**Example Quality Assurance / Quality Control Plan**

**for**

**Continuous Emission Monitor Systems**

**and**

**Continuous Opacity Monitor Systems**

**(CEMS/COMS)**

The following is an example of a Quality Assurance / Quality Control (QA/QC) Plan for Continuous Emissions Monitoring Systems or CEMS. This QA/QC Plan meets the minimum requirements of the Indiana State Rule 326 IAC 3-5-4 Standard Operating Procedures and Chapter 20 of the Indiana Quality Assurance Manual.

This example QA/QC Plan may be used as a guide for the construction of your CEMS QA/QC Plan. Please keep in mind that this example plan has the basic elements that comprise a good QA/QC Plan but, it may not cover all the areas that are specific to your plant's CEMS. Be sure to incorporate your specific operational knowledge, experience and applicable State and Federal requirements into the QA/QC Plan for your company. If you have any questions please call Jarrod Fisher at (317) 233-2723, fax at (317) 233-6865 or e-mail at jfisher@idem.in.gov.

NOTE:

***BOLD , UNDERLINED, UPPER CASE ITALICS*** in this Plan's text is intended for areas in which company names, boiler numbers or other text can be inserted. Text which is ***bold, underlined lower case italics*** is intended for areas where additional text may be inserted into the Plan.

# Continuous Emission Monitoring Systems

# (CEMS)

# Quality Assurance/Quality Control Plan

**for**

***COMPANY - PLANT***

***UNIT - MONITOR(S)***

***DATE***

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## 1.0 INTRODUCTION

A Quality Assurance (QA) Plan is the basis for assessing and maintaining of the quality of continuous emission monitoring data. This QA Plan has been prepared for the ***COMPANY*** operators of Continuous Emission Monitoring Systems (CEMS) at the ***PLANT NAME*** in ***CITY OR COUNTY***, Indiana. These CEMS are used for measurement of effluent pollution concentrations from boiler(s) No. ***BOILER NUMBER OR DESIGNATION*** and stack opacity from boilers number(s) ***BOILER NUMBER OR DESIGNATION***.

***In the Plan, list the CEMS covered by the Plan. For example:***
The following CEMS have been installed and certified at ***PLANT NAME:***

| CEM | BRAND-MODEL | SERIAL NUMBER | SPAN | LOCATION |
|---|---|---|---|---|
| NOx | TECO 42 | 42D-12345-269 | 1000 ppm | Unit #1-Stack A |
| CO2 | Milton Roy 3300 | N1 E03924 | 20% | Unit #1-Stack A |

These CEMS were installed to comply with the specific requirements of the ***OPERATING PERMIT, STATE RULE, FEDERAL REGULATION, AGREED ORDER, ETC***. These CEMS also provide process data to aid in the operation and the maintenance of the pollution control equipment required at this facility. This quality assurance plan was developed from guidelines developed by Indiana Department of Environmental Management, Office of Air Quality (IDEM - OAQ) and the U. S Environmental Protection Agency. All documents used in the development of this quality assurance plan are listed in Section 10, References.

## 1.1 QUALITY ASSURANCE AND QUALITY CONTROL (QA / QC) - DEFINITION AND FUNCTION

Quality Assurance and Quality Control are two independent and interrelated functions. First, Quality Assurance will be defined as a system of general programmatic activities implemented to ensure Quality Control is performing adequately. Whereas, Quality Control is defined as a series of specific activities performed to provide a reproducible quality product. Consequently, quality assurance serves as a "quality control" for the quality control function..

QA Plans consist of primarily two functions: (1) the QA function which is the assessment of the quality of the data (accuracy and precision) and, (2) the QC functions which are the activities that maintain or improve data quality. These two functions combined form a control loop. For instance, when accuracy or precision (a QA function) is unacceptable, QC functions must increase until the quality of the data is acceptable.

Quality Assurance involves meeting programmatic requirements but on occasion requires the implementation of external checks on data quality. These external checks may include independent system audits, third party sample and analysis for accuracy and precision, comparison to know calibration standards or interlaboratory audits.

Conversely, Quality Control functions are usually a series of frequent (daily, weekly, monthly) routine internal checks, such as system inspections, periodic calibrations, and routine maintenance. A complete Quality Assurance Plan encompasses both QA and QC functions and strives to identify which function is addressed by a specific activity.

## 1.2 QUALITY ASSURANCE POLICY, GOAL, AND OBJECTIVE

It is ***COMPANY NAME'S*** policy to efficiently operate and maintain its facilities and CEMS in accordance with good operating practices and all applicable local, state and federal environmental regulations. ***COMPANY NAME*** is committed to collecting all necessary data to demonstrate that its operations are in compliance with its operating permit. The ***COMPANY NAME*** is also committed to ensuring that all environmental control systems are operating within acceptable limits.

The goal of this QA program is to provide emission data of known and acceptable quality and in sufficient quantity to demonstrate compliance with the following air pollution emission and monitoring regulations:

***List the applicable regulations, for example:***

***40 CFR 60, SUBPART Db***
***INDIANA OPERATING PERMIT NO. XXXXX***
***40 CFR 60, APPENDIX F***
***40 CFR 60 APPENDIX B***
***326 IAC 3-1.1-4***

***COMPANY NAME*** recognizes that the reliability and acceptability of CEMS data is directly dependent on satisfactory completion of all activities stipulated in a well-defined QA plan. Accordingly, the objective of this QA Plan is to define those activities necessary to guarantee that CEMS data quality is maintained at acceptable levels. The Plan also provides the framework for carrying out QA activities by addressing items such as documentation, training, corrective actions, and preventive maintenance activities.

This Plan addresses other necessary support services and activities, such as manual methods source testing, data reduction, missing data routines, inventory control and report preparation and submittal, all of which are required to maintain data quality.

It should be noted that some QA/QC activities may not be discussed in as great detail as other more critical activities. Activities not fully discussed may include, but are not limited to, development of instrument maintenance manuals (usually provided by the manufacturer), procurement procedures, and plant operation procedures. These procedures are referenced is this QA Plan and may be updated as the CEM program develops through operational experience.

## 1.3 DISTRIBUTION AND DOCUMENT CONTROL

This QA Plan will be reviewed annually and any changes and revisions will be forwarded to all appropriate parties. In the event a major revision to the QA Plan is required, each copy will be reissued to all appropriate persons. All revisions to the Plan will be clearly marked on each page with a revision number and revision date.

When modifications to the QA Plan become necessary, ***TITLE*** is responsible for ensuring that current revisions are included in the QA Plan, and that distribution of the revised Plan is made to all appropriate parties.

A copy of this QA Plan will be sent to the Indiana Department of Environmental Management Office of Air Quality (IDEM - OAQ) for their review and comment. All future changes or revisions to the Plan will also be forwarded to IDEM - OAQ.

## 2.0 ORGANIZATION AND RESPONSIBLE INDIVIDUALS

***Provide a listing or flow chart of the individuals and/or their titles in the company/plant responsible for CEMS and CEMS-related operations. Include duties and responsibilities such as basic plant operations, CEMS operation and maintenance, procurement, QA/QC, data and report review, training and supervisory functions.***

## 2.1 COMMUNICATION OF INFORMATION, DATA AND REPORTS

For a QA plan to be function properly, provisions must be made for the effective communication of the results from QA/QC activities to all affected parties. Clear channels of communication and responsibility must exist within the responsible department and throughout the Plant.

Emissions data and emissions reports are crucial parts when determining the operational status of a CEMS system. This Plan also provides for the communication of QA and QC information and the necessary mechanisms for triggering corrective actions based on the contents of the QA/QC reports.

## 2.2 EMISSION DATA AND EMISSION REPORTS

***TITLE*** is responsible for the preparation and distribution of all emission reports. Therefore, CEMs data must flow through this position to ensure the accurate and complete preparation of quarterly reports. ***TITLE*** is responsible for verifying that the data are reduced, validated, and reported properly. Additionally, as an independent QA/QC check, ***TITLE*** will decide if the emission data is following an acceptable trend as based on documented boiler and control equipment operating records. This review of emission data is used to identify periods of unusual operation, which may be indicative of CEM operating problems.

## 2.3 QC DATA AND REPORTS

There are many types of QC checks performed routinely. With respect to the numerous types and the various levels of stringency involved in these tests it is impractical to discuss every possible direction of information flow or exchange.

However, an example of a QC information exchange would be the daily zero/span calibration check. The CEMS automatically switches to sampling known gas concentrations once every 24 hours and these values are logged to a computer data acquisition and handling system (DAHS). On a daily basis, ***TITLE*** would review the measured values compared to the known concentrations to determine if the QC check is within permissible limits. If values are outside limits, the ***TITLE*** would proceed to the instrument to complete a visual inspection checklist. Normally, it the values are confirmed to be outside the operating limits a recalibration of the instrument is necessary. After recalibration, the visual checklist, the daily calibration report and a description of corrective action would be submitted to the ***TITLE*** for review. If any unusual conditions continue to be observed, the ***TITLE*** will initiate a maintenance request to determine and repair the observed problem. Upon completion of the maintenance repair request, a detailed description of the problem and its' resolution will be entered in the maintenance log records and reported to the ***TITLE*** for any further post-maintenance QA/QC actions.

After the review of these reports is completed, each report will be placed in a permanent file for later documentation and use in report submittal.

## 2.4 QA AUDIT DATA AND REPORTS

Quality assurance audits include quarterly Cylinder Gas Audits (CGA) , annual Relative Accuracy Test Audits (RATA) and quarterly opacity Calibration Error (CE) audits. These audits are performed in accordance with standard procedures and are used to determine CEM accuracy on a periodic basis. The actual performance of an audit may be conducted by a contractor or by ***TITLE***. Regardless of whom actually conducts the audit, ***TITLE*** is responsible for the completeness and the correctness of the final audit report. This report details a comparison between results and comparable CEM data and consists of all raw data as well as final results.

## 2.5 QA RESULTS AND QA REPORTS

***TITLE*** is responsible for compilation, preparation and distribution of QA results and reports to all appropriate groups. ***TITLE*** is also responsible for preparation of the final QA report and its submittal to the Indiana Department of Environmental Management Office of Air Quality (IDEM - OAQ).

## 2.6 EMISSION DATA AND EMISSION REPORTS

In compliance with our operating permit requirements, all emission data is available for review, either as a computerized data base or printed emission logs, and maintained in a file for 24 months. All quarterly compliance reports will be submitted to the IDEM - OAQ within 30 days of the end of the quarter as defined in the operation permit.

## 3.0 DESCRIPTION OF FACILITY AND CEMS

### 3.1 FACILITY

***Provide a brief description and a diagram of the plant/boiler(s) and stacks related to the CEMS, for example:***

***BOILER NUMBER OR DESIGNATION*** is a Folster Wheeler 200,000 pounds of steam per hour circulating fluidized bed, firing Indiana bituminous coal. Dry limestone injection into the furnace area is used to control sulfur dioxide emissions.

***[DIAGRAM]***

### 3.2 CONTINUOUS EMISSION MONITORING SYSTEM

***Provide a general description and diagram of the CEMS, for example:***

The specific CEMS employed here is based on an extractive sample acquisition system using a dilution probe for moisture, gases and particulate control. Major component groups of this system include: sample probe, sample transport, sample analyzers, support hardware, and data acquisition handling system (see figure). Effluent components monitored and measured include ***LIST THE MEASURED GASES AND/OR FLOWS***. Opacity is measured using stack mounted in-situ devices.

***[DIAGRAM]***

### 3.2.1 Sample Probes

***Describe the sample probe, its construction materials, components, flow rates, dilution ratio, etc., for example:***

Each probe consists of a 12-inch tip mounted on an extension to position the tip at the sample extraction point. The sample point is a representative location within the effluent stream. Contained within the probe are:

- a course steel mesh particulate filter,
- a fine quartz wool particulate filter,
- a sonic orifice and,
- an air powered sample educator.

The filters, course and fine particulate, are designed to prevent plugging of the sonic flow critical orifice. To minimize maintenance requirements on these filters, a high vacuum (min. 15 inches of Hg), low flow (1 to 5 cubic feet per day) is utilized to reduce the total amount of particulate being exposed to the filters. This effluent sample is drawn through the filters using the air educator. A dilution ratio of 1:250 is achieved through the use of a restricted flow (sonic) orifice.

### 3.2.2 Sample Transport

***Describe the sample transport system, for example:***

The sample umbical transport is a multiple line unit used to connect the probe, analyzer and calibration gas delivery system. The umbilical cord consists of a polyethylene line for dilution air, a Teflon line for the diluted sample, a Teflon line for calibration gases, and a polyethylene line for monitoring vacuum at the sonic orifice. This tube bundle is wrapped in a Mylar R (thin plastic liner) and enclosed in a PVC (heavy plastic) jacket for protection.

### 3.2.3 Analyzers

***Describe the analyzers, for example:***

After transport to the instrument location, the diluted sample is distributed to the analyzers for determination of the various pollutant concentrations. The diluted sample flows into a manifold at a rate of 5 to 7 liters per minute (lpm). Each analyzer uses approximately 0.5 to 1.0 lpm. The excess sample is exhausted to an atmosphere dump manifold.



### 3.2.3.1 Nitrogen Oxides (NOx)

***Describe each type of analyzer (e.g.,. $SO_2$, NOx, $CO_2$.Opacity), for example:***
(***DISCLAIMER) The CEMS/COMS monitoring equipment used to illustrate this example are not to be construes as endorsement of the particular product or manufacturer)***

A Thermo Environmental (TECO) Model 42 analyzer is used to monitor and measure Oxides of Nitrogen (NOx) emissions. This analyzer is a part of an dilution extraction analysis system, and receives an effluent sample that has been diluted in a ratio of 1:250 with clean dry air.

This analyzer measures NOx concentrations by reacting nitric oxide (NO) with ozone ($O_3$) to form nitrogen dioxide ($NO_2$). This chemical reaction produces a small amount of light that is directly proportional to the amount of NO present in the sample. To measure $NO_2$ concentrations, the sample passes through a converter unit which transforms any $NO_2$ present to NO. The sample is then introduced to the reaction chamber where it combines with $O_3$. A photomultiplier tube detects this light produced by the chemical reaction of $O_3$ with $NO_2$ and an output signal is sent to the data system.

### 3.2.3.2 Opacity

***Describe the opacity monitor , for example:***

The COMS monitoring system consists of an opacity monitor (transceiver and retroreflector), control unit and a DAHS collection system. All components listed make up the COMS system and are certified in concert with each other thus providing a "CERTIFIED SYSTEM". An example of an opacity monitor which might be used are the Durag Model 281 units (in -situ) which are located on the individual stacks (as determined by the regulatory or permit conditions). The measurement of a stack opacity is accomplished by passing a beam of visible light across the stack (through the effluent) and reflecting it back thus measuring the percent absorbance caused

by the particulate matter in the effluent. This analyzer uses a double-pass measurement technique that allows easier zero and span calibration checks.

### 3.2.4 Support Hardware

***Describe the applicable systems that support the operation of the CEMS.***

#### 3.2.4.1 Air Filter/Dryer

#### 3.2.4.2 Programmable Timer

#### 3.2.4.3 Dilution/Calibration Control



### 3.2.5 Data Acquisition and Handling System (DAHS)

***Describe the DAHS, for example:***

The CEMs DAHS is an automated system that records both pollutant and diluent data for subsequent calculations and report preparation. DATA generated by the system include not only the sample data but monitor operational data such as alarm status, calibration data, and routine emission reports. Table xx lists the pollutant/diluent data recorded by the DAHS. Listed in Table xx are the values calculated by the DAHS.

## 4.0 TRAINING

## 4.1 QUALITY ASSURANCE TRAINING

Training is an essential element of a successful QA/QC program. It provides the basic knowledge required to accomplish a procedure correctly. Training also provides the understanding of a given task or procedure, thereby enabling the individual involved to make an informed and effective decision. Training is a framework about which required activities are taught in a consistent manner.

### 4.1.1 General Training

General training is viewed as providing an initial foundation. It is not intended much to deliver detailed or specific knowledge but to provide an general understanding of the overall system and program goals. This training is common to all individuals directly involved in the CEM program. General training is training provided by ***Company Name*** which is specific to this facility's operation and considered beyond any monitor vendor supplied training. This training is

presented in the following sections.

#### 4.1.1.1 Quality Assurance Plan

All employees directly involved in the CEMS program must have access to this QA/QC Plan. All employees must at a minimum become familiar with this Plan and review appropriate SOP's.

#### 4.1.1.2 Special and Refresher Training

Special and refresher training is necessary to maintain current levels of monitoring competency. All new hires are required to attend QA plan training programs offer periodically. Additionally all CEMS senior staff will receive refresher training on SOP changes, operating parameters, or as QA/QC changes are made.



## 5.0 QUALITY ASSURANCE /QUALITY CONTROL ACTIVITIES

## 5.1 QUALITY ASSURANCE ACTIVITIES

Quality Assurance audits are performed on CEMS in order to verify the precision and accuracy of the data. QA audits also serve to confirm operational and maintenance procedures are being properly implemented.

### 5.1.1 Relative Accuracy Test Audit (RATA)

A RATA as described in EPA's, 40 CFR 60 Appendix B, is a test designed to assess the accuracy of the CEMS monitors relative to the appropriate EPA reference method tests. Its primary use is in determining effluent concentrations. RATA's are conducted in accordance with Performance Specification 2 for $SO_2$ and NOx, and Performance Specification 3 for $CO_2$. Should the measured inaccuracy exceed $\pm$ 20% of the reference method (percent expressed as the sum of the mean differences plus the 95% confidence interval), corrective action is immediately taken by the staff responsible for CEM maintenance and repair. Normally a recalibration is appropriate followed by a reaudit of the "OUT OF CONTROL" (failed) monitor. This reaudit is conducted to demonstrate that the monitor is no longer "OUT OF CONTROL" and also reaffirms the effectiveness of the training program on increased QC procedures. In order in ensure the accuracy of the Reference Method analysis being performed during a RATA, EPA audit samples should be analyzed by both the Reference Method and the CEM. These blind audit performance samples are available through IDEM.

### 5.1.2 Cylinder Gas Audit (CGA)

CGA's is a quarterly audit test employed to show monitor linearity. The test consists of triplicate non consecutive injections of three (3) certified protocol 1 gases covering zero (0), 20 to 30% and 50 to 60% of span for each analyzer. The CGA is designed to assess calibration error, response time, and the effect of the sample handling system on representativeness.

A CGA is performed by individually injecting three known gases at the probe so that the entire sampling train will be used to dilute and transport the gas to the analyzer. A total of three non-consecutive readings are taken for each upscale gas concentration. The individual gases are injected singly and the monitor operated in the calibration mode. Once a stable reading is obtained, the response times (minimum 95% of known concentration) and CEMS instrument responses are recorded.



### 5.1.3 Opacity Audit (Calibration Error - CE)

Opacity monitor audits shall be done according to EPA's 40 CFR 60 Appendix B Performance Specification 1. Three separate and certified neutral density filters are used to challenge the operation of the opacity monitors. A total of fifteen (15) non-consecutive readings are taken, five for each filter.

### 5.1.4 Performance Specification Testing (PST)

First a QA audit using Performance Specification Testing guidelines is performed to establish initial acceptability of the CEMS. It is performed in accordance with EPA's 40 CFR 60 Appendix B, (PST 1, 2, 3). Required Appendix B Reference Method testing is conducted by a competent, professional testing contractor, in accordance with approved EPA procedures

Should the PST not produce acceptable results, corrective action is taken and the PST is repeated. Full documentation of all corrective action's performed is required.

## 5.2 QUALITY CONTROL ACTIVITIES

Quality control activities are designed and performed to ensure that monitor operations and maintenance are adequate and appropriate. Application of these activities ranges from system installation to data handling and reporting procedures. Quality control activities rely upon a

qualified and well-trained staff.

Initial installation of any monitoring system is carried out in strict accordance with procedures established by the vendor. These procedures also included initial start-up, debugging, and inspection of the systems to ensure proper operation.

A complete set of operational and maintenance manuals for all components of the system is maintained by the ***TITLE OF RESPONSIBLE PERSON***. These manuals provide complete descriptions of the system including theory, installation, operation, trouble shooting, repair and general maintenance.

### 5.2.1 Calibration Gases

The calibration of all gaseous emission monitors is accomplished through the use of known concentration zero and span gases of the applicable gas species. These gases are required to be protocol 1 gases , certified to within $\pm$ 2 ppm of the listed concentration.

Opacity calibration checks use an internal filter system which is factory calibrated. External zero is performed either during actual or stimulated clear stack conditions. Alignment checks between the transceiver and retroreflector are performed during any external zero adjustment or any routine maintenance.



### 5.2.2 Calibration Check

Dynamic calibration checks are performed by challenging the monitors once every 24 hours with a calibration gas of a known concentration. A programmable timer automatically initiates the precision check. This system can be manually calibrated at the operators behest.

During the calibration check, the values read by the analyzer are sent to the DAHS, which automatically compares the value to the certified values of the gas cylinders. Should any individual zero drift or span drift exceed two (2) times the applicable standard or any reading exceeding four (4) times the applicable standard, the DAHS initiates an instrument "OUT OF CONTROL" alarm.

During the calibration checks of the opacity monitors, the data system verifies the proper completion of the calibration cycle. Should any individual zero drift exceed 2% of the instrument span, or any calibration drift exceeds 2% of the instrument span, an alarm condition is indicated and corrective actions as per the written QC SOP’s are initiated.

### 5.2.3 Systems Audit

A systems audit involves a general inspection of the monitoring system. Walk-through

audits are used to provide quick assessment of the availability of data, general effectiveness of operation and maintenance, and completeness of recordkeeping procedures. Systems audit involves the following areas:

Administrative
- maintenance logs: completed in a timely and detailed manner by authorized personnel
- recordkeeping: completeness, availability
- verification: correct span values entered into the data system

Technical
- printer: operational, legible print, readings consistent with the process conditions
- data system: shelter cabinets clean, areas maintained
- monitor enclosure: clean, all operational systems, i.e., heating & cooling
- span gas cylinders: with certification dates, in the correct concentration range, above the 250 psi minimum pressures
- sampling/analysis: sample flows, vacuums, and pressures within applicable ranges
- opacity monitor: alignmentverification, purge air blowers operational



## 5.3 DATA RECORDING AND REPORTING

Data collected as part of the auditing of the CEMS falls into two categories: (1) Routine data from the normal operation of the CEMS (See Section 6.3); and (2) Data generated as a function of the audit.

The ***TITLE*** checks and prepares both audit and routine emission data into a summary report.

## 5.4 PREVENTIVE MAINTENANCE

The preventive maintenance program for the CEMS is based on the vendor's recommended procedures. Additional procedures may be included as experience dictates. These procedures may be modified to be more specific for the installation. Preventive maintenance is scheduled and performed in a timely manner by the ***TITLE***.

## 5.5 REPAIR PROGRAM

The CEMS repair program shall be maintained by ***TITLE OF RESPONSIBLE PERSON(S***). System faults are monitored by both ***TITLE*** (technician level) and ***TITLE*** (supervisory level). In the event of a system problem, the ***TITLE*** will be notified directly and in writing. A notation of the problem is placed in the shift log book.

## 5.6 SPARE PARTS INVENTORY___

***TITLE*** maintains a spare parts inventory adequate to meet the normal operating requirements. Emergency parts are available through the vendor on a next day basis. ***TITLE*** has the overall responsibility for maintaining the adequacy of the spare parts inventory. The current inventory is based on the vendor's recommended list for 90% data availability, and is modified on an as-required basis.

## 5.7 ACTIVITY MATRIX

An activity matrix summarizing the various routine QA/QC activities is presented in the table on pages 5 and 6. Daily activities will include checks of daily zero and span values and observation of routine data from the normal operation of the CEMS.



| Activity/ QA Checks | Weekly | Monthly | Quarterly | Annually |
|---|---|---|---|---|
| 1. Calibration Gas Pressure | | X | | |
| 2. Sample Gas Pressure/Vacuum | | X | | |
| 3. Sample Gas Pressure/Flows-Analyzer | | X | | |
| 4. NOx Analyzer Desiccant | | X | | |
| 5. Replace Filters Analyzers | | | X | |

| | | | | |
|---|---|---|---|---|
| 6. Replace Filters/ Scrubbers Air System | | | X | |
| 7. Replace/Clean Filters-Probe | | | X | |
| 8. Temperature Control Analyzer Enclosure | X | | | |
| 9. AC Filter Cleaned | | | X | |
| 10. Clean Interior of Enclosure/ Analyzer | | | | |
| 11. Leak Check Gas Connections | | | | |
| 12. Clean Disc Drive Head | | | | |
| 13. Printer Maintenance | | | | |
| 14. System Audit | | | | X |



| **Activity/ QA Checks** | **Weekly** | **Monthly** | **Quarterly** | **Annually** |
|---|---|---|---|---|
| 15. Clean Optical Surfaces | | | | |
| 16. Check Air Hoses | | | | X |
| 17. Clean/Replace Filters | | | X | |
| 18. Check/Adjust Alignment | | | | X |

| Activity/ QA Audit | | |
|---|---|---|
| 1. CGA | X | |
| 2. Opacity Audit | X | |
| 3. RATA | | X |



## 6.0 DOCUMENTATION AND REPORTS

The documentation of QA/QC data and information system is an integral part of this QA Plan. This section describes reports and other records that provide adequate documentation of QA/QC activities. The two primary means of documentation used are:

(1) Data Acquisition and Handling System (DAHS)

(2) Manually prepared QA/QC forms, logs and reports

The following subsections describe the DAHS and its uses in QA/QC documentation, and presents examples of DAHS-generated routine data reports. During QA audits, the DAHS will be operated to collect data in a normal fashion, but will print all instantaneous engineering units for a real time hard copy of tested values.

The DAHS is used not only to document QA/QC data and information, but it also serves as the CEMs data acquisition and processing system. Each of the following types of documentation are described in subsequent subsections: hourly reports, daily reports, alarm reports, quarterly reports.

Written QA/QC reports are necessary to provide supporting documentation of the continued operation of the CEM in an acceptable manner.

Reports are used to notify individuals of problems related to operation of the CEMS. Compilation of these reports is intended to assist in identifying the need for preventive maintenance, operational procedural changes, training updates, or surplus inventory action.

**6.1 DAHS**

***Describe of the Data Handling and Acquisition System. Provide a simplified block diagram of the DAHS showing the flow of information and process signals.***

***[DIAGRAM]***



**6.2 EMISSION MEASUREMENT DATA PROCESSING**

***Describe the signal processing by the DAHS. Provide examples of the various reports that the DAHS generates.***

**6.3 DAHS REPORTS**

**6.3.1 Current (Hourly) Reports**

### 6.3.2 Daily Reports

### 6.3.3 Alarm Reports

### 6.3.4 Quarterly Reports

## 6.4 MAINTENANCE RECORD

This record is maintained through ***TITLE.*** The ***TITLE*** enters descriptions of routine preventive and maintenance actions performed on the monitoring system components. These entries are kept in maintenance files or site log books. This record also documents the use of spare parts, and its periodic review by the maintenance department provides information to the spare parts inventory.

## 6.5 AUDIT REPORTS

Each audit procedure discussed in section 5 of this Plan is documented in a report. All supporting data are kept on file by ***TITLE***. These audits serve as verification of the accuracy of emissions data in the quarterly report.

## 6.6 CGA GAS CERTIFICATION

Manufacturer/distributors of all Protocol 1 span gases under this QA Plan must provide a gas concentration certificate for each cylinder of gas supplied. ***TITLE*** is responsible for maintaining a file of these certifications, including the date of production, certified value, and cylinder serial number.



# 7.0 QUALITY ASSURANCE PROCEDURES

## 7.1 INTRODUCTION

The purpose of these procedures is to ensure the CEMS system provides accurate and reliable data. These procedures compare the pollutant/diluent values obtained from the CEMS to values

obtained by EPA Reference Method or approved alternative testing method. The results of these tests provide verification of the continued comparability of the CEM data to, data collected by and compared to, outside references. The procedures for these tests are published in EPA 40 CFR 60, Appendix A, B and F ***[OR OTHER APPLICABLE RULES OR REGULATIONS]***.

## 7.2 RATA PROCEDURES

### 7.2.1 Preliminary Activities

Prior to the actual RATA testing procedures there are testing prerequisites required by IDEM. These activities include notification to IDEM, informing them of the intent to test. This is done by submittal of the test protocol form.

Verifications are made that the boiler to tested will not be undergoing scheduled maintenance and that no other condition exists which would preclude testing the boiler emissions under representative operating conditions.

Verify the availability of all personnel required to perform testing.

Verify that all scheduled maintenance on the CEMS has been performed.

Verify that the test location conditions are adequate for testing, and that necessary support services are available.

Review Reference Methods that will be used in EPA's 40 CFR 60 Appendix A and B procedures.



### 7.2.2 RATA Testing Detailed Procedures

These procedures are to be conducted before, during and after RATA testing. Verify that the CEM operating conditions are normal by conducting a systems audit.

Notify ***TITLE OF RESPONSIBLE PERSON*** of testing and request notification should any condition arise that would result in less than a 50% stable load during the testing.

Proceed to the test location and verify the following for the stack testing crew.

1. Safe access
2. Electrical power 110 volts @ 30 amp
3. Safety belts, if required
4. Hoist equipment
5. Small work space for processing samples

Verify availability of plant or pollution control equipment operating data required for the report.

Upon completion of the testing, notify the ***TITLE*** that testing has been completed.

Obtain copies of CEM reports covering the test period.

Perform the post test calibration, document the results of the calibration.

Document results from CEM and Reference Method analysis of blind audit samples.

### 7.2.3 Data Reduction and Analysis

The results of the manual Reference Methods, as part of the RATA, are calculated according to procedures included in EPA's 40 CFR 60, Appendix A. Each test run is calculated individually, and these results are used with the concurrent CEM data to calculate relative accuracy.



### 7.2.4 Relative Accuracy Calculations

The calculation procedure for relative accuracy is as found in Performance Specification 2. In this procedure, the results of the Reference Method testing in units of the standard are compared to the CEM data.

For each test run, compute the difference between the Reference Method results and the corresponding CEM results with the following equation:

Diff = CEM Results - Reference Method Results

Relative Accuracy = (d + |cc|) / Reference Method x 100

### 7.2.5 Report Preparation

A report of the results of each RATA is prepared for inclusion in the current Quarterly Emission Report. The RATA report follows the following outline.

I. Introduction
- briefly describe the audit and purpose

II. Results
-give the date of the audit & a brief description of the results
- if corrective action was required, describe
- present the results of repeat audits, if required

III. Supporting Data
- include RATA summary report

## 7.3 PROCEDURES FOR CGA

### 7.3.1 Introduction

During a CGA, the CEMs is challenged dynamically through the sampling and the analysis systems. Zero, low, and mid-range audit gases are introduced in lieu of the normal calibration gases. The DAHS calibration report is used in stressing calibration error.

The normal concentrations of low and mid-range audit gases used at each monitoring location are shown in table xx. Audit data and observations, including concentrations of gases actually used during the audit, are recorded on the CGA audit sheet (Form xx).

Besides this SOP, the following documents are reference materials which, as necessary, should be reviewed before performing the CGA:

DAHS Operation and Maintenance Manual

40 CFR Part 60, Appendix F

**7.3.2 Cylinder Gas Audit**

For each system to be audited, record on the data sheets the appropriate audit cylinder serial numbers, certified gas concentrations and the dates of analysis. The following steps should be performed:

1. Notify the appropriate staff that the audit is ready to begin and to disregard the CEM calibration alarms.

2. Initiate a Zero and Span check of the CEMS by manually switching gases on. Upon completion, disconnect the "routine operation" calibration gas and connect the appropriate audit gas cylinders.

3. Verify the audit cylinder concentration values as listed on the audit data sheet, and initiate a calibration.

4. Repeat with all concentrations - zero, low and mid values, for three non consecutive runs.

5. The values for the computer are entered on the CGA Audit Data Form.

6. Disconnect the audit cylinders and reconnect the routine operation cylinders.

7. Verify that the system has been returned to normal operation (alarm conditions).

8. Advise the appropriate staff that the audit is complete. Record completion in the CEM log.

### 7.3.3 Data Reduction and Analysis

1. Obtain CGA Audit Data Form and enter data from the DAHS calibration report.

2. Calculate the percent difference (% diff) for each value as follows:

    % diff = (average reading - known concentration) / known concentration x 100

3. Verify that the % diff does not exceed 15% ( or applicable limit) for any data point.

4. Add any remarks relating to the audit on the data sheet.

If any audit value exceeds the acceptable limits, initiate immediate appropriate correction actions, as specified in the QA Plan. Upon completion of the necessary corrective actions, the CGA must be repeated. The results of the original audit, corrective actions, and any repeat audits are reported.

### 7.3.4 Reporting

A report of the results from each CGA is prepared for inclusion in the current Quarterly Emission Report. The CGA report should use the following outline:

I. Introduction
- briefly describe the audit and purpose

II. Results
- give the date of the audit & a brief description of the results
- describe any comments from observation that may have affect the results
- present the results of repeat audits, if required

III. Supporting Data
-include the CGA Audit Data, Calibration Report and any other supporting data ( i.e.,

vendor's gas cylinder certification reports).

## 8.0 QC PROCEDURES

## 8.1 INTRODUCTION

Quality control checks may be defined as all those checks performed on a routine basis such as system inspections, periodic calibrations and routine maintenance. The procedure discussed here are presented as documented written procedures. Other procedures will be inherent in the use of emission data for boiler operations.

## 8.2 DAILY CALIBRATION CHECK

Each CEMS is automatically challenged to a know standard once each 24 hour period. The DAHS calculates the percent difference from entered known values. The ***TITLE OF RESPONSIBLE PERSON*** will be responsible for verifying monitor response to be within specifications of 40 CFR 60, Appendix F at a minimum. Recalibration of the CEM will be performed if drift is indicated.

## 8.3 WEEKLY SYSTEMS AUDIT

A weekly systems audit will be performed and recorded in a bound logbook. A systems audit may be performed at any time if operating problems are observed during routine checks of emission data on daily zero/span checks. This audit is a general appraisal of the CEMS operating parameters. The following checks will be recorded during the systems audit and may be revised as operating experience dictates.

1. Obtain multiday calibration report for previous 7 days for all CEMS. Check for trends in drift.
2. Verify that the correct span values are entered into the computer.
3. Insect the instrument cabinet for general cleanliness and temperature within limits of 68 to 86 degrees F. Check air conditioning filter for cleanliness.
4. Check that the gas cylinder pressures are above 250 psi.
5. Examine opacity remote panel, note any alarms displayed and that readings are consistent with monitor operation.

6. Check dilution air pressure and corresponding probe vacuum for any changes.
7. Verify that scrubbers in the air system are acceptable and indicating silica gel is blue. Verify that regenerative dryer and absorber units are cycling every 30 seconds.
8. Check NOx analyzer desiccant.
9. Check NOx analyzer sample vacuum.
10. Check SO2 analyzer sample vacuum, sample flow and lamp voltage.
11. Check CO2 sample flow.
12. Re-calibrate monitors if necessary.

## 8.4 QUARTERLY SYSTEMS AUDIT

Administrative

1. Check maintenance logs for timely and complete repairs.

Technical (include all checks associated with weekly systems audit)

1. Printer operational and legible, readings consistent with process conditions.
2. Computer data table clean and area is maintained.
3. Monitor enclosure clean and area well maintained.
4. Purge air blowers for opacity operational and alignment of opacity monitor is correct.

## 9.0 ROUTINE PREVENTIVE MAINTENANCE

All maintenance of the CEMS can be classified into one of two areas:

Routine preventive maintenance: A regularly scheduled set of activities designed to prevent problems before they occur.

Non-routine preventive maintenance: A set of activities is also designed to prevent problems, but the need for it cannot be predicted, so it is done on an as-needed basis. For example, if sample vacuum on the NOx analyzer drops from its normal reading, the pump, gauge or sample capillaries should be replaced or cleaned. This would be considered non-routine preventive maintenance. Non-routine preventive maintenance is not discussed in the QA/QC manual because it is neither practical nor necessary to develop written procedures for it.

The routine preventive maintenance required for the CEMS is listed in Table 9-1. The ***TITLE OF THE RESPONSIBLE PERSON*** is ultimately responsible for since all routine preventive maintenance is completed on schedule.

TABLE 9-1 RECOMMENDED ROUTINE PREVENTIVE MAINTENANCE

**Opacity**

**Quarterly**

1. Clean blower pre-filter
2. Replace blower filter element
3. Check optic alignment
4. Clean optics, set window check value

**Semi-Annual**

1. Check external zero when boiler is off line
2. Scale system (electronically)

**SO2**

**Quarterly**

1. Change Teflon inlet filter

**NOx**

**Weekly**

1. Check drierite canister & change if expended

**Quarterly**

1. Replace Teflon inlet filter

**Air System**

**Quarterly**

1. Replace regent scrubbers

**Annual**

1. Replace particulate filters

**Probes**

**Quarterly**

1. Check connections for leaks
2. Clean coarse screen and quartz wool plug

**Computer System (DAHS)**

**Weekly**

1. Back-up the fixed disk



## 10.0 CORRECTIVE ACTION AND REQUIRED NOTIFICATIONS

Whenever the CEMS is found to be "out-of-control" the data generated from the system cannot be used to show compliance with permit limits or data capture requirements. Corrective action must be performed as soon as possible after determining that the CEMS is not operating within ***40 CFR 60, Appendix F***. Corrective action is defined as the resolution of problems that occur on a non-routine basis.

## 10.1 SUGGESTED CORRECTIVE ACTION

References to specific troubleshooting procedures are listed in Table 10-1.

## 10.2 REQUIRED NOTIFICATIONS

Immediately after learning the CEMS is non operational, the following individuals must be notified:

***TITLE OF THE RESPONSIBLE PERSON***

***TITLE OF THE RESPONSIBLE PERSON***

***TITLE OF THE RESPONSIBLE PERSON***

***List the specific responsibilities for each person.***

TABLE 10-1 REFERENCES TO TROUBLE-SHOOTING/CORRECTIVE ACTION

***List the appropriate references to the analyzer, probe, DAHS, etc. manuals where troubleshooting procedures are specified.***

## 11.0 REFERENCES

***List all references used to compile this QA Plan.***

## 12. ATTACHMENTS

***Include any pertinent information such as:***

***1. Operating Permit***

***2. Applicable CFRs or portions of the CFR.***

***3. Applicable analyzer, probe, DAHS, etc. manuals or portions of the manuals***

***4. Applicable State Rules or portions of the Rules***

***5. Examples of audit and calibration forms***

***6. Examples of operation and maintenance logs***

***7. Examples of reporting forms***

***8. Example DAHS printouts***