second readings are invalid, the resulting 1-minute average will be considered invalid.

- 6-Minute Block Average (40CFR60.13(h), 40CFR63.8(g)(2)): The average will consist of all six 1-minute block averages for the 6-minute block period (total of 36 readings). The resulting 6-minute average will be considered invalid if any 1-minute average is invalid. The 6-minute blocks span minute intervals of 00-05, 06-11, 12-17, 18-23, 24-29, 30-35, 36-41, 42-47, 48-53, and 54-59

- 1-hour block average (Part 60 standard Subpart A §60.13h): The average will include all the valid operating (startup, shutdown, or normal operation) 1-minute averages for an hour starting with minute 00 through minute 59. A valid 1-hour average shall be computed from four or more data points equally spaced over each 1-hour period (ex. one valid minute in each 15-minute quadrant of the hour), unless the source is in calibration or maintenance, in which case only 2 quadrants of data are required. Data recorded prior to a failed calibration event can't be used in the validity determination for the hour. Only one data point needs to be collected per operating quadrant for New Source Performance Standards (NSPS) subparts that require partial operating hour reporting.

- 24-Hour rolling arithmetic average (VIM Standard): The average will consist of all the valid 1-hour averages that occur for (24) successive operating hours, including the current hour. The 24-hour rolling averages will be updated every hour. All 24-hour averages will be calculated as an arithmetic mean. Data validity will be evaluated once

the data set contains twenty-four hours. A valid 24-hour rolling average must consist of at least one valid 1-hour average.

- 12-Month Rolling Average or Total: The average or total will include all the valid 1-hour averages for the current month and the eleven previous months. All operating hours (startup, shutdown, normal operation) will be included in the calculation. For totals, 1-hour mass or volumetric rates will be scaled to the true mass or volume produced or consumed in the hour by multiplying the rate by the kiln or fuel operating time for the hour.

The table below details the types of data averages constructed by the PLC and DAHS for each parameter using the CEMS analyzer readings and distributed control system (DCS) signals:

Table 2.7 – CEMS Data Averaging

Description	1-Min	6-Min	1-Hr	24-Hr	Month Avg.	12-Month Rolling	Comments
NO_x ppmw	☒	☐	☒	☐	☐	☐	
NO_x lb/hr	☒	☐	☒	☒	☐	☐	24 hr Roll
NOx tons	☐	☐	☐	☒	☒	☒	12 month Roll
CO Selected ppmw	☒	☐	☒	☐	☐	☐	Dual Range
CO Low ppmw	☒	☐	☒	☐	☐	☐	
CO High ppmw	☒	☐	☒	☐	☐	☐	
CO lb/hr	☒	☐	☒	☒	☐	☐	24 hr Roll
CO tons	☐	☐	☐	☒	☒	☒	12 month Roll
Kiln Flow DP	☒	☐	☒	☒	☐	☐	
Kiln Stack Flow scfh	☒	☐	☒	☐	☐	☐	
Opacity %	☒	☒	☐	☐	☐	☐	

Equations Used to Calculate Emissions

Data from these monitoring systems is processed by the front-end processor into hourly averages. The calculations are identical for all kilns.

- NO_x and CO mass (lb/hr) is measured and calculated as follows: Equation 2.6

$$E_h = \mathrm{K}\, C_h\, Q_h$$

where
E_h - pollutant mass emission rate, lb/hr.
C_h - pollutant concentration, ppm (wet)
K - 1.194 x 10-7 for NOx, (lb/scf)/ppm
- 7.267 x 10-8 for CO, (lb/scf)/ppm
Q_h - Stack volumetric flow rate, wet basis, scfh

- Calculate the velocity of the stack gas using stack temperature and delta p measurements. Reference: 40 CFR 60, Appendix A, Method 2, Equation 2-7.

$$v_S = K_P \; x \; C_P \; x \; \sqrt{\Delta P_S} \; x \; \sqrt{\frac{T_S}{P_S \; x \; MW_S}}$$

- Calculate volumetric stack flow using stack velocity. Reference: 40 CFR 60 Appendix A, Method 2, Equation 2-8

$$\mathrm{Q}_{sd} = 3600 \; x \; (1 - B_{ws}) \; x \; v_s \; x \; A \; x \left(\frac{P_S}{P_{STD}}\right) \; x \left(\frac{T_{STD}}{T_S}\right)$$

Where:
Q_{sd} - dry standard volumetric stack flow, dscf/hour or dscm/hour for metric
V_S - stack velocity, ft/sec or m/sec metric
T_S - stack temperature, °R = °F + 460 or °K = °C + 273 metric
T_{STD} - absolute stack temperature, fixed value of 528 °R for English or 293 °K for metric
ΔP_S - Stack differential pressure, in. H_2O or mm H_2O metric
K_P - pitot constant, fixed value of 85.49 English or 34.97 metric, dimensionless
C_P - pitot coefficient, fixed value of 0.84 (typical for S-pitot type)
P_S - stack absolute static pressure, in. Hg or mm Hg metric
P_{STD} - standard absolute pressure, fixed value of 29.92 in. Hg or 760 mm Hg metric
MW_S - gas density, lb/lb-mole or g/g-mole metric (operator entered constant)
A - cross-sectional area of the stack, sq. ft or sq. meters (operator entered constant) – 82”
B_{WS} - proportion by volume of water vapor in gas stream, (%H2O/100) – 7%
3600 - conversion factor, sec/hour

Notes:
1. Wet stack flow is same equation with BWS= 0 % moisture.

2. In Hg = PSIA x 2.036 = hPa x 0.02953
3. Replace 3600 x VS x A in Equation 2-8 with the analyzer acf/min reading if the analyzer outputs this measurement.

Reports

The DAHS will provide the CEMS downtime and excess emissions reports in the standard VIM format. These reports can be printed on a daily, monthly, quarterly, or semi-annual basis and will contain the following items.

- EPA Summary Report. The EPA Summary report will list all the CEMS downtime totals and the Excess Emissions totals (by the EPA category) on a single page report. The report format is based on the requirements listed in 40CFR60.7. The duration for opacity reports will be in 6-minute periods and all other reports will be in hours, unless specified otherwise.

- Downtime Logs. All downtime periods will be determined using the status bit of an average. An invalid average will be assigned an appropriate status bit. A downtime incident occurs whenever an invalid average occurs during an operating hour. A single downtime incident will start with the first invalid operating hour and will end with a valid average or a non-operating average. The status bit of the first invalid average is assigned to the whole downtime incident. Each compliance event has a Corrective Action field, which can be manually edited in the Alarms/Events screen. This screen will also allow the reason and action codes to be changed for each incident. Individual downtime reports will be provided for each downtime log. There are two types of downtime logs:

  - CEMS Downtime Logs. This log will be built using the status bit of a major compliance parameter for lb/hr averages. Duration will be listed in hours.
  - Opacity Downtime Logs. These logs are built using the status bit of the opacity 6-minute averages. Duration will be listed in 6-minute periods. The following status bits will not be included as Downtime Events: Automatic Calibration.

Table 2.8 below details the parameters for which downtime logs will be supplied:

Table 2.8 – Downtime Logs

Description	Parameter	Exclusions	EPA Codes	Notes
NO_x	P60 1-hour NO_x lb/hr		☑	List in EPA Summary Report
NO_x	P60 1-hour NO_x ppmw		☑	List in EPA Summary Report
CO	P60 1-hour CO ppmw		☑	List in EPA Summary Report
CO	P60 1-hour CO lb/hr		☑	List in EPA Summary Report
Opacity	P60 6-minute block	SU/SD	☑	List in EPA Summary Report
Opacity	P60 6-minute block		☑	List in EPA Summary Report
Stack Diff Press	P60-1-hour Diff Press inwc		☑	List in EPA Summary Report

- Excess Emission Logs. The duration of the excess emission incident will include all consecutive averages that are above the emission limit (Note: an alternative method is to produce a separate incident record for each average above the excess emission limit). Each incident will contain a field for the following: Start Date/Time, End Date/Time, an incident average, the maximum value for the incident, and a Reason/Corrective Action description. If an EPA Summary report is produced using this log then an EPA excess emission category will be provided for each incident. Refer to 40CFR60.7 for more information on the EPA categories. The Alarms/Events screen will have a compliance event for each Excess Emission, which will allow someone to enter the Reason/Corrective Action description and change the EPA category as necessary. Individual Excess Emission reports will be provided for each log. The following table lists the parameters for which excess emissions reports will be supplied:

Table 2.9 – Excess Emission Logs

Description	Parameter	Limit	EPA Summary Report	Notes
Opacity	P60 6-minute block	> 10%	☑	Exclude startup and shutdown
NOx lb/hr	P60 24-hour rolling average	> 132.6	☑	
NOx tons	P60 12-month rolling average	>532	☑	

CO lb/hr	P60 24-hour rolling average	>113.2	☑	
CO tons	P60 12-month rolling average	>456	☑	

Data Assessment Reports

The Data Assessment Procedure 3 requires a "Data Assessment Report" (DAR) to be filled out and submitted along with the quarterly excess emissions reports.

At a minimum, the DAR must include the following information:

- Name of person completing the report and facility address;
- Identification and location of your COMS;
- Manufacturer, model, and serial number of your COMS;
- Assessment of COMS data accuracy/ acceptability and date of assessment as determined by a performance audit. If the audit results show your COMS to be out of control, you must report both the audit results showing your COMS to be out of control and the results of the audit following corrective action showing your COMS to be operating within specifications
- Summary of all corrective actions you took when you determined your COMS was out of control.

The Data Assessment Procedure 1 requires a "Data Assessment Report" (DAR) to be filled out and submitted along with the quarterly excess emissions reports.

As a minimum, the DAR must contain the following information:

- Source owner or operator name and address.
- Identification and location of monitors in the CEMS.
- Manufacturer and model number of each monitor in the CEMS.
- Assessment of CEMS data accuracy and date of assessment as determined by a RATA, RAA, or CGA including the RA for the RATA, the A for the RAA or CGA, the RM results, the cylinder gases certified values, the CEMS responses, and the calculations results. If the accuracy audit results show the CEMS to be out-of-control, the CEMS operator shall report both the audit results showing the CEMS to be out-of-control and the results of the audit following corrective action showing the CEMS to be operating within specifications.
- Results from EPA performance audit samples.
- Summary of all corrective actions taken when CEMS was determined out-of-control.

Please see the DAR templates in Appendix B of the plan.

Security and Data Backup

Physical system integrity is an important component of quality assurance and quality control activities. This chapter details the means by which the CEMS is secured against fraudulent acts or damage from untrained employees.

- Password and Menu Security

In addition to the file and account protection provided by the Microsoft Windows operating system, the software provides system and program-level security to guard against data access and modification by unauthorized personnel. System security consists of an individual user ID/password entry requirement for logging on to the system, except for general instrumentation & control technicians and control room operators, who share a low-level password. Standard higher-level IDs and passwords are set up by the software vendor for performing specific system management functions such as software upgrade installation and job status management, and for database entry functions, such as correcting operating data. Passwords and user IDs are maintained by the HSE Specialist.

- Data Backup

Data backups are automatically scheduled and initiated by the Scheduler on the DAHS at the same time every day. The backup is a complete backup event where the entire database is written to the storage media.

The backup routine copies the data to an external hard drive that is connected to the DAHS server, which is located in the CEMS shelter. Each month, the Instrumentation Technician will check the directory on this external drive to ensure that the backup copy was made, by verifying that the file dates are stamped with the previous day's date.

Because the backup routine simply copies the database files to a hard drive that is in the same physical vicinity of the DAHS, an additional backup to a removable media external hard drive will be performed once each month to safeguard against physical hard drive malfunctions or

physical damage to the environment in which the backup device is located. Procedure *CEMS-101 Data backup* will be followed.

- Disaster Recovery

In the event of power failure, the uninterruptible power supply (“UPS”) will perform an orderly shutdown. The UPS will also perform a reboot of the system when power is restored. A DAHS should never be turned off without following the proper system shutdown procedure.

- Physical Security

The server for the CEMS is located in the CEMS shelter.

3. QA/QC Activities

This chapter summarizes the purpose, frequency, performance criteria, and reporting and recordkeeping requirements for each activity identified in Chapter 1. Detailed instructions for conducting many of the activities are supplied in Procedures Section. The intent of this chapter is to provide an overall summary of the functions to illustrate their integration into the overall QA/QC program.

Data Management and Quality Control

Activities related to data management are implemented to ensure the accuracy, representativeness, and timeliness of the data being collected to be able to correct data collection problems and generate accurate reports within the time frames required by the regulations.

Each day, the hourly data, alarm, downtime and excess emission data that was generated by the previous day's operation is reviewed and processed by HSE Specialist. The exception to the daily review and processing frequency is on weekends or holidays, when multiple days may be reviewed and processed to "catch up" the backlog. Each person who has a role in data management activities should develop a sense of what "normal" data ranges are for that kiln. The daily data review must be meaningful and timely. Data indicating equipment malfunctions will be reported to the appropriate personnel, as necessary, immediately so that corrective action can be scheduled to minimize system downtime and invalid data periods.

Each quarter an Excess Emissions Report (EER) and Data Assessment Report (DAR) is also prepared and submitted to the EGLE Air Quality Division within 30 days of the end of the quarter. Before the report is generated, all relevant records for the quarter should be processed, reason and action codes must be verified for any excess emissions, and all downtime periods must be properly coded. The EER and DAR must then be reviewed to ensure completeness and accuracy.

Analyzer Quality Assurance

Analyzer quality assurance activities ensure that the analyzers are collecting data that is accurate and is acceptable according to Part 60

provisions. Please see eCFR for Part 60, Appendix B and Appendix F references. Since this is the very basis of determining valid data, it is imperative that these activities be carried out as quickly as is possible to avoid large segments of missing data.

- Calibrations

A CEMS calibration drift check must be performed at least once daily (approximately 24 hours) at zero and high-level values for gaseous analyzers, opacity monitors, and stack flow monitors.

Each morning, the Instrumentation Technician is responsible for evaluating the daily calibration report for that day to ensure that each analyzer passed its calibration test and is functioning properly. If the calibration (either for the span range or the zero range) for an analyzer is at the pre-determined action level, Instrumentation Technician will initiate corrective action consisting of a re-zero and a re-span. A logbook entry detailing the problem and the corrective work performed will be filled out. Since a calibration failure marks the start of the out-of-control period, corrective action should be started immediately. All corrective actions must be followed by a full system “hands-off” calibration to show that the data collection system is now functioning properly and to establish the end of the out-of-control period.

Judgment should be exercised when performing analyzer adjustments. If the calibration error greatly exceeds the allowable range, there is likely more wrong with the analyzer than a simple recalibration will correct. In fact, re-spanning or re-zeroing the analyzer in that situation will not result in accurate data collection for the long-term.

The analyzer calibration value will be recorded using a minute average that starts 60 seconds before the end of the step and includes values at 10-second intervals. The minute average will be built using instantaneous raw or pressure corrected values, as required for that analyzer.

Out-of-Control (OOC) Criteria. An analyzer will be declared out-of-control (OOC) as follows:

- When the performance specifications (PS) for 40 CFR 60 have not been met.

Part 60 Opacity Analyzers. The analyzer is immediately declared OOC whenever the calibration drift exceeds 2 times the PS drift (2%). Data is

invalid forward in time until a calibration check occurs that is within the drift limits.

Table 3.1 Calibration Drift Limits

Analyzer	Warning Limit: 2 X Performance Specification	Out of Control Limit: 2 X Performance Specification for 5 Consecutive Days	Out of Control Limit: 4 X Performance Specification for 1 Day
NOx	5.0% of span	5.0% of span	10.0% of span
CO	10.0% of span	10.0% of span	20.0% of span
Opacity	4.0% of span	4.0% of span	8.0% of span
Flow	6.0% of span	6.0% of span	12.0% of span

According to Part 60, if the daily calibration drift for NOx, CO and flow exceeds two times the applicable Performance Specification an adjustment is required to be made to the analyzer and an auto calibration drift check is performed.

Auditing Requirements

Each CEMS must be audited at least once each calendar quarter. Successive quarterly audits shall occur no close than two months (60 days) in accordance with 40 CFR 60, Appendix F, Procedure 1. A RATA must be conducted at least once every four calendar quarters. A CGA may be conducted in three of every four calendar quarters, but in no more than three quarters in succession. The opacity filter audit will be conducted quarterly in accordance with 40 CFR 60, Appendix F, Procedure 3.

- Cylinder Gas Audits (CGA)

Each quarter, the HSE Specialist and Instrumentation Technician assigned to CEMS performs a system check to verify proper operation of all components. This check includes checking gas cylinder pressures, sampling system operation, and analyzer operation. A checklist is used to record that the work was done and the findings of the inspections. The procedure titled *CEMS-305 Quarterly Preventative Maintenance* describes the items to be inspected and includes a copy of the checklist.

A CGA is a two-level check using calibration gases of known concentrations, and three injections are made for both gas levels. Please see procedure titled *CEMS-204 Quarterly Cylinder Gas Audit*. These test results are submitted only to EGLE in the quarterly reports as part of the DAR.

Table 3.2 Cylinder Gas Audit Acceptance Limits

Analyzer	Performance Specification
NOx	15% of reference or 5 ppm (whichever is greater)
CO	15% of reference or 5 ppm (whichever is greater)

- Opacity Filter Audit

Each quarter, the HSE Specialist and Instrumentation Technician assigned to CEMS performs a system check to verify proper operation of all components. This includes the alignment, filters, and continuous opacity monitoring system. A checklist is used to record that the work was done and the findings of the inspections. Please see *CEMS-305 Quarterly PM*.

A filter audit is a three-point calibration error test of the COMS using calibration attenuators, for five nonconsecutive readings. Please see procedure titled *CEMS-205 Quarterly Opacity Audit*. These test results are submitted only to the EGLE Air Quality Division in the quarterly reports as part of the DAR.

An annual opacity clear stack test is performed by the HSE Specialist and Instrumentation Technician. Please see the procedure titled *CEMS-207 Annual Opacity Clear Stack.* The test results are submitted to the EGLE Air Quality Division in in the associated quarterly report that the test was performed.

Table 3.3 Opacity Filter Audit Limits

Analyzer	Performance Specification
Opacity	<3% for each of the attenuator filters

- Relative Accuracy Test Audit (RATA)

Once each year each monitor or monitoring system undergoes a RATA. This test requires that an independent testing firm be retained to concurrently measure emissions, which are then compared against CEMS-measured emissions, and the statistical difference is calculated. The RATA is scheduled by the HSE Specialist. The RATA results are entered into the DAHS for processing and reporting to EPA and the state agency, and an audit report is prepared by the test vendor and reviewed by the HSE Specialist and CEMS Consultant/Technical Advisor.

Table 3.4 Relative Accuracy Acceptance Limits

Analyzer	Calculation Method	Relative Accuracy
NOx	If average emissions during the RATA are ≥50% of emission standard (use Eq 2-6 with RM in denominator)	≤20%
NOx	If average emissions during the RATA are <50% of emission standard (use Eq 2-6 with emission standard in denominator)	≤10%
CO	If average emissions during the RATA are ≥50% of emission standard (use Eq 2-6 with RM in denominator)	≤10%
CO	If average emissions during the RATA are <50% of emission standard (use Eq 2-6 with emission standard in denominator)	≤5%
Flow Rate	Using RM for flow rate	≤20%

▶ Additional Guidance for Quality Assurance

Maintaining an adequate supply of calibration gases is critical to the success of the CEMS. Once each week, the Instrumentation Technician performs an inventory of the calibration gases remaining in the CEM shelter. Replacement stock for empty or expired cylinders is then re-ordered. The Instrumentation Technician notifies the HSE Specialist of cylinder changes and then files the cylinder certification forms when the cylinders are taken out of service. All cylinder details are also verified along with the data.

Corrective actions, audits, and maintenance activities should be performed as to generate valid hourly averages whenever possible. The *Daily, Weekly, Quarterly, and Annual Checks* details the conditions that generate valid hourly averages. All maintenance activities must be followed by a full system “hands-off” calibration and must be logged.

Alarm Management

CEMS alarms will be detected from the analyzers, the sampling system, and the DAHS and sent to the distributive controls system (DCS) consoles in the plant control room. Control room operators are responsible for responding to alarms on the CEMS by initiating appropriate corrective action. They do not, however, assign reason codes or action codes. The HSE Specialist assigns reason and action codes to exceedances and suspect alarms. The Instrumentation Technician will assign them in the absence of the HSE Specialist. Upon return of the HSE Specialist to the plant, they will review codes entered by the Instrumentation Technician. Control room operators are responsible for calling out an Instrumentation Technician.

Recordkeeping Activities

General recordkeeping requirements for continuous emissions monitoring systems are detailed in and §60.7. Records should be kept on site of all measurements, data, reports, audits and maintenance logs for at least 5 years from the date the record was created (Part 60 requires retention for 2 years; the facility’s Title V Air Operating Permit requires a 5-year retention). These records should be kept in an organized manor suitable for inspection by the EGLE or EPA representatives.

There are several elements of documentation for the CEMS. The first, hardware maintenance, has been previously described, and is detailed in several procedures. The second has also been described: assignment of missing data period reason and action codes. These codes will be reviewed by the HSE Specialist in the review of the quarterly reports.

The third type of documentation is the requirement that the monitoring plan for the system be kept current. All changes in hardware, software, or configuration must be detailed and submitted to the EPA in both paper and electronic form. This is the combined responsibility of the plant staff and the HSE Specialist.

The final type of documentation consists of records documenting that this plan was reviewed each year, and the discussions and changes made as a result of those reviews. This documentation will be located in the Environmental archived files.

On a quarterly basis, the designated representative (DR) or alternate designated representative (ADR) must certify the accuracy and completeness of all CEMS records submitted, including the CEMS quarterly reports. In order to make this certification, the DR and/or ADR should receive copies of the following CEMS records:

- Cylinder Gas Audit Test Reports
- RATA Test Reports
- Quarterly Maintenance Checklists
- Logbooks
- Quarterly CEMS Report (electronic)

Reporting Activities

Reports for this facility are filed under these programs:

- Various sections of Title 40 of the Code of Federal Regulations including 40 CFR Part 60
- 40 CFR 63, Subpart AAAAA for Lime Manufacturing Plants
- EGLE Air Quality Division Operating Permit MI-ROP-N7362-2015

Each of the required reports is discussed below:

- An Excess Emission Report (EER) and/or Summary Report shall be generated for each calendar quarter and submitted to the EGLE within 30 days following the end of each calendar quarter. This report specifies the date, time, duration, and magnitude of any exceedance of an emission standard that is monitored by a continuous monitoring system (CEMS or COMS). The report also specifies the date, time, duration, and cause of any period when the CEMS/COMS was inoperative, as well as the nature of the system repairs or adjustments. Specific identification of any period of excess emission that occurred during startup, shutdown, or process malfunction events shall also be submitted, as well as the nature and cause of the malfunction and a description of the corrective action taken, or preventive measures adopted.

An Excess Emission Report (EER) and/or Summary Report will be generated and submitted for NOx, CO and Opacity, as specified in Permit MI-ROP-N7362-2015, Section VII, condition 4 for Kiln 1.The report also contains a listing of any quarterly audit test or relative accuracy test audit (RATA) performed during the reporting period. The EER accompanying quality data will be submitted to EGLE in the format of the attached Graymont DAR template report in Appendix B.

Spare Parts

A list of spare parts that are maintained on-site for maintenance and malfunction/repairs is included in Appendix C.

4. Procedures

For many of the activities identified in this manual, procedures have been written to provide step-by-step instructions for executing that task. The procedures are presented in numeric order; the table of contents below lists them by topic of interest.

Table A.1 – Listing of Procedures by Topic

Analyzer Quality Assurance

Maintenance Activities

Miscellaneous

4. Procedures

PROCEDURE 1. QUALITY ASSURANCE REQUIREMENTS FOR GAS CONTINUOUS EMISSION MONITORING SYSTEMS USED FOR COMPLIANCE DETERMINATION

1. Applicability and Principle

1.1 Applicability. Procedure 1 is used to evaluate the effectiveness of quality control (QC) and quality assurance (QA) procedures and the quality of data produced by any continuous emission monitoring system (CEMS) that is used for determining compliance with the emission standards on a continuous basis as specified in the applicable regulation. The CEMS may include pollutant (e.g., $S0_2$ and $N0_x$) and diluent (e.g., 0_2 or $C0_2$) monitors.

This procedure specifies the minimum QA requirements necessary for the control and assessment of the quality of CEMS data submitted to the Environmental Protection Agency (EPA). Source owners and operators responsible for one or more CEMS's used for compliance monitoring must meet these minimum requirements and are encouraged to develop and implement a more extensive QA program or to continue such programs where they already exist.

Data collected as a result of QA and QC measures required in this procedure are to be submitted to the Agency. These data are to be used by both the Agency and the CEMS operator in assessing the effectiveness of the CEMS QC and QA procedures in the maintenance of acceptable CEMS operation and valid emission data.

Appendix F, Procedure 1 is applicable December 4, 1987. The first CEMS accuracy assessment shall be a relative accuracy test audit (RATA) (see section 5) and shall be completed by March 4, 1988 or the date of the initial performance test required by the applicable regulation, whichever is later.

1.2 Principle. The QA procedures consist of two distinct and equally important functions. One function is the assessment of the quality of the CEMS data by estimating accuracy. The other function is the control and improvement of the quality of the CEMS data by implementing QC policies and corrective actions. These two functions form a control loop: When the assessment function indicates that the data quality is inadequate, the control effort must be increased until the data quality is acceptable. In order to provide uniformity in the assessment and reporting of data quality, this procedure explicitly specifies the assessment methods for response drift and accuracy. The methods are based on procedures included in the applicable performance specifications (PS's) in appendix B of 40 CFR part 60. Procedure 1 also requires the analysis of the EPA audit samples concurrent with certain reference method (RM) analyses as specified in the applicable RM's.

Because the control and corrective action function encompasses a variety of policies, specifications, standards, and corrective measures, this procedure treats QC requirements in

general terms to allow each source owner or operator to develop a QC system that is most effective and efficient for the circumstances.

2. Definitions

2.1 Continuous Emission Monitoring System. The total equipment required for the determination of a gas concentration or emission rate.

2.2 Diluent Gas. A major gaseous constituent in a gaseous pollutant mixture. For combustion sources, CO_2 and O_2 are the major gaseous constituents of interest.

2.3 Span Value. The upper limit of a gas concentration measurement range that is specified for affected source categories in the applicable subpart of the regulation.

2.4 Zero, Low-Level, and High-Level Values. The CEMS response values related to the source specific span value. Determination of zero, low-level, and high-level values is defined in the appropriate PS in appendix B of this part.

2.5 Calibration Drift (CD). The difference in the CEMS output reading from a reference value after a period of operation during which no unscheduled maintenance, repair or adjustment took place. The reference value may be supplied by a cylinder gas, gas cell, or optical filter and need not be certified.

2.6 Relative Accuracy (RA). The absolute mean difference between the gas concentration or emission rate determined by the CEMS and the value determined by the RM's plus the 2.5 percent error confidence coefficient of a series of tests divided by the mean of the RM tests or the applicable emission limit.

3. QC Requirements

Each source owner or operator must develop and implement a QC program. As a minimum, each QC program must include written procedures which should describe in detail, complete, step-bystep procedures and operations for each of the following activities:

1. Calibration of CEMS.

2. CD determination and adjustment of CEMS.

3. Preventive maintenance of CEMS (including spare parts inventory).

4. Data recording, calculations, and reporting.

5. Accuracy audit procedures including sampling and analysis methods.

6. Program of corrective action for malfunctioning CEMS.

As described in section 5.2, whenever excessive inaccuracies occur for two consecutive quarters, the source owner or operator must revise the current written procedures or modify or replace the CEMS to correct the deficiency causing the excessive inaccuracies.

These written procedures must be kept on record and available for inspection by the enforcement agency.

4. CD Assessment

4.1 CD Requirement. As described in 40 CFR 60.13(d), source owners and operators of CEMS must check, record, and quantify the CD at two concentration values at least once daily (approximately 24 hours) in accordance with the method prescribed by the manufacturer. The CEMS calibration must, as minimum, be adjusted whenever the daily zero (or low-level) CD or the daily high-level CD exceeds two times the limits of the applicable PS's in appendix B of this regulation.

4.2 Recording Requirement for Automatic CD Adjusting Monitors. Monitors that automatically adjust the data to the corrected calibration values (e.g., microprocessor control) must be programmed to record the unadjusted concentration measured in the CD prior to resetting the calibration, if performed, or record the amount of adjustment.

4.3 Criteria for Excessive CD. If either the zero (or low-level) or high-level CD result exceeds twice the applicable drift specification in appendix B for five, consecutive, daily periods, the CEMS is out-of-control. If either the zero (or low-level) or high-level CD result exceeds four times the applicable drift specification in appendix B during any CD check, the CEMS is out-ofcontrol. If the CEMS is out-of-control, take necessary corrective action. Following corrective action, repeat the CD checks.

4.3.1 Out-Of-Control Period Definition. The beginning of the out-of-control period is the time corresponding to the completion of the fifth, consecutive, daily CD check with a CD in excess of two times the allowable limit, or the time corresponding to the completion of the daily CD check preceding the daily CD check that results in a CD in excess of four times the allowable limit. The end of the out-of-control period is the time corresponding to the completion of the CD check following corrective action that results in the CD's at both the zero (or low-level) and high-level measurement points being within the corresponding allowable CD limit (i.e., either two times or four times the allowable limit in appendix B).

4.3.2 CEMS Data Status During Out-of-Control Period. During the period the CEMS is out-ofcontrol, the CEMS data may not be used in calculating emission compliance nor be counted towards meeting minimum data availability as required and described in the applicable subpart [e.g., §60.47a(f)].

4.4 Data Recording and Reporting. As required in §60.7(d) of this regulation (40 CFR part 60), all measurements from the CEMS must be retained on file by the source owner for at least 2 years. However, emission data obtained on each successive day while the CEMS is out-ofcontrol

may not be included as part of the minimum daily data requirement of the applicable subpart [e.g., §60.47a(f)] nor be used in the calculation of reported emissions for that period.

5. Data Accuracy Assessment

5.1 Auditing Requirements. Each CEMS must be audited at least once each calendar quarter. Successive quarterly audits shall occur no closer than 2 months. The audits shall be conducted as follows:

5.1.1 Relative Accuracy Test Audit (RATA). The RATA must be conducted at least once every four calendar quarters, except as otherwise noted in section 5.1.4 of this appendix. Conduct the RATA as described for the RA test procedure in the applicable PS in appendix B (e.g., PS 2 for SO_2 and NO_X). In addition, analyze the appropriate performance audit samples received from EPA as described in the applicable sampling methods (e.g., Methods 6 and 7).

5.1.2 Cylinder Gas Audit (CGA). If applicable, a CGA may be conducted in three of four calendar quarters, but in no more than three quarters in succession.

To conduct a CGA: (1) Challenge the CEMS (both pollutant and diluent portions of the CEMS, if applicable) with an audit gas of known concentration at two points within the following ranges:

	Audit range		
		Diluent monitors for—	
Audit point	**Pollutant monitors**	**CO_2**	**O_2**
1	20 to 30% of span value	5 to 8% by volume	4 to 6% by volume.
2	50 to 60% of span value	10 to 14% by volume	8 to 12% by volume.

Introduce each of the audit gases, three times each for a total of six challenges. Introduce the gases in such a manner that the entire CEMS is challenged. Do not introduce the same gas concentration twice in succession.

Use of separate audit gas cylinder for audit points 1 and 2. Do not dilute gas from audit cylinder when challenging the CEMS.

The monitor should be challenged at each audit point for a sufficient period of time to assure adsorption-desorption of the CEMS sample transport surfaces has stabilized.

(2) Operate each monitor in its normal sampling mode, i.e., pass the audit gas through all filters, scrubbers, conditioners, and other monitor components used during normal sampling, and as much of the sampling probe as is practical. At a minimum, the audit gas should be introduced at the connection between the probe and the sample line.

(3) Use Certified Reference Materials (CRM's) (See Citation 1) audit gases that have been certified by comparison to National Institute of Standards and Technology (NIST) Standard Reference Materials (SRM's) or EPA Protocol Gases following the most recent edition of the EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (See Citation 2). Procedures for preparation of CRM's are described in Citation 1. Procedures for preparation of EPA Protocol Gases are described in Citation 2. In the case that a suitable audit gas level is not commercially available, Method 205 (See Citation 3) may be used to dilute CRM's or EPA Protocol Gases to the needed level. The difference between the actual concentration of the audit gas and the concentration indicated by the monitor is used to assess the accuracy of the CEMS.

5.1.3 Relative Accuracy Audit (RAA). The RAA may be conducted three of four calendar quarters, but in no more than three quarters in succession. To conduct a RAA, follow the procedure described in the applicable PS in appendix B for the relative accuracy test, except that only three sets of measurement data are required. Analyses of EPA performance audit samples are also required.

The relative difference between the mean of the RM values and the mean of the CEMS responses will be used to assess the accuracy of the CEMS.

5.1.4 Other Alternative Audits. Other alternative audit procedures may be used as approved by the Administrator for three of four calendar quarters. One RATA is required at least every four calendar quarters, except in the case where the affected facility is off-line (does not operate) in the fourth calendar quarter since the quarter of the previous RATA. In that case, the RATA shall be performed in the quarter in which the unit recommences operation. Also, cylinder gas audits are not be required for calendar quarters in which the affected facility does not operate.

5.2 Excessive Audit Inaccuracy. If the RA, using the RATA, CGA, or RAA exceeds the criteria in section 5.2.3, the CEMS is out-of-control. If the CEMS is out-of-control, take necessary corrective action to eliminate the problem. Following corrective action, the source owner or operator must audit the CEMS with a RATA, CGA, or RAA to determine if the CEMS is operating within the specifications. A RATA must always be used following an out-of-control period resulting from a RATA. The audit following corrective action does not require analysis of EPA performance audit samples. If audit results show the CEMS to be out-of-control, the CEMS operator shall report both the audit showing the CEMS to be out-of-control and the results of the audit following corrective action showing the CEMS to be operating within specifications.

5.2.1 Out-Of-Control Period Definition. The beginning of the out-of-control period is the time corresponding to the completion of the sampling for the RATA, RAA, or CGA. The end of the out-of-control period is the time corresponding to the completion of the sampling of the subsequent successful audit.

5.2.2 CEMS Data Status During Out-Of-Control Period. During the period the monitor is out-ofcontrol, the CEMS data may not be used in calculating emission compliance nor be counted towards meeting minimum data availability as required and described in the applicable subpart [e.g., §60.47a(f)].

5.2.3 Criteria for Excessive Audit Inaccuracy. Unless specified otherwise in the applicable subpart, the criteria for excessive inaccuracy are:

(1) For the RATA, the allowable RA in the applicable PS in appendix B.

(2) For the CGA, ±15 percent of the average audit value or ±5 ppm, whichever is greater.

(3) For the RAA, ±15 percent of the three run average or ±7.5 percent of the applicable standard, whichever is greater.

5.3 Criteria for Acceptable QC Procedure. Repeated excessive inaccuracies (i.e., out-of-control conditions resulting from the quarterly audits) indicates the QC procedures are inadequate or that the CEMS is incapable of providing quality data. Therefore, whenever excessive inaccuracies occur for two consecutive quarters, the source owner or operator must revise the QC procedures (see section 3) or modify or replace the CEMS.

6. Calculations for CEMS Data Accuracy

6.1 RATA RA Calculation. Follow the equations described in section 8 of appendix B, PS 2 to calculate the RA for the RATA. The RATA must be calculated in units of the applicable emission standard (e.g., ng/J).

6.2 RAA Accuracy Calculation. Use the calculation procedure in the relevant performance specification to calculate the accuracy for the RAA. The RAA must be calculated in the units of the applicable emission standard.

6.3 CGA Accuracy Calculation. Use Equation 1-1 to calculate the accuracy for the CGA, which is calculated in units of the appropriate concentration (e.g., ppm SO_2 or percent O_2). Each component of the CEMS must meet the acceptable accuracy requirement.

$$A = \frac{C_m - C_a}{C_a} \times 100 \qquad Eq.\ 1\text{-}1$$

where:

A = Accuracy of the CEMS, percent.

C_m = Average CEMS response during audit in units of applicable standard or appropriate concentration.

C_a = Average audit value (CGA certified value or three-run average for RAA) in units of applicable standard or appropriate concentration.

6.4 Example Accuracy Calculations. Example calculations for the RATA, RAA, and CGA are available in Citation 3.

7. Reporting Requirements

At the reporting interval specified in the applicable regulation, report for each CEMS the accuracy results from section 6 and the CD assessment results from section 4. Report the drift and accuracy information as a Data Assessment Report (DAR), and include one copy of this DAR for each quarterly audit with the report of emissions required under the applicable subparts of this part.

As a minimum, the DAR must contain the following information:

1. Source owner or operator name and address.

2. Identification and location of monitors in the CEMS.

3. Manufacturer and model number of each monitor in the CEMS.

4. Assessment of CEMS data accuracy and date of assessment as determined by a RATA, RAA, or CGA described in section 5 including the RA for the RATA, the A for the RAA or CGA, the RM results, the cylinder gases certified values, the CEMS responses, and the calculations results as defined in section 6. If the accuracy audit results show the CEMS to be out-of-control, the CEMS operator shall report both the audit results showing the CEMS to be out-of-control and the results of the audit following corrective action showing the CEMS to be operating within specifications.

5. Results from EPA performance audit samples described in section 5 and the applicable RM's.

6. Summary of all corrective actions taken when CEMS was determined out-of-control, as described in sections 4 and 5.

An example of a DAR format is shown in Figure 1.

8. Bibliography

1. "A Procedure for Establishing Traceability of Gas Mixtures to Certain National Bureau of Standards Standard Reference Materials." Joint publication by NBS and EPA-600/7-81-010, Revised 1989. Available from the U.S. Environmental Protection Agency. Quality Assurance Division (MD-77). Research Triangle Park, NC 27711.

2. "EPA Traceability Protocol For Assay And Certification Of Gaseous Calibration Standards." EPA-600/R-97/121, September 1997. Available from EPA's Emission Measurement Center at *http://www.epa.gov/ttn/emc.*

3. Method 205, "Verification of Gas Dilution Systems for Field Instrument Calibrations," 40 CFR 51, appendix M.

FIGURE 1—EXAMPLE FORMAT FOR DATA ASSESSMENT REPORT Period ending date

Year
Company name
Plant name Source unit no. CEMS
manufacturer Model no.
CEMS serial no.
CEMS type (e.g., in situ)
CEMS sampling location (e.g., control device outlet)

CEMS span values as per the applicable regulation: _____ (e.g., SO_2 ____ ppm, NO_X ____ ppm). _____

I. Accuracy assessment results (Complete A, B, or C below for each CEMS or for each pollutant and diluent analyzer, as applicable.) If the quarterly audit results show the CEMS to be out-of-control, report the results of both the quarterly audit and the audit following corrective action showing the CEMS to be operating properly.

A. Relative accuracy test audit (RATA) for ____ (e.g., SO_2 in ng/J).

1. Date of audit ____.

2. Reference methods (RM's) used ____ (e.g., Methods 3 and 6).

3. Average RM value ____ (e.g., ng/J, mg/dsm^3, or percent volume).

4. Average CEMS value ____.

5. Absolute value of mean difference [d] ____.

6. Confidence coefficient [CC] ____.

7. Percent relative accuracy (RA) ____ percent.

8. EPA performance audit results:

a. Audit lot number (1) ____ (2) ____

b. Audit sample number (1) ____ (2) ____

c. Results (mg/dsm^3) (1) ____ (2) ____

d. Actual value (mg/dsm^3)* (1) ____ (2) ____

e. Relative error* (1) ____ (2) ____

B. Cylinder gas audit (CGA) for ____ (e.g., SO_2 in ppm).

	Audit point 1	**Audit point 2**	
1. Date of audit			
2. Cylinder ID number			
3. Date of certification			
4. Type of certification			(e.g., EPA Protocol 1 or CRM).
5. Certified audit value			(e.g., ppm).
6. CEMS response value			(e.g., ppm).
7. Accuracy			percent.

C. Relative accuracy audit (RAA) for ____ (e.g., SO_2 in ng/J).

1. Date of audit ____.

2. Reference methods (RM's) used ____ (e.g., Methods 3 and 6).

3. Average RM value ____ (e.g., ng/J).

4. Average CEMS value ____.

5. Accuracy ____ percent.

6. EPA performance audit results:

a. Audit lot number (1) ____ (2) ____

b. Audit sample number (1) ____ (2) ____

c. Results (mg/dsm^3) (1) ____ (2) ____

d. Actual value (mg/dsm^3) *(1) ____ (2)

e. Relative error* (1) ____ (2) ____

*To be completed by the Agency.

D. Corrective action for excessive inaccuracy.

1. Out-of-control periods.

a. Date(s) ____.

b. Number of days ____.

2. Corrective action taken

3. Results of audit following corrective action. (Use format of A, B, or C above, as applicable.)

II. Calibration drift assessment. A.

Out-of-control periods.

1. Date(s) ____.

2. Number of days ____.

B. Corrective action taken

PROCEDURE 3—QUALITY ASSURANCE REQUIREMENTS FOR CONTINUOUS OPACITY MONITORING SYSTEMS AT STATIONARY SOURCES

1.0 What are the purpose and applicability of Procedure 3?

The purpose of Procedure 3 is to establish quality assurance and quality control (QA/QC) procedures for continuous opacity monitoring systems (COMS). Procedure 3 applies to COMS used to demonstrate continuous compliance with opacity standards specified in new source performance standards (NSPS) promulgated by EPA pursuant to section 111(b) of the Clean Air Act, 42 U.S.C. 7411(b)—Standards of Performance for New Stationary Sources.

1.1 *What are the data quality objectives of Procedure 3?* The overall data quality objective (DQO) of Procedure 3 is the generation of valid and representative opacity data. Procedure 3 specifies the minimum requirements for controlling and assessing the quality of COMS data submitted to us or the delegated regulatory agency. Procedure 3 requires you to perform periodic evaluations of a COMS performance and to develop and implement QA/QC programs to ensure that COMS data quality is maintained.

1.2 *What is the intent of the QA/QC procedures specified in Procedure 3?* Procedure 3 is intended to establish the minimum QA/QC requirements to verify and maintain an acceptable level of quality of the data produced by COMS. It is presented in general terms to allow you to develop a program that is most effective for your circumstances.

1.3 *When must I comply with Procedure 3?* You must comply with Procedure 3 no later than November 12, 2014.

2.0 What are the basic functions of Procedure 3?

The basic functions of Procedure 3 are assessment of the quality of your COMS data and control and improvement of the quality of the data by implementing QC requirements and corrective actions. Procedure 3 provides requirements for:

(1) Daily instrument zero and upscale drift checks and status indicators checks;

(2) Quarterly performance audits which include the following assessments:

(i) Optical alignment,

(ii) Calibration error, and

(iii) Zero compensation.

Sources that achieve quality assured data for four consecutive quarters may reduce their auditing frequency to semi-annual. If a performance audit is failed, the source must resume quarterly testing for that audit requirement until it again demonstrates successful performance over four consecutive quarters.

(3) Annual zero alignment.

3.0 What special definitions apply to Procedure 3?

The definitions in Procedure 3 include those provided in Performance Specification 1 (PS-1) of Appendix B of this part and ASTM D6216-12 and the following additional definitions.

3.1 Out-of-control periods. Out-of-control periods mean that one or more COMS parameters falls outside of the acceptable limits established by this rule.

(1) *Daily Assessments.* Whenever the calibration drift (CD) exceeds twice the specification of PS-1, the COMS is out-of-control. The beginning of the out-of-control period is the time corresponding to the completion of the daily calibration drift check. The end of the out-of-control period is the time corresponding to the completion of appropriate adjustment and subsequent successful CD assessment.

(2) *Quarterly and Annual Assessments.* Whenever an annual zero alignment or quarterly performance audit fails to meet the criteria established in paragraphs (2) and (3) of section 10.4, the COMS is out-of-control. The beginning of the out-of-control period is the time corresponding to the completion of the performance audit indicating the failure to meet these established criteria. The end of the out-of-control period is the time corresponding to the completion of appropriate corrective actions and the subsequent successful audit (or, if applicable, partial audit).

4.0 What interferences must I avoid?

Opacity cannot be measured accurately in the presence of condensed water vapor. Thus, COMS opacity compliance determinations cannot be made when condensed water vapor is present, such as downstream of a wet scrubber without a reheater or at other saturated flue gas locations. Therefore, COMS must be located where condensed water vapor is not present.

5.0 What do I need to know to ensure the safety of persons using Procedure 3?

Those implementing Procedure 3 may be exposed to hazardous materials, operations and equipment. Procedure 3 does not purport to address all of the safety issues associated with its use. It is your responsibility to establish appropriate health and safety practices and determine the applicable regulatory limitations before performing this procedure. You should consult the COMS user's manual for specific precautions to take.

6.0 What equipment and supplies do I need?

The equipment and supplies that you need are specified in PS-1. You are not required to purchase a new COMS if your existing COMS meets the requirements specified in Procedure 3.

7.0 What reagents and standards do I need?

The reagents and standards that you need are specified in PS-1. You are not required to purchase a new COMS if your existing COMS meets the requirements specified in Procedure 3.

8.0 What sample collection, preservation, storage, and transport are relevant to this procedure? [Reserved]

9.0 What quality control measures are required by this procedure for my COMS?

You must develop and implement a QC program for your COMS. Your QC program must, at a minimum, include written procedures which describe in detail complete step-by-step procedures and operations for the activities in paragraphs (1) through (4):

(1) Procedures for performing drift checks, including both zero and upscale drift and the status indicators check,

(2) Procedures for performing quarterly performance audits,

(3) A means of checking the zero alignment of the COMS, and

(4) A program of corrective action for a malfunctioning COMS. The corrective action must include, at a minimum, the requirements specified in section 10.5.

9.1 *What QA/QC documentation must I have?* You are required to keep the QA/QC written procedures required in section 9.0 on site and available for inspection by us, the state, and/or local enforcement agencies.

9.2 *What actions must I take if I fail QC audits?* If you fail two consecutive annual audits, two consecutive quarterly audits, or five consecutive daily checks, you must either revise your QC procedures or determine if your COMS is malfunctioning. If you determine that your COMS is malfunctioning, you must take the necessary corrective action as specified in section 10.5. If you determine that your COMS requires extensive repairs, you may use a substitute COMS provided the substitute meets the requirements in section 10.6.

10.0 What calibration and standardization procedures must I perform for my COMS?

(1) You must perform daily system checks to ensure proper operation of system electronics and optics, light and radiation sources and detectors, electric or electro-mechanical systems, and general stability of the system calibration. Daily is defined as any portion of a calendar day in which a unit operates.

(2) You must subject your COMS to a performance audit to include checks of the individual COMS components and factors affecting the accuracy of the monitoring data at least once per

QA operating quarter. A QA operating quarter is a calendar quarter in which a unit operates at least 168 hours.

(3) At least annually, you must perform a zero alignment by comparing the COMS simulated zero to the actual clear path zero. Annually is defined as a period wherein the unit is operating at least 28 days in a calendar year. The simulated zero device produces a simulated clear path condition or low-level opacity condition, where the energy reaching the detector is between 90 and 110 percent of the energy reaching the detector under actual clear path conditions.

10.1 *What daily system checks must I perform on my COMS?* The specific components required to undergo daily system checks will depend on the design details of your COMS. At a minimum, you must verify the system operating parameters listed in paragraphs (1) through (3) of this section. Some COMS may perform one or more of these functions automatically or as an integral portion of unit operations; other COMS may perform one or more of these functions manually.

(1) You must check the zero drift to ensure stability of your COMS response to the simulated zero device. The simulated zero device, an automated mechanism within the transmissometer that produces a simulated clear path condition or low-level opacity condition, is used to check the zero drift. You must, at a minimum, take corrective action on your COMS whenever the daily zero drift exceeds twice the applicable drift specification in section 13.3(6) of PS-1.

(2) You must check the upscale drift to ensure stability of your COMS response to the upscale drift value. The upscale calibration device, an automated mechanism (employing an attenuator or reduced reflectance device) within the transmissometer that produces an upscale opacity value is used to check the upscale drift. You must, at a minimum, take corrective action on your COMS whenever the daily upscale drift check exceeds twice the applicable drift specification in section 13.3(6) of PS-1.

(3) You must, at a minimum, check the status indicators, data acquisition system error messages, and other system self-diagnostic indicators. You must take appropriate corrective action based on the manufacturer's recommendations when the COMS is operating outside preset limits.

10.2 *What are the quarterly auditing requirements for my COMS?* At a minimum, the parameters listed in paragraphs (1) through (3) of this section must be included in the performance audit conducted on a quarterly basis as defined in section 10.0(2).

(1) For units with automatic zero compensation, you must determine the zero compensation for the COMS. The value of the zero compensation applied at the time of the audit must be calculated as equivalent opacity and corrected to stack exit conditions according to the procedures specified by the manufacturer. The compensation applied to the effluent by the monitor system must be recorded.

(2) You must conduct a three-point calibration error test of the COMS. Three calibration attenuators, either primary or secondary must meet the requirements of PS-1, with one exception. Instead of recalibrating the attenuators semi-annually, they must be recalibrated annually. If two annual calibrations agree within 0.5 percent opacity, the attenuators may then be calibrated once

every five years. The three attenuators 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. Additional guidance for conducting this test is included in section 8.1(3)(ii) of PS-1. The low-, mid-, and high-range calibration error results must be computed as the mean difference and 95 percent confidence interval for the difference between the expected and actual responses of the monitor as corrected to stack exit conditions. The equations necessary to perform the calculations are found in section 12.0 of PS-1. For the calibration error test method, you must use the external audit device. When the external audit device is installed, with no calibration attenuator inserted, the COMS measurement reading must be less than or equal to one percent opacity. You must also document procedures for properly handling and storing the external audit device and calibration attenuators within your written QC program.

(3) You must check the optical alignment of the COMS in accordance with the instrument manufacturer's recommendations. If the optical alignment varies with stack temperature, perform the optical alignment test when the unit is operating.

10.3 *What are the annual auditing requirements for my COMS?*

(1) You must perform the primary zero alignment method under clear path conditions. The COMS must be removed from its installation and set up under clear path conditions. There must be no adjustments to the monitor other than the establishment of the proper monitor path length and correct optical alignment of the COMS components. You must record the COMS response to a clear condition and to the COMS's simulated zero condition as percent opacity corrected to stack exit conditions. For a COMS with automatic zero compensation, you must disconnect or disable the zero compensation mechanism or record the amount of correction applied to the COMS's simulated zero condition. The response difference in percent opacity to the clear path and simulated zero conditions must be recorded as the zero alignment error. You must adjust the COMS's simulated zero device to provide the same response as the clear path condition as specified in paragraph (3) of section 10.0.

(2) As an alternative, monitors capable of allowing the installation of an external zero device may use the device for the zero alignment provided that: (1) The external zero device setting has been established for the monitor path length and recorded for the specific COMS by comparison of the COMS responses to the installed external zero device and to the clear path condition, and (2) the external zero device is demonstrated to be capable of producing a consistent zero response when it is repeatedly (i.e., three consecutive installations and removals prior to conducting the final zero alignment check) installed on the COMS. This can be demonstrated by either the manufacturer's certificate of conformance (MCOC) or actual on-site performance. The external zero device setting must be permanently set at the time of initial zeroing to the clear path zero value and protected when not in use to ensure that the setting equivalent to zero opacity does not change. The external zero device response must be checked and recorded prior to initiating the zero alignment. If the external zero device setting has changed, you must remove the COMS from the stack in order to reset the external zero device. If you employ an external zero device, you must perform the zero alignment audits with the COMS off the stack at least every three years. If the external zero device is adjusted within the three-year period, you must

perform the zero alignment with the COMS off the stack no later than three years from the date of adjustment.

(3) The procedure in section 6.8 of ASTM D6216-12 is allowed.

10.4 *What are my limits for excessive audit inaccuracy?* Unless specified otherwise in the applicable subpart, the criteria for excessive inaccuracy are listed in paragraphs (1) through (4).

(1) What is the criterion for excessive zero or upscale drift? Your COMS is out-of-control if either the zero drift check or upscale drift check exceeds twice the applicable drift specification in PS-1 for any one day.

(2) What is the criterion for excessive zero alignment? Your COMS is out-of-control if the zero alignment error exceeds 2 percent opacity.

(3) What is the criterion to pass the quarterly performance audit? Your COMS is out-of-control if the results of a quarterly performance audit indicate noncompliance with the following criteria:

(i) The optical alignment indicator does not show proper alignment (i.e., does not fall within a specific reference mark or condition).

(ii) The zero compensation exceeds 4 percent opacity, or

(iii) The calibration error exceeds 3 percent opacity.

(4) What is the criterion for data capture? You must adhere to the data capture criterion specified in the applicable subpart.

10.5 *What corrective action must I take if my COMS is malfunctioning?* You must have a corrective action program in place to address the repair and/or maintenance of your COMS. The corrective action program must address routine/preventative maintenance and various types of analyzer repairs. The corrective action program must establish what diagnostic testing must be performed after each type of activity to ensure that the COMS is collecting valid, quality-assured data. Recommended maintenance and repair procedures and diagnostic testing after repairs may be found in an associated guidance document.

10.6 *What requirements must I meet if I use a temporary opacity monitor?*

(1) In the event that your certified opacity monitor has to be removed for extended service, you may install a temporary replacement monitor to obtain required opacity emissions data provided that:

(i) The temporary monitor has been certified according to ASTM D6216-12 for which a MCOC has been provided;

(ii) The use of the temporary monitor does not exceed 1080 hours (45 days) of operation per year as a replacement for a fully certified opacity monitor. After that time, the analyzer must complete a full certification according to PS-1 prior to further use as a temporary replacement monitor. Once a temporary replacement monitor has been installed and required testing and adjustments have been successfully completed, it cannot be replaced by another temporary replacement monitor to avoid the full PS-1 certification testing required after 1080 hours (45 days) of use;

(iii) The temporary monitor has been installed and successfully completed an optical alignment assessment and status indicator assessment;

(iv) The temporary monitor has successfully completed an off-stack clear path zero assessment and zero calibration value adjustment procedure;

(v) The temporary monitor has successfully completed an abbreviated zero and upscale drift check consisting of seven zero and upscale calibration value drift checks which may be conducted within a 24-hour period with not more than one calibration drift check every three hours and not less than one calibration drift check every 25 hours. Calculated zero and upscale drift requirements are the same as specified for the normal PS-1 certification;

(vi) The temporary monitor has successfully completed a three-point calibration error test;

(vii) The upscale reference calibration check value of the new monitor has been updated in the associated data recording equipment;

(viii) The overall calibration of the monitor and data recording equipment has been verified; and

(ix) The user has documented all of the above in the maintenance log.

(2) Data generated by the temporary monitor is considered valid when paragraphs (i) through (ix) in this section have been met.

10.7 *When do out-of-control periods begin and end?* The out-of-control periods are as specified in section 3.1.

10.8 *What are the limitations on the use of my COMS data collected during out-of-control periods?* During the period your COMS is out-of-control, you may not use your COMS data to calculate emission compliance or to meet minimum data capture requirements in this procedure or the applicable regulation.

10.9 *What are the QA/QC reporting requirements for my COMS?* You must report in a Data Assessment Report (DAR) the information required by sections 10.0, 10.1, 10.2, and 10.3 for your COMS at the interval specified in the applicable regulation.

10.10 *What minimum information must I include in my DAR?* At a minimum, you must include the information listed in paragraphs (1) through (5) of this section in the DAR.

(1) Name of person completing the report and facility address,

(2) Identification and location of your COMS(s),

(3) Manufacturer, model, and serial number of your COMS(s),

(4) Assessment of COMS data accuracy/acceptability and date of assessment as determined by a performance audit described in section 10.0. If the accuracy audit results show your COMS to be out-of-control, you must report both the audit results showing your COMS to be out-of-control and the results of the audit following corrective action showing your COMS to be operating within specifications, and

(5) Summary of all corrective actions you took when you determined your COMS was out-of-control.

10.11 *Where and how long must I retain the QA data that this procedure requires me to record for my COMS?* You must keep the records required by this procedure for your COMS on site and available for inspection by us, the state, and/or the local enforcement agency for the period specified in the regulations requiring the use of COMS.

11.0 What analytical procedures apply to this procedure? [Reserved]

12.0 What calculations and data analysis must I perform for my COMS?The calculations required for the quarterly performance audit are in section 12.0 of PS-1.

13.0 Method Performance [Reserved]

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 References

16.1 Performance Specification 1-Specifications and Test Procedures for Continuous Opacity Monitoring Systems in Stationary Sources, 40 CFR part 60, Appendix B.

16.2 ASTM D6216-12-Standard Practice for Opacity Monitor Manufacturers to Certify Conformance with Design and Performance Specifications, American Society for Testing and Materials (ASTM).

17.0 What tables, diagrams, flowcharts, and validation data are relevant to this procedure? [Reserved]