Continuous Emissions Monitoring System

Quality Assurance And Quality Control Plan

Company: Packaging Corp.
Site: Filer City, MI
System: CEMS
Revision Date: August 11, 2017

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Introduction

This Quality Assurance/Quality Control (QA/QC) Plan has been prepared to support the operation of the Continuous Emissions Monitoring System (CEMS) at Packaging Corp., Filer City, MI installed for measurement of pollutant concentrations of nitrogen oxide (NO_X) and Oxygen (O_2).

The EPA has established requirements for monitoring, record keeping, and reporting pollutant levels in flue gases emitted from affected units. The CEMS discussed in this manual are governed by the regulations established under *Title 40 Code of Federal Regulations Part 60* (40 CFR Part 60), Appendix B, Performance Specifications and Appendix F, Quality Assurance Procedures, which include general requirements for the installation, certification, operation, and maintenance of the CEMS.

Definitions of Quality Assurance and Quality Control

The QA procedures consist of two distinct and equally important functions.

Quality Assurance is the series of activities performed to evaluate the overall effectiveness of the maintenance and QC efforts. QC involves those activities undertaken to determine that the product or service is effective in maintaining an accurate and reliable output of CEMS data.

Quality Control functions are the control and improvement of the quality of the CEMS data by implementing QC policies and corrective actions. QC functions are often comprised of a series of frequent internal checks, such as system inspections, periodic calibrations, and routine maintenance. Quality Assurance involves less frequent external checks on product quality and is used to evaluate the total quality control process.

These two functions form a control loop: When the evaluation function indicates that the data quality is inadequate, the control effort must be increased until the data quality is acceptable. In order to provide uniformity in the assessment and reporting of data quality, this procedure explicitly specifies the assessment methods for response drift and accuracy.

External quality assurance evaluations may include independent system audits, third party sampling and analysis, and/or comparisons to known calibration standards.

Quality Assurance Policy

It is the policy of Packaging Corp.'s to efficiently operate and maintain its facilities in accordance with good operating practices (GOP) and applicable environmental regulations. Packaging Corp. is committed to ensuring that all environmental systems are operating within acceptable limits and that its operations are in compliance with operating and environmental permits.

Objective of Quality Assurance Plan

Packaging Corp. recognizes that the reliability and acceptability of CEMS data depends on completion of all activities stipulated in a well-defined QA plan. The objective of this QA plan is to define the necessary activities that guarantee CEMS data quality is maintained at acceptable levels. The plan also provides the framework for implementing QA activities by addressing items such as documentation, training, corrective actions, and preventive maintenance measures.

Scope of Quality Assurance Plan

This QA plan is specific to the operation and maintenance of the CEMS installed at Packaging Corp., Filer City, MI. The QA Plan goal is to obtain and evaluate emissions data of known and acceptable quality in support of the air pollution control equipment operation. The data obtained is used to demonstrate compliance with the following EPA, state and local emission and monitoring regulations:

40 CFR 60, Appendix B, Performance Specifications

40 CFR 60, Appendix F; Quality Assurance Procedures

Packaging Corp. Operating Permit

Additionally, this plan describes the necessary support services and activities, such as manual source testing, data reduction and report preparation, required to maintain data quality. However, this plan is not exhaustive in that some QA/QC activities are not discussed in detail here. Activities not fully discussed may include, but are not limited to, instrument maintenance, plant operating procedures, plant quality control procedures, and plant internal procedures for procurement and inventory control. These activities may be referenced in this QA Plan and may be updated, replaced, or deleted without notice or change to this plan.

Document Control

This QA/QC Plan includes procedures that ensure changes and revisions to this plan are communicated to all appropriate individuals. The Plant Manager will be responsible for ensuring that all changes and revisions are incorporated in the basic document. Periodic review of this QA Plan will help to insure that the QA process is working to provide efficient notice of required actions. Whenever inaccuracies occur for two consecutive quarters, Packaging Corp. must revise the current procedures or modify or replace the CEMS to correct the deficiency causing the excessive inaccuracies. The procedures must be kept on record and available for inspection by the enforcement agency.

This quality assurance plan must be reviewed annually. If revised, the revised QA plan must be submitted with the report of required annual quality assurance activities. Quality assurance plans for monitoring systems approved prior to the effective date of this manual revision must be submitted with the first report of required annual quality assurance activities conducted after such effective date.

Description of Facility and CEMS

Facility

The PCA Filer City Mill is located at 2246 Udell Street in filer City, Michigan and is a semi-chemical mill that produces corrugated medium, which is used as the inner layer in corrugated cardboard. The plant produces the corrugated medium from whole logs, which are debarked and then processed into chips which pass through scalping screens and are transferred to storage piles or storage silos. Purchased chips are also used along with recycled cardboard.

Particulate emissions from processing, conveying and transfer of the chips are controlled by cyclone dust collection systems. The chips are softened in digesters by cooking under high pressure using sodium carbonate solution (white liquor) and mechanical action is used to separate the wood fibers. The fibers are then washed, mixed with various additives in the stock chests and processed on the paper machines into corrugated medium.

Non-condensable gasses (NCGs) from the pulping process are collected by the Low Volume High Concentration (LVHC) system which routes the NCGs to the Mill's No. 1 and 2 boilers where they are thermally oxidized. The resulting solution after the fibers have been removed is referred to as black liquor. The black liquor is burned through a fluidized bed reactor (Copeland reactor) to produce sodium carbonate that is used again to produce white liquor in the process.

Exhaust gasses from the Copeland reactor are controlled by cyclones, a venturi scrubber, and a Regenerative Thermal Oxidizer. A wet electrostatic precipitator (WESP) is located following the venturi scrubber and demister that control the PM emissions from the Copeland reactor. The WESP is located prior to the regenerative thermal oxidizer but only serves to protect the operation of this unit and not to demonstrate compliance with any emission limits. Polished whitewater from the paper machines, black liquor and other process waste streams can be digested in the biogas system by anaerobic microorganisms.

A product of this biological digestion is the generation of methane-rich biogas that is scrubbed and then fired as fuel in Boiler No. 1, Boiler No. 2, and/or Boiler No. 4A. The No. 1 and No. 2 boilers also have the capability to be fired on coal, oil, or natural gas and are controlled by a shared baghouse when burning coal. The No. 4A boiler burns natural gas and biogas and is equipped with low NOx burners.

EUBOILER2 at the stationary source is subject to the New Source Performance Standards for Industrial-Commercial-Institutional Steam Generating Units promulgated in Title 40 CFR Part 60, Subparts A and Db. It is also subject to the NESHAP for Industrial, Commercial, and Institutional Boilers and Process Heaters in 40 CFR Part 63, Subparts A and DDDDD (Boiler MACT) and the federal CAM rule under 40 CFR Part 64. This emission unit has a control device (baghouse) and potential pre-control emissions of particulate matter greater than the major source threshold level. The CAM monitoring selected for the control device is the existing COMS which was chosen because opacity can be used as a surrogate for PM emissions with appropriate ranges established during PM emissions testing. Additionally, the COMS provides a continuous means of monitoring the process emissions.

Organization and Responsible Individuals

Certain individuals and groups at the facility will have designated responsibilities to ensure that QA/QC activities are performed as required by this QA program. The following is a typical organizational structure of responsibilities.

Operations Supervisor:

- Oversees the CEMS QA/QC program.
- Reviews all plans and reports for accuracy.
- Prepares certification/recertification applications and notifications to required regulatory agencies.
- Stays abreast of EPA regulation updates that may affect the CEMS programs and interprets as required.
- Coordinates and schedules CEMS audits, diagnostic tests and certification/recertification tests as required.
- Reviews the quarterly CEMS reports from each plant prior to submittal.
- Submits quarterly reports and certification/recertification test results to the applicable regulatory agencies.
- Supports and provides training in the administration and maintenance of the CEMS QA program and CEMS Standard Operating Procedures (SOP) documents.
- Reviews CEMS data for validity and makes any necessary corrections so the proper data will be entered in the quarterly reports.
- Ensures records are maintained for out-of-control conditions.
- Notifies the Plant Manager of any abnormal conditions that cannot be resolved within existing CEMS procedures in a reasonable amount of time.
- Maintains files of all plant CEMS data (hardcopy and electronic), reports, calibration gas certificates, etc. for three years as required by the EPA (or as applicable to local regulatory requirements).
- Notifies appropriate plant personnel of scheduled CEMS audits and certification/recertification tests.
- Arranges for support needed by contractor for periodic audits and certification/recertification tests.

- Provides plant resources to assist contractors during audits and certification/recertification testing.

Plant Manager:

- Designates and manages manpower and other resources needed to properly maintain and operate the CEMS.
- Reviews and approves all plant-specific CEMS plans, procedures, and reports.
- Ultimately responsible for ensuring that all routine preventive maintenance is completed on schedule.

Technician or Operator

- Perform the daily checks on CEMS systems.
- Perform regular maintenance on equipment as recommended by each manufacturer.
- Address and report any abnormal conditions to the Plant Manager.
- Make appropriate entries into the maintenance log.
- Maintain the spare parts inventory.
- Maintain calibration gas and audit filter certifications (if applicable).

System Overview

The following figure presents a simplified illustration of CEMS gas flow (reference system drawings for specific component detail). The *Sample probe* extracts a continuous sample of concentrated flue gas. The umbilical *system* transports the extracted sample through a *gas sample conditioner* and then a *gas control panel* distributes the sample to specific *gas analyzers*. The *gas control panel* controls air pressure to the probe purge. The assembly also regulates the flow of calibration gases to the probe during calibration. The *CEMCON* controls the operation and calibration of the CEMS and converts the emissions data for transfer to *CEMDAS*.

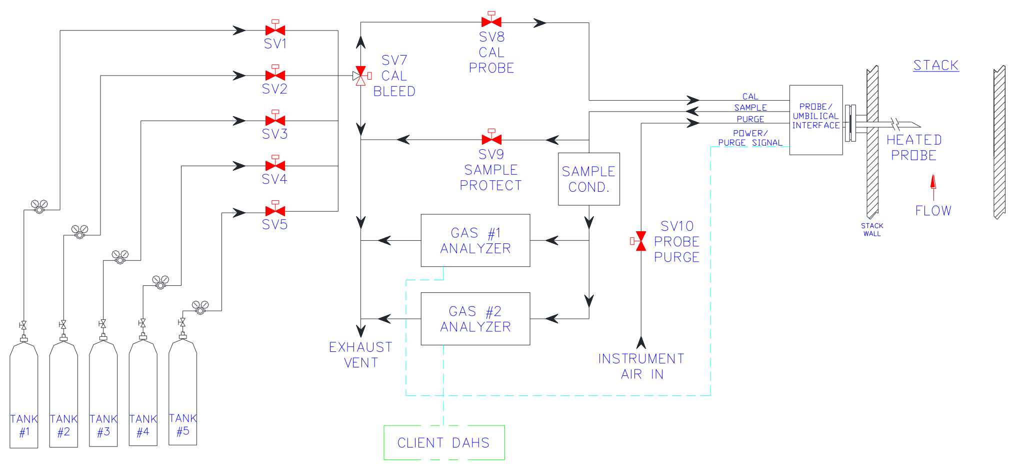


Figure 1. CEMS Overview

The system discussed in this manual consists of the following major interactive subsystems:

CEMS (Continuous Emission Monitoring System) - performs the sampling and measuring of the flue gas. It also generates data in the form of analog or digital signals that are a result of the measurements. Primary components of the CEMS include the gas sampling probe, sample gas conditioner, sample transport umbilical, gas analyzers, and gas control panel.

CEMCON (Continuous Emission Monitoring CONtroller System) receives and stores data generated by CEMS and automatically controls CEMS operations such as system purge, sample air flow, calibration, and detection of alarm conditions. In addition, it provides the communication link between CEMS and CEMDAS. The CEMCON system consists of a PLC controller with power supply and an operator interface.

CEMDAS (Continuous Emission Monitoring Data Acquisition System) retrieves the data stored by the CEMCON and performs the required calculations to determine if the readings are within required limits. The system is designed to provide alarm messages and signals in the event the results do not meet applicable requirements. CEMDAS can also generate the required reports used in EPA audits and in evaluating system operability.

A complete set of operation and maintenance manuals for all components of the system is maintained by the Operations Supervisor. These manuals provide complete descriptions of the system including theory, installation, operation, and maintenance.

Sample Probe

The sample probe performs the extraction of the emission sample from the flue gas flow. The probe is inserted into the gas stream and angled slightly downward. Sample pumps (contained in the sample gas conditioners) extract a gas sample through a filter.

The primary components of the typical probe are: the probe housing where extraction takes place, probe extension, probe heater, thermocouple to monitor temperature, the sample pump, a two (2) micron filter and a small surge tank. The probe extension and heater are constructed of 316L stainless steel.

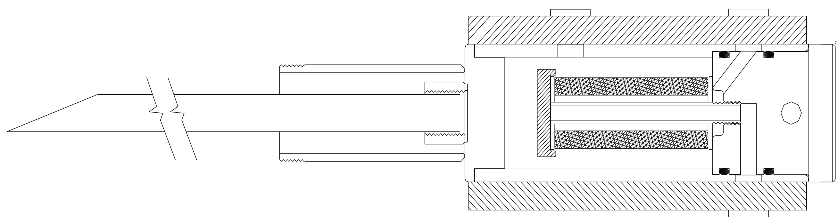


Figure 2. Sample Probe

The Model 34C Heated Filter Probe is designed to be mounted on a stack or duct for use in high particulate applications. Its primary function is to provide a heated environment to maintain sample gas temperatures above dewpoint and remove particulate material from the gas sample. The Model 34C features a standard 2 micron sintered ceramic filter element, an external regulated heater jacket, an integral calibration gas port on both sides of the filter element, a NEMA 4 enclosure, and a single direct blowback system to clean the filter element.

Figure 3. Sample Probe with Stinger

Operation of the sample probe is described in greater detail in the *Baldwin-Series Heated Filter Probes General Purpose Series Model 34C-Monsol Instruction Manual* which is included with the system O&M manual.

Mounting

The Model 34C is designed to be mounted directly on a stack or duct with a 1¼" Schedule 40 male pipe nipple. This pipe nipple can be screwed into a standard ASA flange, either flat or raised face. The probe boot can be heat shrunk to the sample line to eliminate cold spots.

The sample probe will be mounted on a 3-4 degree slope toward the base of the stack to allow moisture to 'run-out'.

Flanging	4" 150# Raised Face-Standard 4" Flat Face - Optional
Probe Stinger Diameter	0.5" (Full Extractive)
Material	316L Stainless Steel
Heater	Maintains probe/filter at 400° F min.
Controller	Heater control with failure alarm and temperature indication
Calibration	Calibration port is designed to insert gas before filter
Filter	2 micron borasilica glass, replaceable without probe removal; changed quarterly. (May also be a 2 micron sintered 316 S.S., replaceable without probe removal. Can be cleaned in an ultrasonic parts cleaner.) 2 micron sintered ceramic, replaceable without probe removal; changed quarterly. May also be a 2 micron borasilica glass or screen type filter. (A stainless steel filter should NOT be used for THC applications.)
Purge System	Accumulator tank for use at a predetermined interval with instrument air. Purge frequency based on process.
Power	120 VAC 60 Hz, Single Phase supplied through the sample umbilical

Blowback (Purge)

The Model 34C comes with a blowback air accumulator tank and 2-way solenoid. To operate blowback, connect a 50-90 psig instrument airline to the blowback air accumulator tank. The customer controls blowback via a PLC or other means determined by customer. The 2-way blowback solenoid is rated high temperature and 100 psig maximum pressure. The valve has a 1/8" orifice and the blowback instantaneous flow rate is 14scfh.

Calibration

To operate calibration gas to the probe, open the user supplied calibration gas control valve, adjust the cylinder pressure not to exceed 35 psig, and adjust the calibration gas flow rate to 125% to 150% of the total gas sample flow rate.

Maintenance Schedule

The typically preventative maintenance required for the probe is to clean or replace the ceramic filter in the probe head. Inspection of all tubing and wiring connections should also be performed. The ceramic filter, o-rings, and blowback solenoid should be considered when determining spare parts requirements.

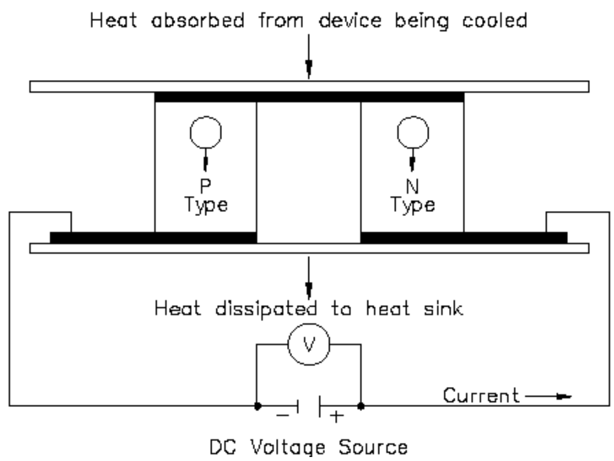
Sample Gas Conditioner

The Perma Pure Model 8210 sample gas conditioner is used to dry and filter the extractive sample of any moisture and other contaminants.

Figure 4. Model 8210 Sample Gas Conditioner

The Heavy Duty Series Thermo-Electric Coolers are specifically designed for high ambient temperature & high water volume applications. The process of sampling stack gas requires a method to remove the moisture from the sample, without removing the gas components of interest.

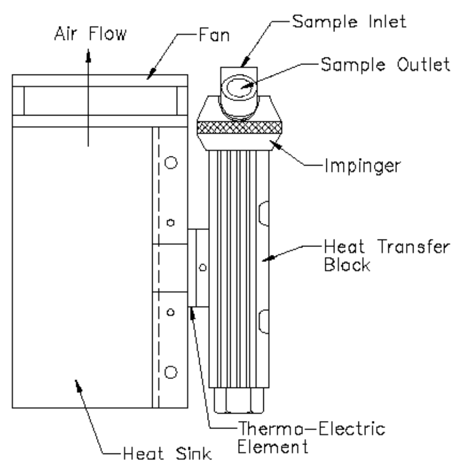
The sample gas is passed to the thermo-electric cooler (to remove moisture) via the heated filter sample probe and heated sample line. The thermo-electric cooler lowers the sample dew point to 5°C (41°F). As the gas cools and the moisture vapor condenses, the condensate exits the heat exchanger through the bottom drain connection. Particulate matter passing through the sample cooler is removed by an optional pre-filter, located downstream from the cooler along with an optional water slip sensor. The conditioned sample gas can then be directed to the gas analyzers.



Thermo-electric element (Peltier)

The coolers use thermo-electric elements (Peltiers) to cool the sample gas to the desired dew point temperature. A thermo-electric cooler is best illustrated as a small heat pump with no moving parts. The Peltiers operate on direct current and may be used for heating or cooling by reversing the direction of current flow. This is achieved by moving heat from one side of the module to the other with current flow and the laws of thermodynamics. A typical single stage Peltier (See Figure) consists of two ceramic plates with p- and n-type semiconductor material (bismuth telluride) between the plates. The elements of semiconductor material are connected electrically in series and thermally in parallel.

When a positive DC voltage is applied to the n-type thermo-electric element, electrons pass from the p- to the n-type thermo-electric element and the cold side temperature will decrease as heat is absorbed. The heat absorption (cooling) is proportional to the current and the number of thermo-electric couples. This heat is transferred to the hot side of the Peltier element where it is dissipated into the heat sink and surrounding environment.



Sample Conditioner Layout

The Thermo-Electric Coolers remove the moisture from the sample gas by cooling the gas as it passes through a laminar impinger (heat exchanger). The heat exchanger, made of 316L stainless steel, Durinert ® (a corrosion-resistant inert coating over 316L stainless steel), PVDF (Kynar), or glass, is mounted within a thermally insulated heat transfer block bored to receive the heat exchanger without a mechanical lock. This assembly allows the easy removal of any heat exchanger simply by slipping it out of the cooling block by hand. The heat transfer block cools the heat exchanger through the heat pumping action of the peltier element. The heat transfer block is on the cold side of the thermo-electric element and the heat sink is on the hot side of the thermo-electric element. The heat from the heat transfer block is pumped to the heat sink where it is then dissipated into the air by the heat sink fan (see figure). The desired temperature is maintained by a closed loop control system, which is implemented through an analog proportional controller.

The controller uses a type K thermocouple in the heat transfer block located very close to the cold side of the peltier element as the input sensor.

The sample gas is passed to the thermo-electric cooler via the heated filter sample probe and heated sample line. The thermo-electric cooler lowers the sample dew point to 5°C (41°F). As the gas cools and the moisture vapor condenses, the condensate exits the heat exchanger through the bottom drain connection. Particulate matter passing through the sample cooler is removed by an optional pre-filter, located downstream from the cooler along with an optional water slip sensor. The conditioned sample gas can then be directed to the gas analyzers.

Maintenance Schedule

The typically preventative maintenance required for the sample conditioner is to clean or replace the ceramic filter, replace the peristaltic pump drain tubing, and service the sample pump (replace the diaphragm and valve) on a quarterly basis or more frequently, if necessary. Inspection of all tubing and wiring connections should also be performed. The ceramic filter, peristaltic tubing, and pump rebuild kit should be considered when determining spare parts requirements.

Umbilical System

The umbilical is a bundle of pneumatic tubes and electrical wires used to interconnect the probe, the gas analyzers and gas transport system. The umbilical is heated to keep it flexible and free of condensation. The umbilical system contains the following lines:

a) One 3/8-in tube for transporting calibration gas to the probe.

b) One 3/8-in tube for transporting sample to the analyzers via the gas control panel and the analyzers.

c) One 3/8-in tube for transporting instrument / purge air to the probe.

Additional components of the umbilical system include the control wiring for the stack J-box, AC voltage for the probe and umbilical heaters, and wiring for the enclosure pressure switch. Two Type "K" thermocouple wires are provided for measuring the temperature of the umbilical and the probe heater. The tube/wire bundle is wrapped in a thermal barrier and is surrounded with thermal insulation. The total umbilical system is enclosed in a flexible fire retardant jacket for protection. The power end is typically marked with yellow tape and the stack end marked with white tape.

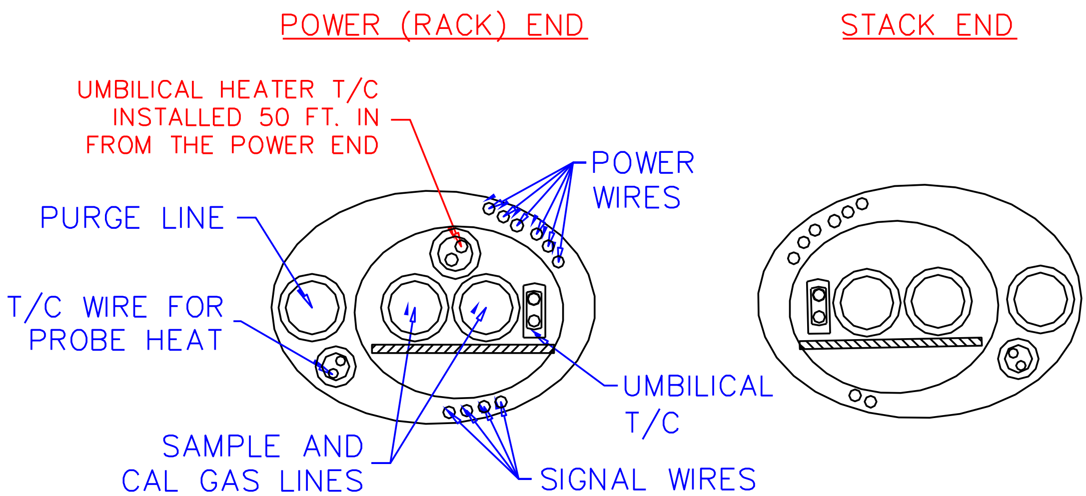


Figure 5. Full Extractive Umbilical

Maintenance Schedule

Preventive maintenance of the umbilical includes a visual inspection of the exterior for any damage or cuts to the outer jacket and any obvious kinking or low spots. Supports should also be considered during the inspection.

Heater Controllers

Figure 6. Auber Temperature Controller

Setup

Temperatures of the umbilical and probe heaters are set by controls located in the system rack.

The umbilical temperature should be set to a point between 275°F and 300°F. If a system is analyzing CO gas emissions, the umbilical temperature setpoint should be set towards the lower end of the range.

The probe temperature setpoint is dependent on the type of probe. The full extractive probe temperature should be set to a point between 300°F and 350°F.

Maintenance Schedule

There is typically no preventative maintenance required for the heater controller assembly. Some systems utilize a solid state relay. Both heater controller and relay should be considered when determining spare parts requirements.

Thermo Electron Corp. Model 42i-HL NO_X Analyzer

Figure 7. TECO Model 42i-HL High Level NOX Analyzer

The NO_X analyzer discussed in the following paragraphs is covered in greater detail by the *Model 42i High Level Chemiluminescence NO-NO_2-NO_X Analyzer Instruction Manual* supplied with this manual. The analyzer is an analytical instrument capable of measuring oxides of nitrogen at levels from 10 to 5000 parts per million. The Model 42i-HL offers fast response time, increased sensitivity, linearity through all ranges, and simplicity of operation. It features a sample pump, independent NO_X ranges, and a replaceable converter cartridge.

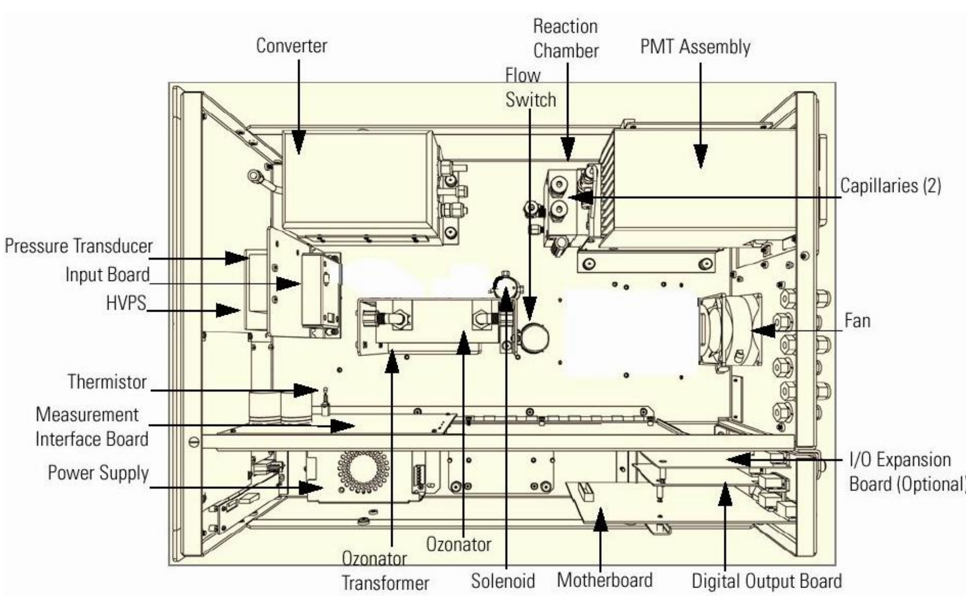


Figure 8. TECO Model 42i-HL NOX Analyzer Component Layout

Principles of Operation

The Model 42i-HL operates on the principle that nitric oxide (NO) and ozone (O_3) react to produce a characteristic luminescence with an intensity linearly proportional to the NO concentration. Infrared light emission results when electronically excited NO_2 molecules decay to lower energy states. Specifically,

$$NO + O_3 \rightarrow NO_2 + O_2 + h\nu$$

Nitrogen dioxide (NO_2) must first be transformed into NO before it can be measured using the chemiluminescent reaction. NO_2 is converted to NO by a stainless steel NO_2-to-NO converter heated to about 625°C (the optional molybdenum converter is heated to 325°C).

The ambient air sample is drawn into the Model 42i-HL through the sample bulkhead. The sample flows through a capillary, and then to the mode solenoid valve. The solenoid valve routes the sample either straight to the reaction chamber (NO mode) or through the NO_2-to-NO converter and then to the reaction chamber (NO_X mode). A flow sensor prior to the reaction chamber measures the sample flow.

Dry air enters the Model 42i-HL through the dry air bulkhead, passes through a flow switch, and then through a silent discharge ozonator. The ozonator generates the ozone needed for the chemiluminescent reaction. At the reaction chamber, the ozone reacts with the NO in the sample to produce excited NO_2 molecules. A photomultiplier tube (PMT) housed in a thermoelectric cooler detects the luminescence generated during this reaction. From the reaction chamber, the exhaust travels through the ozone (O_3) converter to the pump, and is released through the vent.

The NO and NO_X concentrations calculated in the NO and NO_X modes are stored in memory. The difference between the concentrations is used to calculate the NO_2 concentration. The Model 42i-HL outputs NO, NO_2 and NO_X concentrations to the front panel display, the analog outputs, and also makes the data available over the serial or Ethernet connection.

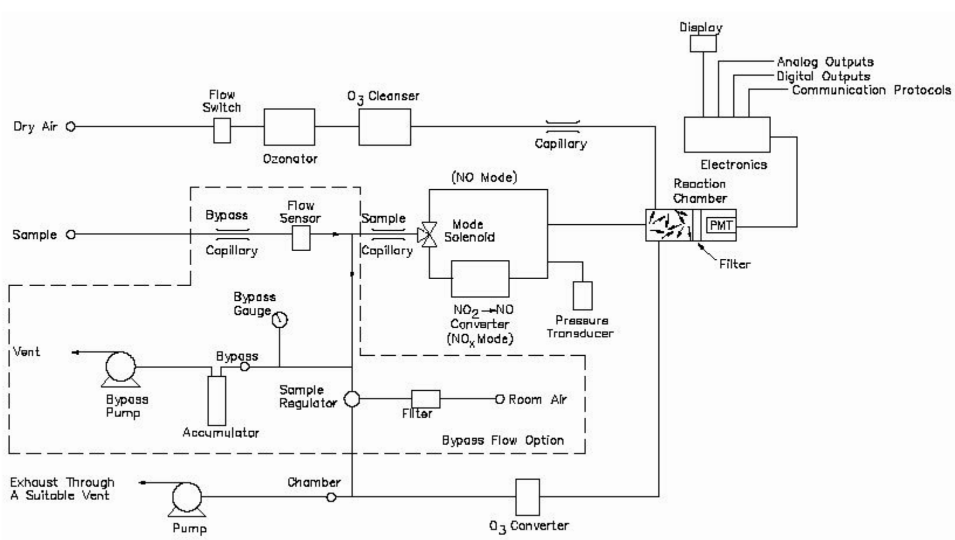


Figure 9. TECO Model 42i-HL NOX Analyzer Flow diagram

The NO_X analyzer discussed in the following paragraphs is covered in greater detail by the *Model 42i High Level Chemiluminescence NO-NO_2-NO_X Analyzer Instruction Manual* supplied with this manual.

Gas Control Panel

Calibration and Purge solenoids

The gas control panel is used to route the calibration gases (both zero air and span gas) to the probe and to regulate the sample flow rate to each analyzer. The sample flow rate is regulated by a flowmeter for each analyzer and should be set to approximately 1.5 lpm for each analyzer. The zero air and the span gas flow are set and monitored by the CALIBRATION GAS flowmeter to approximately 1 lpm above the sum of the analyzer flows when cal to the probe is active.

The switching of the flows of zero, span, and purge gases is performed by solenoids mounted within the solenoid assembly. The high pressure/volume purge is controlled by a purge solenoid located in the stack probe box. High density Teflon tubing is used to interconnect the gas control panel and the solenoids.

Operator Interface Controller

The Operator Interface Controller controls the activation of the calibration and purge solenoids. Two contacts are provided to the client for remote activation of the Daily Calibration Check sequence and the Quarterly CGA sequence. These sequences, as well as activation of individual solenoids, can be performed manually by an operator at the controller.

The frequency and duration of the probe purges is set within the controller. A “First Purge of the Day” purge time is set and subsequent purges occur based on the frequency (in minutes) set in the controller.

Maintenance Schedule

There is typically no maintenance required for the Gas Control Panel, however, the solenoids should be considered when determining spare parts requirements

CEMDAS™ Data Acquisition System

Overview

CEMDAS™ is an automated PC-based data acquisition system custom designed for each client. Its primary functions are the acquisition, processing, storage, and reporting of CEMS data and related information. CEMDAS™ facilitates all of the data reporting requirements necessary to establish compliance with EPA, state, and local operation permit limits. Coupled with a Monitoring Solutions PLC controller, the CEMDAS™ package is a powerful, user-friendly Windows-based system for monitoring, recording, and reporting stack emission information. CEMDAS™ receives analog and status signals from CEMS components such as monitors via the PLC. CEMDAS™ uses these inputs to prepare reports and summarize the data and information derived from the input signals.

Besides the standard reporting features, CEMDAS™ is designed to allow a user to better diagnose and understand their CEMS system. Some of the features include trending, system activity logs, alarm logs, and screen reports.

The typical hardware components included are a Windows-based computer, UPS, monitor, keyboard, mouse, and printer. The specific CEMDAS™ computer configuration is customized for each client and is developed and tested to function with the CEMDAS™ Evolution software.

User Interface

The User Interface (UI) is responsible for providing the user with access to the many features of CEMDAS™. From the UI the user can view real time scan and average data, generate reports, edit system parameters, take monitors out of service, start and stop the flow of calibration gas, and trigger the start of daily or quarterly calibration test cycles.

The typical appearance of the CEMDAS UI is shown below.

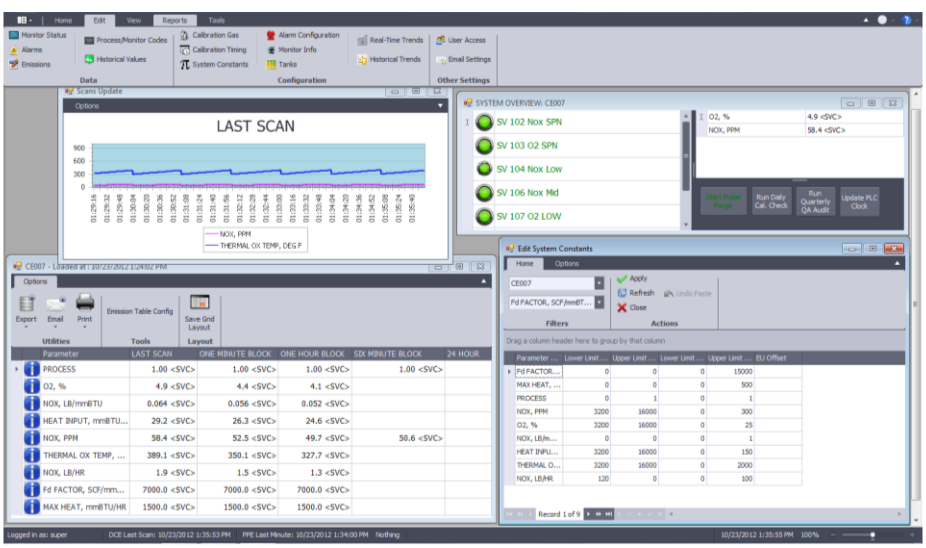


Figure 10. Typical CEMDAS Screen

CEMCON Controller

Programmable Logic Controller (PLC)

CEMDAS™ utilizes a PLC-based CEMCON System Controller, including all necessary I/O. Besides the I/O utilized by the CEMDAS™ software for monitoring and reporting functions, a number of other I/O are available including Digital Inputs, Digital Outputs, Analog Inputs and Analog Outputs.

Maple Systems Model HMI5043L Human Machine Interface

Manual Calibration Checks, as well as purges, can be initiated from the Maple Systems HMI. The HMI allows control of the gas solenoids from the analyzer rack when the CEMDAS™ computer is not located nearby.

Figure 11. Maple Systems Model HMI5043L Operator Interface

CAUTION: Any activity initiated from the HMI unit should be deactivated at the HMI. Switching between the HMI and CEMDAS™ computer may cause the system to fault resulting in a loss of data!

Calibration Overview

During normal operation of the CEMDAS™ Evolution program, the analyzer readings are recorded and displayed on the computer screen for the user to read and evaluate. In order for the readings to be accurate, the analyzers have to be periodically checked with a known standard for comparison. This is done daily per EPA regulations and is known as the "Daily Calibration Check". During the Daily Calibration Check, known values of gases flow to the analyzers and the analyzers' responses are compared to the known values (zero and span gas values are based on federal, state, and local permits). If an analyzers' responses to the known gas values are within tolerances, then the system will continue to operate normally with no action required by the user.

If, during a daily calibration check, an analyzer doesn't read the zero gas or span gas correctly, CEMDAS™ will either indicate a BAD or FAIL status for the calibration on the daily calibration report (typically, ±5% for BAD and ±10% for FAIL). If an analyzer FAILs a daily calibration check, the status of the analyzer will change to MOC (Monitor Out of Control). ***All data collected by CEMDAS™ from this point forward will be considered INVALID for the analyzer that failed its calibration and all data calculated from this analyzer's raw data will also be considered INVALID.***

If the analyzer's response exceeds the permitted limits, the user must take immediate action to bring the analyzer readings back to within limits. Analyzers may have different procedures for performing a manual calibration, but they all must first have the known standard gases flowing to the analyzers so that the analyzers can be calibrated to these known standards.

1) The value of the gas in calibration bottle(s) will vary slightly every time that calibration bottle(s) is changed.

2) Every time a bottle is changed, it is necessary to record the calibration gas value(s) and enter the new value(s) into the CEMDAS™ *Calibration Config* menu.

    - The CEMDAS™ program is compares the analyzer reading with the values entered into the *Calibration Config* menu.

    - If the values in CEMDAS™ are not updated with the new calibration bottle values, the analyzers will read correctly, but the DAILY CALIBRATION REPORT will be incorrect because CEMDAS™ will be comparing with the wrong values.

Calibrations from the System Overview Screen

1) Manually start the flow of calibration gases via the CEMDAS computer.

    a. Access the SYSTEM OVERVIEW screen by selecting the VIEW tab, then selecting <u>System Overview</u> in the ribbon.

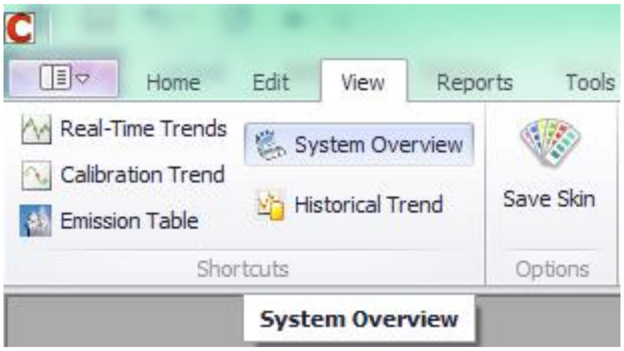


Figure 12. System Overview Select

    b. Once the SYSTEM OVERVIEW screen is open, a graphical representation of the various gas bottles that the system uses will be displayed.

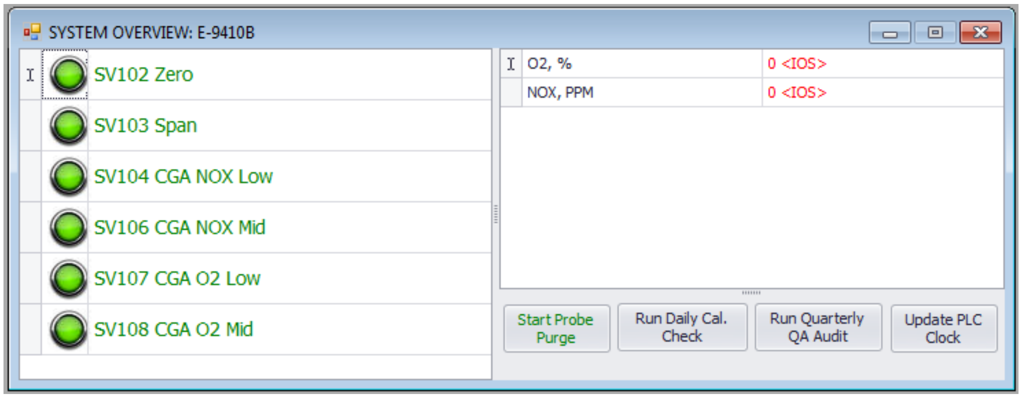


Figure 13. System Overview Screen

c. Each individual gas bottle can be turned on and off from the SYSTEM OVERVIEW screen.

2) Typically, a system will have a ZERO bottle, a DAILY SPAN bottle, a LOW CGA/LIN bottle and a MID CGA/LIN bottle.

   a. The exact number of gas bottles in a system, are determined by the type of system and types of analyzers in the system.

   b. A system may have more bottles than another system and they may have different labels also.

   c. The principles for turning the bottles on and off will be the same regardless of the number of bottles or type of system.

3) Activate a calibration gas bottle.

   a. Each bottle will have a green button next to it. Clicking on the green button will bring up a small menu asking if you are sure you want to turn on the selected gas bottle.

   b. Select YES to activate the solenoid for that gas bottle and the selected gas will begin flowing to the probe for sampling by the system analyzers.

      i. Anytime calibration gases are flowing, the analyzers are no longer sampling stack gases, therefore the readings from the analyzers are not representative of what is in the stack and the status of the analyzers will change from SVC (In Service) to MOS (Monitor Out of Service).

      ii. Once YES has been selected and the gas has begun to flow, the button next to the selected bottle will become a red button.

   c. Select the red button to turn off the selected gas bottle. A small menu will pop up asking if you are sure you want to turn off the selected gas bottle.

d. Select YES to de-activate the solenoid for that gas bottle and stop the flow of the selected gas to the probe.

   i. The status of the analyzers will change from MOS to NSA (No Sample Available) when the gas flow to the probe is stopped. This is a recovery period, approximately 2 minutes, and allows the system to clear the calibration gases, begin to bring the stack gases down from the probe, and stabilize again so that the analyzer readings are representative of what is in the stack.

   ii. The status will then return to SVC indicating that the data being collected is valid.

Always leave the SYSTEM OVERVIEW screen open while flowing calibration gases from the SYSTEM OVERVIEW screen!

Closing the SYSTEM OVERVIEW screen while a gas bottle is turned on can potentially cause problems, and when the SYSTEM OVERVIEW screen is re-opened to turn the bottles off, the screen will indicate the opposite state of the gas bottle.

Once all gases are turned off, it is safe to close the SYSTEM OVERVIEW screen.

Calibrations from the HMI (Human-Machine Interface)

These general guidelines apply to CEMDAS^{TM} systems utilizing Maple Systems Human-Machine Interface Model HMI5043L touchscreen display unit.

1) Upon power up of the PLC to which the HMI is connected, the first screen to appear after its initialization will display “Monitoring Solutions” and the Date “MM/DD/YYYY” and time “HH:MM:SS”.

2) Pressing the Close Screen text at the bottom of any screen will take the user one screen back.

3) Begin by touching the *Press to Login* button. The system options screen will be displayed.

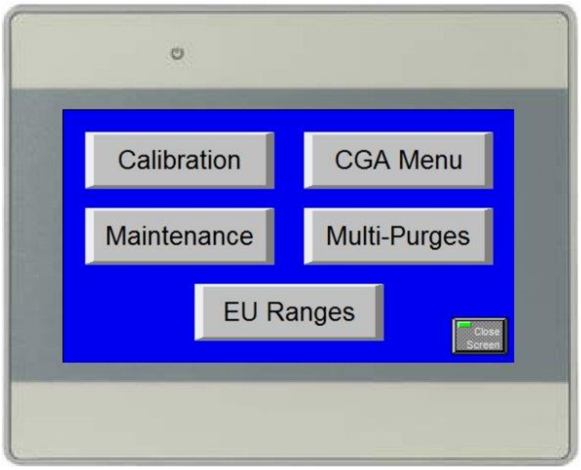


Figure 14. HMI System Options

Manual Calibrations

1) Select the Maintenance button to navigate to the Maintenance Menu. From this menu, a user can manually activate a calibration gas solenoid or purge solenoid(s).

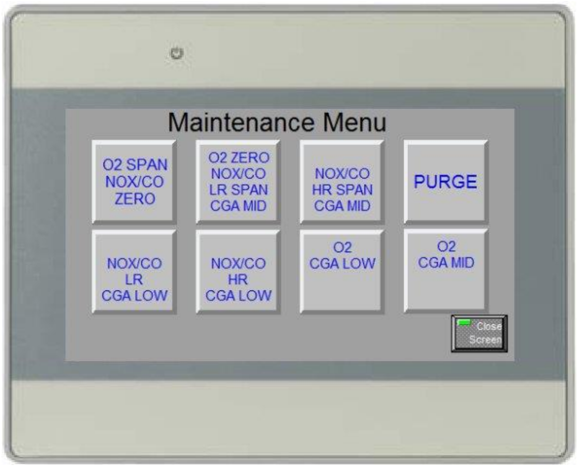


Figure 15. HMI Maintenance Menu

2) Select the desired solenoid. The solenoid activate/deactivate screen will be displayed.

Figure 16. HMI Solenoid Activate Screen

3) A user can toggle the solenoid ON and OFF by pressing the appropriate button. The text and color of the button will switch to correspond to the state of the solenoid. Select the ON button. A click should be heard from the corresponding calibration solenoid, allowing calibration gas to flow from the corresponding gas cylinder.

    a. The *Calibration Gas Rotometer* on the front panel of the analyzer rack allows the gas flow to the corresponding analyzer to be observed and adjusted. The ball in a rotometer indicates gas flow to the analyzer and should be approximately 2 liters/minute for dilution systems and approximately 10-12 liters/minute for full extractive systems.

    CAUTION! All calibration gas bottles toggled ON from the HMI must be toggled OFF from the HMI also. Never turn bottles on from the HMI and attempt to turn off from the CEMDAS OVERVIEW screen or vice versa. ALWAYS TURN BOTTLES ON AND OFF FROM THE SAME LOCATION!

    b. Once the span calibration gas is flowing, allow the analyzers to stabilize for a few minutes so that the calibration gas being sent up to the probe will have time to return back down to the system. This may take a long time if the probe is a very long distance from the analyzer rack. Adjustments and readings may then be taken from the analyzers. (Each analyzer may have different calibration procedures, but will typically involve entering a calibration menu on the analyzer and scrolling to the appropriate screen and forcing the analyzer to output the value of the span calibration gas in the corresponding bottle for its reading.)

4) Once the analyzers are correctly reading the calibration gas, turn off the calibration gas.

Figure 17. HMI Solenoid Deactivate Screen

a. Again, the click of the corresponding solenoid should be heard each time the calibration bottle is toggled on or off.

b. Observe the ball in the *Calibration Gas Rotometer* to verify that calibration gas flow has stopped.

c. It will take approximately 2 minutes for the system to recover and stabilize and for the status of the analyzers to change from NSA to SVC as indicated on the CEMDAS^{TM} *System Overview* screen.

d. In order to activate a different calibration gas bottle, turn OFF the current solenoid. Touch the Close Screen button to go back to the Maintenance Menu.

e. Regardless of whether the calibration gases were manually activated and the analyzers have been calibrated and are reading the calibration gases correctly, if the previous *Automatic* Daily Calibration Check FAILED, the analyzer status will still be MOC.

f. In order to clear the MOC status and return the analyzer(s) status to SVC, the system needs to be run successfully through another *Automatic* Daily Calibration Check.

Automatic Daily Calibration Check cycle

1) From the *System Options* screen, select *Calibration*. This will provide the user with options for manually starting an Automatic Daily Calibration Check cycle.

Figure 18. HMI Calibration Screen

2) Pressing the *Daily* button will initiate a full Automatic Daily Calibration Check cycle.

    a. A Purge will ALWAYS be performed at the end of an Automatic Daily Calibration Check cycle.

    b. A typical sequence would include a Zero check, Span check, and then a Purge. Reference the system drawings for sequence details.

CGA (Cylinder Gas Audit)

1) From the *System Options* screen, select *CGA Menu*. This will display a screen that will allow the user to change the number of CGA runs that will cycle when the CGA is initiated. The typical number of runs is three, however, being able to change the number of runs provides an option for troubleshooting.

Figure 19. HMI CGA Number of Runs Screen

   a. Use the Up and Down arrow keys to select the desired number of runs.

   b. Once the desired number is displayed, press the *Close Screen* button and the number will be stored.

2) From the *System Options* screen, select *Calibration*. This will provide the user with options for starting a CGA.

   a. Pressing the CGA button will initiate a full CGA Calibration Check cycle sequence and will perform the sequence repeatedly based on the number of runs selected in the *CGA Number of Runs* screen. Some systems require a change of cylinders and a second CGA Calibration Check cycle sequence. Reference the system drawings to see if a second sequence is required.

   b. Once the CGA is initiated, it ***CANNOT*** be stopped!

Multi-Purges

The system can be setup via the HMI so that a purge is performed multiple times throughout the day.

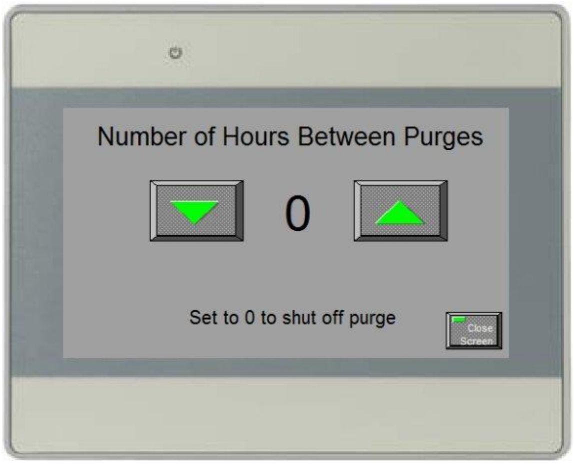


Figure 20. HMI Multi-Purge Setup Screen

1) From the *System Options* screen, select *Multi-Purges*. This will provide the user with options for setting the frequency of the purges.

2) The number that is entered is equal to the number of hours ***BETWEEN*** purges.

> ***CAUTION: If power is lost to the HMI, the purge frequency will return to its default setting upon power up and values will, if previously changed, need to be re-entered.***

DTR (Downtime Recovery) for CEMDAS Evolution

Some systems are equipped with an additional external device that will perform in conjunction with the PLC to store data and provide a utility to recover the data in the event that there are issues with the CEMDAS™ computer. Monitoring Solutions' approach to collecting data when the Computer has lost its connection to the PLC, due to a network problem, the computer being shut down, or a computer failure, is to store as much as 90 days of data in a local storage device located near the PLC. The external device is a Red Lion modular controller with data collection and storage. Data is collected every 2 seconds and stored as a CSV (Comma Separated Variable) type file. The connection between the Red Lion storage device and the PLC will depend on the type of PLC being used and the ports available. In most cases this will be an Ethernet communications. The Red Lion device will communicate with the CEMDAS™ computer via Ethernet communications in all cases.

The CEMDAS™ computer is set up as a time server and as an FTP server. The DTR device will write the data to the CEMDAS™ computer into a subdirectory location of "C:\Cemdas\DTR\logs". A file will be generated for each day. The file will be updated on a periodic basis to the CEMDAS™ computer.

The DTR device will synchronize its time with the CEMDAS™ computer so that the times will match on the two devices. The scan data on the DTR Device will be transferred on a periodic basis from the DTR device to the CEMDAS™ computer DTR subdirectory by the Sync Manager function in the DTR device. If the CEMDAS™ computer has not been communicating with the PLC, the data from the DTR subdirectory will be used to fill in the missing scan Data.

Caution: A user should wait at least 15 minutes after the CEMDAS™ application has been launched prior to performing any down time recovery process to allow for the CEMDAS™ application and the DTR to completely sync any missing data.

A user must have the proper access rights to initiate the Downtime Recovery process. The following procedure should be followed:

1) Within the CEMDAS™ application, select the *Tools* tab, then select the *Downtime Recovery* option in the menu ribbon.

Figure 21. Downtime Recovery Select

2) The Downtime Recovery window will pop up. The timeframe shown is typically the last timeframe for which CEMDAS™ detected missing data. Select the desired Start Date and Time and the End Date and Time.

Caution: Do not select a timeframe that contains valid data as this may potentially overwrite valid data depending on the reason for the missing data.

Do NOT perform RECALC while the down time recovery process is running.

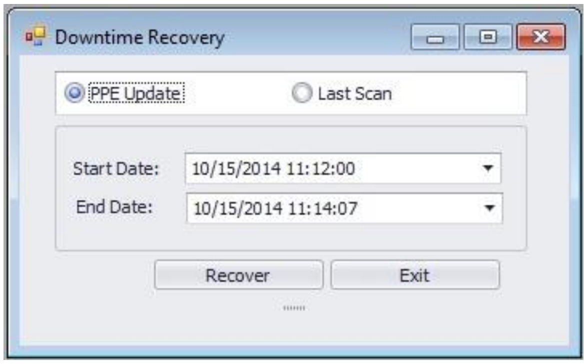


Figure 22. Manual Downtime Recovery Initiate

3) Left click on the Recover button to initiate the process.

   CEMDAS™ will then read in the CSV files data for the period of time selected and perform a conversion of the data from the "raw" CSV file into the appropriate engineering units and status information. During this conversion, any calibration data missed will also be converted and stored into the CEMDAS™ database. All averages will be calculated and the data added to the SQL data bases. This process will take a few minutes. The time required will vary depending on the number of PLC's and the time period for which data must be recovered.

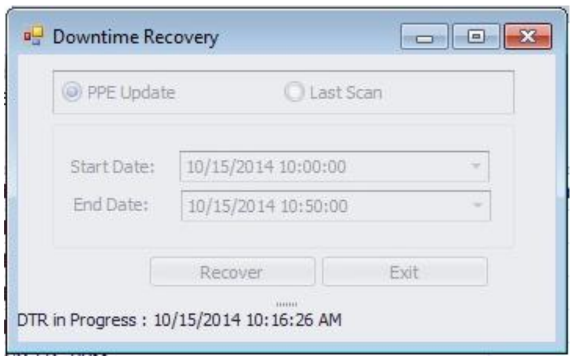


Figure 23. Downtime Recovery In Process

During the recovery time period, there may be a number of alarms generated as CEMDAS™ converts all the data collected during the period the program was not running. All of the alarms will be stored in the CEMDAS™ database for use in reporting.

At the end of the Downtime Recovery process, CEMDAS™ will return to normal operation. The DTR device will also continue to collect data and transfer it to the CEMDAS™ computer for future use when, or if, it is needed.

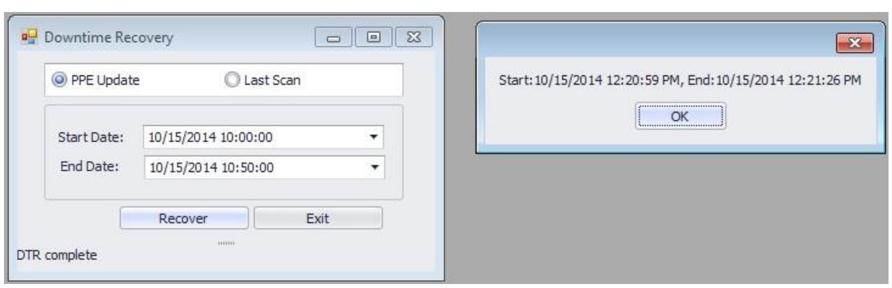


Figure 24. Downtime Recovery Complete

The functions and operation of the CEMDAS™ Evolution program are covered in greater detail by the ***Continuous Emissions Monitoring Data Acquisition System Operation and Manual*** supplied on the CEMDAS™ computer and in the Appendix of the CEMS O&M Manual.

Quality Assurance Activities

Overview

The purpose of these procedures is to ensure that the CEMS installed at the Packaging Corp. - Filer City, MI facility operates in such a manner as to provide accurate and reliable data.

CEMS Analyzer Summary

Table 1. CEMS Analyzer Summary

Measured Parameter	Full Scale Range	Analyzer Mfg	Model
NO_X	0-500ppm	TECO	42i-HL
O_2	0-25%	Brand Gaus	4705

Daily Calibration Drift Check

Calibration Gases

Calibration gases shall be NIST/EPA approved Standard Reference Materials, Certified Reference materials per 40 CFR 60, Appendix F, Section 5.1.2 (3). A separate calibration gas cylinder must be used for each concentration.

Multicomponent mixtures are acceptable provided that none of the components interferes with the analysis of other components and provided that individual components must not react with each other or with the balance gas.

Calibration Error Test for Pollutant and Diluent Monitors – Part 60

Perform a two-point calibration error test on each pollutant and diluent gas monitor at least once per unit operating day (24 hours). A separate calibration gas cylinder must be used for each audit point. The following concentrations must be used:

Table 2. Daily Calibration gas allowable ranges

Audit Level	40 CFR 60
Low-level	0-20% of span
High-level	50-100% of span

Dynamic calibration checks challenging the entire sampling and analysis of the CEMS automatically occur once every 24 hours and are controlled by the PLC. The PLC controls solenoids that open and close to allow low and mid-level calibration gases to be alternately introduced to the pollutant analyzers. Each gas passes through all components used during normal sampling, including the sample probe. Gas is injected until a stable reading is obtained. All analyzer responses during calibration are recorded by CEMDAS Evolution. Calibration gas can be manually initiated at any time.

The results of the CD check are calculated as the measurement device reading minus the value of the calibration gas used.

If a post-maintenance zero or calibration drift checks show drift in excess of twice the applicable performance specifications, recalibration must be conducted in accordance with the quarterly calibration error check procedures.

For CEMS, the zero (low-level) and high-level calibration drifts shall not deviate from the reference value of the calibration gas by more than two times the specification for five consecutive days, or four times the specification for one day.

If a monitor fails a calibration error test, corrective action must be performed and documented, and a successful daily calibration error test performed before data can be considered valid. The CEMS calibration must, as minimum, be adjusted whenever the daily zero (or low-level) CD or the daily high-level CD exceeds two times the limits of the applicable PS. The Monitoring Solutions CEMS Operations and Maintenance Manual provides detailed calibration procedures.

Out-of-Control Period for Pollutant and Diluent Analyzers – Part 60

An out-of-control period occurs for a pollutant or diluent analyzers when the daily low-level or daily mid-level CD exceeds two times the limit for five consecutive days, or four times the limit for one day.

Table 3. Out of Control Limits for Pollutant and Diluent Analyzers

Pollutant or Diluent	Daily Calibration Drift	Out-of Control	
		Five (5) consecutive daily calibrations	Any daily calibration
NO_X	≤ 2.5 % of Span	≥ 5.0 % of Span	≥ 10.0% of Span
O_2	≤ 0.5% by volume	≥ 1% by volume	≥ 2.5% by volume

Monitor adjustments, calibration, or repairs must be performed whenever CD limits are exceeded. The CD check must be repeated after any adjustment or repair. Whenever the CD is exceeded, a warning is displayed on the computer screen and a message is logged to a printable alarm file.

The beginning of the out-of-control period is the time corresponding to the completion of the fifth, consecutive daily CD check with a failed CD or the time corresponding to the completion of the daily CD check preceding the daily CD check that results in a failed CD. The end of the out-of-control period is the time corresponding to the completion of appropriate adjustment and subsequent successful CD check.

Any time the CEMS is declared "out of control" or "out of service", it cannot be used to show compliance with permit limits or data capture requirements and shall be considered downtime for reporting purposes. Therefore, corrective action must be performed as soon as possible after determining that the CEMS is not operating to within required specifications.

Quarterly Audit: CEMS – Pt 60

Conduct the test for calibration error on each range of each measurement device, except for fuel flow meters, in accordance with the procedures in 40CFR60 App. B Performance Specifications.

An audit shall be performed on each pollutant analyzer at least once every calendar quarter in which the source operates for 168 hours or more, except that if four consecutive calendar quarters elapse after the last audit, the test must be performed within 168 source operating hours (If source did not operate at all, the provisions of the Extended outage/Shutdown will apply). Successive quarterly audits shall occur no closer than 2 months.

Calibration Gases – Pt 60

Calibration gases shall comply with per 40 CFR 60, Appendix F, Section 5.1.2 (3). Use audit gases that have been certified by comparison to National Bureau of Standards (NBS) gaseous Standard Reference Materials (SRM's) or NBS/EPA approved gas manufacturer's Certified Reference Materials (CRM's) following EPA Traceability Protocol No. 1. As an alternative to Protocol No. 1 audit gases, CRM's may be used directly as audit gases. A separate calibration gas cylinder must be used for each audit point. The following concentrations must be used:

Table 4. Calibration gas allowable ranges – Part 60

Audit Level	Pollutant Monitors	O2
Low-level	20 - 30 % of span	4-6% by volume
Mid-level	50 - 60 % of span	8-12% by volume

Procedure

The known gases are individually injected at the probe to be sampled through the entire sampling train, as the path used in extracting from the process. Gas is injected until a stable reading is obtained.

The procedure is conducted as follows:

1) Connect all quarterly gas cylinders to the system and turn them on.

2) Verify/Set the corresponding calibration gas cylinder values in the calibration configuration menu in the DAS.

3) Then initiate the sequence by selecting the CGA option on the CEMDAS screen or the OIT.

4) Each gas is routed through the system until a stable response is achieved.

5) Values are recorded as the system is allowed to operate in a normal sampling and analysis manner without adjustment.

6) The sequence is repeated through three audit runs.

For each audit cylinder (or audit point), the percent accuracy is determined by using the following equation:

$$A = \frac{(Cm - Ca)}{Ca} x100$$

Where:

A = Accuracy of CEMS (%)

Cm = Average CEMS response during audit in units of applicable standard or concentration

Ca = Average audit (cylinder gas certified value) in units of applicable standard or concentration

Accuracy (A) value of ±15% or less is considered acceptable for criteria pollutants gas. If excessive inaccuracies occur for two consecutive quarters, Packaging Corp. must revise the QC procedures or modify or replace the CEMS.

Measurements are calculated and recorded by the PLC. The audits serve as verification of the accuracy of the CEMS data. Various reports can be generated to support audits and are kept on file by Packaging Corp.. The manufacturer's certification statement (if applicable) for the calibration gases are also included.

Periodic Audit

Relative Accuracy Test Audit

At least once in every four calendar quarters, conduct a Relative Accuracy Test Audit (RATA), as described in 40 CFR 60, App. B, PS 2, to assess the accuracy of the CEMS relative to the appropriate EPA reference methods used in determining pollutant concentrations. Measured inaccuracy exceeding 20% of the mean value of the reference method results or 10% of the applicable standard, whichever is greater, requires corrective action to be taken. When appropriate, additional audits are conducted to demonstrate the effectiveness of the repair or adjustment.

RATA Preparation

A number of quality assurance activities are undertaken before, during, and after each audit. The following paragraphs detail the quality control techniques, which are rigorously followed during the testing projects.

Each instrument's response is checked and adjusted in the field prior to the collection of data via multi-point calibration. The instrument's linearity is checked by first adjusting its zero and span responses to the zero nitrogen and an upscale calibration gas in the range of the expected concentrations. The instrument response is then challenged with other calibration gases of known concentrations and accepted as being linear if the response of the other calibration gases agreed within ±2 percent of range of the predicted value.

After each test run, the analyzers are checked for zero and span drift. This allows each test run to be bracketed by calibrations and documents the precision of the data just collected. Data is considered acceptable if the instrument drift is no more than 3 percent of the full-scale response. Quality assurance worksheets are prepared to document the multipoint calibration checks and zero and span checked performed during the tests.

The sampling systems are leak checked by demonstrating that a vacuum greater than 10 in Hg could be held for at least 1 minute with a decline of less than 1 in Hg. A leak test is conducted after the sample system is set up and before the system is dismantled. These checks are performed to ensure that ambient air has not diluted the sample. Any leakage detected prior to the tests would be repaired and another leak check conducted before testing commenced.

The absence of leaks in the sampling system is also verified by a sampling system bias check. The sampling system's integrity is tested by comparing the responses of the analyzers to the calibration gases introduced via two paths. The first path is directly into the analyzer and the second path via a sample system at the sample probe. Any difference in the instrument responses by these two methods is attributed to sampling system bias or leakage. The criteria for acceptance is agreement within 5% of the span of the analyzer.

RATA Activities - CEMS

1) Verify that all plant operations will be normal (e.g., no scheduled maintenance) and that no other condition exists which could prevent testing emissions under representative operating conditions.

2) Verify the availability of all personnel required to perform testing.

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

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

5) Perform the following procedures immediately prior to, during, and following RATA testing:

6) Perform and document a pre-test calibration of the CEMS.

7) Notify appropriate levels of management of testing.

8) Verify CEMS operating conditions are normal by conducting walk-through audits.

9) Verify load remains stable and at least 50% of maximum prior to, and during, testing.

10) Perform and document a post-test calibration of the CEMS.

Quality Control Activities

Quality control activities are performed to ensure that the CEMS operation and maintenance are adequate and appropriate. Application of these activities ranges from installation to data handling and reporting procedures. Quality control activities rely upon a qualified and well-trained staff.

Installation of the CEMS has been carried out in strict accordance with specifications submitted by Packaging Corp.. A complete set of Operation and Maintenance manuals for all components of the CEMS are provided with the CEMS. These manuals provide complete descriptions of the system including theory, installation, operation and maintenance including procedures used for initial start-up, debugging, and inspection.

Training

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

General Training

General training may be viewed as providing a foundation. It is not intended as much to deliver detailed and specific knowledge, as it is to provide an understanding of the overall system and program goals. General training is common to all individuals directly involved in the CEMS program.

Quality Assurance/Quality Control Plan

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

1) Calibration of CEMS.
2) CD determination and adjustment of CEMS.
3) Preventive maintenance of CEMS (including spare parts inventory).
4) Data recording, calculations, and reporting.
5) Accuracy audit procedures including sampling and analysis methods.
6) Program of corrective action for malfunctioning CEMS.
7) Clients must develop and have an approved QA/QC procedure for their COMS. The QA/QC procedure must have a corrective action program for a COMS system that is malfunctioning. The corrective action program must address routine and/or preventative maintenance and various types of analyzer repairs. The corrective action program must establish what type of diagnostic testing must be performed after each type of activity to ensure the COMS is collecting valid data.

All employees involved in the CEMS program must read this QA/QC Plan.

Standard Operating Procedures

As with the QA Plan, all affected employees must, at a minimum, be familiar with and review appropriate SOP's as they are developed with experience.

Periodic and Refresher Training

Special and refresher training is presented annually. Each affected employee receives appropriate training as SOP's, operating parameters, or as personnel changes are made.

Record Keeping

The Operations Supervisor will be responsible for training as the need arises. Training records are maintained for each affected employee.

QC Activities

An activity matrix summarizing various routine recommended maintenance activities is presented in the following tables.

Activity: Quality Control	Daily	Quarterly	As Required
DAS Alarms Status	X		
Analyzer Alarms Status	X		
Zero Value Cal Check Passed/Record	X		
Span Value Cal Check Passed/Record	X		
Calibration gas cylinder(s) >250psi	X		
Walk-through Audit		X	
Clean/Replace Filters - Analyzers		X	
Clean/Inspect Sample Conditioner		X	
Replace/Clean Filters - Probe		X	
Change Air System Filters/Scrubbers		X	X
Clean Interior of Enclosure/Rack		X	X
Printer Maintenance			X

Daily Activities

Once every day, the Maintenance Personnel will:

1) Verify that the Pollutant and Diluent Daily Calibration checks have PASSED and that the zero and span calibration values are recorded in CEMDAS.

2) Verify that the calibration cylinders have pressures greater than 250psi and the certifications have not expired.

3) Check/address any CEMDAS/analyzer/monitor alarms. If any parameter is found to be out of tolerance, appropriate corrective actions will be initiated promptly.

Quarterly Activities

1) Perform Walk-through Audit

   The walk-through audit involves a general inspection of the monitoring system. The walk-through audit is used to provide a quick assessment of the availability of data, general effectiveness of operation and maintenance, and the completeness of record keeping procedures.

   The walk-through audit is conducted at least once every quarter and is documented on a walk-through audit sheet.

   Prior to performing any scheduled maintenance on the CEMS, the Maintenance Personnel (or a hired contractor) will notify the Plant Manager so that any necessary steps can be taken to adjust the process, so as to not cause any excess air emissions during the scheduled maintenance.

   The Walk-Through Audit involves the following (May be completed by contractor):

2) Administrative

   a. Maintenance logs - Check for timeliness of work, completion of entries.

   b. Record keeping - Check that all records are available and complete.

   c. Data system - Verify correct span values entered.

   d. Check maintenance logs for timely and complete repairs.

   e. Ensure all maintenance log entries are current and contain all maintenance performed.

3) Technical

   a. Check that printer and strip chart recorder are operational, output is legible, and readings consistent with process conditions.

   b. Check that shelter cabinets are clean and the area maintained; monitor enclosure clean and all systems operational (i.e., heating/cooling).

   c. Check computer disc drive and clean as necessary.

   d. Clean/Replace sample inlet filters on all analyzers. Clean the analyzer screens.

   e. Clean/Inspect sample conditioner. Check the filter bowl for excess moisture. Replace the peristaltic tubing.

   f. Clean/Replace filter on the sample probe.

   g. Replace filter elements and scrubbers on the air clean up system.

CEMS Maintenance

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

1) Routine preventive maintenance. This is a regularly scheduled set of activities designed to prevent problems before they develop.

2) Non-routine preventive maintenance. This set of activities is designed to prevent problems, which cannot be predicted. These procedures are performed on an as-needed basis. For example, if sample vacuum on the analyzer drops from its normal reading, the pump, gauge or sample capillaries should be replaced or cleaned. Non-routine preventive maintenance is not discussed in this plan since the procedural methods must be developed as the need dictates.

3) Corrective Maintenance. Those activities required to correct problems that occur due to equipment malfunction. Corrective maintenance actions are determined and performed by the Monitoring Solutions maintenance technician or other qualified personnel based on the nature of the malfunction.

All preventive maintenance is scheduled and performed in a timely manner by the Operations Supervisor.

Spare Parts Inventory

The Technician or Operator will:

1) Maintain a spare parts inventory adequate to meet the normal operating requirements.

2) Maintain the spare parts inventory based on vendor recommended lists.

3) Modify the current inventory on an "as required" basis.

A list of the parts recommended to adequately maintain the normal operating requirements of the CEMS is located in the *Monitoring Solutions CEMS Operations and Maintenance Manual*. Contact Monitoring Solutions at (317) 856-9400, fax (317) 856-9410 for information on pricing and availability.

Data Recording and Reporting

General Requirements

An effective quality assurance program communicates the results of QA/QC activities to all affected parties. This QA plan makes provisions for the proper recording and communication of QA and QC information and provides the necessary mechanisms for triggering corrective actions based on the contents of QA/QC reports.

Documentation of QA/QC data and information is an integral part of this QA Plan. This section describes reports and other records that provide appropriate documentation of QA/QC activities. Packaging Corp. utilizes two primary means of documentation:

1) Data Acquisition System - CEMDAS Evolution

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

All required monitoring data, support information and all reports, including reports of all instances of deviation from permit requirements, shall be kept and furnished to the department upon request for a period of not less than 5 years from the date of the monitoring sample, measurement, report or application. Support information includes all calibration and maintenance records and all original strip-chart recordings, or other original data records, for continuous monitoring instrumentation and copies of all reports required by the renewable operating permit.

All reporting is to be on an Eastern Standard Time basis.

The data acquisition system must be capable of reading all values over the full range of each measurement device and must create a permanent record of all required raw and calculated data for storage, review and reporting. In addition, a continuous readout in units of each applicable emission standard or operating criteria is required.

Notification, Reporting and Record Keeping requirements

1) In the event of any malfunction or breakdown of process or emission control equipment for a period of four hours or more which results in increased emissions, the owner or operator shall submit a written report which describes the cause of the breakdown, the corrective actions taken, and the plans to prevent future occurrences. This report must be submitted by means that would insure the District Office's receipt of the report by no later than seven days after the occurrence. The information submitted shall be adequate to allow the District Office to determine if the increased emissions were due to a sudden and unavoidable breakdown. Such a report shall in no way serve to excuse, otherwise justify or in any manner affect any potential liability or enforcement action.

2) Packaging Corp. shall maintain records of the occurrence and duration of any startup, shutdown, or malfunction in the operation of an affected facility, any malfunction of the air pollution control equipment or any periods during which a continuous monitoring system or monitoring device is inoperative.

3) Packaging Corp. shall submit a written report postmarked within 30 days after the semiannual period as prescribed by the District Office semiannual. The semiannual periods shall cover the periods of January 1 to June 30 and July 1 to December 31. The report shall contain as a minimum, the following:

   a) The nature and cause of the deviation, the time and date of occurrences, and any initial and final corrective action taken.

   b) A summary of any days for which any of the required operation and maintenance surveillance checks were not made and the reason for such failure to perform the surveillance.

   c) Any corrective actions taken to prevent any further deviations.

Maintenance Record

The Maintenance Record is maintained by the Operations Supervisor, who enters descriptions of preventive and remedial actions performed on the monitoring system components. These entries are kept in the maintenance files. This record also documents the use of spare parts. A periodic review of the CEMS maintenance record provides a guide to possible problem trends with the CEMS and input as to the needs of the spare parts inventory.

CEMDAS Evolution records an Alarm/Message at the time of the alarm to provide a real-time mechanism for alerting operating personnel to excess emissions and monitoring system problems. When alarm messages are received, Plant Operations personnel advise the Operations Supervisor and appropriate inspection/maintenance activities are initiated. The alarm/message provides for automated and also manually entered documentation of the CEMS operating status during alarm conditions.

Component Addition, Maintenance or Replacement

Maintenance

1) Zero and calibration drift checks should be conducted immediately prior to any maintenance, if possible.

2) Zero and calibration drift checks must be conducted immediately following any maintenance.

3) If the post-maintenance zero or calibration drift checks show drift in excess of twice the applicable performance specifications, recalibration must be conducted in accordance with the quarterly calibration error check procedures.

Addition or Replacement

Scheduled addition of or replacement of components or software programs with components or software programs of different makes or models requires submittal of the record of proposed maintenance prior to such change. For unscheduled addition of or replacement of components or software programs with components or software programs of different makes or models, submittal of the record of conducted maintenance must be made as soon as possible after such replacement. Successful completion of performance testing may be required prior to use of data from the monitoring system. Contact the Department for specific instructions.

Addition of or replacement of components or software programs with like makes and models may require successful completion of performance testing prior to use of data from the monitoring system. Contact the Department for specific instructions.

Troubleshooting

Recommended troubleshooting procedures are located in the *Monitoring Solutions CEMS Operations and Maintenance Manual*. Contact Monitoring Solutions at (317) 856-9400, fax (317) 856-9410 for service and parts.

Glossary of Terms and Acronyms

A-B
: Family of Programmable Logic Controllers used in the CEMCON. Manufactured by Allen-Bradley Products.

Accuracy
: The measure of the closeness of a measurement to its true value. Although the true value of gas is not known, it can be approximated by the use of an appropriate standard of reference. For example, a National Institute of Standard and Technology Standard (formerly NBS) Reference Material (NIST-SRM) is a primary standard used to assess accuracy. Secondary standards are also used as an approximation to the "true value" although errors may be introduced using these secondary standards.

Analyzer
: Instrument that measures concentration of a specific gas - such as CO_2, CO, O_2, NO_X, or SO_2 - in a flue gas sample.

ANSI
: American National Standards Institute - a standards-making organization.

ASTM
: American Society for Testing and Materials

Audit
: An audit is an independent assessment of the accuracy of data. Independence is achieved by having the audit performed by an operator other than the person conducting the routine measurements and by using audit standards and procedures different from those routinely used in the monitoring.

CAI
: California Analytical Instruments. Manufacturer of the NOx, CO, CO2, and THC analyzers in the CEMS

Calibration Drift (CD)
: The difference in the CEMS output reading from a reference value after a period of operating during which no unscheduled maintenance, repair, or adjustment took place. For opacity, the reference value is supplied by a reflecting mirror and a neutral density filter or screen which can be automatically or manually inserted into the light beam path of the monitor. For pollutant analyzers, the reference value is supplied by injecting gases of known values into the system. The CD error is calculated as the difference between the correct value and the observed value for the zero and upscale calibration value.

Calibration Error Test (CE)
: A calibration error test is a performance audit of a CEMS in which a three point audit is conducted. For opacity, three certified neutral density filters (low, mid, and high-range) are placed in the monitor light beam five nonconsecutive times and the monitor responses are recorded from the opacity data recorder. For CEMS analyzers, three known reference gases are used. From the data, a calibration error is calculated.

cc
: cubic centimeter - A unit measure of volume equal to 1 milliliter (ml).

Carulite	Scrubbing media used in the Air Clean Up system to filter Carbon Monoxide. Should always be placed after a drying media, such as Drierite, as moisture will damage the scrubbing media.
CEMCON	CEM Controller - A sub system that provides control logic for numerous activities, including daily automatic calibration error check and quarterly cylinder gas audit. The CEMCON collects and passes test data to the CEMDAS for processing.
CEMDAS	Continuous Emissions Monitoring Data Acquisition System.
CEMS	Continuous Emissions Monitoring System. The total equipment required for the determination of pollutant gas concentrations, flow, or opacity on a continuous basis.
CFR	Code of Federal Regulations. The CEMS is designed to help the user meet their applicable requirements.
CGA	Cylinder Gas Audit.
chip	Integrated Circuit - a microelectronic semiconductor device.
CU	Count Units – The scaling factor used by a DAS to coincide the analog input/output signal with the engineering units or range.
DAS	Data Acquisition System - a shortened version of CEMDAS.
DIP Switch	A group of subminiature switches, usually slide switches, housed in a Dual In-line Package (integrated circuit header) configuration.
Drierite	Indicating granular silica gel desiccant used as a dryer in the air cleanup units.
DTR	Down Time Recovery – Refers to the process of recovering data lost to the main CEMDAS computer via means of a backup or secondary collection method.
Flue Gas	The gas produced as a result of combustion or some other industrial process. The gas may be made up of multiple components such as particulate matter, liquids, condensed solids, vapors, and gases. The flue gas may also be referred to as: stack gas, duct gas or smoke.
EPA	Environmental Protection Agency; regulating body that oversees and controls environmental issues.
EU	Engineering Units
FET	Field Effect Transistor - an active three terminal semiconductor device.
HMI	Human Machine Interface – Operator interface typically mounted at the equipment location to assist in maintenance activities. See also MDU.

In Hg	Inches of mercury, a unit measure of pressure (One atmosphere = 14.696 psi = 0 psig = 29.921 in Hg = 406.8 in WC).
In WC	in H_2O, Inches of Water (Column), a unit measure of pressure. See In Hg, above.
LED	Light Emitting Diode - a solid state miniature indicator light.
LPM (l/min)	Liters per minute
Maple	See MDU
MDU	Message Display Unit (Maple) - The operator interface panel on the CEMCON PLC. Manufactured by Maple Systems, Inc.
Millivolt (mv)	An electrical unit of measure equal to 1×10^{-3} volt.
MMBtu	One million Btus.
Monitor	Instrument that measures a flue gas characteristic such as opacity or flow.
Monitor Malfunction	Any interruption in the collection of data as a result of the failure of any component of the CEMS to operate within specifications of the manufacturer or Performance Specification.
MSDS	Material Safety Data Sheet - Standardized format sheet containing health, safety, fire, first aid, chemical properties and other necessary information supplied by manufacturer of hazardous materials.
Nanometer (nm)	A unit measure of length equal to 1×10^{-9} meter. Commonly used to describe wavelengths of light.
NBS	National Bureau of Standards - an agency of the US government chartered to maintain standards of measurement.
NEMA	National Electrical Manufacturers Association - a standards-making organization. CEMS enclosures (e.g., junction boxes, instrument racks, switch boxes, etc.) are rated by their manufacturers to meet various NEMA standards.
NO_X	Oxides of Nitrogen
OIT	Operator Interface Terminal
OSHA	Occupational Safety and Health Administration.
Out-Of-Control Period	The time period which the CEMS may not be collecting valid data; or data which may not be used to demonstrate compliance.

Performance Audit	A quantitative evaluation of CEMS operation. Usually the accuracy of the CEMS is determined by using known reference standard.
PLC	Programmable Logic Controller - the heart of the CEMCON.
PMT	Photomultiplier Tube - an electronic device used to convert light energy into electrical energy. In the CEMS, a PMT is used in the Model 42i series Analyzer to measure NO_X concentration.
Pot	Potentiometer, a 3-terminal variable resistor. Position of sliding contact can be adjusted by rotating a shaft or screw or by sliding a control tab or knob. Miniature screw-adjusted units are commonly called trimpots; multi-turn knob-adjusted units are called helipots; linear-adjusted units are called slidepots.
PPM (or ppm)	Parts per million, a measure of concentration (1000 ppm = 0.1%).
psi	Pounds per square inch - a unit of measure of pressure.
psia	Pounds per square inch absolute.
psig	Pounds per square inch gauge.
psiv	Pounds per square inch vacuum.
Purafil	An expendable material used in the Monitoring Solutions Air Clean-Up System as a scrubber for SO_2 and NO_X.
QA/QC	Quality Assurance/Quality Control
RATA	Relative Accuracy Test Audit (performed semi-annually or annually, depending on results from the previous RATA).
Routine Maintenance	An orderly program of actions designed to prevent the failure of monitoring parts and systems during their use.
SOP	Standard Operating Procedure.
Span (Daily)	Refer to Upscale Calibration Value.
ss (or SS)	Stainless steel - Standard abbreviation is CRES (Cold Rolled Electroless Steel).
Systems Audit	A qualitative evaluation of CEMS Operation. Emissions data, logs, QA/QC data and the operational information are reviewed by regulator officials or by a corporate environmental auditor in order to determine the operational status of the CEMS relative to the applicable regulations or to the company's objectives.

Upscale Calibration Value	Sometimes referred to as the span or daily span. The calibration check of the CEMS is performed by simulating an upscale condition. For pollutants and diluents, the upscale value is simulated with a calibration gas. For opacity, the upscale calibration value is simulated with a calibrated filter or screen.
Zero	A simulated or actual level where the system value is at zero (0) percent. For opacity, a simulated zero is initiated daily when a mirror in the transceiver unit moves into the light path. An actual zero may be performed when the opacity is mounted on the stack and no emissions are in the stack or duct (clean stack conditions) or by removing the opacity (transceiver and retro reflector) from the stack to achieve the actual zero. For CEMS analyzers, zero is simulated using known standards, typically calibration gases, where the value is at zero (0).

Attachments

Attachment 1. CEMDAS Minute Report sample printout

CLIENT | **Minute Report** | Created on : Apr 07, 2016 15:03:20

LOCATION | 04/07/2016 07:00 - 04/07/2016 15:02 | UNIT

04/07/2016	Fc FACTOR, SCF/mmBTU	DIESEL Hc, BTU/GAL	PROCESS	NOX LR, PPM	NOX HR, PPM	CO LR, PPM	CO HR, PPM
07							
07:00:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.3 MOC	0.0 MOC	0.0 MOC
07:01:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.3 MOC	0.0 MOC	0.0 MOC
07:02:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.3 MOC	0.0 MOC	0.0 MOC
07:03:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.3 MOC	0.0 MOC	0.0 MOC
07:04:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.3 MOC	0.0 MOC	0.0 MOC
07:05:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.3 MOC	0.0 MOC	0.0 MOC
07:06:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.3 MOC	0.0 MOC	0.0 MOC
07:07:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.3 MOC	0.0 MOC	0.0 MOC
07:08:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:09:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:10:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.3 MOC	0.0 MOC	0.0 MOC
07:11:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.3 MOC	0.0 MOC	0.0 MOC
07:12:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.3 MOC	0.0 MOC	0.0 MOC
07:13:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.3 MOC	0.0 MOC	0.0 MOC
07:14:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:15:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:16:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.3 MOC	0.0 MOC	0.0 MOC
07:17:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:18:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:19:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:20:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:21:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:22:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:23:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:24:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:25:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:26:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:27:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:28:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:29:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC
07:30:00	1420.0 SVC	128488.0 SVC	0.0 UNO	0.1 MOC	1.4 MOC	0.0 MOC	0.0 MOC

Status Code Definitions

MOC = MONITOR OUT OF CONTROL   SVC = MONITOR IN SERVICE   UNO = UNIT NOT OPERATING

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Attachment 2. CEMDAS Emissions sample printout

CLIENT

Emissions Report

Created on : Apr 07, 2016 15:04:43

LOCATION

04/04/2016 00:00 - 04/07/2016 15:00

UNIT

04/07/2016	Fc FACTOR, SCF/mmBTU		DIESEL Hc, BTU/GAL		PROCESS		NOX LR, PPM		NOX HR, PPM		CO LR, PPM		CO HR, PPM	
00:00	1420.0	SVC	128488.0	SVC	0.0	UNO	0.1	MOC	1.3	MOC	0.0	MOC	0.0	MOC
01:00	1420.0	SVC	128488.0	SVC	0.0	UNO	0.1	MOC	1.3	MOC	0.0	MOC	0.0	MOC
02:00	1420.0	SVC	128488.0	SVC	0.0	UNO	0.1	MOC	1.3	MOC	0.0	MOC	0.0	MOC
03:00	1420.0	SVC	128488.0	SVC	0.0	UNO	0.1	MOC	1.3	MOC	0.0	MOC	0.0	MOC
04:00	1420.0	SVC	128488.0	SVC	0.0	UNO	0.1	MOC	1.3	MOC	0.0	MOC	0.0	MOC
05:00	1420.0	SVC	128488.0	SVC	0.0	UNO	0.1	MOC	1.3	MOC	0.0	MOC	0.0	MOC
06:00	1420.0	SVC	128488.0	SVC	0.0	UNO	0.1	MOC	1.3	MOC	0.0	MOC	0.0	MOC
07:00	1420.0	SVC	128488.0	SVC	0.3	SVC	0.1	MOC	1.3	MOC	0.0	MOC	0.0	MOC
08:00	1420.0	SVC	128488.0	SVC	1.0	SVC	0.3	MOC	1.3	MOC	0.1	MOC	0.9	MOC
09:00	1420.0	SVC	128488.0	SVC	1.0	SVC	0.6	MOC	1.2	MOC	0.3	MOC	2.1	MOC
10:00	1420.0	SVC	128488.0	SVC	1.0	SVC	289.0	NSA	1732.3	NSA	115.5	NSA	1731.8	NSA
11:00	1420.0	SVC	128488.0	SVC	1.0	SVC	289.0	SVC	1732.3	SVC	115.5	SVC	1731.8	SVC
12:00	1420.0	SVC	128488.0	SVC	1.0	SVC	289.0	SVC	1732.3	SVC	115.5	SVC	1731.8	SVC
13:00	1420.0	SVC	128488.0	SVC	1.0	SVC	289.8	SVC	1734.9	SVC	109.5	SVC	1734.3	SVC
14:00	1420.0	SVC	128488.0	SVC	1.0	SVC	289.8	SVC	1734.9	SVC	109.5	SVC	1734.3	SVC

Totals:	11360.0	1027904.0	7.3	1157.6	6934.4	450.0	6932.2
Maximum:	1420.0	128488.0	1.0	289.8	1734.9	115.5	1734.3
Minimum:	1420.0	128488.0	0.3	289.0	1732.3	109.5	1731.8
Average:	1420.0	128488.0	0.9	289.4	1733.6	112.5	1733.1
Valid / Oper hrs:	8 / 8	8 / 8	8 / 8	4 / 8	4 / 8	4 / 8	4 / 8

Status Code Definitions

MOC = MONITOR OUT OF CONTROL   NSA = NO SAMPLE AVAILABLE   SVC = MONITOR IN SERVICE

UNO = UNIT NOT OPERATING

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Attachment 3. CEMDAS Daily Calibration Report Sample Printout

CLIENT

LOCATION

Calibration Report

04/07/2016 - 04/07/2016

Created on : Apr 07, 2016 12:48:08

UNIT

Date	Timestamp	Parameter	Type	Measured	Expected	Error	Result
04/07/2016							
	06:19:02	CO HR, PPM	Zero	0.4	0.0	0.0	Pass
	06:19:02	CO LR, PPM	Zero	-1.9	0.0	1.0	Pass
	06:19:02	CO2, %	Zero	0.1	0.0	0.1	Pass
	06:19:02	NOX HR, PPM	Zero	-1.9	0.0	0.1	Pass
	06:19:02	NOX LR, PPM	Zero	-0.4	0.0	0.1	Pass
	06:23:01	CO LR, PPM	Span	-2.0	111.0	56.5	Fail
	06:23:01	NOX LR, PPM	Span	-0.3	275.7	55.2	Fail
	06:27:03	CO HR, PPM	Span	0.4	1,658.0	55.3	Fail
	06:27:03	CO2, %	Span	0.1	12.1	12.0	Fail
	06:27:03	NOX HR, PPM	Span	-2.0	1,693.0	56.5	Fail
	10:56:07	CO HR, PPM	Zero	6.7	0.0	0.2	Pass
	10:56:07	CO LR, PPM	Zero	0.4	0.0	0.2	Pass
	10:56:07	CO2, %	Zero	0.0	0.0	0.0	Pass
	10:56:07	NOX HR, PPM	Zero	6.4	0.0	0.2	Pass
	10:56:07	NOX LR, PPM	Zero	1.1	0.0	0.2	Pass
	11:00:06	CO LR, PPM	Span	115.5	116.2	0.4	Pass
	11:00:06	NOX LR, PPM	Span	289.0	291.1	0.4	Pass
	11:04:05	CO HR, PPM	Span	1,632.8	1,744.4	3.7	Pass
	11:04:05	CO2, %	Span	11.6	11.6	0.0	Pass
	11:04:05	NOX HR, PPM	Span	1,734.1	1,743.7	0.3	Pass

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Attachment 4. CEMDAS Alarms Report sample printout

CLIENT | **Alarms Report** | Created on : Apr 07, 2016 14:52:18

LOCATION | 04/04/2016 - 04/07/2016 | UNIT

Date	Timestamp	Parameter	Alarm Value	Alarm Type	Alarm Description	Limit	Reason Code	Comment
04/04/2016								
	15:13:47				CEMDAS IN		9	
	15:13:48	NOX LR, PPM	0		UMBILICAL FAULT		9	
	15:13:48	NOX HR, PPM	0		UMBILICAL FAULT		9	
	15:13:48	CO LR, PPM	0		UMBILICAL FAULT		9	
	15:13:48	CO HR, PPM	0		UMBILICAL FAULT		9	
	15:13:48	CO2, %	0		UMBILICAL FAULT		9	
	15:13:48	NOX, PPM	0		UMBILICAL FAULT		9	
	15:13:48	CO, PPM	0		UMBILICAL FAULT		9	
	15:13:48	NOX, LB/mmBTU	0		UMBILICAL FAULT		9	
	15:13:48	CO, LB/mmBTU	0		UMBILICAL FAULT		9	
	15:13:48	NOX, LB/HR	0		UMBILICAL FAULT		9	
	15:13:48	CO, LB/HR	0		UMBILICAL FAULT		9	
	15:13:48				I/O SYS IN		9	
04/05/2016								
	07:21:43				CEMDAS IN		9	
	07:21:44				I/O SYS IN		9	
	09:43:02	NOX LR, PPM	0		MONITOR FAULT		9	
	09:43:02	NOX HR, PPM	0		MONITOR FAULT		9	
	09:43:02	NOX, PPM	0		MONITOR FAULT		9	
	09:43:02	NOX, LB/mmBTU	0		MONITOR FAULT		9	
	09:43:02	NOX, LB/HR	0		MONITOR FAULT		9	
	09:43:22	CO LR, PPM	0		MONITOR FAULT		9	
	09:43:22	CO HR, PPM	0		MONITOR FAULT		9	

Reason Code Definitions

9 = Unknown

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Attachment 5. CEMDAS Availability Report sample printout

CLIENT | **Availability Report** | Created on : Apr 07, 2016 14:53:45

LOCATION | 04/04/2016 - 04/07/2016 | UNIT

Start Time	End Time	NOX LR, PPM Status	Reason Code	Comments
04/04/2016 00:00:00	04/04/2016 15:12:59	COS		
04/04/2016 15:13:00	04/04/2016 15:15:59	UTF	9	
04/04/2016 15:16:00	04/05/2016 07:20:59	COS		
04/05/2016 09:44:00	04/05/2016 09:45:59	FLT		
04/05/2016 13:24:00	04/05/2016 13:25:59	IAF		
04/05/2016 13:31:00	04/05/2016 13:45:59	FLT		
04/05/2016 13:46:00	04/05/2016 13:48:59	IAF		
04/05/2016 13:52:00	04/05/2016 13:55:59	MOS	9	
04/05/2016 15:11:00	04/05/2016 15:12:59	FLT		
04/06/2016 06:21:00	04/06/2016 07:42:59	MOC		
04/06/2016 07:43:00	04/06/2016 07:44:59	FLT	9	
04/06/2016 07:45:00	04/06/2016 07:45:59	COS		
04/06/2016 07:46:00	04/06/2016 08:06:59	IOS		
04/06/2016 08:07:00	04/06/2016 08:19:59	FLT		
04/06/2016 08:20:00	04/06/2016 11:59:59	MOC		
04/06/2016 12:04:00	04/06/2016 12:28:59	MOC		
04/06/2016 12:29:00	04/06/2016 14:04:59	COS		
04/06/2016 14:05:00	04/06/2016 15:59:59	MOC		
04/06/2016 16:04:00	04/06/2016 19:59:59	MOC		
04/06/2016 20:04:00	04/06/2016 23:59:59	MOC		
04/07/2016 00:04:00	04/07/2016 03:59:59	MOC		

Reason Code Definitions

9 = Unknown

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CLIENT | **Availability Report** | Created on : Apr 07, 2016 14:53:45

LOCATION | 04/04/2016 - 04/07/2016 | UNIT

Start Time	End Time	NOX LR, PPM Status	Reason Code	Comments
04/07/2016 04:04:00	04/07/2016 06:04:59	MOC		
04/07/2016 06:21:00	04/07/2016 07:59:59	MOC		
04/07/2016 08:05:00	04/07/2016 08:17:59	MOC		
04/07/2016 08:18:00	04/07/2016 08:18:59	MOS		
04/07/2016 08:21:00	04/07/2016 08:26:59	MOC		
04/07/2016 08:27:00	04/07/2016 08:28:59	MOS	9	
04/07/2016 08:31:00	04/07/2016 08:32:59	MOC		
04/07/2016 08:33:00	04/07/2016 08:33:59	MOS		
04/07/2016 08:36:00	04/07/2016 08:36:59	MOC		
04/07/2016 08:37:00	04/07/2016 08:38:59	MOS	9	
04/07/2016 08:39:00	04/07/2016 08:40:59	UTF		
04/07/2016 08:41:00	04/07/2016 08:48:59	MOS	9	
04/07/2016 08:50:00	04/07/2016 08:52:59	MOS	9	
04/07/2016 08:55:00	04/07/2016 09:10:59	MOC		
04/07/2016 09:11:00	04/07/2016 09:11:59	MOS		
04/07/2016 09:14:00	04/07/2016 09:16:59	MOC		
04/07/2016 09:17:00	04/07/2016 09:19:59	MOS	9	
04/07/2016 09:22:00	04/07/2016 09:23:59	MOC		
04/07/2016 09:24:00	04/07/2016 09:27:59	MOS	9	
04/07/2016 09:30:00	04/07/2016 09:33:59	MOC		
04/07/2016 09:34:00	04/07/2016 09:38:59	MOS	9	

Reason Code Definitions

9 = Unknown

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CLIENT | **Availability Report** | Created on : Apr 07, 2016 14:53:45

LOCATION | 04/04/2016 - 04/07/2016 | UNIT

Start Time	End Time	NOX LR, PPM Status	Reason Code	Comments
04/07/2016 09:40:00	04/07/2016 09:47:59	MOC		
04/07/2016 09:48:00	04/07/2016 09:55:59	MOS	9	
04/07/2016 09:57:00	04/07/2016 09:58:59	MOS	9	
04/07/2016 10:01:00	04/07/2016 10:04:59	MOC		
04/07/2016 10:05:00	04/07/2016 10:06:59	MOS	9	
04/07/2016 10:08:00	04/07/2016 10:39:59	MOC		
04/07/2016 12:49:00	04/07/2016 13:05:59	MOC		

Reason Code Definitions

9 = Unknown

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CLIENT | **Availability Report** | Created on : Apr 07, 2016 14:53:45

LOCATION | 04/04/2016 - 04/07/2016 | UNIT

Availability Summary for NOX LR, PPM

```
CEMDAS OUT OF SERVICE <COS>     for      32 hours 55 minutes (37.89%)
UMBILICAL FAULT <UTF>           for       0 hours  5 minutes (0.10%)
MONITOR FAULT <FLT>             for       0 hours 34 minutes (0.65%)
CONVERTER FAULT <IAF>           for       0 hours  5 minutes (0.10%)
MONITOR OUT OF SERVICE <MOS>    for       0 hours 46 minutes (0.88%)
MONITOR OUT OF CONTROL <MOC>    for      24 hours 38 minutes (28.35%)
I/O SYS OUT <IOS>               for       0 hours 21 minutes (0.40%)
PROBE TEMP FAULT <PTF>          for       0 hours  0 minutes (0.00%)
MOISTURE FAULT <MST>            for       0 hours  0 minutes (0.00%)

MONITOR AVAILABLE                  27 hours 29 minutes  (31.63%)
```

Reason Code Definitions

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Attachment 6. CEMDAS Monthly Average & Total Report sample printout

CLIENT | **Average and Totals Report** | Created on : Apr 07, 2016 14:59:10

LOCATION | 04/01/2016 - 04/07/2016 | UNIT

Date	PROCESS Daily Block	PROCESS, Hrs Daily Total
04/01/2016	0.0	0.0
04/02/2016	0.0	0.0
04/03/2016	0.0 UNO	0.0
04/04/2016	0.0 UNO	0.0
04/05/2016	0.0 SVC	0.3
04/06/2016	0.0 UNO	0.0
04/07/2016	0.0	0.0
	0.0	0.3

Status Code Definitions

SVC = MONITOR IN SERVICE UNO = UNIT NOT OPERATING

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CLIENT | **Average and Totals Report** | Created on : Apr 07, 2016 14:59:10

LOCATION | 04/01/2016 - 04/07/2016 | UNIT

Date	DIESEL FLOW, GAL/HR Daily Block	DIESEL FLOW, GALs Daily Total
04/01/2016	0.000	0.000
04/02/2016	0.000	0.000
04/03/2016	0.000 COS	0.000
04/04/2016	0.000 NSA	0.000
04/05/2016	0.000 NSA	0.000
04/06/2016	0.012 NSA	0.000
04/07/2016	0.000	0.000
	0.000	0.000

Status Code Definitions

COS = CEMDAS OUT OF SERVICE NSA = NO SAMPLE AVAILABLE

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CLIENT | **Average and Totals Report** | Created on : Apr 07, 2016 14:59:10

LOCATION | 04/01/2016 - 04/07/2016 | UNIT

Date	DIESEL HEAT, mmBTU/HR Daily Block	DIESEL HEAT, mmBTUs Daily Total
04/01/2016	0.0	0.0
04/02/2016	0.0	0.0
04/03/2016	0.0 COS	0.0
04/04/2016	0.0 NSA	0.0
04/05/2016	0.0 NSA	0.0
04/06/2016	0.0 NSA	0.0
04/07/2016	0.0	0.0
	0.0	0.0

Status Code Definitions

COS = CEMDAS OUT OF SERVICE NSA = NO SAMPLE AVAILABLE

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CLIENT | **Average and Totals Report** | Created on : Apr 07, 2016 14:59:10

LOCATION | 04/01/2016 - 04/07/2016 | UNIT

Date	NOX, LB/mmBTU Daily Block	NOX, LB/mmBTU 30-Day Rolling
04/01/2016	0.000	0.000
04/02/2016	0.000	0.000
04/03/2016	0.000 COS	0.000
04/04/2016	0.000 COS	0.000
04/05/2016	0.000 FLT	0.000
04/06/2016	0.000 NSA	0.000
04/07/2016	0.000	0.000
	0.000	

Status Code Definitions

COS = CEMDAS OUT OF SERVICE FLT = MONITOR FAULT NSA = NO SAMPLE AVAILABLE

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CLIENT
Average and Totals Report
Created on : Apr 07, 2016 14:59:10

LOCATION
04/01/2016 - 04/07/2016
UNIT

Date	CO, LB/mmBTU Daily Block		CO, LB/mmBTU 30-Day Rolling
04/01/2016	0.000		0.000
04/02/2016	0.000		0.000
04/03/2016	0.000	COS	0.000
04/04/2016	0.000	COS	0.000
04/05/2016	0.196	FLT	0.000
04/06/2016	0.000	NSA	0.000
04/07/2016	0.000		0.000
	0.000		

Status Code Definitions

COS = CEMDAS OUT OF SERVICE FLT = MONITOR FAULT NSA = NO SAMPLE AVAILABLE

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CLIENT
Average and Totals Report
Created on : Apr 07, 2016 14:59:10

LOCATION
04/01/2016 - 04/07/2016
UNIT

Date	NOX, LB/HR Daily Block		NOX, LB/HR 30-Day Rolling	NOX, LBs Daily Total
04/01/2016	0.00		0.00	0.00
04/02/2016	0.00		0.00	0.00
04/03/2016	0.00	COS	0.00	0.00
04/04/2016	0.00	COS	0.00	0.00
04/05/2016	0.00	FLT	0.00	0.00
04/06/2016	0.00	NSA	0.00	0.00
04/07/2016	0.00		0.00	0.00
	0.00			0.00

Status Code Definitions

COS = CEMDAS OUT OF SERVICE FLT = MONITOR FAULT NSA = NO SAMPLE AVAILABLE

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CLIENT
Average and Totals Report
Created on : Apr 07, 2016 14:59:10

LOCATION
04/01/2016 - 04/07/2016
UNIT

Date	CO, LB/HR Daily Block		CO, LB/HR 30-Day Rolling	CO, LBs Daily Total
04/01/2016	0.00		0.00	0.00
04/02/2016	0.00		0.00	0.00
04/03/2016	0.00	COS	0.00	0.00
04/04/2016	0.00	COS	0.00	0.00
04/05/2016	0.00	FLT	0.00	0.00
04/06/2016	0.00	NSA	0.00	0.00
04/07/2016	0.00		0.00	0.00
	0.00			0.00

Status Code Definitions

COS = CEMDAS OUT OF SERVICE FLT = MONITOR FAULT NSA = NO SAMPLE AVAILABLE

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Attachment 7. CEMDAS Excess Emissions Report sample printout

CLIENT **Excess Emissions Report** Created on : Apr 07, 2016 15:14:52

LOCATION 04/01/2016 - 04/07/2016 UNIT

Timestamp	NOX, LB/mmBTU 30 Day Rolling Limit Based Hi Hi	Limit	Reason Code	Comments

There were no periods in excess of standard.

Total exceedance incidents during the period: 0

Reason Code Definitions

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Attachment 8. CEMDAS Uptime Report sample printout

CLIENT | **Uptime Report** | Created on : Apr 07, 2016 15:12:23

LOCATION | 04/01/2016 - 04/07/2016 | UNIT

Fc FACTOR, SCF/mmBTU

Start Time	**End Time**	**Status**	**Reason Code**	**Comments**

There were no invalid periods of 'Fc FACTOR, SCF/mmBTU' downtime during unit operation.

Reason Code Definitions

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CLIENT | **Uptime Report** | Created on : Apr 07, 2016 15:12:23

LOCATION | 04/01/2016 - 04/07/2016 | UNIT

Uptime Summary for Fc FACTOR, SCF/mmBTU

MONITOR OUT OF SERVICE <MOS>	for	0	hours	(0.00%)
UNKNOWN STATUS (PRESUMED INVALID) <UNK>	for	0	hours	(0.00%)
CEMDAS OUT OF SERVICE <COS>	for	0	hours	(0.00%)
I/O SYS OUT <IOS>	for	0	hours	(0.00%)
PURGE CALIB <PRG>	for	0	hours	(0.00%)
LOW QTRLY CALIBRATION <LOW>	for	0	hours	(0.00%)
MID QRTLY CALIBRATION <MID>	for	0	hours	(0.00%)
HI QRTLY CALIBRATION <HIL>	for	0	hours	(0.00%)
PROBE FAULT <PRB>	for	0	hours	(0.00%)
HEATER FAULT <HTR>	for	0	hours	(0.00%)
MOISTURE FAULT <MST>	for	0	hours	(0.00%)
MONITOR FAULT <FLT>	for	0	hours	(0.00%)
CALIBRATION <CAL>	for	0	hours	(0.00%)
SPAN CALIBRATION <SPN>	for	0	hours	(0.00%)
ZERO CALIBRATION <ZER>	for	0	hours	(0.00%)
INTERFERENCE FAULT <INT>	for	0	hours	(0.00%)
NO SAMPLE AVAILABLE <NSA>	for	0	hours	(0.00%)
MONITOR OUT OF CONTROL <MOC>	for	0	hours	(0.00%)
MONITOR OUT OF RANGE <MOR>	for	0	hours	(0.00%)
HOLD LAST VALUE <HLD>	for	0	hours	(0.00%)
EXCLUDED ALARM <XCL>	for	0	hours	(0.00%)
MONITOR IN SERVICE <SVC>	for	9	hours	(100.00%)
CONVERTER FAULT <IAF>	for	0	hours	(0.00%)

TOTAL ELAPSED TIME WAS : 159 hours
UNIT OPERATING FOR : 9 hours
UNIT NOT OPERATING FOR : 150 hours

MONITOR UPTIME PERCENTAGE : 100.00%

Reason Code Definitions

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Attachment 9. CEMDAS Quarterly CGA Report sample printout

CLIENT

CGA Report

Created on : Apr 07, 2016 12:48:40

LOCATION

04/07/2016 - 04/07/2016

UNIT

Date	Parameter	Run#	Timestamp	Type	Expected	Measured	Low Difference	Mid Difference
04/07/2016								
	CO HR, PPM	1	12:28:13	QTR_LOW	749.6	1,731.8	982.2	
	CO HR, PPM	1	12:30:15	QTR_MID	1,658.0	1,731.8		73.8
	CO HR, PPM	2	12:36:22	QTR_LOW	749.6	1,731.8	982.2	
	CO HR, PPM	2	12:38:24	QTR_MID	1,658.0	1,731.8		73.8
	CO HR, PPM	3	12:44:29	QTR_LOW	749.6	1,731.8	982.2	
	CO HR, PPM	3	12:46:31	QTR_MID	1,658.0	1,731.8		73.8

Arithmetic Mean of Quarterly Low: 1731.8
Calibration Error of Quarterly Low: 131.0

Arithmetic Mean of Quarterly Mid: 1731.8
Calibration Error of Quarterly Mid: 4.5

Calibration Tolerance: 15.0
Calibration Result : Fail

CEMS Type : Full Extractive
Manufacturer: CAI
Model Number : 602
Serial Number: C01012-M
Monitor Certification Date:

Tested By : ____________________________

Date: _________________________________

CEMDAS Evolution™

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CLIENT

CGA Report

Created on : Apr 07, 2016 13:31:20

LOCATION

04/07/2016 - 04/07/2016

UNIT

Date	Parameter	Run#	Timestamp	Type	Expected	Measured	Low Difference	Mid Difference
04/07/2016								
	CO HR, PPM	1	13:12:01	QTR_LOW	484.0	476.4	7.6	
	CO HR, PPM	1	13:14:04	QTR_MID	1,744.4	1,736.8		7.6
	CO HR, PPM	2	13:20:10	QTR_LOW	484.0	475.2	8.8	
	CO HR, PPM	2	13:22:13	QTR_MID	1,744.4	1,735.6		8.8
	CO HR, PPM	3	13:28:17	QTR_LOW	484.0	473.9	10.1	
	CO HR, PPM	3	13:30:20	QTR_MID	1,744.4	1,734.3		10.1

Arithmetic Mean of Quarterly Low: 475.2
Calibration Error of Quarterly Low: 1.8

Arithmetic Mean of Quarterly Mid: 1735.6
Calibration Error of Quarterly Mid: 0.5

Calibration Tolerance: 15.0
Calibration Result : Pass

CEMS Type : Full Extractive
Manufacturer: CAI
Model Number : 602
Serial Number: C01012-M
Monitor Certification Date:

Tested By : ____________________________

Date: _________________________________

CEMDAS Evolution™

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Attachment 10. CEMDAS RATA Audit Results sample printout

CLIENT

RATA Data Report

Created on : Apr 07, 2016 15:13:28

LOCATION

4/7/2016 2:52:14 PM - 4/7/2016 3:12:14 PM

UNIT

Time	Fc FACTOR, SCF/mmBTU	DIESEL Hc, BTU/GAL	PROCESS	NOX LR, PPM	NOX HR, PPM	CO LR, PPM	CO HR, PPM
14:52:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
14:53:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
14:54:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
14:55:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
14:56:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
14:57:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
14:58:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
14:59:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
15:00:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
15:01:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
15:02:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
15:03:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
15:04:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
15:05:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
15:06:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
15:07:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
15:08:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
15:09:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
15:10:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
15:11:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
15:12:00	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3
Average :	1420.0	128488.0	1.0	289.8	1734.9	109.5	1734.3

* Invalid Status

RATA Run # 1
Verified By: ______________________________

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Attachment 11. CEMDAS System Constants Sample Report

CLIENT

LOCATION

System Constants

Created on : Apr 12, 2016 15:03:50

Parameter	Lower Limit CU	Upper Limit CU	Lower Limit EU	Upper Limit EU	EU Offset	Maximum Operation	Minimum Operation	Potential Maximum	Maximum Recorded
Fc FACTOR, SCF/mmBTU	0	0	0	15000	0	0	0	0	0
DIESEL Hc, BTU/GAL	0	0	0	200000	0	0	0	0	0
SPARE, 1	0	0	0	100	0	0	0	0	0
PROCESS	0	1	0	1	0	0	0	0	0
NOX LR, PPM	-23839	-55	0	500	0	0	0	0	0
NOX HR, PPM	-23831	-17	0	3000	0	0	0	0	0
CO LR, PPM	-23822	2	0	200	0	0	0	0	0
CO HR, PPM	-23824	29	0	3000	0	0	0	0	0
CO2, %	-23821	22	0	20	0	0	0	0	0
NOX, PPM	0	0	0	3000	0	0	0	0	0
CO, PPM	0	0	0	3000	0	0	0	0	0
DIESEL FLOW, GAL/HR	-29788	29834	0	296.042	0	0	0	0	0
DIESEL HEAT, mmBTU/HR	0	0	0	250	0	0	0	0	0
NOX, LB/mmBTU	0	0	0	1	0	0	0	0	0
CO, LB/mmBTU	0	0	0	10	0	0	0	0	0
NOX, LB/HR	0	0	0	200	0	0	0	0	0
CO, LB/HR	0	0	0	200	0	0	0	0	0
Fc FACTOR, SCF/mmBTU	0	0	0	15000	0	0	0	0	0
DIESEL Hc, BTU/GAL	0	0	0	200000	0	0	0	0	0
SPARE, 1	0	0	0	100	0	0	0	0	0
PROCESS	0	1	0	1	0	0	0	0	0
NOX LR, PPM	-23834	-67	0	500	0	0	0	0	0
NOX HR, PPM	-23836	-53	0	3000	0	0	0	0	0
CO LR, PPM	-23823	-46	0	200	0	0	0	0	0
CO HR, PPM	-23821	24	0	3000	0	0	0	0	0

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