Walker, Elizabeth (AIR)

From: Arif, Syed
Sent: Monday, February 16, 2009 10:26 AM
To: Walker, Elizabeth (AIR)
Subject: FW: Quality Assurance Plan - JEA Northside Hg CEMS.docx
Attachments: Quality Assurance Plan - JEA Northside Hg CEMS.pdf

Elizabeth,

This should be in the project file for JEA Northside Hg CEMS project. I'll be sending you some more files.

Syed

-----Original Message-----
From: Holbrooks, Kevin E. - Director, Compliance [mailto:HolbKE@jea.com]
Sent: Monday, February 02, 2009 1:07 PM
To: Arif, Syed
Cc: Vielhauer, Trina; Davis, Ken D.; Gianazza, N. Bert; Raesemann, Rob
Subject: Quality Assurance Plan - JEA Northside Hg CEMS.docx

Syed,
Attached for your viewing pleasure is the updated QA plan addressing the modifications we discussed. If you need anything else just let me know.

Thanks
Kevin

Mercury CEMS Quality Assurance Plan

JEA

Northside Generating Station

Units 1 and 2
Jacksonville, Florida
ORIS: 000667
Revision Number: 1.1

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LIST OF FORMS

TABLES

EQUATIONS

REVISION NOTES

Revision No.	Revision Date	Revised Sections	Notes
Draft	July 2008	NA	Draft
1.0	Dec 2008	All	Revised to accurately reflect JEA Northside Systems
1.1	Feb 2009	All	Revised to reflect feedback from FDEP. 7 day drift added, annual RATA added.

Chapter 1.0 Quality Assurance Plan Overview

1.1 Introduction

This Quality Assurance Plan (QAP) is designed to provide guidance and support in the operation and maintenance of the Thermo Fisher Scientific (Thermo) Mercury Freedom™ System installed at the JEA Northside Generating Station (NGS), Jacksonville, FL. This document consists of a description of the QAP, the organizational structure that will implement to support the plan, and the procedures for carrying out the plan. This QAP must be used along with the following documents. Those included in the Appendices are noted in parenthesis.

- Northside Generating Station, CEMS/COMS Quality Assurance Plan, specifically the Flow Monitoring and Data Acquisition and Handling System sections, which are utilized by the these Mercury CEMS
- Thermo Mercury Freedom™ System Operation and Maintenance Manuals, including:
  - *Model 80i Hg Analyzer Instruction Manual 103194-00*
  - *Model 81i Hg Calibrator Instruction Manual 103068-00*
  - *Model 82i Hg Probe Controller Instruction Manual 103519-00*
  - *Model 82X Fiber Optic Probe Controller Instruction Manual 105464-00*
  - *Model 83i Extraction Probe Instruction Manual 101187-00*
  - *Model 83i GC Hg Non-Inertial Dilution Probe Instruction Manual 101187-00*
  - *Mercuric Chloride Generator Instruction Manual 105648-00*
  - *Mercury System Manual 105648-00*
- Mercury Freedom™ System Recommended Spare Parts (Appendix AA)

The NGS is located at 4377 Heckscher Drive, Duval County, Jacksonville, FL and is within the jurisdiction of USEPA Region 4 and the Florida Department of Environmental Protection (FDEP). The Northside Generating Station Units 1 and 2 are coal and petroleum coke-fired circulating fluidized bed (CFB) boilers, each rated at 2764 mmBtu/hr heat input and 325 MW electrical output. Unit 3 is oil and pipeline natural gas fired dry-bottom boiler, rated at 5290 mmBtu/hr heat input and 540 MW electrical output.

1.2 Quality Assurance Policy

It is the policy of JEA to adhere to all applicable rules and regulations. All necessary air emission data will be obtained in order to demonstrate compliance with data quality objectives. This Hg QAP establishes operational procedures that will ensure data and measurements are accurate and precise. At no time will non-quality assured data be reported as valid data.

1.3 Definitions

In specific terms relating to the CEM systems, "Quality Control" refers to the specific procedures performed regularly (e.g., daily calibration checks, routine filter replacements or quarterly calibration error tests to ensure CEM data is of high quality. "Quality Assurance" is defined as a management program designed to ensure that QC activities are being performed.

Following is a general list of terms and acronyms used in this Quality Assurance and Quality Control Plan and the CEMS/COMS Quality Assurance Plan.

Acid Rain Program (ARP) - the national sulfur dioxide and nitrogen oxides air pollution control and emissions reduction program established in accordance with Title IV of the Clean Air Act, November 15, 1990.

Administrator (when used in the regulatory definitions of this QA/QC Manual) – the Administrator of the United States Environmental Protection Agency or the Administrator's duly authorized representative.

Alternate designated representative (ADR) - a responsible person authorized by the owners and operators of an affected source, as evidenced by a certificate of representation, submitted in accordance with Subpart B of the Acid Rain Program, to act on behalf of the designated representative in matters pertaining to the Acid Rain Program.

As-fired - the taking of a fuel sample just prior to its introduction into the unit for combustion.

Calibration error - the difference between:

(1) The response of a gaseous monitor to a calibration gas and the known concentration of the calibration gas;
(2) The response of a flow monitor to a reference signal and the known value of the reference signal.

Calibration error is calculated as:

$$CE = \frac{|R - A|}{S} \times 100$$

where,

CE	=	Calibration Error
R	=	Reference Value
A	=	Actual CEMS Response
S	=	CEMS Span Value

Calibration gas: (1) a standard reference material; (2) a NIST traceable reference material; (3) a Protocol 1 gas; (4) a research gas material; or (5) zero air material

Capacity factor - the ratio of a unit's actual annual electric output (expressed in MWe-hr) to the unit's nameplate capacity times 8760 hours, or the ratio of a unit's annual heat input (in mmBtu) to the unit's maximum design heat input times 8760 hours.

Commence commercial operation - to have begun to generate electricity for sale, including the sale of test generation.

Commence construction - that an owner or operator has either undertaken a continuous program of construction or has entered into a contractual obligation to undertake and complete, within a reasonable time, a continuous program of construction.

Common Stack - the exhaust of emissions from two or more units through a single flue.

Continuous emissions monitoring system (CEMS) - the equipment used to sample, analyze, measure, and provide a permanent record of emissions. Emission readings are taken at least once every 15 minutes. For mercury the measurement is micrograms per dry standard cubic meter (ug/m^3).

The following systems are component parts included in the JEA Unit 1 & 2 Northside Generating Station continuous emissions monitoring system. (NOTE: only the Mercury CEMS are addressed in this QAP.):

(1) Mercury concentration monitors;
(2) Sulfur dioxide pollutant concentration monitor;
(3) Flow monitor;
(4) Nitrogen oxides pollutant concentration monitors;
(5) Diluent gas monitor (at Northside Generating Station Units 1 - 3, the diluent gas is CO_2); and
(6) A data acquisition and handling system (DAHS).

DAHS (Data Acquisition and Handling System) - For the CEMS at Northside Generating Station, this refers to the Microsoft Windows™-based computer system by GE Energy Systems.

Designated Representative (DR) - a responsible person authorized by the owners and operators of an affected source and of all units at the source or by the owners and operators of a combustion source or process source, as evidenced by a certificate of representation, submitted in accordance with Subpart B of the Acid Rain Program, to represent and legally bind each owner and operator, as a matter of federal law, in matters pertaining to the Acid Rain Program. The DR at Northside Generating Station is the Senior Vice President - Generation.

Diluent gas - a major gaseous constituent in a gaseous pollutant mixture, which in the case of emissions from fossil fuel-fired units are carbon dioxide and oxygen. At Northside Generating Station, the diluent gas is carbon dioxide (CO_2).

Gaseous fuel - a material that is in the gaseous state at standard atmospheric temperature and pressure conditions and that is combusted to produce heat.

Gas-fired:

1) The combustion of:
   a) Natural gas or other gaseous fuel (including coal-derived gaseous fuel), for at least 90.0 percent of the unit's average annual heat input during the previous three calendar years and for at least 85.0 percent of the annual heat input in each of those calendar years; and
   b) Any fuel other than coal or coal-derived fuel (except for coal-derived gaseous fuel) for the remaining heat input, if any; provided that for purposes of 40 CFR Part 75, any fuel used other than natural gas, shall be limited to:
      i) Gaseous fuels containing no more sulfur than natural gas; or
      ii) Fuel oil.
2) For purposes of 40 CFR Part 75, a unit may initially qualify as gas-fired under the following circumstances:
   a) If the designated representative provides fuel usage data for the unit for the three calendar years immediately prior to submission of the monitoring plan, and if the unit's fuel usage is projected to change on or before January 1, 1995, the Designated Representative submits a demonstration satisfactory to the EPA Administrator that the unit will qualify as gas-fired under the first sentence of this definition using the years 1995 through 1997 as the three calendar year period; or
   b) If a unit does not have fuel usage data for one or more of the three calendar years immediately prior to submission of the monitoring plan, the designated representative submits:
      i) The unit's designed fuel usage;
      ii) Any fuel usage data, beginning with the unit's first calendar year of commercial operation following 1992;
      iii) The unit's projected fuel usage for any remaining future period needed to provide fuel usage data for three consecutive calendar years; and
      iv) Demonstration satisfactory to the Administrator that the unit will qualify as gas-fired under the first sentence of this definition using those three consecutive calendar years as the three calendar year period.

Missing data period - the total number of consecutive hours during which any component part of a certified CEMS is not providing quality-assured data, regardless of the reason.

Natural gas - a naturally-occurring fluid mixture of hydrocarbons (e.g., methane, ethane, or propane) produced in geological formations beneath the Earth's surface that maintains a gaseous state at standard atmospheric temperature and pressure under ordinary conditions. Natural gas contains 1.0 grain or less of hydrogen sulfide per 100 standard cubic feet and the hydrogen sulfide constitutes more than 50% (by weight) of the total sulfur in the gas fuel. Additionally, natural gas must meet either be composed of at least 70% methane by volume or have a gross calorific value between 950 and 1100 Btu per standard cubic foot.

Out-of-control period - any period:

(1) Beginning with the hour corresponding to the completion of a daily calibration error, linearity check, or quality assurance audit, such as a relative accuracy test audit, that indicates that the instrument is not measuring and recording within the applicable performance specifications; and

(2) Ending with the hour corresponding to the completion of an additional calibration error, linearity check, or quality assurance audit following corrective action that demonstrates that the instrument is measuring and recording within the applicable performance specifications.

Pipeline natural gas - Pipeline natural gas means natural gas that is provided by a supplier through a pipeline and that contains 0.3 grains or less of hydrogen sulfide per 100 standard cubic feet and the hydrogen sulfide in content of the gas constitutes at least 50% (by weight) of the total sulfur in the fuel.

Protocol 1 gas - a calibration gas mixture prepared and analyzed according to the "Procedure for NBS-Traceable Certification of Compressed Gas Working Standards Used for Calibration and Audit of Continuous Emission Monitors

Quality Control (QC) - the procedures, policies, and corrective actions necessary to ensure data quality. QC procedures are typically routine, scheduled activities including daily, weekly, quarterly, semi-annual, and annual checks and inspections designed to optimize CEMS performance and reliability.

Quality Assurance (QA) - the independent checks performed to ensure that the quality control procedures are functioning as designed. QA procedures are external checks performed by individuals that are not normally involved with QC and maintenance operations. For these CEMS systems, QA checks are performed based on a schedule specified in this plan. These procedures are also performed on an as-needed basis. The resulting quality assurance assessments may activate QC measures and corrective actions if necessary. If corrective actions are taken, the quality assurance procedure is repeated.

Reference value or reference signal - the known concentration of a calibration gas, the known value of an electronic calibration signal, or the known value of any other measurement signal, assumed to be the true value for the pollutant or diluent concentration or volumetric flow being measured.

Relative accuracy - a statistic designed to provide a measure of the systematic and random errors associated with data from continuous emission monitoring systems, and is expressed as the absolute mean difference between the pollutant concentration or volumetric flow measured by the pollutant concentration or flow monitor and the value determined by the applicable reference method(s) plus the 2.5 percent error confidence coefficient of a series of tests divided by the mean of the reference method tests.

Standard conditions - 68°F at 1 atmosphere (29.92 inches of mercury).
Substitute data - emissions or volumetric flow data provided to assure 100 percent recording and reporting of emissions when all or part of the continuous emission monitoring system is not functional or is operating outside applicable performance specifications.
Unit - a fossil fuel-fired combustion device.

Unit operating hour - any hour (or fraction of an hour) during which a unit combusts any fuel.

Zero air material - either:

(1) a calibration gas certified by the gas vendor not to contain concentrations of either SO_2, NO_X, or total hydrocarbons above 0.1 parts per million (ppm); a concentration of CO above 1 ppm; and a concentration of CO_2 above 400 ppm, or

(2) ambient air conditioned and purified by a continuous emissions monitoring system for which the CEMS vendor certifies that the particular model produces conditioned gas that either does not contain concentrations of either SO_2, NO_X, or total hydrocarbons above 0.1 ppm or CO_2 above 400 ppm; and that does not contain concentrations of other gases that interfere with instrument readings or cause the instrument to read concentrations of SO_2, NO_X, or CO_2 for a particular CEMS model..

1.4 Objective

The objective of the QAP is to establish a series of Quality Assurance (QA) and Quality Control (QC) activities that will provide a high level of confidence in the data reported by the CEMS. Quality Control is considered the procedures, policies, and corrective actions necessary to ensure data quality. QC procedures are typically routine, scheduled activities including daily, weekly, quarterly, semi-annual, and annual checks and inspections designed to optimize CEMS performance and reliability. Quality Assurance is defined as the independent checks performed to ensure that the quality control procedures are functioning as designed. QA procedures are external checks performed by individuals that are not normally involved with QC and maintenance operations. If corrective actions are taken, the quality assurance procedure is repeated.

The QAP provides guidelines for implementing QA and QC activities. This document is intended to provide both the foundation for the establishment and maintenance of the QA/QC plan as well as a guidance document for the day-to-day operation of the CEMS. It is intended to be an integral and dynamic part of the QA/QC program. It shall continually reflect the current state of the program as it is actually implemented at the facility. It has been designed for easy updating and modification as the program grows and changes over time. It is only by making this a "living," changing document that a truly effective QA/QC plan can be maintained.

1.5 How to Use This Plan

This Plan is intended to be used in several ways.

- Internal Use: To provide direction and guidance in the operation and maintenance of the CEM systems.
- Regulatory Agency Use: To meet the requirements and to demonstrate to regulatory personnel that a comprehensive QA/QC Plan is being implemented at the facility.
- CEM Vendor Use: FOR ON-SITE REVIEW ONLY. To determine what procedures are in use if a vendor is required to diagnose or repair system problems.
- Training: To provide new employees with a source of comprehensive information and step-by-step procedures for system operations and maintenance. This reduces the "learning curve" for new employees.

1.6 Scope of Quality Assurance Plan

In order to comply with the vacated CAMR rules (see Important Note in Section 1.1), JEA has installed two Mercury Freedom^{TM} System CEMS at Units 1 and 2 at the NGS.

The Mercury Freedom^{TM} System is comprised of:

- Hg analyzer (Model 80i)
- Hg calibrator (Model 81i)
- Hg probe controller (Model 82i)
- High temperature, dilution-based probe (Model 83i) and
- Zero air supply
- Chlorine (Cl_2)

The Hg CEMS are connected to a central Data Acquisition and Handling System (DAHS) and Flow Monitoring System, which are presented in the NGS CEMS/COMS QAP.

1.6.1 Quality Assurance Procedures

QA procedures consist of a series of checks and audits that are performed on the CEMS on a predetermined, as well as an "as needed", basis. The resulting assessments activate QC measures and corrective actions. After the corrective actions are performed, the data quality is again assessed. The quality of the data will determine whether the corrective actions were successful or whether further actions are required.

The following is a brief description of the type and frequency of QA/QC procedures.

QC procedures are specific maintenance activities necessary to optimize the CEMS performance and reliability. These activities include daily, weekly, quarterly, semi-annual, and annual checks and inspections (Refer to Table 1-1). Corrective actions, such as corrective maintenance and recalibrations, are performed when needed.

Table 1-1: Summary of QA and QC procedures in this Quality Assurance Plan

Frequency	Test
Daily	Calibration Error (CE) test
	Daily CEMS Checklist
	Data Review and Validation
Weekly	System Integrity Check (single-level) - if daily CE is elemental only
	Preventative Maintenance: Analyzer Checks
Quarterly	System Integrity Check (oxidized)
	Linearity Check (3-level)
	Preventative Maintenance: Analyzer Checks
Semiannual / Annual	RATA- Annually
	Annual Relative Accuracy Test Audit (RATA)
	Bias Test / Adjustment Factor
	Preventative Maintenance: Analyzer Checks
Certification/Recertification	7 Day Drift Linearity Cycle Response Time System Integrity Check (oxidized) RATA

1. Daily Assessments
   a. Two-point (Zero and Span) calibration error tests for Hg monitors must fall within 5.0% of the span value. The calibration error test can be done using either elemental or oxidized Hg standards.
   b. If an Out-of-control event occurs as due to failure of the daily assessment, the appropriate maintenance and corrective action(s) will be performed and the daily assessment repeated for the affected monitor.
   c. Data recording and tabulation of all calibration error tests according to month, day, and magnitude.

2. Weekly Assessments
   a. Weekly system integrity check for Hg monitors using oxidized mercury to check converter efficiency.

3. Quarterly Assessments
   a. Quarterly three-point linearity check for Hg monitors must fall within 10.0% of the reference value. The linearity check must be done using elemental Hg standards.
   b. If an Out-of-control event occurs due to failure of the quarterly assessment, the appropriate maintenance and corrective action(s) will be performed and the quarter assessment repeated for the affected monitor.

4. Annual QA Activities
   a. An annual RATA will be performed following current industry standards and regulatory practices.

1.7 Document Control

To ensure that all copies of the QAP are revised to contain current procedures, the following document control headers and footers are provided on each page:

- Revision Number
- Date of Revision
- Section/Page Number

This QAP is an important regulatory document. As a result, strict document controls are required. ***Do not copy this QA/QC Plan.*** Unauthorized copies cannot be updated.

1.7.1 Responsible Individuals

The Environmental Services Coordinator shall be responsible for ensuring this QAP remains current and complete. The Environmental Services Coordinator will also be responsible for compiling the Document History in Section 1.5.5 of this Plan. The Manager of Instrumentation & Controls shall serve as an alternate and shall remain familiar with this QAP as well as all environmental policies and procedures.. Copies of this QAP shall be maintained in the following locations:

LOCATION
1. Plant I&C Shop
2. CEMS Shelter
3. Environmental Services Coordinator's Office

The Environmental Services Coordinator may designate other locations for this QAP as needed.

1.7.2 Revisions

Only the Environmental Services Coordinator is authorized to revise this document. Errors or omissions should be pointed out to the Environmental Services Coordinator to ensure this document remains accurate and complete. The Environmental Services Coordinator will distribute updates to ensure these documents remain consistent. The Environmental Services Coordinator will also archive the outdated versions of this Plan for reference. At least once each year the Environmental Services Coordinator, Maintenance Manager, I&C Technicians and Operations Supervisor shall meet to review QA/QC procedures. This meeting shall take place during the second quarter each calendar year.

It is important that all owners of this document have the most recently revised information and that outdated information is discarded. When the document owner receives the update, he/she should remove the old section, initial it, and return it to the Environmental Technician within five (5) days. This acknowledges receipt of the replacements. If the old section(s) is not received within five (5) days, the Environmental Technician will follow-up until the old section(s) is returned.

1.7.3 QA/QC Plan Forms

Listed below are the specific forms to be used when completing the QA/QC procedures. These forms must be used to document the completion of the QA and QC procedures identified in this Plan.

1. DAILY PREVENTATIVE MAINTENANCE CHECKLIST (Example Form 7-1)
2. QUARTERLY PREVENTATIVE MAINTENANCE CHECKLIST (Example Form 7-2)
3. SEMI_ANNUAL PREVENTATIVE MAINTENANCE CHECKLIST (Example Form 7-3)
4. ANNUAL PREVENTATIVE MAINTENANCE CHECKLIST (Example Form 7-4)
5. LONG TERM STORAGE (Example Form 7-5)
6. CORRECTIVE ACTION REPORT (Example Form 7-6)

1.7.4 Instrument User's Manuals

The Mercury Freedom™ Systems are supplied from the manufacturer with the User's Manuals. These manuals are an important part of this QAP and should be used in conjunction with this

Plan whenever servicing or troubleshooting the CEMS system. The Environmental Services Coordinator shall be responsible for ensuring that these User's Manuals are kept current.

These manuals should be kept in the Plant Library and the Maintenance Office for reference. Copies of these manuals may be removed from these locations for short periods, but should be returned before leaving the plant for the day.

1.8 Data Recording and Reporting

Air emissions reports will be submitted to the Florida Department of Environmental Quality, Air Quality Division, and EPA on an as required basis. The contents of the reports will be specified in the air operating permit.

These may include the following:

All required hourly data must be recorded electronically and not be manually edited. This includes all CEM data. This data can be recorded through different DAHS components and combined at the end of the quarter. The owner/operator must provide State auditors real time access to this data. Other data, including sampling results, default rates, hourly load data, hourly operating status and long-term fuel measurement data may be recorded electronically or entered manually into the DAHS.

A central CEMS file is maintained in the Environmental Office and the CEMS Shelter. The file contains QAP check forms, audit results, corrective action forms, and calibration gas certificates of analysis. This central file also serves as an archive for all CEM records including logbooks, daily data summaries, agency correspondence, applicable permits, emissions reports, maintenance request forms, and strip charts (as applicable).

The CEMS data acquisition and reporting is controlled by a central Data Acquisition and Handling System (DAHS). The DAHS provides automated data monitoring and management capabilities to the CEMS using GE Energy Services NETDAHS software on a Microsoft Windows platform.

The CEMS has a Programmable Logic Controller (PLC) that transmits data from the analyzer to the central DAHS. The DAHS polls the PLC every ten (10) seconds for data to generate and store one (1) minute averages. The DAHS will indicate any occurrence of specification limit excedances or CEM operational problems. In the DAHS, necessary reports are generated in the required format for submittal to the applicable regulatory agencies.

All information reported to EPA Region 4 is maintained on file for a minimum of three years.

1.9 Data Capture Requirements

The CEMS must be capable of completing a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 15-minute interval. Emissions concentrations collected by the monitors will be reduced to hourly averages. Hourly averages will consist of at least one data point in each fifteen-minute quadrant of an hour, where the unit combusted fuel during that quadrant of an hour.

An hourly average may be computed from two data points separated by a minimum of 15 minutes (where the unit operates for more than one quadrant of an hour) if data are unavailable due to performance of a calibration, quality assurance, or preventive maintenance activities. All valid measurements or data points collected during an hour will be used to calculate hourly averages. All data points collected during an hour will be, to the extent practicable, evenly spaced over the hour.

Failure to acquire the minimum number of data points for calculation of an hourly average will result in the failure to obtain a valid hour of data and the loss of such component data for the entire hour.

If a valid hour of data is not obtained, the owner/operator will report that the mercury instrument was out of service and detail the events in a monthly report that lists instrument downtime with an availability report.

1.10 Quality Assurance Status

A monitor is considered out-of-control starting with the hour of the failure of any quality assurance test. A test that is initiated and discontinued because the monitoring system is failing to meet the applicable performance specification or is otherwise found to be out-of-control is considered a failed test and the monitoring system is considered out-of-control starting with the hour in which the test was discontinued.

A system is also considered out-of-control beginning in the first hour following the expiration of a previous test if the owner/operator fails to perform a required periodic test.

A system is considered in-control in the hour in which all tests were failed or missed is successfully completed.

1.11 Reporting During Out-of-Control Hours

During the period that the CEMS is out-of-control, not operating, or otherwise determined, based on sound engineering judgment or for a known reason, to be producing inaccurate data, the owner/operator must perform the following:

1. Repair the analyzer and return it to service.
2. Provide a detailed description of the event in the CEMS logbook.
3. Provide a summary of the downtime in a quarterly report.

Chapter 2.0 Facility and CEM Description

2.1 Facility Description

The JEA - NGS is located at 4377 Heckscher Dr in Jacksonville, FL, which falls under the jurisdiction of EPA's Region IV. The Northside Generating Station is a nominal 1136 MW electric generating plant that consists of a two coal and petroleum coke-fired circulating fluidized bed (CFB) boilers rated at 325 MW each and one oil and natural gas-fired boiler rated at 540 MW. Units 1 & 2, the coal units, exhaust into a dual-flue 495-foot stack. Emissions will be monitored in the individual flues.

The Hg CEMS system configuration and flow diagrams are shown in Figures 2-1 and 2-2 on pages 2-2 through 2-3.

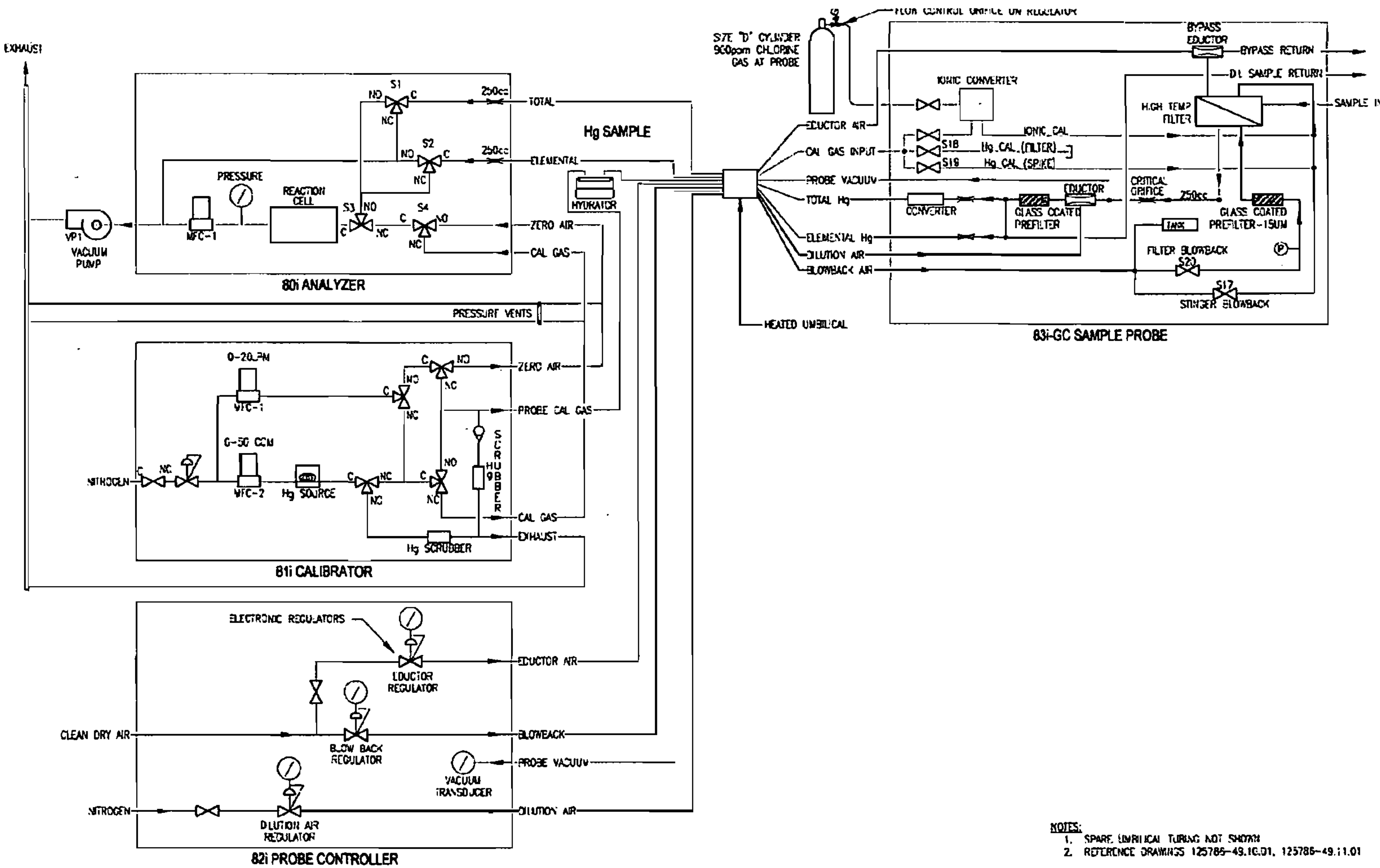
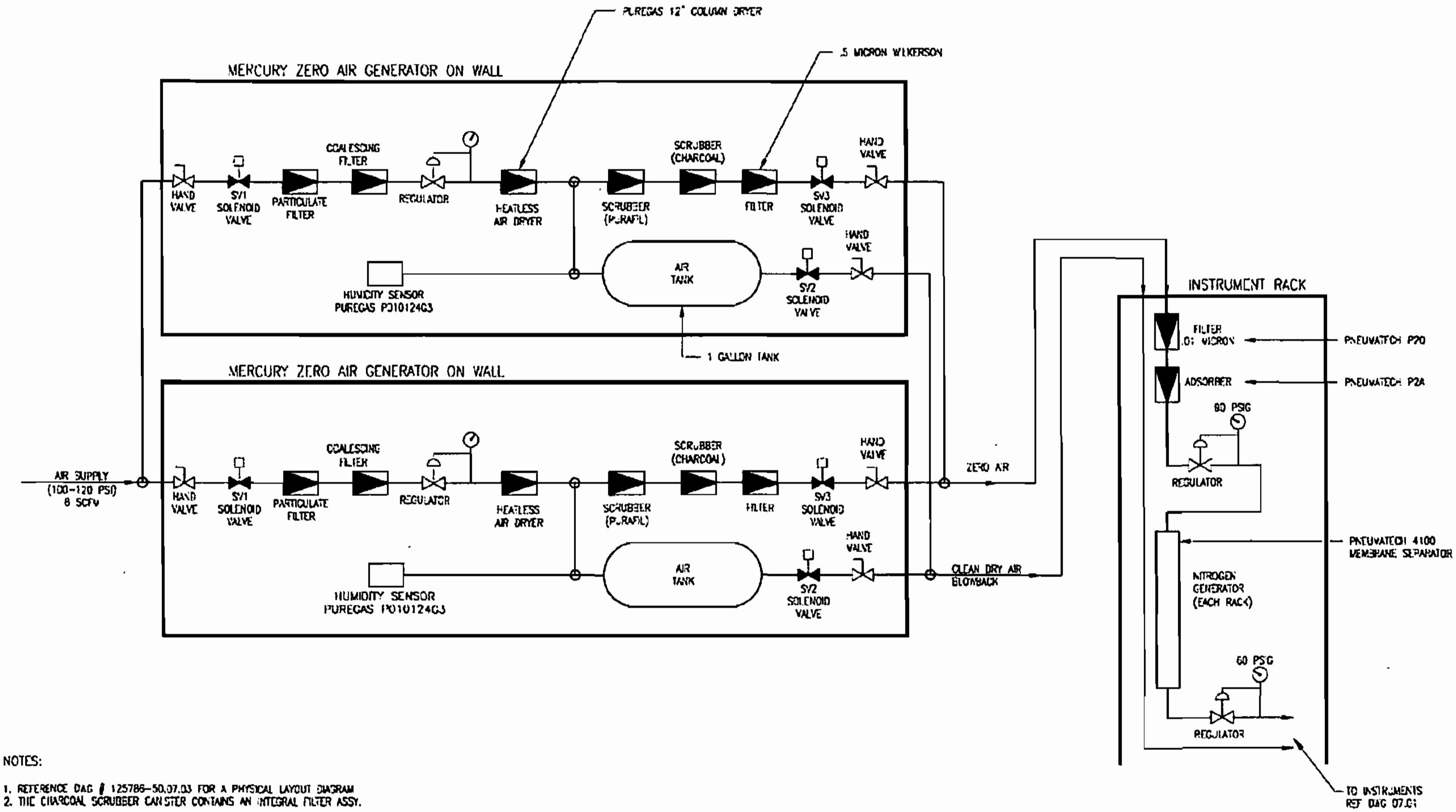


Figure 2-1: Mercury Freedom™ System Configuration

Figure 2-2: Mercury Freedom™ System Flow Diagram



NOTES:

1. REFERENCE DWG # 125786-50.07.03 FOR A PHYSICAL LAYOUT DIAGRAM
2. THE CHARCOAL SCRUBBER CANISTER CONTAINS AN INTEGRAL FILTER ASSY.

2.2 CEM System Description

The Mercury Freedom™ System automatically and continuously measures concentrations of mercury (Hg). The system is connected to the central data logger and Data Acquisition and Handling System (DAHS).

The data logger converts the analog signals to digital signals from the analyzers located in each shelter to digital data. The signals are transmitted to the DAHS links which converts the raw data to the units of the standard and prints out the reports when the appropriate commands are entered. Contact closures are provided for alarms and system status. Complete system operation, including calibration and sequencing is automatic. Operator attention is necessary only for periodic manual verification of accuracy and normal maintenance. Historical data may be downloaded onto disk or tape for reporting, record keeping, or backup.

2.2.1 Mercury Freedom™ System

UNITS 1 & 2
Dilution Ratio: 40:1

Analyzer	Manufacturer/Model	Analyzer Range
Hg	Mercury Freedom™ System	0 – 10 μg/m^3

The Thermo Mercury Freedom™ System measures mercury, using cold vapor atomic fluorescence (CVAF). The analyzer is capable of measuring either elemental or total Hg. In order to measure elemental Hg, the sample that comes into the probe must be reduced from mercuric chloride to elemental mercury.

Elemental, ionic and total mercury are measured by converting all phases of mercury to elemental mercury for analysis. In CVAF, free-mercury atoms in a carrier gas are excited by a collimated ultraviolet light source at 253.7 nm. The excited atoms re-radiate their absorbed energy (fluorescence) at this same wavelength. Unlike a directional excitation source, fluorescence is omni-directional and may be detected using a photomultiplier tube or UV photodiode. The technique differs from the more conventional atomic absorption (AA) technique in that it is more sensitive, more selective, and is linear over a wide range of concentrations.

The sample enters a chamber where it is excited and decays back to ground state; the UV light given off by the decaying sample is proportional to the concentration. During calibration, the gas from the calibrator flows through the solenoids and the samples bypass the chambers and are sent to the exhaust.

The sampling probe is designed to minimize measurement artifacts due to interactions with fly ash. It uses a high flow sintered metal inertial filter to provide a particulate free, vapor phase sample for analysis. Automated blow back helps to ensure continuous operation and all components exposed to the sample are coated with glass to prevent reactions with mercury. A separate dilution air system for the analyzer is not necessary since the dilution system has been built into the probe. Dilution, calibration and Hg conversion all take place within the probe. A high temperature thermal converter reduces Hg to elemental Hg within the probe before it is sent to the analyzer.

The calibrator uses known concentrations of elemental Hg by combining saturated Hg vapor with Hg-free dilution air or nitrogen. The Hg-free dilution air can be fed with high flow or low flow. Any Hg saturated flow passes through an internal scrubber before being exhausted. The dilution sample probe for Hg is used in drawing a stack gas sample. The system uses an air driven aspirator to extract a sample from the stack. The sample is drawn through a coarse and fine particulate filter. The stack gas is then drawn through a critical orifice and then diluted with air from the aspirator. The air used for dilution and zero air calibrations is provided from the dedicated CEM compressor. The sample is transported via a Teflon sample line to the CEMS shelter and introduced to the analyzer.

A probe controller is included in the Freedom System between the probe and the analyzer. It contains three electro/pneumatic pressure transducers, two are used to adjust and maintain output pressure and blowback, the third adjusts and maintains the dilution air pressure of Hg-free zero air.

The system also includes a Mercuric Chloride Generator which is used in the 3-level system integrity checks. The generator acts as an oxidizer to produce oxidized Hg. This is used during the system integrity check to ensure the reduction of oxidized mercury to elemental mercury is being done correctly. The generator consists of two inlets, one for Hg calibration gas and the other for Chloride gas. The two gases are mixed and the mercuric chloride is sent to the probe for the integrity check.

2.3 Data Acquisition System

The Data Acquisition System is a pre-existing piece of equipment which will be used in conjunction with the Mercury Freedom™ System.

NOTE: For a more detailed description of the Data Acquisition System, please refer to the NGS CEMS/COMS QAP

The GE Energy Services Data Acquisition and Handling System (DAHS) is referred to as the NETDAHS. NETDAHS consists of software and two hardware components - a Data Acquisition Computer (DAC), and a Remote Data Collection Node (RDCN). The DAC communicates serially via Ethernet with the RDCN to collect all data and store the data to the computer hard drive. The data is stored as minute averages.

The RDCN consists of the programmable logic controller (PLC) modules. Emissions data is collected from the analyzers via the PLC connected to a high-speed local area network using TCP/IP protocol. A number of process-operating parameters are monitored by the RDCN and logged by the DAC. These include calibration control, alarms, analyzer status, and process status.

The NETDAHS DAC consists of a desktop IBM compatible computer, associated hardware and the GE Energy Services NETDAHS software. The DAHS provides the functions required to fully meet 40 CFR Part 60 and/or Part 75/Acid Rain. The system also provides a configurable environment to fulfill all state and local regulations as defined by the site's air permit. Reports may be produced in either hard copy or electronic format.

The operating system for the DAC is Microsoft Windows™. GE Energy Service's DAC uses all the latest features of the Windows™ operating system to allow the user access to the data collected via a variety of networks and software packages. Open access and connectivity is the key design philosophy behind the many features available.

2.3.1 NETDAHS Software

The following information outlines the specific features of GE Energy Service's NETDAHS software:

Relational Database - GE Energy Service's NETDAHS uses SQL Server, an open access relational database that supports standard query language (via OBDC). This database allows users to access the GE Energy Services DAHS database via standard system calls over named pipes on a network.

Graphics - All user interface graphics and use point and click, mouse driven menus. Folders, ICONS, and toolbars are provided for ease of use for all program functions. Most user interactions use mouse driven pushbuttons. Pull-down lists are provided to facilitate user interaction. Graphical displays of historical data and present data are provided for viewing on the screen or printing.

Proven GE Energy Services, Inc. NETDAHS Software - All application software C code used by GE Energy Services in previous UNIX based applications has been ported over to the 2000 platform and enhanced. This provides the customer with a field-tested and demonstrated product.

Reports - All reports and graphs can be imported directly to either Excel or Word for ease of editing. Once in Excel, the Chart Wizard can be used for generating graphical displays of data.

2.3.2 I/O Controller

The RDCN is built around a series of intelligent input and output modules manufactured by Rockwell Automation that are also known as Programmable Logic Controllers (PLC). The use of the PLC simplifies the design of the system and its maintenance and increases the reliability of the entire system. These modules are packaged for harsh industrial environments and communicate with the DAC using Ethernet. The TCP/IP communications protocol ensures a reliable message delivery system with inherent integrity checks on all messages. The RDCN is mounted inside the CEMS shelter for ease of connection and added protection.

Included in a typical system are analog-to-digital (A/D) converters that convert 4-20 mA signals from the analyzers into digital values. These digitized values are converted into engineering units within the RDCN. The digital input points within the RDCN are used to detect the presence of conditions such as “calibration in progress” or “analyzer fault”. The input points can also be used to detect conditions such as “Process On/Off”, “Process Startup”, or “Process Shutdown”.

The RDCN can run in a stand-alone mode (i.e. not connected to the data acquisition computer). Even if the DAC is down, the RDCN continues to calibrate all analyzers. In addition, the RDCN has battery backup memory. Data for each channel can be stored in memory. This ensures that no data is lost if the DAC is down for any reason. When the DAC comes back up, the software “catches up” by retrieving any available data from the RDCN. The data in the RDCN is stored on a “first in first out” (FIFO) basis.

In most PLC installations the PLC software is broken up into two main parts, the processor, and the co-processor. Each part has a dedicated processor to accomplish its task. The first part is the performance of the PLC processor to scan all analog and discrete inputs and control all outputs based on the input status. Also included in this task is the initial qualifying of analog data.

Final analog data processing is done in the co-processor. This co-processor is also the gateway to the DAC, although information may be passed directly from the processor.

2.3.3 Allen Bradley OC-266 INET PLC

The GE INET controller, developed by GE Energy Services, consists of a proprietary Central Processing Unit (CPU), using Compact Flash memory. The PLC operates a 266 MHz Pentium II The CPU makes decisions based on preprogramming.

The type of user memory for the INET PLC is Compact Flash. Compact Flash is a fast, low-power memory that can easily be examined and changed up to 7 million writes. Compact Flash memory is a non-volatile type of memory. A battery is included in the module to power the on-board clock on the processor.

Faults are handled by a software alarm processor function, which time-stamps and logs I/O and system faults in two tables: PLC Fault Table and I/O Fault Table.

The PLC software structure uses a common architecture that manages memory and execution priority in the Pentium II microprocessor. This operation supports both program execution and basic housekeeping tasks, such as diagnostic routines, input/output scanners, and alarm processing. These routines provide for the upload and download of application programs, return of status information, and control of the PLC.

The INET module provides math functions, report generation, and CEMSPEAK language capabilities. The INET module runs a LINUX operating system. CEMSPEAK is a GE Energy Services proprietary programming language that runs in the INET module. The module also contains a serial communications port, which works with ASCII terminals, providing operator program interaction, command level input, printer output, and various other functions.

Baseplate - The baseplate provides backplane connections for the I/O modules for the Allen Bradley Open Controller. All modules operate at 24 VDC. I/O modules are retained in their slots by molded latches that easily snap onto the upper and lower edges of the baseplate, when the module is fully inserted into its slot, to prevent accidentally loosening or disengagement of the modules.

The INET module must be installed in the first slot of the backplane. Module addressing is determined by the position (slot number) in the rack, in which it is installed; there are no jumpers or DIP switch settings required to address modules.

Power Supply Module - The Power Supply Module accepts 120 AC input power, and converts it into 24 VDC output power for an I/O chassis backplane.

Digital Input Module - The DC Input Module converts up to 16 (10 to 30 VDC) inputs to logic-level signals compatible with the PLC. The input section provides terminals for the field wiring coming from the sensing devices in the CEM enclosure. All customer signals are interfaced through relays to the module. The input also provides a visual indication, for the state of each input terminal, with indicators. Another function of the input section is signal conditioning. The input section receives the electrical signal from the machine and converts it to a voltage compatible with the PLC. The Discrete Input Modules convert AC and DC power levels from user devices to the logic levels required by the PLC. An optical coupler provides isolation between the incoming power and the logic circuitry.

Digital Output Module - Each Digital Output Module provides 16 outputs for the PLC. With indicators, the digital output also provides a visual indication for the state of each output terminal.

The Model 30 Discrete Output Modules convert logic levels into AC or DC power levels required for driving user-supplied devices. A power semiconductor provides the drive and isolation for each output point.

Analog Input Module - Each Analog Input Module consists of up to eight analog current inputs. The Analog Input Modules provide A/D conversion by converting an analog voltage into a scaled 12-bit number.

Analog Output Module - The Analog Output Module consists of up to eight analog outputs. The Analog Output Modules provide D/A conversion by converting a scaled 12-bit number into an analog voltage, which is then output as a current.

Chapter 3.0 Responsible Individuals

Throughout this QAP, reference is made to responsible individuals who have the primary responsibility for the procedure in that section. The responsible individuals identified below should review this Plan periodically to ensure that they are familiar with the required procedures.

3.1 Control Room Operators

The Control Room Operators are responsible for monitoring the status of the CEMS, review calibration tests daily and after unit startups, and informing the I&C Technician or Environmental Services Coordinator of CEMS alarms. (There is no tape backup at NGS but rather two mirrored hard drives that automatically back up daily.)

3.2 CEMS Technicians

In this document, "*Technician*" refers to the Instrument & Control CEMS Technicians, or any other individual responsible for adjusting or repairing the CEMS. The Technicians are responsible for performing all CEMS calibrations, adjustments, maintenance, and repair. These responsibilities are detailed throughout this QAP. Technicians are also responsible for keeping themselves familiar with the procedures in this QAP, maintaining detailed maintenance records, and recommending changes if necessary.

3.3 I&C Manager and Foreman

The I&C Manager and Foreman supervise and coordinate the Technicians in the maintenance and repair of the CEMS. They also manage and coordinate CEMS contract maintenance personnel, and works with the Environmental Services Coordinator in reviewing CEMS maintenance activities.

3.4 Environmental Services Coordinator

The Environmental Services Coordinator is the primary individual responsible for ensuring that the CEMS is operated and maintained according to this QAP. The Environmental Services Coordinator is also the primary individual responsible for ensuring that this QAP remains current and accurate. The Environmental Services Coordinator will coordinate CEMS testing, review CEMS system changes and upgrades, and assist in providing upgrades and training to plant employees. The Environmental Services Coordinator will also compile all periodic reports required by regulatory agencies, and assists in other CEMS related activities.

The Environmental Services Coordinator is responsible for all data validation, report generation, and report submittal. The Environmental Services Coordinator will also provide for review and analysis the CEMS Quarterly Emission Reports for the DR.

3.5 Plant Manager

The Plant Manager has the overall responsibility for this facility.

3.6 Designated Representative (DR)

NOTE: THIS SECTION IS NOT CURRENTLY REQUIRED UNDER THE REGULATIONS FOR MERCURY MONITORING.

Chapter 4.0 CEM Startup, Calibration, and Routine Operation

4.1 General

The goal of each CEM system is to provide data that is true, precise, complete, and representative of the gas stream from which it was sampled. Because the operating characteristics of all CEM instruments change over time, these instruments must be calibrated regularly to ensure that data quality remains high.

The JEA Northside Generating facility analyzers are automatically calibrated each day. This calibration is initiated and controlled by monitors. During calibration, the sample stream is temporarily turned off and calibration gases are flowed to each of the analyzers.

Two gases are required for the daily calibration procedure. A "zero" or low concentration gas is used to test the baseline response of each instrument. A "span" or high concentration gas is then used to test the response of the instrument at the high end of its range. These two gas concentrations are then utilized in performing the daily and quarterly assessments for running calibrations and linearity checks. Other ranges may be introduced besides the low and high gas concentrations, to verify and establish the linearity of the analyzers (i.e.: a mid-range) during the quarterly linearity check.

Table 4-1: Analyzer Span

Analyzer	Span	Unit of Measure
Hg	10	ug/scm

4.1.1 Instrument Level vs. Probe Tip Calibration

For an instrument calibration check, gases are introduced at the flow panel in order to conserve calibration gas. This is referred to as an "instrument level calibration". However, for the daily calibration of the sampling system, the gases must be introduced near the probe. This is referred to as a "probe tip calibration". Probe tip calibrations must also be performed whenever there is any change to, or maintenance of, any portion of the gas handling and conditioning system. It must also be performed prior to the quarterly QA audit. A probe tip calibration value which deviates by more than 5% from the instrument calibration value indicates that there may be a problem (leaks, condensation, etc.) with the sample transport/conditioning system.

4.2 The Sample Analysis System

To fully understand the calibration process and the effect it has on instrument performance, it is necessary to examine the sample analysis system more closely. The sample analysis system consists of the mercury analyzers. In the most general terms, a gas sample is introduced into the analyzer. The analyzer measures some physical property of the gas which is (ideally) unique to the pollutant of interest and produces a response which is proportional to the concentration.

It is important to understand several characteristics of analyzers which relate to the calibration process and to data interpretation. These are:

- Linearization
- Analyzer Drift
- Drift Compensation
- Interference

4.2.1 Linearization

The detector is the heart of any pollutant analyzer. The detector translates pollutant concentration into an electronic signal that is proportional to the pollutant concentration. This signal can then be interpreted by a data recording device.

Frequently, the relationship between pollutant concentration and detector response is non-linear. To compensate for this fact, some vendors provide electronic linearizer circuits internal to the analyzer. These circuits compensate for non-linear detector output.

Other vendors may provide a multi-point linearization table which allows the data acquisition and handling system to perform the linearization function.

A few manufacturers characterize an entire instrument line with a single linearization curve. This does not provide accurate characterization of an individual instrument and may require a multi-point calibration to accurately characterize the response of the instrument.

4.2.2 Analyzer Drift

The operating characteristics of any instrument change from day-to-day, indeed they change continuously. For example, instrument optics degrade by accumulation of a particulate matter or condensation film; critical optical alignments shift from vibration; and the characteristics of light sources, which are used in many analysis systems, change as they age. In addition, there are continuous, random fluctuations in electrical quality, ambient temperature and pressure which also affect instrument performance.

This change in analyzer response over time is called "drift." Drift may be either random or directional. Random drift may be caused by environmental factors such as electronic or electrical noise or temperature and pressure variations in the sample cell. Climate controlled instrument enclosures and electrical power conditioners are often used to minimize these environmental factors. Over time, random drift tends to cancel itself out.

Directional drift is generally caused by the degradation or contamination of analyzer components over time. This degradation or contamination may cause the analyzer response to drift in either a positive or negative direction depending on the type of analyzer.

Each system will be checked for drift through daily calibrations. If drift is detected, the CEM operator has three options:

- Do nothing. Minor variations due to random drift will always be present. Attempting to continually compensate for minor random drift is an exercise in futility. CEM regulations specify when the cumulative drift is substantial enough to warrant other action.
- Compensate for the drift by applying a compensation factor to all data generated. When cumulative drift becomes substantial it may indicate a directional drift problem. An adjustment must then be made to all data to compensate for the drift. Automatic compensation, when required, can be enabled by the operator.

- Identify and correct the root cause of the drift. When drift compensation is applied continuously to compensate for directional drift, the accuracy and precision of the data may suffer. When two or more consecutive compensations of the same direction and magnitude are necessary, corrective action should be initiated to identify and correct the problem causing the excessive drift. After the corrective action has been completed, the instrument may require manual re-calibration.

4.2.3 Drift Compensation

When cumulative analyzer drift becomes "excessive" (twice the performance specification), a compensation factor must be applied to all data in order to re-establish an accurate relationship between the pollutant concentration and the data output. Automatic compensation, when required, can be enabled by the operator. Currently, manual corrections are made at the analyzers.

Data compensation is often referred to as "data correction". However, this is a misnomer, since continually adjusting the data to compensate for directional drift does not correct the underlying problem. When drift compensation is applied continuously in lieu of corrective action, the accuracy and precision of the instrument may suffer.

In an absorption-type instrument, as the sample cell degrades the detector receives less light energy. The effective span of the instrument decreases as a result of this light attenuation. This results in a decrease in the accuracy of the analyzer. Data acquisition systems compensate for the changes in zero and span but cannot increase analyzer accuracy once it is lost.

When two or more consecutive compensations of the same direction and magnitude are necessary, corrective action should be initiated to identify and remedy the problem causing the excessive drift. After the corrective action has been completed, the instrument may require re-calibration.

4.2.4 Interference

Interference occurs when one or more constituents of a gas stream create the same analyzer response as the pollutant of interest, resulting in data which is biased high. Interference may also occur when detection of the pollutant of interest is blocked by the presence of one or more constituents of the gas stream, resulting in data which is biased low.

Each analyzer contained in the CEMS is required to demonstrate the lack of interference from the specific components contained in the units exhaust gas stream. It is suggested that one (1) of the following directions be adopted:

- Obtain an analyzer that is "immune" from the interference in question. Check with the vendor to provide you with a certificate and/or data that the analyzers are not going to be affected by the constituents in the gas stream.
- Conduct an interference check on each analyzer following guidelines as specified in 40 CFR 60, Appendix A, EPA Method 20, Section 5.4 "Interference Response". (Note: If this option is selected it is suggested that the gases used for the interference check be similar to actual exhaust gas values.)
- Measure the interfering substance. In the event the sum of interference responses for any analyzer is greater than 2.5 % of the applicable span value, corrective action must be taken to remove the substance from the gas stream prior to analysis.

4.3 General Calibration Concepts

The DAHS at the Northside Generation Station is programmed to perform a calibration sequence beginning at a specific time each day. In addition to these automatic calibrations, manual calibration should be performed prior to the quarterly audit or after any invasive QC procedure. Manual calibrations allow the operator to make an electronic compensation for drift. Both instrument level and probe tip calibrations can be performed manually.

4.3.1 Manual Instrument Level Calibration Procedure

Check the vendor's manual for analyzer manual calibration procedures. Instrument Level Calibrations are initiated at the analyzer.

The following describes the general procedure for manual analyzer calibration:

Calibration Drift
Verify that the response is within manufacturer's written specifications. If it is not within the written specifications, the CEMS is considered out-of-control. It is extremely important to ensure that the response is within specifications to limit errors associated with contamination or degradation of the analyzer components.

Calibration Error
Verify that the response is within manufacturer's written specifications. If it is not within the written specifications, the CEMS is considered out-of-control. It is extremely important to ensure that the response is within specifications to limit errors associated with damage of the analyzer components and to minimize out-of-control periods.

Instrument Flow Check
Verify that the gas flows are within manufacturer's written specifications. It is extremely important to ensure that the flows in all modes (sample, zero and span) are within specifications to limit errors associated with sample cell over pressure and sluggish response times.

Zero Adjustment
On any instrument, the zero adjustment should be made first. This ensures the baseline of the instrument is set to zero and allows an opportunity to identify and correct any zero noise and to compensate electrically for any directional drift.

Span (Gain) Adjustment
Following the initial zero adjustment, the span adjustment must be performed. This adjustment will compensate electrically for any decrease in detector sensitivity (directional drift) and adjust the response of the analyzer to a traceable standard (the calibration gas).

Zero/Span Check
Following any span adjustments, it is important to verify that the zero baseline has not shifted. If a change is noted, an adjustment to the instrument must be made. Whenever an adjustment to the zero or the span is made, a subsequent check to the span or zero must be made. This check process must continue until no further adjustments are made.

Automatic Calibration
After any manual calibration on any instrument, an automatic calibration must be performed. This allows the data acquisition system to reset the compensation factors it applies to the data if the automatic compensation option of the DAS is enabled. Currently, manual corrections are made at the analyzers.

Linearity and System Integrity Check
A weekly single point system integrity check must be performed and a quarterly three point integrity check or linearity check must be performed. It is extremely important to ensure that the error in linearity and integrity does not deviate from the reference value.

4.3.2 Manual Probe Tip Calibration Procedure

After a complete manual instrument level calibration (where the calibration gas is run directly into the analyzer), a check of the sample transport and conditioning system should be made. This may be accomplished either manually or through the DAHS.

Important Note: The probe tip calibration is a diagnostic check only and no adjustments are to be made.

Warning: If the probe tip calibration deviates by more than 5% from the instrument level calibration, there may be problems with the sample transport/conditioning system.

The numbers of the instrument calibration and the DAHS probe tip calibration (check of the sample transport and conditioning system) should match within 5%. If they are not, then a bias exists in the sample transport and conditioning system, which needs to be addressed through initiation of Corrective Action.

4.3.3 Automatic Calibrations

The automatic probe tip calibration is the "Daily Calibration" that is performed each morning. The parameters for this calibration have been programmed into the DAHS and no action on the part of the CEM operator is required to initiate this procedure.

4.4 Calibration Procedures

The system includes: 80i, Model 81i, 82i, 83i, 83i GC, and the Mercury Chloride Generator. Of these, Model 80i and Model 81i have specific calibration procedures. Model 80i controls the calibration for the entire system. The calibration procedures include both elemental Hg and total Hg being calibrated simultaneously. Model 81i has been factory calibrated and does not require routine calibration.

4.4.1 Frequency of Calibration

The following sections detail the calibration procedures for the Mercury Freedom™ System and can also be found in the User Manual.

Table 4-2: Calibration Frequency

	Specification	Acceptance Criteria		Calibration Standard
Daily	Zero and Span*	Zero and Span Checks indicate a shift in instrument gain of < 5%		Elemental Hg or Oxidized Hg standard
Weekly	System Integrity Check	≤ 10% of the reference value		Oxidized Hg standard
Quarterly	Linearity Check	≤ 10% of the reference value		Elemental Hg standard
Yearly	RATA	annual test using current industry standard and regulatory practices		Elemental Hg or Oxidized Hg standard

*Also run prior to initial Start-up

4.4.2 Initial Start-up Calibration for Model 80i

To calibrate the Model 80i, the Model 81i Calibrator is required. In turn, a zero air source is required for feed gas to the 81i Calibrator.

Drying

Several drying methods are available. Passing the compressed air through a bed of silica gel, using a heatless air dryer, or removing water vapor with a permeation dryer are three possible approaches. Any air dryer should be preceded by an oil/water coalesces.

Scrubbing

Fixed bed reactors are commonly used in the last step of zero air generation to remove the remaining contaminants by either further reaction or absorption. Table 4-3 lists materials that can be effective in removing contaminants.

Table 4-3: Scrubbing Materials

To Remove	Use
Hydrocarbons	Molecular Sieve (4A), Activated Charcoal
O_3, Hg^0 and SO_2	Activated charcoal

4.4.3 Pre-Calibration Procedure

Note: The calibration and calibration check duration times should be long enough to account for the transition (purge) process when switching from sample to zero and from zero to span.

Depending on the plumbing configuration and the instrument, data from approximately the first several minutes of a zero calibration or check should be disregarded because of residual sample air. Also, data from approximately the first several minutes of a span calibration or check should be disregarded because the span is mixing with the residual zero air.

1. Allow the instrument to warm up and stabilize overnight.
2. Check to see that there are no alarms.
3. Be sure the instrument is in the auto mode, that is, Hg^0, Hg^{2+}.
4. Hg^t measurements are being displayed on the front panel display. If the instrument is not in auto mode:
   a. Press to display the Main Menu, then choose Instrument Controls > Auto/Manual Mode.
   b. Select Hg(0)/Hg(t), and press .
   c. Press to return to the Main Menu.
5. From the Main Menu, select Averaging Time to display the Averaging Time screen. It is recommended that a higher averaging time be used for best results.

Note: During an auto calibration, the averaging time should be less than the zero duration and less than the span duration.

4.4.4 Calibration Procedure

In order to calibrate the Model 80i analyzer, first connect the CAL GAS from the 81i to the SPAN port on the 80i. Ensure that an atmospheric dump is present. Connect the ZERO AIR from the 81i to the ZERO port on the 80i.

4.4.4.1 Setting Hg^0 and Hg^t Background to Zero

Note Hg^0 is equivalent to Hg ELEMENTAL and Hg^t is equivalent to Hg TOTAL

1. Put the Model 80i in Inst Zero mode.
2. Put the Model 81i in Analyzer Zero mode.
    a. Allow instrument to sample zero air until the Hg^0, Hg^t, and Hg^{2+} readings stabilize
    b. Next, choose Calibration > Cal Hg(0) Background from the Main Menu
    c. Press to set the Hg(0) reading to zero.
    d. Press to return to the Calibration menu.
    e. Repeat this procedure to set the Hg^t background to zero.
3. Set the 80i to Analyzer Span mode and set the desired calibration concentration using one of the six preset span values in the 80i (Calibration > Inst Hg Span Conc.).
4. Set the 80i to Analyzer Span mode.

4.4.4.2 Setting the Hg0 Channel to the Hg0 Calibration Gas

1. Allow the instrument to sample the Hg0 calibration gas until the Hg^0, Hg^t, and Hg^{2+} readings stabilize.
2. Next, choose Calibration > Calibration Hg^0 Coefficient from the Main Menu.
3. Enter the output conc. at the model 81i (the Hg^0 calibration gas concentration) in the SPAN CONC line of the display. The Hg(0) line of the Calibrate Hg(0) screen displays the current Hg^0 concentration. Use the left and right arrows to move the cursor left and right and use the up and down arrows to increment or decrement the numeric character at the cursor.

4.4.4.3 Calibrating the Hgt Channel

Note: Since the Hg^{2+} converter is located in the Model 83i, Hg^0 cal gas should be used to calibrate the Model 80i if it is used as a stand-alone unit. Do not introduce Hg^{2+} gas directly into the 80i without running it through a converter.

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1. Press to return to the Calibration menu, and choose Cal Hg(t) Coefficient. The Hg^t line of the Calibrate Hg^t screen displays the current Hg^t concentration. Enter the Hg^0 calibration gas concentration from the 81i into the SPAN CONC line of the display.
2. Press to calculate and save the new Hg^t coefficient based on the entered span concentration.
3. Record the Hg^t concentration and the instrument's Hg^t response if desired.

4.4.4.4 Daily Zero and Span Checks for the Model 80i

The system calibration check requires the calibration gas to go through all system components. The calibration check must be done daily with either Hg^0 or $HgCl_2$. Since the system uses a converter, if elemental Hg is used, you must do weekly system integrity checks. The 80i automatic calibration check requires the following pre-conditions:

Analyzer Service Mode must be OFF.
Analyzer must control the Calibrator.

1. Allow instrument to sample zero gas until a stable reading is obtained on the Hg^0, Hg^t, and Hg^{2+} channels then record these readings.
2. Attach a supply with known Hg^0 concentration to the sample port (Hg TOTAL or Hg ELEMENTAL) or SPAN bulkhead.
3. Allow instrument to sample the calibration gas until a stable reading is obtained on the Hg^0, Hg^t, and Hg^{2+} channels and record these readings.
4. This check can be repeated for the system using system zero/system span gas modes. Stabilization time will vary.

Note: For frequency of calibration, see Section 6.1.

4.4.5 Calibration for the Model 81i

The Model 81i is calibrated to NIST standards at the factory and should not require calibration prior to startup. However, when a mass flow controller or pressure transducer is replaced it must be calibrated before operating the instrument.

IMPORTANT NOTE The replacement or recalibration of any component will void the overall NIST Traceability of the Model 81i and will require re-certification.

4.4.5.1 Mass Flow Controller Calibration

In order to calibrate the mass flow meter section of the zero or gas mass flow controller, a NIST traceable flow meter is required. The term calibration means determining the actual flow versus the flow setting for seven equally spaced flows along the range of the device. The Model 81i then corrects the output according to an internal algorithm.

Calibration may be done with a properly calibrated flow meter. For the most accurate calibration procedure, use a volumetric NIST traceable calibrator with the following step-by-step calibration procedure.

1. Connect a source of clean, dry air to the inlet of the mass flow controller.
2. Measure barometric pressure and room temperature.
3. Connect a suitable flow meter to the mass flow controller outlet.
4. Set Model 81i to Hg Flow or Zero Air Flow Calibration.
5. Set flow controller to 95 percent of full scale, then wait until flow meter reading stabilizes.
6. Enter the flow meter reading using the flow input screen.
7. Repeat Steps 5 and 6 for the remaining flow settings.

If you encounter a flow controller malfunction, contact Thermo Fisher Scientific.

4.4.5.2 Cooler Temperature Calibration

Use the following procedure to calibrate the cooler temperature when the cooler temperature does not match the cooler set temperature.

1. Connect an appropriate resistor for the desired setting temperature to J24 pins 1 and 2 on measurement interface board. For example, for a temperature of 14°C, use a resistor with a value of 15,797 Ohms. Refer to the following table for a list of resistors and associated temperature values.

Note: After plugging in the test resistor, it may take several minutes for the reading to stabilize.

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1. From the Main Menu, press [↓] to scroll to Service, press [↵] > [↓] to scroll to Cooler Temp Calibration, and press [↵]. The Calibrate Cooler Temp screen displays. If Service is not displayed on the Main Menu, use the following procedure to display it:
   a. At the Main Menu, press [↓] to scroll to Instrument Controls, press [↵] > [↓] to scroll to Service Mode, and press [↵]. The Service Mode screen displays.
   b. Press [↵] to toggle the Service Mode to ON.
   c. Press [■] > [■] to return to the Main Menu.
   d. Continue the procedure at Step 2 to access the Calibrate Cooler Temp screen.
2. At the Calibrate Cooler Temp screen, use [↑] [↓] until the temperature reads 14°C, then press [↵] to save the value.

Table 4-4: Temperature Values and Associated Resistors

Temperature (°C)	R Value (Ohms)
0	29,490
1	28,157
2	26,891
3	25,689
4	24,547
5	23,462
6	22,430
7	21,450
8	20,517
9	19,631
10	18,747
11	17,983
12	17,219
13	16,490
14	15,797
15	15,136
16	14,507
17	13,906
18	13,334
19	12,778
20	12,268

4.4.6 Calibration of Models 82i, 83i, and Mercuric Chloride Generator

All of the components of the Mercury Freedom™ System work together as one whole unit. The calibration procedures for Model 80i serve as calibration procedures for the system as a whole; due to this, Models 82i, 83i, and the generator do not require their own specific calibration procedures.

Chapter 5.0 Quality Control Activities

5.1 Introduction

Quality Control (QC) is the procedures, policies, and corrective actions necessary to ensure product quality. QC procedures are routine activities. These activities include but are not limited to daily calibrations and routine maintenance.

5.2 Maintenance Policy

A thorough and consistent maintenance program is essential for the collection of high quality CEMS data. The guidance provided in this section shall be followed completely and consistently to ensure high data integrity and availability.

The materials in this section, as well as the associated standard operating procedures, have been adapted from material supplied by the equipment vendor. In many cases, these materials have been modified to accommodate the unique characteristics of the system installed at this facility. In situations where this document does not cover a particular topic of concern, the vendor's documentation shall be used as a guide.

As inspection and maintenance procedures evolve, this document shall be updated at least annually by Environmental Services Coordinator, approved by the Plant Manager and the QA/QC team, so as to reflect actual current practice.

The specific preventative maintenance procedures can be found in the worksheets in this section.

5.3 System Maintenance Log

In order to ensure consistency and follow-through on system maintenance and to provide documentation of system operation, a log shall be kept of any system malfunctions, maintenance, adjustments, inspections or operator observations. This log shall be referred to as the System Maintenance Log. It shall consist of a bound notebook with pre-numbered pages. All entries in the log shall be made in non-erasable ink. The logbook shall be updated daily as part of the daily inspection procedure. The logbook shall be kept in the analyzer shelter at all times.

5.4 Daily Inspections and Preventative Maintenance (I/PM)

The CEM systems shall be inspected daily by the I&C Technicians. The daily inspection checklist shall be filled out completely and filed as part of the maintenance log of the system. The objectives of the daily inspections are to:

- Check that all instruments are operating within checklist parameters;
- Check that all gas flows are within specified limits;
- Verify that required daily calibrations have been performed;
- Review results of daily calibration for possible system adjustment;
- Inspect suspected "trouble spots" as a preventative measure;
- Check that all consumables are present in sufficient quantity for the day's activities;
- Check that all data collected is being properly analyzed and stored.

This daily inspection is designed to provide a quick overview of the operation of the system. It should take no longer than one (1) hour to complete. This time includes about 30 minutes to inspect the instruments of the CEM systems and 30 minutes in the CEMS Shelter reviewing data.

In addition to completing a daily checklist, the System Maintenance Log shall be updated each day. Descriptions of the entries for various situations are described below.

5.4.1 System Maintenance Log Entry – No Areas of Concern Identified

If the daily inspection uncovers no problems or potential problems, an entry shall be made in the System Maintenance Log. The entry shall consist of:

- the date;
- a notation that the daily inspection was performed and that no problems were found;
- the signature of the Technician.

5.4.2 System Maintenance Log Entry – Areas of Concern Identified

If problems or areas of concern are discovered during the daily inspection, an entry shall be made in the System Maintenance Log. The entry shall consist of:

- the date;
- a notation describing the problem or potential problem;
- a notation describing the corrective action which will be taken;
- who is responsible for performing the corrective action;
- a completion date for the corrective action;
- the signature of the Technician;
- optional condition of how the system was left (i.e.) needs calibration, parts in operable, etc.).

If a Work Order is submitted, the third, fourth and fifth items may be omitted. A reference to the Work Order number must be made in the System Maintenance Log. This is essential since it provides the critical link between the System Maintenance Log and the Work Order.

5.5 Monthly I/PM

The monthly inspection and preventative maintenance (I/PM) activities shall be completed and logged as part of the System Maintenance Log.

Log entries, problem reports, and documentation of problem resolution shall be handled according to the procedures outlined in the Corrective Action Program.

5.6 Quarterly I/PM

The quarterly I/PM is the major system diagnostic procedure. It requires more invasive inspection and testing than any other I/PM. This I/PM shall be performed two (2) to three (3) weeks before the quarterly QA audit. This allows enough time to identify and correct any problems that may impact the results of the audit. The quarterly I/PM checklist shall be filled out completely and filed as part of the maintenance log of the system.

Important Note: If the quarterly QA/QC Testing shows inadequate system performance, the quarterly I/PM activities (or an appropriate subset of these activities) shall be performed monthly until consistent, acceptable performance is achieved.

Log entries, problem reports, and documentation of problem resolution shall be handled according to the procedures outlined in the Corrective Action Program.

5.7 Problem Reports and Initiation of Corrective Action

Whenever a problem or area of concern is identified or found during an inspection, it shall be reported to the Maintenance Supervisor. If the problem is non-routine or major, a Corrective Action Worksheet shall be submitted to the I&C Maintenance Manager or Foreman.

The Environmental Services Coordinator and I&C Manager or Foreman shall be responsible for reviewing the situation and/or the Corrective Action Worksheet, determining whether corrective action is required, deciding on an appropriate timetable, and issuing work orders or taking other steps to ensure that corrective actions are taken. The Environmental Services Coordinator and I&C Manager or Foreman are also responsible for verifying that the corrective action has been taken and that the problem is resolved.

5.8 Documentation of Problem Resolution

Upon verification that the problem is resolved, the *I&C Technician* shall make an entry into the System Maintenance Log. The entry shall consist of:

- the date;
- a notation referring to the initial problem entry in the log;
- a description of any changes or modifications to the corrective action as described in the initial problem entry;
- a notation that he/she has verified that the corrective action has been taken and the problem is resolved;
- the signature.

(Note: If a Corrective Action Worksheet is filed, this entry may be omitted.)

5.9 Corrective Actions Requiring Additional Testing

Any change that affects the monitors measuring systems or analysis systems in such a way that measurements or calibrations have changed significantly (including the DAHS) shall require additional testing. Change resulting from routine or normal corrective maintenance and/or quality assurance activities do not require recertification, nor do software modifications in the automated data acquisition and handling system, where the modification is only for the purpose of generating additional or modified reports.

The following are examples of situations that require addiontal testing. These changes include, but are not limited to, the following:

- Changes in gas cells;
- Path lengths;
- Sample probe;
- System optics;
- Replacement of analytical methods (including the analyzer(s), monitor(s));
- Change in location or orientation of the sampling probe or site;
- Rebuilding of the analyzer or all monitoring system equipment.

5.10 Routine Maintenance

This section contains suggestions for performing routine preventive maintenance. For detailed maintenance procedures, refer to the manufacturers' instruction manuals and other technical data included under separate cover(s).

5.10.1 Abnormal Measurement Output Voltage

If output voltage/current range is not between the required range for each analyzer and calibration is completed successfully, refer to the analyzer manufacturer's instruction manuals for adjustment and/or repair information.

5.10.2 Water Contamination

Following a sample-failure-alarm, first check for any water in the moisture sensor bowl or a high cooler temperature. To find the cause of the water contamination, proceed as follows:

1. Check to see that the temperature of the sample gas cooler is at least 35°F.
2. Remove, dry out, and replace the moisture-sensor filter-elements.

5.11 Routine Maintenance for the Sample Probe

The probe has no moving parts. It does have a particulate filter and an electric heater. The electric heater can be checked by using a clamp-on AC amp meter to detect current on the power wires going from the analyzer cabinet into the sample line up to the probe. The probe also has a low temperature alarm contact that will detect an inoperable probe heater. The filter is manually checked as part of scheduled routine maintenance as described later.

5.12 Routine Maintenance for the Sample Line

The sample line requires no maintenance. However, it is advisable to inspect periodically the sample line visually to detect any damage or wear due to rubbing, vibration, physical damage, etc. If the sample line is installed properly, there should be no stress points that could cause the tubing to become kinked in any manner. Typical life of the heat-trace sample-line is approximately 10-12 years depending on the temperature maintained and ambient conditions. Sample line heat trace is not a serviceable item and thus would require replacement in its entirety.

5.13 Preventative Maintenance Schedule

This section contains a suggested schedule, Form 5-1, for performing preventive maintenance. Maintenance schedule may vary depending upon site-specific conditions.

Thermo Fisher SCIENTIFIC

11/27/2006

Preventative Maintenance Schedule for Mercury Freedom System

This document is a guideline only, many items are site specific
See recommended spares list for part numbers and pricing

		Monthly	Quarterly	Semi-Annually	Annually
Model 80	Clean outside of case	x			
	Visual Inspection and cleaning	x			
	Critical orifice inspection (qty 2)	x			
	Fan filter inspection	x			
	Lamp voltage/frequency check	x			
	Leak Test				x
	Replace analyzer lamp				x
	Daily analyzer worksheet				
Model 81	Cleaning outside of case	x			
	Chiller fins inspection and cleaning	x			
	Fan filter inspection and cleaning	x			
	Leak test				x
	Replace scrubbers				x
	Daily calibrator worksheet				
Model 82	None				
Model 83	Hg converter core replacement			x	
	15 micron filter				x
	Hg scrubber (elemental channel)			x	
	Thermocouple converter				x
	Preventative maintenance kit				x
	Clean inertial filter with brush		x		
	Clean out inlet and outlet stingers		x		
System	Cleaning sample lines (2)				x
	Check indicating silica gel on dryer	x			
	Replace Dryrite				x
	Replace carbon				x
	Replace Purafil				x
	Filter for black canister (Cl)				x
	Pump replacement				as needed

Figure 5-1: Preventative Maintenance Schedule

Chapter 6.0 QUALITY ASSURANCE ACTIVITIES

Quality Assurance (QA) is a series of checks performed to ensure the QC procedures are functioning properly. The activities include, but are not limited to, quarterly and annual audits.

6.1 Daily Calibration Error Tests for the Hg Monitors

The Control Room Operator is responsible for reviewing and printing the CEMS Calibration Report each day and to report any CEMS alarms to the I&C Technician and/or Environmental Services Coordinator as soon as possible after an alarm is detected. The Control Room Operator is also responsible for ensuring that calibration error and calibration drift tests are initiated after a unit startup, according to the frequency and test requirements of this section.

The I&C Technician is responsible for taking corrective actions when calibrations are outside of acceptable standards, and repeating tests when necessary. The I&C Technician shall report problems or failed calibration tests to the Environmental Services Coordinator.

The Environmental Services Coordinator is responsible for ensuring that the calibration checks and adjustment procedures in this Section are performed according to this QAP. The Environmental Services Coordinator should periodically review CEMS calibration error data to ensure the tests are within the accuracy requirements and that the reports are filed for recordkeeping.

A two-point calibration error test of the Hg (for Units 1 and 2) monitors is performed automatically once during each unit operating day. The manufacturer recommends the daily calibration error tests to be performed during quality assurance testing. This is because the readings from the CEMS are affected by temperature and pressure conditions.

In general, all daily calibrations must be performed while the units are on-line. However, daily calibrations may be performed when the unit is off-line if the monitoring systems pass an "off-line calibration demonstration" as described below. ***Note that this test must be conducted for each stack and each analyzer.***

6.1.1 Conducting the Daily Calibration Error Test

The two-point calibration error test calculates the calibration error for two gas concentrations. During calibration, the system controller flows calibration gases to the probe. The monitors are challenged once with each level of the calibration gases. Each gas flows for approximately 10 minutes. The monitor response is recorded by the DAHS.

Do not make manual adjustments to the monitor settings until after taking measurements at both zero and high concentration levels for that day.

The DAHS compares the actual analyzer reading with the expected value of the calibration gas. If the analyzer drift exceeds the specification limits, the failure is indicated on the calibration report. When the daily calibration exceeds the specification limits, this indicates a need for corrective actions. Corrective actions may include, but are not limited to, manual calibration of the failed analyzer.

6.1.2 Daily Calibration Error Test Results

Daily Calibration Error Test Results may be viewed two ways, using CalHist or by viewing the Daily Calibration Report.

To view in CalHist, single click on the Calibrations and Constants tab from the Main Menu, then select Calibrations History. Select the appropriate channels and time frame and click "OK". The results will take a moment to appear.

To view as a report, select Reports from the Main Menu, and then select Generate/Configure Reports. Select the appropriate report and time frame, then single click "Generate". Once the report is generated, single-click "View" to view the report.

6.1.3 Out-of-Control Limits

A calibration error (CE) is required to be initiated for every 24- to 26-continuous-hour period, for zero and span drift assessments. In the event that the drift exceeds the limitations, the CEMS is deemed out-of-control.

The out-of-control period begins with the hour of the failed calibration error test and ends with the hour of the next satisfactory calibration error test after corrective action. If the failed calibration error test, corrective action, and satisfactory calibration error test occur within the same hour, the hour is not considered out-of-control if two or more valid readings are obtained during the hour.

The DAHS records the calibration-error-test-results and "flags" the calibration report if the recalibration (or out-of-control) criteria are exceeded. Recalibration or corrective action is taken when the failure is identified.

During the period, the CEMS is out-of-control; the CEMS data may not be used in calculating emission compliance nor be counted towards meeting minimum data availability.

6.2 Daily Assessment Start-Up Grace Period

A start-up grace period may apply when a unit begins to operate after a period of non-operation. The requirements to qualify for a start-up grace period are as follows:

1. The unit must have resumed operation after being in outage for 1 or more hours (i.e., the unit must be in a start-up condition) as evidenced by a change in operating time from zero in one clock hour to an operating time greater than zero in the next clock time.

2. For a monitoring system to be used to validate data during the grace period, the previous daily assessment must have passed on-line within 26 clock hours prior to the last hour in which the unit operated before the outage. The monitoring system must also be in-control with respect to quarterly and semi-annual or annual assessments.

If these conditions are met, then a start-up grace period of up to eight (8) clock hours applies, beginning with the first hour of unit operation following the outage. During the start-up grace period, data generated by the monitoring system are considered quality-assured. A start-up grace period for a calibration error test ends when:

1. A daily assessment (calibration error test or flow-interference check) is performed; or

2. Eight (8) clock hours have elapsed (starting with the first hour of unit operation following the outage), whichever occurs first.

6.3 Data Recording and Data Validation

Record and tabulate all calibration-error test data according to month, day, clock-hour, and magnitude in ppm, or percent volume (as applicable to individual applications). For program monitors that automatically adjust data to the corrected calibration values either record the unadjusted concentrations measured in the calibration error test prior to resetting the calibration or the magnitude of any adjustment.

When a monitoring system passes a daily assessment (daily calibration error test), data from that monitoring system are considered valid for 26 clock hours (24 hours plus a 2-hour grace period.) The 26 clock hours begin with the hour in which the test is passed, unless another assessment is failed within the 26-hour period. These other assessments consist of additional calibration error checks, or a quarterly linearity check, or a relative accuracy test audit.

Data is considered invalid, beginning with the first hour following the expiration of a 26 hour data validation period or beginning with the first hour following the expiration of an 8-hour start-up period (refer to next section), if a subsequent passing daily assessment has not been conducted.

If an on-line daily calibration error test of the monitoring system is not conducted and passed within 26 unit-operating hours of an off-line calibration error test that is used for data validation, then data from that monitoring system are invalid beginning with the 27th unit-operating hour following that off-line calibration error test.

6.4 Quarterly Assessments

The following assessments will be performed during each calendar quarter that the unit combusts fuel.

6.4.1 Linearity Check

The Environmental Services Coordinator is responsible for ensuring that quarterly linearity checks are performed according to the procedures in this QAP. The Environmental Services Coordinator is also responsible for reviewing the linearity check schedule to ensure that the audits are performed according to the required frequency. The Technician are responsible for informing the Environmental Services Coordinator when major CEM analyzer maintenance or setup changes occur (i.e., changes in analyzer span values, major analyzer repairs, or new analyzers are installed) so that the Environmental Services Coordinator can determine if a linearity check may be required.

The Technician is responsible for performing the actual linearity check audit. The Technician is also responsible for taking corrective actions when test results are outside of acceptable standards, and repeating these checks when necessary.

The CEM linearity check is performed once each. The linearity check is performed by repeatedly challenging the CEM systems with three (3) concentrations of calibration gas. The difference between the actual concentration of the audit gases and the concentration indicated by the analyzer is used to assess the overall accuracy and linearity of the CEM systems. A linearity check is not required in quarters with less than 168 operating hours.

6.4.2 Viewing the Results

Linearity Check Test Results may be view two ways, using CalHist or by viewing the Linearity Calibration Report.

To view in CalHist, single click on the Calibrations and Constants tab from the Main Menu, then select Calibrations History. Select the appropriate channels and time frame and click "OK". The results will take a moment to appear.

To view as a report, select Reports from the Main Menu, then select Generate/Configure Reports. Select the appropriate report and time frame, then single click "Generate". Once the report is generated, single-click "View" to view the report.

6.4.3 Data Validation – Linearity Check

A linearity check cannot be performed if the monitoring system is operating out-of-control with respect to any required daily or semiannual quality assurance.

The linearity check may be done after performing only routine or non-routine calibration adjustments at the various calibration gas levels (zero, mid, or high), but no other corrective maintenance, repair, re-linearization or reprogramming of the monitor is allowed. Trial gas injection runs may be performed after the calibration adjustments prior to the linearity check to optimize the performance of the monitor. The trial gas injections do not have to be reported provided they meet the specification for trial gas. However, if this specification is not met, the trial injection will be counted as an aborted linearity check.

The linearity check may be done after repair, corrective maintenance or reprogramming of the monitor. In this case, the monitor will be considered out-of-control from the hour of the repair, corrective maintenance, or reprogramming was performed until the hour of a successful linearity check. Alternately, the data validation procedures and associated timelines may be followed when the repair, corrective maintenance, or reprogramming of the monitor has been completed.

Once the linearity check has been started, no adjustments of the monitor are permitted during the test period other than routine calibration adjustments.

If a daily calibration error test failed during a linearity test period, prior to completing the test, the linearity check must be re-started. Data from the monitor are invalidated from the hour of the failed calibration error test until the hour of a successful calibration error test. The linearity error check cannot be re-started until a successful calibration error test has been completed.

For each monitoring system, report results of all completed and partial linearity tests that affect data validation in the required quarterly report. Linearity attempts that were aborted because of problems with the calibration gases or plant operational problems do not need to be reported. A record of all linearity tests, trail gas injections and test attempts (reported or unreported) must be kept on-site as part of the official test log for each monitoring system.

No more than four successive calendar quarters shall elapse after the quarter in which a linearity check was last performed without conducting a subsequent linearity test. If a linearity test has not been completed by the end of the fourth calendar quarter since the last linearity test, then the linearity test must be completed within a 168-unit operating hour grace period following the end of the fourth successive elapsed calendar quarter. Otherwise, data collected by the monitoring system will be considered invalid.

6.4.4 Linearity Error Grace Period

When a required linearity test has not been completed by the end of the QA operating calendar quarter in which it is due, or because of infrequent operation of a unit, infrequent use of a required high range monitor or monitoring system, four successive calendar quarters have elapsed after the quarter in which a linearity was last performed, the owner/operator has a grace period of 168 consecutive operating hours in which to perform the linearity test. The grace period starts with the operating hour following the calendar quarter in which the linearity test was due.

If at the end of this 168-unit operating hour grace period, the required tests have not been performed, data from the monitoring system will be considered invalid beginning with the hour of the missed 168 hour grace period. Data from the monitoring system will remain invalid until the hour of completion of a subsequent successful hands-off linearity test. A linearity test performed within a grace period satisfies the QA requirements for the missed quarter but not for the quarter that the grace period linearity test was completed.

6.4.5 Out-of-Control Period

An out-of-control period occurs when the error in linearity at any of the three concentrations (six for dual range) exceeds the applicable specifications of >5% error. The out-of-control period begins with the hour of the failed linearity check and ends with the hour of a satisfactory linearity check following the corrective action. During the time the CEMS is out-of-control the CEMS data may not be used in calculating emission compliance nor be counted towards meeting minimum data availability.

6.5 Semiannual and Annual Assessments

An annual RATA will be conducted following standard industry and regulatory practices.

6.5.1

6.5.2

Chapter 7.0 ROUTINE PREVENTIVE MAINTENANCE

Routine preventative maintenance actions, descriptions, and schedules can be found in Section 5.0 Quality Control Activities.

7.1 Preventive Maintenance Forms

This section contains a suggested form for performing preventive maintenance. Maintenance schedules may vary depending upon site-specific conditions (i.e., filters may need to be changed more often in a "dirty" environment or less often under "clean" conditions). For detailed maintenance, procedures refer to the manufacturer's instruction manuals and other technical data included separate cover.

Some items, such as filter checks, may not exhibit a failure condition until damage has occurred to other components. Initially, these items will require careful and frequent checking to determine replacement frequency specific to individual applications. Any changes of the operating characteristics of the system should trigger a maintenance response to prevent loss of data and/or equipment damage. This includes paying attention to any shift (sudden or prolonged) in one direction and close observation of the visual indicators in the system.

CEMS alarms indicate that service is required. They do not necessarily indicate that the collected data is invalid. The alarms do indicate that the system is operating outside of design tolerance and incorrect data and equipment damage will occur if the system continues operation without corrective action. For this reason, the alarms themselves should be tested on a regular basis to assure that they are operating as designed. All alarm conditions require quick attention and resolution.

Example Form 7-1: Monthly Preventive Maintenance Check

Unit No.: ____________ Date: ____________________

ITEM	INITIALS	RECORD VALUES WHERE APPLICABLE	COMMENTS
Model 80			
Clean outside of case			
Visual Inspection and cleaning			
Critical orifice inspection (qty 2)			
Fan filter inspection			
Lamp voltage/frequency check			
Model 81			
Cleaning outside of case			
Chiller fins inspection and cleaning			
Fan filter inspection and cleaning			
System			
Check indicating silica gel on dryer			

Example Form 7-2: Quarterly Preventive Maintenance Check

Unit No.: ___________ Date: __________________

ITEM	INITIALS	RECORD VALUES W/ APPLICABLE	COMMENTS
Model 83			
Clean inertial filter with brush			
Clean out inlet and outlet stingers			

Example Form 7-3: Semi-Annual Preventive Maintenance Check

Unit No.: __________ Date: ______________

ITEM	INITIALS	RECORD VALUES WHERE APPLICABLE	COMMENTS
Model 83			
Hg convertor core replacement			
Hg scrubber (elemental channel)			

Example Form 7-4: Annual Preventive Maintenance Check

Unit No.: __________ Date: ________________

ITEM	INITIALS	RECORD VALUES WHERE APPLICABLE	COMMENTS
Model 80			
Leak Test			
Replace analyzer lamp			
Model 81			
Leak Test			
Replace scrubbers			
Model 83			
15 micron filter			
Thermocouple converter			
Preventative maintenance kit			
-System			
Cleaning sample lines (2)			
Replace Dryrite			
Replace carbon			
Replace Purafil			
Filter for black canister (Cl)			
Pump replacement as needed			

Example Form 7-5: Long Term Storage

Unit No.: __________ Date: ________________

ITEM	INITIALS	RECORD VALUES WHERE APPLICABLE	COMMENTS
DAHS			
The DAHS computer hard drive needs to be replaced after three years of operation.			

Example Form 7-6: Corrective Action Report Sheet

Date: ____________________ Initials: ____________________

Time: ____________________ Reviewed By: ____________________

Locations: ____________________ Unit: ____________________

Analyzer/Monitor/Component Being Serviced: ____________________

Problem (Describe the problem that initiated the corrective action, including active alarms, out-of-control conditions etc.):

Corrective Action (Describe the procedures, checks, tests, etc. performed to correct the problem. Include a list of parts used.):

As Corrected Condition: (Describe the state of the analyzer/monitor/component/system following corrective action. Include alarms cleared, calibration results, analyzer readings, etc.):

Chapter 8.0 CORRECTIVE MAINTENANCE

This section contains information on performing troubleshooting and corrective maintenance. For detailed procedures refer to the manufacturer's instruction manuals and other technical data included under separate cover. The Technician should be familiar with the material in these manuals before attempting any troubleshooting.

8.1 Objectives of the CEMS Corrective Action Program

The objectives of the Northside Generating facility Corrective Action program are to:

- Identify and report CEM systems problems at the earliest stage of development.
- Correct or otherwise address CEM systems problems in a timely manner in order to minimize the impact of these problems.
- Identify and eliminate the root causes of the problems, where appropriate, in order to prevent the same type of problems from arising in the future.
- Establish guidelines for responding to problem situations in a manner which contributes to the probability of making correct decisions and minimizes possible legal consequences.
- Define lines of communication to management in order to facilitate management's role in reducing the frequency of problems and insuring the adequacy and timeliness of corrective actions.

The implementation of each of these objectives is discussed below.

Identify and report CEM systems problems at the earliest stage of development

The Inspection/Maintenance Procedures discussed in Section 5, are designed to identify problems early in their development. Minor adjustments and corrections to the system are performed on a routine basis as part of the Daily/Weekly and Quarterly I/PM. When a non-routine or major problem is found, a more formal corrective action process should begin.

For the purposes of this program, a non-routine or major problem is one that causes or has the immediate potential to cause:

- The health or safety of employees or the surrounding community to be endangered;
- The facility to be non-compliant with local, state, or federal regulations;
- A loss of CEM data;
- An "out of control" condition to occur with one or more analyzers;
- Damage to the CEM systems or its components;
- A significant liability to JEA Northside Generating Station.

The Corrective Action Program is initiated with the Corrective Action Report Sheet (Example Form 7-8). The report must be completed in accordance with the instructions on the reverse of the form. This report is completed by the person who discovers the problem or area of concern. It is submitted to the Plant Manager who shall maintain a file of all such reports. Reports shall be kept for at least five years. All employees are encouraged to use this report form if a problem situation or area of concern is identified.

Once a corrective action is completed, Plant Engineer evaluates the results in order to determine if the action is effective. If not, the action/evaluation cycle continues until an effective solution is found.

Initiation of corrective action and notification/reporting requirements are discussed in more detail in the objectives below.

Correct or otherwise address CEM systems problems in a timely manner in order to minimize the impact of these problems

The Plant Manager shall respond to each report within a time frame appropriate to the item in question. In all cases the response time will be ten days or less. The response shall consist of:

- reviewing the report;
- determining whether a corrective action is warranted;
- deciding on the nature and timing of such a corrective action;
- determining if intermediate measures are required;
- completing the Work Order;
- returning it to the Originator;
- filing the report in the ongoing Open Items file.

The response must be completed according to the instructions on the reverse of the form. Copies of each report shall be maintained in Records Office for a period of at least five years.

If the Plant Manager determines that a corrective action is necessary, the appropriate information shall be completed. Once the corrective action is completed, the Plant Manager shall evaluate the results in order to determine if the action is effective. If not, the action/evaluation cycle shall continue until an effective solution is found.

The Plant Manager may determine that intermediate measures are required to protect the health or safety of workers or the community, to maintain facility compliance, to prevent damage to the CEM systems or other assets, or to minimize any potential liability to the Northside Generating Station Facility. These measures must be listed in the appropriate section of the form. The Plant Manager has the responsibility to ensure that these measures are implemented and are effective.

Identify and eliminate the root causes of the problems, where appropriate, in order to prevent the same type of problems from arising in the future.

In some cases, a problem may be only a symptom of another more fundamental problem. Correcting the symptom without addressing the root problem may not be the best approach. B. W. Marguglio in his book "Environmental Management Systems" has suggested the following criteria be used to determine when the root cause of a problem should be addressed:

- When the problem can recur and adversely affect public and/or employee health and safety.
- When the problem can recur and any single recurrence will cost considerably more than the cost of identifying and correcting the root cause.
- When the problem has been recurring and is expected to continue to recur and the cumulative cost of future recurrences considerably exceeds the cost of identifying and correcting the root cause.
- When the problem can recur and cause political or regulatory embarrassment.

Unless the cost is significant, most root cause decisions do not require a detailed cost/benefit analysis. In many cases the root cause may be known or suspected and simple tests should determine the appropriate corrective action. In cases where significant time or money must be expended to determine the root cause or the appropriate corrective action, the Plant Manager will discuss the issues and costs with the Plant Manager. This discussion shall result in a corrective action decision which will be implemented and monitored by the Plant Manager.

Establish guidelines for responding to problem situations in a manner which contributes to the probability of making correct decisions and minimizes possible legal consequences.

- *Timeliness* - The Environmental Services Coordinator is responsible for evaluating each situation as it occurs and determining an appropriate response time. In the absence of the Environmental Services Coordinator this task falls to the Maintenance Supervisor.
- Proper Individual - It is important that the individual assigned to implement the corrective action be qualified. A comprehensive and on-going training program extends the skills and expertise of the employees and increases the probability that the right person can be found. It is also important to recognize when the appropriate expertise is not available "in-house." A current list of outside contractors should be maintained for quick reference when this situation arises.
- *Systematic Approach* - A "gut-feel" or haphazard approach to identifying problems and solutions is not an acceptable methodology. Standard Operating Procedures have been developed to ensure that thorough and systematic methods are used. It is important that these SOPs be continually updated and that new SOPs are developed as operators become more familiar with the CEM systems and its unique characteristics.
- *Test Effectiveness of Solutions* - At the conclusion of each corrective action procedure, an evaluation should be performed to determine if the corrective action was effective. The Work Order includes a section that addresses this requirement.
- *Proper Documentation* - Since all of the information regarding the CEM systems is being audited by state and federal regulatory agencies, it is essential to maintain a "paper trail" of all actions and decisions on this system. The Maintenance Log and the CEM systems Work Order are the key elements in establishing this paper trail. These documents must be completed and archived on a routine basis.

Define lines of communication to facilitate management's role in reducing problem frequency and insuring the adequacy and timeliness of corrective actions.

Each week, the Environmental Services Coordinator shall submit copies of all pending and recently finalized report to the Plant Manager for closure and filing. The I&C Technician will also submit any supplemental information that will assist the Environmental Services Coordinator in the review of the material.

The Environmental Services Coordinator shall review these reports in order to ensure that:

- Corrective action decisions are adequate and do not expose the Northside Generating Station Facility to increased liability;
- Corrective action activities are proceeding according to schedule;
- Root cause decisions are made where appropriate;
- Corrective actions are effective.

If the Plant Manager finds that any of these items are of concern, he will address those with the Plant Manager.

8.2 Troubleshooting the Mercury Freedom™ System

Please refer to the Mercury Freedom™ System Operating Manual for Troubleshooting items and actions.

Chapter 9.0 Data Validation and Reporting

9.1 Record Keeping

General record keeping requirements for continuous emissions monitoring systems are detailed in this plan. ***Records should be kept on site of all start-up/shutdown operations, malfunctions, measurements, data, reports, audits and maintenance logs for at least 3 years from the date the record was created.*** These records should be kept in an organized manor suitable for inspection by U.S. EPA representatives.

9.1.1 Responsible Individual

The Environmental Services Coordinator is responsible for maintaining all required records of the CEMS system in a central location known to all responsible individuals.

NOTE:

Records should be kept in a central location known to all responsible individuals in this QA/QC Plan. These files should be made available to representatives of the United States EPA with proper identification upon demand.

9.1.2 Records Required

This list includes all data and records required to comply with the quarterly reporting requirements, and this QAP.

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

- Linearity Test Reports (written)
- Quarterly Maintenance Checklists and Log sheets (written)
- Quarterly CEMS Report (electronic)

9.1.3 Notifications

JEA will follow these guidelines for notification and submittals for the mercury CEMS.

Table 9-1:
Notification Requirements

Type of Notification	Notification Requirements
Initial Certification & Recertifications	21 days in writing prior to testing. (see note)
Recertifications after initial certification	21 days in writing and/or phone prior to testing. (see note)
New Units and Stacks	45 days in writing prior to commercial operation and/or when stack exhausts emissions.
-- If planned date changes	7 days in writing and/or phone following planned commercial operation and stacks exhausting to the atmosphere.
Planned unit shutdown on compliance data & postpone certification testing	45 days in writing of planned shutdown & recommencement.
Unplanned unit shutdown	7 days in writing after shutdown.

Reporting

JEA will follow these guidelines for notification and submittals for the mercury CEMS.

Table 9-2:
Required Reports

Type of Report	Report Due date	Format
Initial Certification	Within 45 days after certification test	Current agency requirements
Recertifications	Within 45 days after recertification test	Current agency requirements
Quarterly Reports	Within 30 days after end of each calendar quarter	As specified by the Operating Permit requiremetns..
Annual Compliance Certification	Due March 1	Written
Excess Emissions	Not specified by regulations or permit conditions..	

A description of each of these reports is found in the following sections:

9.1.4 Certification and Recertification Test Reports

These reports must be submitted after completing the certification tests. Check with Administrator and Regional EPA office regarding whether electronic format, hardcopy format or both are required. The reports should include the following:

Results of all tests
- Results of DAHS accuracy confirmation
- Equations used

9.1.5 Quarterly Reports

Reports will be submitted as required by regulatory agencies. These reports contain the following information:

- Facility identification and location information;
- Unit operating hours for quarter and cumulative hours for year;
- Total heat input and integrated gross unit load for quarter and year;
- Facility representative affirmation;

Hourly operating parameters:

- Date/hour;
- Unit operating time;
- Gross load;
- Operating load range;
- Total heat input.

Daily gas analyzer calibration error checks:

- Component-system I.D.;
- Instrument span and span scale;
- Date/hour;
- Reference value in appropriate units;
- Monitor response (observed) value;
- Percent calibration error;
- Reference value or calibration gas level;
- Test number and reason for test.

Results of quarterly linearity checks:

- Component-system I.D.;
- Date/hour, minute of each injection;
- Instrument span and span scale;
- Calibration gas level;
- Reference value;
- Monitor response (observed) value;
- Mean of reference values;
- Percent linearity error at each of three levels;
- Test number and reason for test.

Monitoring Plans

The Regulations do not require a monitoring plan for the Mercury Freedom™ System CEMS analyzer.

Chapter 10.0 Certification and Recertification

The use of the term "certification" is somewhat of a misnomer giving that CAMR has been vacated. The system cannot be officially certified due to the lack of a regulatory framework. Nonetheless, the system must be tested and confirmed to be accurately measuring emissions. This section outlines the standard industry practices and guidelines for testing newly installed systems.

10.1 Responsible Individual

The Environmental Services Coordinator is responsible for ensuring that the CEMS system certification is valid. The Environmental Services Coordinator is also responsible for reviewing CEMS analyzer changes; CEMS configuration changes, or changes to the location of the sample probe to determine if recertification testing may be required. The Environmental Services Coordinator is also responsible for all notification and testing required for CEMS recertification.

Each new CEMS system must be tested in accordance with industry standard practices. Table 11-1 outlines the initial suite of tests to be performed on the new systems.

Table 11-1: Hg analyzer certification requirements

1.	7-Day Calibration Error Test	7 Day calibration error test will be performed in accordance with standard regulatory practices. No adjustments to the analyzer are allowed during the 7-day calibration period.
2.	Linearity Check	Will be performed according to standard regulatory practices
3.	System Integrity Check	Will be performed in accordance with manufacturer recommendations
4.	Cycle Repsons Time Test	An upscale and downscale cycle response time test will be conducted to confirm that system response is less than 15 minutes.
5.	Relative Accuracy Test	An EPA Method 30A or 30B RATA test will be conducted.
6.	Bias Adjustment Test	

10.2 Recertification Requirements

Whenever the operator makes a replacement, modification, or change in the CEMS (including the DAHS) *that significantly affects the ability of the CEMS to measure or record Hg*, the CEMS system or component must be recertified. Agency notification will follow such changes

Recertification is not required for changes resulting from routine or normal corrective maintenance, or the routine activities contained in this QA/QC Plan. Examples of changes requiring recertification include:

1. Analyzer replacements (i.e., *complete* analyzer removal and replacement).
2. Change in the placement, location or orientation of the sample probe, including ductwork changes in the vicinity of the sample probe.

The Environmental Services Coordinator should review any proposed changes to the flue gas ducts or stacks within 50 ft of the sample probe to ensure that these changes do not significantly affect the ability of the CEM system to measure Hg.

10.2.1 Notification

For recertification testing, the JEA will notify the agencies.

10.2.2 Analyzer Recertification Test Requirements

When a gaseous analyzer is recertified, the same tests are required as for initial certification.

10.2.3 DAHS Recertification Test Requirements

When a DAHS modification or change is made which affects the emissions calculations performed, recertify the DAHS using the U.S. EPA's DCAS software. In addition, a successful daily calibration of all systems containing that DAHS is required.

10.3 Diagnostics Tests

Changes to CEMS system components may require that QA tests be performed for diagnostics purposes. In such cases, the CEMS system or component is not being recertified, and the notification and testing requirements for recertification noted above do not apply.

Chapter 11.0 Recommended Spare Parts List

Appendix B shows the full list of recommended spare Parts for the Mercury Freedom™ System.

Chapter 12.0 COMMONLY USED EQUATIONS

12.1 CEM Accuracy by Linearity Check (Quarterly Audit):

Accuracy determined by linearity error check is specific to each analyzer or channel for the three audit gases injected.

Equation:	Where:
$LE = \frac{\lvert R - A \rvert}{R} \times 100$ or for alternate criteria use $LE = \lvert R - A \rvert$	LE = Percent accuracy of the CEM. R = Calibration gas reference value. A = Average of monitor response

12.2 CEM Accuracy by RATA:

An annual Relative Accuracy Test Audit will be performed using either EPA Method 30A or EPA Method 30B. Relative Accuracy will be defined as follows:

Equation:	Where:
	RA = Percent relative accuracy. d = Absolute value of the mean difference of the CEM response and the reference method results. cc = Absolute value of the confidence coefficient. RM = Average reference method measured emissions or applicable standard.

12.2.1 Bias Adjustment:

The bias test is conducted using the test data and calculations. If the monitor fails to meet the bias test requirement, adjust the value obtained from the monitor using the following equations.

Equation:	Where:	
$CEM_i^{Adjusted} = CEM_i^{Monitor} \times BAF$	$CEM^{Adjusted}$ =	Data value, adjusted for bias, at time i.
Where	$CEM^{Monitor}$ =	Data (measurements) provided by the monitor at time i.
$BAF = 1 + \frac{\lvert\bar{d}\rvert}{\overline{CEM_{avg}}}$	BAF =	Bias adjustment factor.
	$\bar{d}$ =	Arithmetic mean of the difference obtained during the failed bias test from the arithmetic mean calculation of the relative accuracy test audit.
	$\overline{CEM_{avg}}$ =	Mean of the data values provided by the monitor during the failed bias test.

12.2.2 Pollutant Analyzer and Flow Monitor Daily Calibration Error

Span Calibration Fail	
Equation:	**Where:**
$S_d = \frac{S_r - S_b \times 100}{FS}$ $S_d \geq \text{Setpoint} = \text{Calibration Fail}$	S_d = Span drift in percent (upscale drift.) Sr = Span reading (upscale actual.) S_b = Span bottle value, (calibration variable) (upscale expected.); high reference value for flow monitors FS = Analyzer full-scale value in ppm (for diluent, FS = 100.) Setpoint = 2 x PS (performance standard) for 1 day calibration fail. Setpoint = 4 x PS (performance standard) for 1 day calibration fail.
Zero Calibration Fail	
$Z_d = \frac{Z_r - Z_b}{FS} \times 100$ $Z_d \geq \text{Setpoint} = \text{Calibration Fail}$	Z_d = Zero drift in percent. Zr = Zero reading (zero actual.) Sb = Zero bottle (typical 0.0) (zero expected.); low reference value for flow monitors FS = Analyzer fullscale value, ppm (for diluent, FS = 100.) Setpoint = 2 x PS (performance standard) for 1 day calibration fail. Setpoint = 4 x PS (performance standard) for 1 day calibration fail.

12.2.3 Diluent Analyzer Calibration Drift

Span Calibration Fail		
Equation:	**Where:**	
$S_d = S_r - S_b$ $S_d \geq$ Setpoint = Calibration Fail	S_d =	Span drift, percent (upscale drift.)
	Sr =	Span reading (upscale actual.)
	S_b =	Span bottle value, (calibration variable) (upscale expected.)
	FS =	Analyzer fullscale value in ppm (for diluent, FS = 100.)
	Setpoint =	2 x PS (performance standard) for 1 day calibration fail.
	Setpoint =	4 x PS (performance standard) for 1 day calibration fail.
Zero Calibration Fail		
$Z_d = Z_r - Z_b$ $Z_d \geq$ Setpoint = Calibration Fail	Z_d =	Zero drift in percent.
	Zr =	Zero reading (zero actual.)
	Sb =	Zero bottle (typical 0.0) (zero expected.)
	FS =	Analyzer fullscale value, ppm (for diluent, FS = 100.)
	Setpoint =	2 x PS (performance standard) for 1 day calibration fail.
	Setpoint =	4 x PS (performance standard) for 1 day calibration fail.

Chapter 13.0 Attachments

Attachment A - Air Operating Permit

Attachment B - Spare Parts