MICHIGAN POWER LIMITED PARTNERSHIP
CEMS QUALITY CONTROL/QUALITY ASSURANCE PLAN

Facility Name:	**Michigan Power Limited Partnership**
Type of Facility:	**Cogeneration Power Plant**
Location:	**5795 West Sixth Street** **Ludington, Michigan** **(231) 843-7573**
Owner:	**Rockland Capital** **24 Waterway Avenue, Suite 800** **The Woodlands, TX 77380**
Operator:	**Ethos Energy Power Operations (West) LLC** **12600 Deerfield Parkway, Suite 315** **Alpaharetta, GA 30004**

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REVISED: May 2016
REVIEWED: January 2018

MANAGEMENT APPROVAL

I hereby certify that I have reviewed the contents of this CEMS Quality Control/Quality Assurance Plan, and that all material and references contained within are true and accurate to the best of my knowledge and will be implemented as herein described.

Daniel Cox Date: 1-4-2018

Daniel Cox
Compliance Manager
Michigan Power Limited Partnership

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INTRODUCTION

CEMS Quality Assurance Policy

Michigan Power Ltd. Partnership, located in Mason County, Michigan, is committed to operate in accordance with applicable federal and state environmental regulatory requirements and to ensure that environmental measurements are of high quality and reliability. For these reasons, this Quality Assurance (QA) Plan provides plant personnel, involved with the Continuous Emissions Monitoring System (CEMS) compliance programs, with the procedures and guidance necessary to report accurate, precise, and reliable data.

This document is intended to remain dynamic and responsive to program improvements and regulatory changes occurring over time. For this reason, provisions for the maintenance of this QA Plan as a functional instrument are incorporated herein.

Purpose and Functions of the QA Plan

- Provide quality control (QC) procedures necessary to ensure maximum CEMS data capture, minimum instrument downtime, and high data quality.
- Provide the QC procedures necessary to assure compliance with applicable CEMS installation, operation and maintenance requirements, and the applicable requirements for the quarterly reporting of information to regulatory agencies.
- Define the data acceptance criteria and data quality requirements for Michigan Power Ltd. Partnership.
- Evaluate the adequacy of the QC procedures and data acceptance criteria through the use of periodic audits.
- Provide an effective mechanism to document and implement QA Plan revisions, and necessary, in response to audit findings, system improvements or changes to compliance program objectives.
- Serve as a resource for the overall coordination of the Michigan Power Ltd. Partnership compliance program.

REFERENCES

Code of Federal Regulations, Title 40 Part 60, Subpart A (General Provisions)

Code of Federal Regulations, Title 40 Part 60, Subpart GG (Standards of Performance for Stationary Gas Turbines)

Code of Federal Regulations, Title 40 Part 60, Subpart DA (Standards of Performance for Electric Utility Generating Units)

Code of Federal Regulations, Title 40 Part 60, Appendix B (Performance Specifications)

Code of Federal Regulations, Title 40 Part 60, Appendix F (Quality Assurance Procedures)

Code of Federal Regulations, Title 40 Part 75, Appendix A (Specifications and Test Procedures)

Code of Federal Regulations, Title 40 Part 75, Appendix B (Quality Assurance and Quality Control Procedures)

Code of Federal Regulations, Title 40 Part 75, Appendix B (Conversion Procedures)

Code of Federal Regulations, Title 40 Part 75, Appendix G (Determination of CO_2 Emissions)

Michigan Department of Environmental Quality Permit Number 199600135

Custom Instrumentation Services Corporation (CISCO) Continuous Emissions Monitoring System (CEMS) Operations and Maintenance Manual for Michigan Power Ltd. Partnership

DEFINITIONS

Bias – Systematic error resulting in measurements that will be either consistently low or high relative to the reference value. A bias test following each 40 CFR 75 RATA (Relative Accuracy Test Audit) determines if a CEMS is biased.

CGA Test (Cylinder Gas Audit) – Required by 40 CFR Part 60, Appendix F: NO_X, CO and O_2 analyzers. 2-point Analyzer accuracy test [low (20-30% of span) and mid scale (50-60% of span) ranges] using certified gas. The test is averaged over three trials. The difference between the reference gas and the analyzer values shall not vary more than 15% or 5ppm, whichever is greater.

Calibration Drift – The difference between the analyzer reading and a reference value after a period of normal operation (i.e., 24 hours) during which no unscheduled maintenance work took place.

Continuous Emissions Monitoring System (CEMS) – The total equipment required for the determination and permanent recording of stack emissions at Michigan Power Ltd. Partnership.

Data Acquisition and Handling System (DAHS) – The portion of the CEMS (software and hardware) that permanently records all monitored emission data (including CEMS analyzers and plant signals).

Linearity Test – This test is required by 40 CFR Part 75 for No_x and O_2 emissions analyzers. It is a 3-point [low (20-30%), mid (50-60%), and high scale (80-100%) ranges] test using protocol 1 gases. The test is conducted with three trials. The difference between the reference gas and the analyzer measurement shall not very more than 5% or 5 ppm, whichever is less restrictive.

O&M Manual – CISCO CEMS Operations and Maintenance Manual

Out-of-Control for 40 CFR 60 – (Also see 3.4.2 and Table 7 of this manual)

(1) Calibration Error (drift). Status of an analyzer when the 24-hour calibration drift audit exceeds twice the limit of the applicable Performance Specification in 40 CFR 60, Appendix B for more than five consecutive days. The out-of-control period begins with the hour of completion of the fifth failed calibration error test and ends with the hour of completion following an effective re-calibration. Also, if calibration drift exceeds four times the applicable drift specification in Appendix B during any calibration drift check, the monitor is out-of-control. The out-of-control period begins with the hour of completion of the calibration error test prior to the failed test and ends with the hour of completion following an effective re-calibration.

(2) A monitor is out-of-control if audit results do not meet the criteria of 40 CFR 60, Appendix F. The out-of-control period begins with the hour of completion of the failed audit test (CGA, RAA, or RATA) and ends with the hour of completion of sampling of the subsequent successful audit. A monitor is considered inoperative during out-of-control periods.

Out-of-Control for 40 CFR 75 – (Also see 3.4.3 and Table 8 of this manual)

(1) Calibration Error (drift). A CEMS is out-of-control when calibration drift exceeds twice the limit of the applicable standard in 40 CFR 75, Appendix A for any calibration. The out-of-control period begins with the hour of completion of the failed calibration error test and ends with the hour of completion following an effective re-calibration.

(2) Linearity Check. A CEMS is out-of-control when the error in linearity at any of the three concentrations in a quarterly linearity check exceeds the applicable standard in 40 CFR 75, Appendix A (see Table 8). The out-of-control period begins with the hour of the failed check and ends with the hour of a satisfactory linearity check following corrective action. For NO_x CEMS, the out-of-control designation applies if either of the component analyzers (NO_x or O_2) exceeds the applicable specification.

(3) RATA (Relative Accuracy Test Audit). An out-of-control period occurs if the relative accuracy results from a RATA exceed the standards in 40 CFR 75, Appendix A, Section 3.3 (See also 40 CFR 75, Appendix B, Section 2.3.2(e) and Table 5). The out-of-control period begins with the hour of completion of the failed RATA and ends with the hour of completion of a successful RATA, following corrective action as discussed in section 3.3.1.1. Appendix 6 contains the regulator information referenced in this paragraph.

Quality Assurance (QA) – The activities and procedures that are performed by or on behalf of Michigan Power Ltd. Partnership, to ensure that CEMS data meets USEPA and state criteria with respect to accuracy, precision, availability, and representation after the successful completion of the initial performance specification testing.

Relative Accuracy (RA) – A comparison of CEMS measurements as calculated in 40 CFR Part 60, Appendix B, (Performance Specifications) and/or 40 CFR Part 75, Appendix A (Specifications and Test Procedures). The CEMS measurements are compared to the results of EPA reference method testing performed in accordance with the procedures and criteria established in 40 CFR Part 60, Appendix A.

Span Value for 40 CFR 60 – The upper limit of an analyzer's primary measurement range (40 CFR 60).

Span Value for 40 CFR 75 – Between 100% and 125% of the Maximum Potential Concentration (MPC) or the Maximum Expected Concentration (MEC).

USEPA or EPA – The United States Environmental Protection Agency.

SUMMARY OF APPLICABLE CEMS REGULATIONS

Michigan Power Ltd. Partnership falls under the regulatory requirements listed in Section 1.2. Regulations 40 CFR 75 and 40 CFR 60, Appendix F require quarterly and annual CEMS performance evaluations. This includes an annual Relative Accuracy Test Audit (RATA), a 7-day Calibration Error Test, a Cycle Time (40 CFR 75) and a quarterly Cylinder Gas Audits (CGAs) (40 CFR 60, Appendix F) and/or Linearity Checks (40 CFR 75). Quarterly reports summarizing all recorded excess emissions events and periods of monitor downtime must be prepared and submitted to the EPA and the state within 30 days of the end of each calendar quarter. Quarterly reports in the latest version of the Electronic Data Report (EDR) format are also due to the EPA within 30 days of the end of the quarter. The results of all performance tests and audits conducted during the quarter must be included in both reports. All CEMS records, including raw, reduced and validated date, maintenance records, audit findings and written QA procedures must be maintained for a minimum of five years.

Since this quality assurance document is dynamic it must be maintained in accordance with 40 CFR 75 and 40 CFR 60, Appendix F. Therefore, this document will determine the method that Michigan Power Ltd. Partnership will use to assure the quality of acquired data.

Additionally, the CEMS is designed to meet the performance specifications listed in Table 1 of this plan.

TABLE 1: APPLICABLE PERFORMANCE SPECIFICATIONS REGULATIONS

Gas Turbine/HRSG

Pollutant	Performance Specifications Regulations
NOx	40 CFR 60, Appendix B, PS 2 40 CFR 75, Appendix A.3
O_2	40 CFR 60, Appendix B, PS 3 40 CFR 75, Appendix A.3
CO	40 CFR 60, Appendix B, PS 4, 4a

Fired Boilers

Pollutant	Performance Specifications Regulations
NOx	40 CFR 60, Appendix B, PS 2
O_2	40 CFR 60, Appendix B, PS 3

The CEMS is used to determine compliance with the limits listed in the Operating Permit as shown in Table 2 of this plan.

TABLE 2: OPERATING PERMIT EMISSION LIMITS FOR POLLUTANTS MEASURED WITH CEMS

Gas Turbine/HRSG

Emission Limits (Natural Gas)

Pollutant	Turbine	HRSG	TURBINE/HRSG COMBINED
NOx tons/year	154	149.4	303.5
NOx ppmvd @ 15% O2	9.0	No limit	13.6
CO tons/year	102.5	47.8	150.3
CO ppmvd @ 15% O2	10	No limit	10.7

Fired Boilers

Pollutant	Emission Limits (Natural Gas)
NOx tons/year	69.6
NOx ppmvd @ 15% O_2	15.9
CO tons/year	87.1
CO ppmvd @ 15% O_2	19.9

2. DESCRIPTION OF CEMS PROGRAM

2.1. PLANT DESCRIPTION

The Michigan Power Cogeneration facility is located at 5795 West Sixth Street, Ludington, Michigan, adjacent to the Occidental Chemical Company ("Oxy"). A site location map and facility plot plan are provided in Exhibit 1 and Exhibit 2.

The facility utilizes a General Electric ("GE") Model PG7111EA Gas Turbine Generator unit, exhausting into a heat recovery Steam Generator ("HRSG") equipped with duct burner firing. The HRSG produces both high and low-pressure steam. The steam is used to drive a Steam Turbine Generator. Steam extracted from the Steam Turbine is supplied under long-term contract to Oxy. The power generated is transformed to the required voltage for delivery to Consumer's Energy's power grid.

In order to guarantee steam production at all times and meet variations in steam loads required by Oxy, the facility has two (2) Auxiliary Boilers rated at a maximum input fuel rate of 265,000 SCFH each.

The facility also includes an emergency generator and an emergency fire pump, which are both diesel fired. The emergency generator and emergency fire pump are both operated intermittently for routine testing, maintenance and energy backup.

2.1.1. Gas Turbine

One (1) GE Model PG7111EA package Gas Turbine Generator unit with a nominal rating of 84 MW (ISO). The maximum hourly fuel input rate is 11,136,500 SCF/hr (or 1136.5 MMBtu/hr). The Gas Turbine is equipped with dry, low-NOx combustors for the control of the formation of nitrogen oxides (NOx).

Dry, low-NO_x combustion technology is based on lean-fuel combustion. In lean-fuel combustion, the air-to-fuel ratio at the combustion flame front is increased to lower the peak flame temperature and/or residence time, thus reducing NO_x formation. The formation of carbon monoxide (CO) emissions is lowered through "good combustion practices." Secondary control of CO is provided by a CO catalytic converter installed in the HRSG. The emissions of NO_x and CO from the gas turbine are monitored continuously at the HRSG exhaust stack Exhibit 3 by the CEMS. Plant personnel utilize the CEMS to determine continuous compliance with permit emission limitations. The emission limitations and input fuel limitations for the Gas Turbine are provided in Table 1.

The operating variables that shall be monitored by MPLP to detect a malfunction or failure, which results in an excess emission, will be the CEMS data for NO_X, CO, and O_2. The normal operating range of these variables will be at or below the permitted limitations. Percent O_2 in the stack will normally range from 10-17 percent. MPLP will identify any additional operating variables in future updates of this document.

2.1.2. Duct Burner

The HRSG is equipped with supplementary firing through the utilization of one (1) Duct Burner. The Duct Burner has a maximum natural gas heat input rating of 341 MMBtu/hr (HHV). The duct burner is equipped with low NO_x burners to control the formation of NO_x. NO_x and CO emissions are monitored continuously at the HRSG exhaust stack by the CEMS. The emission limitations and input fuel limitations for the duct burner are provided in Table 1.

The operating variables that shall be monitored by MPLP to detect malfunctions or failures of the duct burner which result in an excess emission will be the CEMS data for NO_x, CO, and O_2. The normal operating range of these variables will be at or below the permitted limitations. MPLP will identify any additional operating variables in future updates of this document.

2.1.3. Carbon Monoxide (CO) Catalyst

A CO catalytic converter is installed in the Gas Turbine exhaust flow train within the HRSG for the primary control of CO emissions resulting from the Gas Turbine and Duct Burner. The emissions of CO are monitored with the CEMS to ensure continuous compliance with permit emission limitations.

The operating variables that shall be monitored by MPLP to detect malfunctions or failures of the CO catalytic converter that result in an excess emission will be the CEMS data for CO. The normal operating range of this variable will be at or below the permitted limitations. In the event of a slow increase in CO emissions overtime, a catalyst sample will be taken and analyzed for degradation.

2.1.4. Auxiliary Boilers

Each of the two (2) natural gas-fired Auxiliary Boilers shall not exceed a maximum heat input fuel rate of 265 MMBtu per hour (HHV). Each Auxiliary Boiler is equipped with low NO_x burners and flue gas recirculation ("FGR") for the control of NO_x emissions. The emissions of NO_x from the Auxiliary Boilers are monitored continuously at each exhaust stack (Exhibit 4) by the CEMS. The two auxiliary boilers share the same CEMS. The CEMS alternately monitors each boiler for 7.5 minutes. Plant personnel utilize the CEMS to determine continuous compliance with permit emission limitations. The emission limitations and input fuel limitations for the auxiliary boilers are provided in Table 1. The facility will typically operate at or below these limitations.

The operating variables that shall be monitored by MPLP to detect malfunctions or failures of the Auxiliary Boilers that result in an excess emission will be the CEMS data for NO_x and O_2. The normal operating range of these variables will be at or below the permitted limitations. MPLP will identify any additional operating variables in future updates of this document.

2.1.5. Emergency Generator

The Emergency Generator shall only fire diesel fuel oil with a sulfur content of less than or equal to 0.05 percent by weight. The maximum heat input of the emergency generator shall not exceed a maximum hourly fuel feed rate of 89.3 gallons per hour. The Emergency Generator and the Gas Turbine shall not be operated simultaneously except during weekly testing, maintenance, for required regulatory purposes, or during an emergency. The Emergency Generator shall not operate more than 20 minutes per week during weekly testing.

2.1.6. Emergency Fire Pump

The Emergency Fire Pump shall only fire diesel fuel oil with a sulfur content of less than or equal to 0.05 percent by weight. The Fire Pump and the Gas Turbine shall not be operated simultaneously except during weekly testing, maintenance, for required regulatory purposes, or during an emergency. The Emergency Fire Pump shall not operate more than 30 minutes per week during weekly testing.

2.2. CEMS EQUIPMENT DESCRIPTION AND MEASURED PARAMETERS

MPLP's Gas Turbine/HRSG stack and Auxiliary Boilers stacks are equipped with CEMS. Each CEMS and the dedicated data acquisition system were packaged by Custom Instrumentation Services Corporation (CISCO).

TABLE 3: MEASURED PARAMETERS

Gas Turbine/HRSG

Parameter	Units
NOx	ppm, Lb/Day, Tons/Year
O_2	%
CO	ppm, Lb/Day, Tons/Year

Fired Boilers

Parameter	Units
NOx	ppm, Lb/Hour, Tons/Year
O_2	%
CO	ppm, Lb/Hour, Tons/Year

2.2.1 Data Acquisition and Handling System (DAHS)

The Data Acquisition and Handling System (DAHS) used at Michigan Power Ltd. Partnership provides historical data storage with access to data for reviewing and editing. It generates all required reports in the formats that are acceptable to the EPA and the state. This includes hourly, daily, and monthly summaries, plus daily and quarterly exceedences data, automatically or on demand. The quarterly report required by the state is generated and submitted within 30 days after the end of the previous quarter. 40 CFR 75 quarterly reports in electronic data reporting (EDR Version 2.62) format are also generated by the DAHS.

The DAHS is designed to be placed in a Control Room environment. An IBM compatible desktop computer will store, manipulate, format, and archive the data. A color monitor, keyboard, printer, and modem are also included.

CeDAR software provided for data acquisition is an integrated, user-friendly, menu-driven software package developed by CISCO for data acquisition, analysis, and reporting. Data acquisition will continue uninterrupted in the background while data manipulation (via Database Editor) and report generation (via Report Generator) are taking place in the foreground. Other software packages include the following:

- Windows for multitasking
- PcAnywhere for phone modem communications
- Cartwright Project 75 and NO_x Budget 2.1 for EPA EDR Reporting

The calculations of emissions in units of the applicable standards (See Table 3) are accomplished by the DAHS.

2.2.2 Oxides of Nitrogen Analyzer – Turbines, HRB, and Boilers

For the analysis of NO_x, a Rosemount Model 951C analyzer is used. The Chemiluminescense detection method quantitatively converts NO to NO_2 by gas-phase oxidation with molecular ozone that is generated by the analyzer ozonater in an environment, of system-supplied dry instrument air. The model 951C converts NO_2 to NO by a stainless steel NO_2-to-NO converter heated to 625 C and a capillary bed is installed to eliminate CO_2 quenching. Each analyzer range is configured into the system (see Table 4 of this plan).

2.2.3 Carbon Monoxide Analyzer – Turbines and HRB

Concentrations of CO are measured using a Siemens ULTRAMAT 5E Non-Dispersive Infared Analyzer, a micro-flow sensor, and a tunable optical coupler for elimination of interference. The tunable optical coupler is spanned with CO calibration gas of approximately 90% of the lower full-scale range. All ranges are linearized within 0.1% by the microprocessor-controlled electronics. Automatic range selection is provided dependant upon level of analysis.

2.2.4 Oxygen Analyzer – Turbines, HRB, and Boilers

For the analysis of O_2, Servomex 1400B paramagnetic analyzer is used. This technique involves the use of dumbbell suspended in the magnetic wind caused by the magnetic attraction of the O_2 molecules, which allows the detection of the O2 as a direct function of the dumbbell displacement. This type of analyzer is characteristically linear and is not sensitive to interference from moisture, combustibles, or physical vibrations. Each analyzer range is configured into the system (see Table 4 of this plan).

2.3. REPORTS

The reports generated for Michigan Power Ltd. Partnership are generated by the DAHS. All reporting is done in accordance with the requirements of 40 CFR 75, 40 CFR 60, and the Operating Permit.

The Operating Permit requires that quarterly reports be submitted to summarize excess emissions and monitor information following the format in 40 CFR 60 Subpart A. The information provided includes a summary of excess emissions, monitor downtime, and quarterly assurance test results. All monitoring data shall be kept on file for a period of at least five years and made available to agency personnel upon request.

To meet the 40 CFR 75 requirements a quarterly report must be submitted to the EPA in electronic format. The file generated by the DAHS is in a prescribed format (EDR Version 2.62) and includes emission and plant data for every hour in the quarter. Periods of missing data are substituted using EPA missing data procedures. The quarterly data is provided to the EPA via email. The accuracy of the data being submitted is verified using the MDC Software. This program verifies that all data is entered in the proper location and is in the proper format.

- Unit Hourly Emissions Report – Summarizes minute totals/averages of mass emission and operating parameters of each hour.
- Unit Daily Emissions Report – Summarizes hourly total/averages of mass emission and operating parameters for each hour in a 24-hour period.
- Unit Monthly Emissions Report – Summarizes daily emission rates and operating parameters for each month.
- Daily Fuel Report – Summarizes hourly fuel flow rates and usage for each hour in a 24-hour period.
- CEMS Downtime Report – (daily, monthly, quarterly, or for a specified duration) – For each reported parameter, shows time and duration when plant is on-line and CEMS is off-line.
- Excess Emissions Report – (daily, monthly, quarterly, or for a specified duration) – Shows all parameter limit exceedences.
- CEMS Performance Summary – Summarizes downtime by reason and calculates excess emissions as a percentage of total source operating time.
- Emissions Data Summary – Summarizes exceedences by reason and calculates downtime as a percentage of total source operating time.
- Audit Report – Shows values for several parameters during a specified period of time.

- Raw Values Report – Shows raw values and monitor codes (in text and code number) for one parameter during a specified period of time.
- Calibration Reports – Summarizes calibration results and calculates out-of-control conditions for each analyzer for each day.

2.4. ORGANIZATIONAL RESPONSIBILITES

The organizational chart for Michigan Power Ltd. Partnership (Figure 1 of this plan) shows the personnel responsible for QA activities. All identified plant personnel have a shared responsibility for the day-to-day operation, maintenance, and quality assurance of the CEMS. The responsibilities for QA activities can be summarized as follows.

Plant Manager

- Administer the QA Plan to ensure compliance, including checking QA results periodically and reviewing/updating the QA Manual as needed, but at least once per year.
- 40 CFR 75 designated representative.
- Review and approve the reports sent out under company letterhead to the appropriate regulatory agencies.
- Contacted if an alarm condition cannot be corrected.

Maintenance Manager and Compliance Manager

- Ensure that all required CEMS accuracy audits, including Linearity Checks, Cylinder Gas Audits (CGAs) and Relative Accuracy Test Audits (RATAs) are performed as required by applicable regulations. This may include retaining the services of an outside stack testing company or initiating corrective maintenance if a CGA, Linearity Check, or RATA fails.
- Maintain the CEMS spare parts inventory at required levels to minimize downtime and data loss. If the part is not available according to the computerized spare parts inventory tracking system, contact CISCO for the part.
- Contacted if an alarm condition cannot be corrected.
- Perform all required corrective actions needed to keep the CEMS operating within specifications, including service to correct out-of-control conditions, service required as a result of preventative maintenance checks, service due to CEMS alarm conditions, and service due to malfunctioning components.
- Ensure corrective measures are taken to respond to analyzer malfunctions.
- Responsible for overall maintenance and inspection program.

Instrumentation & Electrical Technicians

- Responsible for the overall program including maintaining complete files of CEMS data, including records, reports, alarm printouts, QA forms, etc. All required information is stored for five years and shall be made available for inspection upon request. DAHS printed reports with a software back-up copy are archived. Any forms or documents that are not computer-generated will be stored in the plant files in the Administrative offices.
- Maintains documented record of gases in inventory.

- Responsible for monitoring inventory of gases.
- Responsible for maintaining the supply of necessary gases.
- Schedule and perform daily, weekly, monthly, quarterly, and annual maintenance defined in the QA Manual.
- Troubleshoots and corrects alarm conditions.

Operations

- Monitor for CEMS alarms in the control room while Gas Turbine/HRSG and Auxiliary Boilers are operating.
- Records in Control Room logbook any observations, inspections, or work performed on CEMS equipment.
- Monitor for CEMS alarms in the control room on a 24-hour basis.

Perform daily preventative maintenance checks:

1. Review daily reports.
2. Check on the condition of various general items.
3. Visual verification of various general items.

3. QUALITY ASSURANCE REQUIREMENTS

The CEMS for Michigan Power Ltd. Partnership are designed to meet the reporting, record keeping, certification, and quality assurance requirements of 40 CFR 75, 40 CFR 60 and the Renewable Operating Permit.

3.1. DATA VALIDATION REQUIREMENTS

Personnel at Michigan Power Ltd. Partnership strive to achieve 100% availability of the monitors under normal operating conditions. All reasonable and practical means are used to achieve this objective, including overtime-corrective maintenance work, quarterly audits, routine preventative maintenance, and daily calibration checks.

All pertinent regulations require the reduction of emissions to one-hour time-based emissions. 40 CFR 75 and state CEMS Guidelines, however, require different hourly calculations.

3.1.1. Invalid Data

Numerous conditions can render data invalid. If the correct number of valid data points is not collected for any reason, then the data collected is considered invalid.
There is no restriction in 40 CFR 60 on invalid data. For 40 CFR 75 reporting, the invalid data is automatically replaced by the DAHS in accordance with the procedures in 40 CFR 75. The following are examples of conditions that could result in invalid data:

- CEMS control power failure
- Analyzer malfunction
- Water in sample
- Back flush cycle
- Last calibration fail for 40 CFR 75 or out-of-control (for 40 CFR 60)
- Out-of-Service
- CEMS Off-line
- CEMS failed linearity test (out-of-control)
- CEMS failed relative accuracy (out-of-control)

3.1.2. 40 CFR 75 Hourly Data Validation

a) The CEMS must complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 15-minute period. This is defined as a data point.

b) A valid hour of data is computed from four or more data points equally spaced over the one-hour period. Gaseous emissions data are reduced and recorded as one-hour averages. If one of the 15-minute periods (using four data points per hour) is invalid, the hour is considered invalid and the DAHS will replace the hourly data using the missing data procedures in the 40 CFR 75 requirements.

c) For 40 CFR 75 reporting, during periods of calibration, quality assurance or maintenance activities, a valid hour consists of at least two data points separated by a minimum of 15 minutes. If the CEMS does not collect valid data in accordance with these criteria, then the missing data procedures must be used to replace the data. In order to perform calibrations, quality assurance or maintenance, the "out-of-service" periods should begin more than 30 minutes into an hour and end less than 30 minutes into the next hour. In this way, nearly 60 minutes of service can be performed on the system without impacting availability.

d) For quarterly 40 CFR 75 reporting, all missing or invalid data is automatically replaced by the DAHS following the procedures contained in 40 CFR 75, Subpart D (for NO_X) and Appendix D (for fuel flow).

e) After determination of the emissions in the proper reporting parameters, the emissions data is rounded off to the same number of significant digits as the emission limit or the number of significant digits required in EDR version 2.62.

3.2. CEMS GAS ANALYZER CALIBRATION

Each CEMS is equipped with manual and automatic, zero span calibration capabilities. The automatic calibration routine is performed every 24 hours on each of the systems under the programmed control of the system PLC. In addition, a calibration can be started manually at any time with the activation of the "Cal Start" button provided on the local status/control panel.

In either mode, a "Cal-at-Cabinet" valve allows the operator to select one of two modes of calibration. With the valve in the cabinet position, calibration gas is injected directly into the sample flow control components and then into the analyzers. With the valve in the probe position, calibration gas is injected into the sample probe via the ¼" Teflon calibration line in the probe support bundle. The calibration gas is then pulled through the sample conditioning subsystem just as the sample is, and the integrity of the entire system is checked. This is the normal mode which is used during the automatic calibration routine.
In the automatic calibration sequence, either manually or automatically initiated, the cal gas solenoid valves are automatically sequenced by the system PLC. The first four minutes of each five-minute period of gas flow is used for system stabilization. During the last minute, the analyzer response is interrogated by the PLC. Eleven values are read, five seconds apart, and are averaged for an average calibration reading. Initial programming has timed the calibration sequence, five minutes for zero and five minutes for each analyzer span.

If the calibration check passes, a new sample output correction factor is calculated for each analyzer at each sample point and is stored to be used during sampling until the next calibration. If the calibration fails, the calibration fail alarm is activated and the subsequent sample output signal(s) will be uncorrected for each failed analyzer. Programming for 40 CFR 75 allows a maximum □ 1% difference from reference gas for O_2 and □5% of span for NO_X. Programming for the Operating Permit and 40 CFR 60 allows a maximum □10% of range for NO_X, and a □2% for O_2 for calibration and out-of-control.

In order for the PLC to check the validity of a calibration and generate a fail or out-of-control signal if the analyzer response is outside of preset limits, it not only needs to know the actual analyzer response, but it must also "know" a constant to compare it with. For zero, the constant is zero, and is stored in a register in the PLC. All analyzer span concentration values are input to the PLC via thumb wheels on the local status/control panel. These inputs are taken directly from the span gas cylinder labels.

The zero calibration gas should be a zero grade Nitrogen (N_2) as supplied by a specialty gas supplier in a steel cylinder with a brass CGA 580 valve. The nominal span gas concentrations required for Michigan Power Ltd. Partnership are provided in Table 4 of this plan. The reference values for determining the amount of calibration error (drift) may be different for 40 CFR 60 and 40 CFR 75. Table 4 of this plan shows both sets of reference values. The 40 CFR reference value is the full-scale range of the analyzer. The 40 CFR 75 reference value is the span of the analyzer.

TABLE 4: ANALYZER RANGES AND NOMINAL SPAN GAS CONCENTRATIONS

Turbines

ANALYZER	FULL SCALE RANGES (40 CFR 60)	40 CFR 75 SPAN	NOMINAL SPAN GAS (PRIMARY RANGE)
NOx	0-30 ppm	N/A	27 ppm
O_2	0-25%	0-21%	18%
CO	0-20 ppm	N/A	18 ppm

Fired Boiler

ANALYZER	FULL SCALE RANGES (40 CFR 60)	NOMINAL SPAN GAS (PRIMARY RANGE)
O_2	0-10% and 0-25%	9 ppm
NOx	0-100 ppm	90 ppm

The specific analyzer manufacturer's manuals are contained in the CEMS O&M Manual, which is incorporated here by reference.

3.3. INSTALLATION AND CERTIFICATION

The CEMS must meet the installation and initial certification criteria contained in the operating permit; 40 CFR 60, Appendix B; and 40 CFR 75, Appendix A. This includes a Relative Accuracy Test Audit (RATA) on all analyzers and a 7-day calibration error test. The 7-day calibration error test occurred during the initial installation of the CEMS. For 40 CFR 75 certification, linearity, response time, bias, and DAHS verification tests must also be performed.

Once certified, the CEMS is evaluated on a cyclical basis in accordance with the Quality Assurance and Quality Control Procedures under the following: 40 CFR 60, Appendix F; 40 CFR 75, Appendix B; and the operating permit.

3.3.1. Relative Accuracy Test Audit (RATA)

Relative Accuracy Test Audits (RATAs) are conducted on the CEMS as a part of an initial certification and as an annual quality assurance check. The test evaluates the accuracy of the CEMS.

The RATA is performed by a third-party contractor stack sampling team that conducts reference method tests and data collection simultaneously with the CISCO CEMS. The reference method tests are performed in accordance with procedures in 40 CFR 60, Appendix A, Reference Method 3A (O_2), and Method 20 (NO_x). Michigan Power Ltd. Partnership is operated at the normal operating load during the RATA. The data from the CEMS DAHS is evaluated and compared with the data from the reference method test results as a part of the relative accuracy determination. A minimum of nine test runs is performed. A maximum of twelve runs may be performed. Three of the twelve runs may be rejected, as only nine test runs are needed to determine relative accuracy. All relative accuracy test data is reported.

The relative accuracy (RA) specifications for each applicable regulation are in Table 5 of this plan. The results of any RATA above the minimum standard result in the analyzer and CEMS being classified as out-of-control. IN the event RATA results indicate an out-of-control period, the analyzers are re-calibrated, all problems are corrected, and another RATA is initiated immediately. Notice must be forwarded to the EPA and the state within 72 hours of the additional RATA test.

Under 40 CFR 75, the results of the initial certification RATA determine if the next scheduled RATA must be conducted during the next six months or within 12 months. In the event the results from an initial or periodic RATA for the NO_x or O_2 CEMS are between 7.5% and 10.0% relative accuracy, the next RATA test is required in the second quarter following the RATA per 40 CFR 75. In order to perform RATAs on an annual basis instead of a semi-annual basis, the results from an initial or periodic NO_x or O_2 RATA must be less than or equal to 7.5% RA (relative accuracy).

For qualifying low NO_x emitters (□0.20 lb/mmBtu), the units qualify for annual RATAs where the average analyzer value during a RATA is within 0.01 lb/mmBtu of the average reference method value (as per 40 CFR 75, Appendix B, 2.3.1).

TABLE 5: RELATIVE ACCURACY (RA) SPECIFICATIONS

Component	Regulation	Specification
NOx	40 CFR 60 Appendix B	□20% RA of the mean value of reference method tests or □ 10% of the permit limit
NOx Lb/mmBtu	40 CFR 75 Appendix A 3.3	□10% RA of the mean value of reference method tests or □0.02 lb/mmBtu if level during RATA is □0.2 lb/mmBtu
O2	40 CFR 60 Appendix B	□20% RA of the mean value of reference method tests or □1% of the absolute O2 reading
CO	40 CFR 60 Appendix B, Spec 4 and/or 4a	□10% RA of the mean value of reference method tests or □5% of the permit limit (Spec 4) □10% RA of the mean value of reference method tests or □5ppm of the permit limit (Spec 4a)

3.3.1.1. RATA Calculations

The RATA is performed during initial certification or at least once a year, according to the Relative Accuracy Test Procedure in the applicable Performance Specification. To evaluate RATA results, use the following procedure:

1. Calculate the arithmetic mean of the monitor or monitoring system measurement values.
2. Calculate the mean of the reference method values.
3. Using data from the automated DAHS calculate the arithmetic differences between the reference methods and monitor measurement data sets.
4. Calculate the arithmetic mean of the difference (Eq. A-7, 40 CFR 75, Appendix A, Section 7.5.1 or Eq. 2-1, 40 CFR 60 Appendix B), the standard deviation (Eq. A-8 40 CFR 75, Section 7.3.2 or Eq. 2-2), the confidence coefficient (Eq. A-9 or Eq. 2-3), and the monitor or monitoring system relative accuracy (RA) using the equation below.

The relative accuracy for a RATA is defined as (Eq. A-10 40 CFR 75, Section 7.3.4 or Eq. 2-4):

$$RA = \frac{ldl + lccl}{RM} \times 100$$

Where:

BAF = Bias Adjustment Factor (to the nearest 1000th)

Ldl = Arithmetic mean of the difference obtained during bias test using Equation A-7

CEM = Mean of the data values provided by the monitor during the bias test

3.3.2. 7-Day Calibration Error Test

The calibration error test verifies the ability of the CEMS to remain within calibration standards for a specified period of time without unscheduled maintenance, repair, or adjustment. The calibration error test results are determined from the daily calibrations of the analyzers with two concentrations of calibration gas (zero-level and high-level) performed approximately 24 hours apart for seven consecutive days (not necessarily calendar days for 40 CFR 75). For both regulations (40 CFR 60 and 40 CFR 75), the plant must operate at normal load during the test period.

The calibration gases are injected at the CEMS extractive probe to verify the sample lines, sample conditioning, sample analysis, and data acquisition and handling system. The calibration error test is expressed as a percent of the span of the analyzer for 40 CFR 75 or the full scale range of the analyzer for 40 CFR 60. For both 40 CFR 60 and 40 CFR 75,

calibration error for diluent analyzers is expressed as the difference from the reference gas. The calibration error test performance specifications are listed in Table 6 of this plan.

TABLE 6: 7-DAY CALIBRATION ERROR TEST PERFORMANCE STANDARDS

Turbine / HRB

GAS	FULL SCALE RANGE (40 CFR 60)	40 CFR 75 SPAN	ZERO ERROR (SPAN OR RANGE)	SPAN ERROR (SPAN OR RANGE)
NO_x	30 ppm	27 ppm	□ □ 2.5%	□ □ 2.5%
O_2	25%	18%	□ □ 0.5% O_2	□ □ 0.5% O_2
CO	0-20 ppm	N/A	□ □ 5.0%	□ □ 5.0%

Fired Boilers

GAS	FULL SCALE RANGE (40 CFR 60)	40 CFR 75 SPAN	ZERO ERROR (SPAN OR RANGE)	SPAN ERROR (SPAN OR RANGE)
NO_x	0-100 ppm	90 ppm	□ □ 2.5%	□ □ 2.5%
O_2	10%	9 ppm	□ □ 0.5% O_2	□ □ 0.5% O_2

3.3.3. 40 CFR 75 DAHS Verification Tests

The DAHS evaluation and certification include sample calculations to verify the following:

1. Proper computation of all required emissions.
2. Proper computation and application of the missing data substation procedures.
3. Application of the bias adjustment factor.

These tests are performed in accordance with EPA specifications.

3.3.4. 40 CFR 75 Cycle Time/Response Time Test

The cycle time/response time test assesses the time required for the CEMS to respond to a change in monitored gases. The response test includes the response through the entire sample transport, sample conditioning, analyzing and reporting system cycle of the CEMS. Tests are conducted with zero gas and high-level calibration cylinder gas.

While the source is operating and the CEMS is measuring and recording the stack concentrations, zero or high-level calibration gas is injected until a stable response is reached. The response time for the monitor to complete 95.0% of the concentration or emission rate step change at each gas concentration is recorded by the DAHS. Response times of less than 15 minutes are acceptable. The longer of two cycle times (NO_x or O_2 analyzers) is the NO_x system response time.

3.3.5. Linearity Check

A linearity check is required for an initial certification. See 40 CFR 75, Appendix B, Section 2.2.1 – Quarterly QA Requirements.

3.4. DAILY QA ASSESSMENT PLAN

3.4.1. Daily CEMS Calibration Error (Drift)

The daily calibration error (drift) test is used to evaluate the quality of the data collected by the CEMS. The CEMS is calibrated each day approximately 24-hours apart using zero-level and high-level concentration cylinder gases. Calibration error for the analyzers is determined as follows (Eq. A-5, 40 CFR 75, Appendix A).

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

Where:
- CE = Calibration error as a percentage of the span
- R = Reference value of the zero or high-level cylinder gas
- A = Actual monitoring system response
- S = Span of the instrument for 40 CFR 75 and full scale range for 40 CFR 60

Calibration error for the O2 analyzer is determined by the following formula:

$$CE = |R - A|$$

Where:
- CE = Calibration error as a percentage of the span
- R = Reference value of the zero or high-level cylinder gas
- A = Actual monitoring system response

The standards of performance for calibration error are summarized in Table 7 and Table 8 of this plan. Reports of calibration error test results are printed daily. These reports must be filed for record keeping purchases. The calibration results are also archived by the CEMS data acquisition and handling system.

3.4.2. 40 CFR 60 Requirements

If either the zero (low level) or high-level calibration drift exceeds twice the applicable drift specification for five consecutive daily periods, the CEMS is out-of-control. The out-of-control period begins at the time corresponding to the completion of the fifth consecutive daily check with a drift in excess of two times the allowable limit or the time corresponding to the completion of a daily check in excess of four times the allowable limit. The end of the out-of –control period is the time corresponding to the completion of a calibration drift check following corrective action that results in the drift at both low and high levels being within the allowable limit. The applicable drift specifications are:

TABLE 7: 40 CFR 60 ANALYZER DAILY DRIFT SPECIFICATIONS

GAS	CALIBRATION FAIL	OUT-OF-CONTROL
NO_x	5% of full scale range	10% of full scale range
O_2	1.0% O_2	2.0% O_2
CO	10% of full scale range	20% of full scale range

3.4.3. 40 CFR 75 Requirements

An out-of-control period occurs when the calibration error exceeds the following limits. The out-of-control period begins with the hour of completion of the failed calibration error test and ends with the hour of completion following an effective recalibration. For NOx Budget (40 CFR 75 Appendix B 2.1.4), EPA allows a mean difference between the analyzer response and the calibration gas of 10 ppm for NOx analyzers with spans of 200 ppm or less.

TABLE 8: 40 CFR 75 ANALYZER DRIFT SPECIFICATIONS

GAS	OUT-OF-CONTROL
NO_x	10.0 ppm
O_2 (diluent)	1.0% O_2

3.5. QUARTERLY QA ASSESSMENT

The following CEMS quality assessment is completed on the pollutant and diluent analyzers on a quarterly basis. Quarterly linearity checks and cylinder gas audits (CGAs) must not be performed less than two months apart. The Example Quarterly Data Assessment Form (40 CFR 60) is provided in Example Form 2 of this plan. The Example Quarterly Linearity Check Form (40 CFR 75) is provided in Example Form 3 of this plan.

3.5.1. Linearity Checks/Cylinder Gas Audits (CGAs)

Pollutant and diluent analyzers undergo a quarterly cylinder gas audit (CGA) in three of four quarters each calendar year. A linearity check is required in all 4 quarters.

The requirements in 40 CFR 60, Appendix F are similar to 40 CFR 75 except that only two levels of calibration gas are required (low and mid). A CGA is performed on analyzers with gases at 20-30% and 50-60% of full scale. A linearity check is performed on analyzers with gases at 20-30%, 50-60%, and 80-100% of span. Since linearity is stricter than CGA, a linearity check will satisfy CGA requirements. The cylinder gases are injected at the base of the sample probe on the stack to assess the complete sample train. The data is collected by the DAHS.

A two-point (40 CFR 60) CGA (low and mid) or three-point (40 CFR 75) linearity check (low, mid, and high) is performed on the pollutant and diluent analyzers. The quarterly linearity check uses cylinder gases prepared in accordance with EPA Protocol No. 1 procedures when they are being used to meet the 40 CFR 75 requirements.

The accuracy for a CGA is based on the reference value of the cylinder gas concentration. The following equation is used (Eq. 1-1, 40 CFR 60, Appendix F):

$$A = \frac{|C_m - C_a|}{C_a} \times 100$$

Where: A = Accuracy of analyzer, percent
C_m = Average analyzer response during audit in appropriate units
C_a = Average audit value (certified value) in appropriate units

Linearity error for the pollutant analyzers and diluent analyzers are determined as follows (Eq. A-4, 40 CFR 75, Appendix A, Section 7.1):

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

Where: LE = Percent linearity error, based on the reference value
R = Reference value of the cylinder gas (low, mid, or high)
A = Average of three monitoring system responses

The results must be forwarded in a timely manner to the regulatory agencies. The quarterly assessment report is due to the state and to the EPA not later than 30 days after the end of the quarter. The results of the three-point linearity check are provided in electronic format with the quarterly report. A test report is prepared, documenting the specific procedures to be followed. Documentation includes EPA Protocol No. 1 cylinder gas certifications, which meet the concentration requirements. The gases required are listed in Table 9 of this plan.

TABLE 9: AUDIT GASES

Gas Turbine

Linearity 40 CFR 75 Appendix A, 6.2

NO_x 0-30 ppm	
RANGE	**VALUE**
Low	6-9 ppm
High	24-30 ppm

Linearity 40 CFR 75 Appendix A, 6.2

O_2 0-25%	
RANGE	**VALUE**
Low	4-6%
Mid	10-12%
High	16-20%

Linearity 40 CFR 75 Appendix F, 5.1.2

CO 0-20 ppm	
RANGE	**VALUE**
Low	4-6 ppm
Mid	10-12 ppm

Auxiliary Boilers

NO_x 0-100 ppm	
RANGE	**VALUE**
Low	24-30 ppm
Mid	50-60 ppm

O_2 0-10%	
RANGE	**VALUE**
Low	4-6%
Mid	8-10%

To perform the linearity check or CGA, each audit gas must take the same path as the sample gas. First, the calibration bottles are put in place of the gases used for the daily zero and span check. Then, the Audit Switch is pushed and the gas flows up the Teflon line in the probe support bundle and into the probe chamber. The gas is then drawn down the heated sample line and into the analyzers. The flow rates and pressures during the check should be the same as those during calibration. A detailed description of the CGA/Linearity check procedures is located in the Michigan Power Ltd. Partnership O&M Manual.

The difference between the actual concentration of the audit gas and the concentration indicated by the monitor is used to assess the accuracy of the monitoring data. The mean difference at all test points must meet the requirements listed in Table 9 of this plan. Results of the check are kept on file at the plant and reported to the state and the EPA in the quarterly report.

3.5.2. Out-of-Control Linearity Error 40 CFR 75

An out-of-control period occurs when the error in linearity at any of the three concentrations exceeds the applicable standards as summarized below. 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 corrective action and/or monitor repair.

NO_x Errors in linearity results are acceptable if they do not exceed or deviate from the reference values by more than 5%. Linearity results are also acceptable if the absolute value of the difference between the average of the monitor response values and the average reference values is less than or equal to 5 ppm.

O_2 Errors in linearity results are acceptable if they do not exceed or deviate from 5% of the reference value or the absolute value of the difference between the

average of the monitor response values and the average reference values must be less than or equal to 0.5% O_2, whichever is less restrictive.

3.5.3. Out-of-Control CGA 40 CFR 60

According to 40 CFR 60, Appendix F, a CEMS is considered out-of-control if the CGA results exceed the limits listed below. The out-of-control period begins at the time corresponding to the completion of sampling for the CGA and ends at the time corresponding to the completion of a subsequent successful CGA, following corrective action. During an out-of-control period, CEMS data cannot be used to calculate emission compliance or counted towards meeting minimum data availability.

NO_x Less than or equal to ±15% of the gas value or ±5 ppm

O_2 Less than or equal to ±15% of the gas value

3.6. ANNUAL QA ASSESSMENT PLAN (RATA)

See CFR 75, Appendix B, Section 2.3.1 for Relative Accuracy Test Audit and 40 CFR 75, Appendix B, Section 2.3.3 for Bias Adjustment Factor information.

4. MAINTENANCE

4.1. GENERAL

Michigan Power Ltd. Partnership requires a certain level of maintenance to assure a high level of confidence in the validity of the data. A good maintenance program prevents major and costly equipment failures and is required by the applicable regulations.

4.2. DAILY CALIBRATION CHECK

Once every day, an automatic calibration check is performed. The zeros and spans of the gas analyzers are compared to known concentrations of calibration gas. The calibration routine is part of the system timing function programmed into the system PLC and therefore, the time and frequency of each calibration can be field set. Refer to the CISCO CEMS Operations and Maintenance Manual for further details.

Evaluation Procedure for Daily Calibration Reports 40 CFR 75:

1. At the same time each day, the PLC is programmed to initiate an automatic calibration check. The results of these checks are printed on the Daily Calibration Reports. All monitor values are printed. (See sample reports in Example Form 4 of this plan).

2. Collect the daily calibration reports and alarm printouts (See Organizational Responsibilities section).

3. Analyze the Daily Calibration Reports and Alarm Printouts (See Organizational Responsibilities Section). If the monitors or analyzers are operating within specifications, the Example Daily Preventative Checklist (Example Form 3 of this plan) is completed to indicate that the calibration check is ok. If any problems are noted in any step of the process, immediately initiate corrective action to repair the component or analyzer (See Organizational Responsibilities Section). All corrective actions must be documented, including problem description, actions taken, and as-left condition.

4. An automatic calibration check is always required after CEMS maintenance to provide documentation that the CEMS calibration is within specifications.

Daily Gas Analyzer Calibration Drift Determination Procedure 40 CFR 60.13(d)(1)

Step 1: The CEMS computer is programmed to initiate an automatic calibration check at a preset time each day. When necessary, plant personnel can manually initiate the automatic calibration check function by pressing the Auto Calibrate Mode Switch. This will start an automatic calibration test sequence. This test mode takes approximately 25 minutes.

Step 2: After the test sequence is completed, observe the analyzer values that were recorded on the computer printout. The calibration values should have two sets of readings, zero and span check valves.

Step 3: Check the calibration result values to determine if any analyzer failed calibration. If the monitors or analyzers are operating within specifications, the Example Daily Preventative Maintenance Checklist (Example Form 3 of this plan) is completed to indicate that the 40 CFR 75 calibration check is ok.

Step 4: If an analyzer fails calibration, troubleshooting procedures must start immediately to correct the problem (See Organizational Responsibilities Section). All corrective actions must be documented, including problem description, actions taken, and as-left condition.

a. After completing the troubleshooting procedure, repair the analyzer as necessary to insure calibration performance is within the acceptable range.

b. Initiate a parts order to replace the faulty equipment as soon as possible.

c. Manually initiate the automated calibration check function to obtain a new computer printout of calibration values to ensure that the problem has been corrected.

Step 5: Record all steps taken to bring the CEMS into proper operating condition, including problem description, actions taken, and as-left condition.

4.3. DAILY PREVENTATIVE MAINTENANCE

The daily preventative maintenance checks include a review of the calibration error (drift) test results, a check of the calibration gas cylinders, plus visual checks and verification of various general items. CISCO has provided a record book for each CEM System that should be used to document all maintenance.

NOTE: When checking the supply of calibration gases, new calibration bottles should be ordered when the cylinder back-up supply reaches one cylinder. All cylinder gas certification documentation must be filed for permanent reference when new cylinders are received at the plant.

4.4. PERIODIC TEST AND PREVENTATIVE MAINTENANCE CHECKLISTS

The following Example Periodic Test and Preventative Maintenance Checklist (Example Forms 5 through 8 of this plan) list the procedures that must be performed each month, every three months, every six months, and every year to complete the recommended maintenance. Some items on the maintenance sheets, such as filter checks, may not exhibit a failure condition until damage to other components has resulted. These items require caution in determining replacement frequency. Close and continuous observation of the operating characteristics of the system, with particular notation of any shift, either sudden or prolonged, in one direction, of any of the many visual indicators in the system should prompt a maintenance response to prevent loss of data and/or equipment damage.

CEMS alarms indicate that service is required. They do not necessarily indicate that data is invalid. They do announce that the system is operating outside of design tolerance and incorrect data and equipment data will occur if the system is allowed to continue operation without corrective action. For this reason, the alarms should be exercised on a regular bases to assure that they are operational. All alarm conditions require correction in a timely manner.

One of the best indications of system performance is the validity of the data being generated. The CEMS is programmed to conduct a calibration error (drift) test once every 24 hours. Daily scrutiny of these results will dictate whether or not maintenance is needed. As part of a good maintenance program, a stock of spare parts must be kept on site and available at all times.

The Example Periodic Test and Preventative Maintenance Checklists (Example Forms 5 through 8 of this plan) are used to direct and record maintenance activities. Each one must be completely filled out and maintained as part of the CEMS records. Many maintenance items on the checklists have a corresponding Periodic Test Procedure (PTP) or Preventative Maintenance Procedure (PMP) that provides detailed instructions. The correct PTP or PMP numbers are referenced on the checklist for those items. Periodic Test Procedures (PTPs) and Preventative Maintenance Procedures (PMPs) are provided in Appendices 3 and 4 of this plan.

4.5. CORRECTIVE ACTION FOR MALFUNCTIONING CEMS

Due to the complexity of the CEMS, a detailed written procedure is not provided for a malfunctioning system, analyzer, monitor, or component in this manual. Each problem must be evaluated by trained plant personnel utilizing the CEMS Operations and Maintenance Manual (which is incorporated here by reference) and/or factory assistance.

It is recommended that zero and span calibration error (drift) tests be conducted immediately prior to any maintenance and calibration must be performed after any maintenance. If the post-maintenance zero or calibration error (drift) test shows excessive drift, corrective action and recalibration must be conducted to bring the CEMS within specifications. All corrective action activities will be documented and will include problem description, actions taken, and as-left condition.

For 40 CFR 60, data is marginal if the daily calibration drift is less than or equal to four times the applicable performance specification, but greater than or equal to two times the performance specification. For 40 CFR 60, data is out-of-control if the daily calibration drift for five consecutive days is greater than or equal to two times the performance specification (See Table 7 of this plan). Data is out-of-control if a CGA, linearity check, or RATA exceed the applicable accuracy limits.

For 40 CFR 75, data is out-of-control if the daily calibration drift is greater than limits shown in Table 8 of this plan.

4.6. SPARE PARTS INVENTORY

A recommended spare parts inventory is listed the CISCO CEMS Operations and Maintenance Manual (Refer to the Organizational Responsibilities Section).