Gainesville Renewable Energy Center

CEMS Operation Plan

for Continuous Monitoring of HCl and HF

Prepared for:
Gainesville Renewable Energy Center, LLC
20 Park Plaza, Suite 320
Boston, MA 02116

Prepared by:
Birchrun Environmental Consulting, LLC
P.O. Box 70
Birchrunville, PA 19425
(484) 200-7540

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Mr. Jeff Koerner
Program Administrator
Florida Department of Environmental Protection
Division of Air Resource Management
Office of Permitting and Compliance
2600 Blair Stone Road, MS 5500
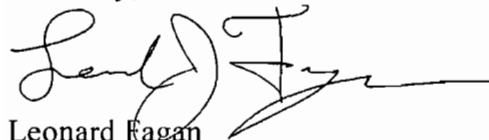Tallahassee, FL 32399-2400

RE: **Submission of HCl/HF CEMS Operations Plan**
       Gainesville Renewable Energy Center
       Air Permit No. 0010131-001-AC (PSD-FL-411)
       Facility ID No. 0010131

Dear Mr. Koerner:

In accordance with the requirements of Section 3B and Section 4 of Appendix CEMS of the above referenced air permit, GREC is submitting our HCl/HF CEMS Operations Plan for review by FDEP.

If you have any questions, please do not hesitate to contact me at 774-644-2240 (cell) or lenfagan@amrenewables.com.

Sincerely,

Leonard Fagan
Vice President of Engineering
GREC Project Manager

LJF/kh

enclosure

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1. INTRODUCTION

The Gainesville Renewable Energy Center (GREC) is a 100-MW_{net} electric generating station that is currently under construction on a site that is located approximately eight miles northwest of downtown Gainesville, Florida. The primary source of air emissions at GREC is a bubbling fluidized bed (BFB) boiler that is fired primarily by clean woody biomass fuel and that also utilizes natural gas as a startup fuel. The BFB boiler is subject to emissions limits for hydrogen chloride (HCl) and hydrogen fluoride (HF) as specified in Section 3 Condition 9 of the facility's Air Construction (AC) permit (Permit Number PSD-FL-411/0010131-001-AC) issued by the Florida Department of Environmental Protection (FDEP). In order to demonstrate compliance with the HCl and HF limits, the AC Permit requires that the facility install, calibrate, maintain, and operate a continuous emission monitoring system (CEMS) to measure and record emissions of these pollutants.

The purpose of this CEMS Operation Plan is to provide the information necessary to demonstrate that the proposed CEMS will meet all applicable regulations and that it is capable of providing HCl and HF measurements that are both accurate and reliable. The CEMS includes components that measure other flue gas constituents and opacity, but those elements of the CEMS are not addressed in this document.

HCl and HF emissions will be measured on a "hot/wet" basis using a relatively new type of CEMS that is based on the principle of Fourier Transform Infrared Spectroscopy (FTIR). This technology is described in Section 3.2.1 of this Plan. While FTIR technology is well-established for use in laboratory applications, scientific field studies, and stack testing, its use for continuous monitoring applications is a recent phenomenon. Consequently, the performance specifications and quality assurance protocols that govern this measurement technique are either relatively new or still under development. For example, the U.S. EPA is currently in the process of developing Performance Specification 18 (PS-18) for HCl CEMS, which is scheduled to be published in the Federal Register in late 2013 and is intended to address the shortcomings of existing certification protocols. Another challenge presented by this installation is that it is not known how the instrument will perform in an industrial environment while measuring extremely low concentrations of HCl and HF.

GREC will perform the initial certification in accordance with U.S. Environmental Protection Agency (EPA) Other Test Method 22 (OTM 22), *"Specifications and Test Procedures for HCl CEMS at Stationary Sources"*. Following initial certification, quality assurance procedures will conform to procedures in EPA Other Test Method 23 (OTM 23), *"QA/QC Requirements for HCl CEMS at Stationary Sources"*. Although these "Other Test Methods" do not appear in the Code of Federal Regulations, they are approved by FDEP for use at GREC per Section 3 Condition 13 of the AC Permit. Copies of these methods are provided in appendices A and B of this plan as well as on the EPA's Emission Measurement Center website at the following address: http://www.epa.gov/ttn/emc/prelim.html.

2. FACILITY DESCRIPTION

2.1   . Facility Location

The GREC facility is located within the city of Gainesville approximately 8 miles northwest of the city center. Specifically, the site is located on approximately 131 acres at the Gainesville Regional Utility Deerhaven Generation Station. UTM coordinates of the BFB boiler stack are Zone 17R; 365.01 kilometers (km) East and 3,293.83 km North.

2.2   Process Description

The power boiler at GREC utilizes bubbling fluidized bed technology, where fuels are burned in a suspension with hot bed materials consisting of sand and ash. Upward-blowing jets of air cause the bed materials to become suspended in the lower part of the boiler. The result is a turbulent mixing of gas and solids, much like a bubbling fluid. The hot sand effectively dries and ignites even demanding fuels with low heating value or high ash content, and various combinations of them. Strong turbulence and good mixing result in high combustion efficiency and low emissions.

The following major equipment and systems are associated with the BFB boiler: a fluidizing bed air supply, natural gas startup burners, overfire air ports, steam drum, superheater, economizer, air heater, ash hoppers, ducts, steam turbine generator, fuel feeding equipment, mechanical draft cooling tower, and air pollution control equipment. Figure 1 is a simplified diagram of the flue gas handling system from the BFB boiler to the stack, including air pollution control equipment.

The project will incorporate the following pollution control strategies and equipment:
- Efficient combustion of clean woody biomass in the BFB boiler to minimize formation of particulate matter (PM), nitrogen oxides (NO_x), carbon monoxide (CO) and volatile organic compounds (VOC);
- Limitation of biomass to woody untreated biomass to minimize sulfur dioxide (SO_2) and hazardous air pollutant (HAP) formation, including acid gas HAP including HCl and HF;
- Use of an inherently clean natural gas as the startup fuel for the BFB boiler;
- Ammonia (NH_3) injection into a selective catalytic reduction (SCR) reactor to destroy NO_x;
- The alkaline properties of the fly ash and an in-duct sorbent injection system (IDSIS) to control SO2, HCl and HF; and
- A fabric filter baghouse to further control PM and to remove injected sorbents.

3. CEM SYSTEM DESCRIPTION

3.1 Analyzer Information

HCl and HF are measured with a single FTIR analyzer that is capable of measuring multiple components simultaneously. Table 3-1 below summarizes key information regarding this analyzer:

Table 3-1 CEMS Analyzer Information

Analyzer	Range(s)	Measurement Principle	Manufacturer & Model No.	Serial No.
HCl	0-50 ppmvw	FTIR[1]	California Analytical Instruments, Inc. Model 600	Y01004
HF	0-50 ppmvw	FTIR[1]	California Analytical Instruments, Inc. Model 600	Y01004

[1] FTIR - Fourier transform infrared spectroscopy

3.2 CEMS Equipment Specifications and Descriptions

Figure 1 includes a simplified representation of the CEMS, including sample probe, analyzer, and DAHS locations. HCl and HF emissions from the BFB boiler will be measured on the outlet stack using an extractive CEMS consisting of a sample extraction probe mounted on the stack, a sample line umbilical to transport the sample to the analyzer location, a heated filter assembly to remove particulate, and an FTIR analyzer for measuring the HCl and HF concentrations. Because the FTIR analyzer is situated prior to the moisture removal system, measurements are made on a hot-wet basis.

Data generated by the monitoring system are managed using a data acquisition and handling system (DAHS) provided by Trace Environmental Systems. The primary components of the DAHS are a system controller and polling computer. DAHS functionality is described in Section 5 of this Plan.

3.2.1 FTIR Analyzer

HCl and HF concentrations will be measured using a California Analytical Instruments Series 600 FTIR analyzer. FTIR is a type of infrared spectroscopy. When infrared radiation is passed through a sample, some of the radiation is absorbed by the sample and some of it is passed through (transmitted). The resulting spectrum represents the molecular absorption and transmission characteristics of the sample. Because each different material is a unique combination of atoms, no two compounds produce the exact same infrared spectrum. Therefore, infrared spectroscopy can result in a positive identification of every different kind of material. In addition, the size of the peaks in the spectrum is a direct indication of the amount of material present.

3.3   Range Determination

When selecting a measurement range(s) for the analyzer, it should be set high enough to prevent full-scale exceedances from occurring, yet low enough to ensure good measurement resolution and to maintain a high signal-to-noise ratio. As indicated in Table 3-1, the FTIR analyzer will have a single range of 0-50 ppmvw for both HCl and HF measurements. Flue gas concentrations of both pollutants is expected to be less than 10 ppm under all expected operating conditions. Therefore, this range is high enough to prevent full-scale exceedances from occurring. However, most HCl and HF readings during normal operations are expected to be less than 20 percent of the full-scale range of the instrument.

While the selected instrument range is less than ideal for measuring such low gas concentrations, the CEMS supplier Trace Environmental rejected lowering the range based on their research showing that 45 ppm is the lowest commercially-available concentration of HCl calibration gas that at least partially meets the criteria for NIST traceability. A representative of the specialty gas vendor Air Liquide America Specialty Gases has informed Trace that, since there currently are no HCl reference standards to calibrate with, there is no true NIST traceability for any HCl calibration gas. However, at 45 ppm a gas is apparently available where there are elements of the blending and analysis that are NIST traceable. Selecting a lower range would preclude calibration of the FTIR instrument with this "semi-NIST traceable" gas. Even with the current range of 0-50 ppm the instrument can only be calibrated with such gases at a high-level concentration (80-100% of span). Low- and mid-level HCl gases will be calibrated to an analytical accuracy of at least 5 percent, but they will likely not meet any of the criteria for NIST traceability.

GREC will monitor the availability and quality of HCl calibration gases in concentrations from 5-50 ppm, and will consider lowering the range in the event that the availability of NIST-traceable gas support such a change. GREC will also re-evaluate the FTIR monitor range following issuance of EPA's proposed PS-18 for HCl CEMS. Any potential range change will also be based on a review of historical monitoring data to assure that the range is appropriate to provide reasonable assurance that the CEMS is accurate over the range of expected pollutant emission levels.

Figure 1 Flue Gas Handling System Diagram
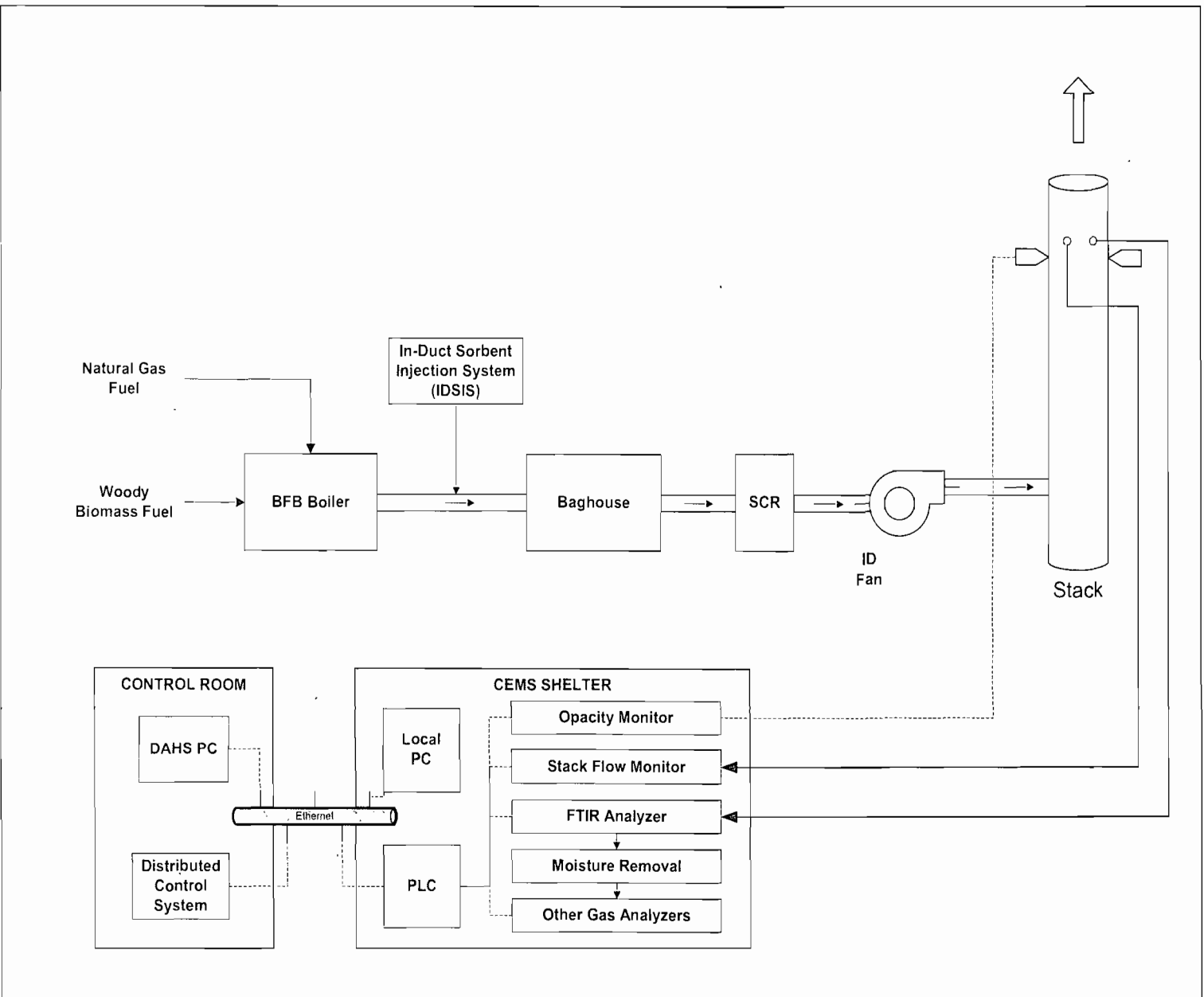
4. SAMPLING LOCATIONS

The stack exhaust gases are vented to the atmosphere through a vertical circular stack made of 1/4 inch-thick carbon steel. The stack is 230 feet tall and has a diameter of 144 inches (12.0 ft). Flue gas enters the stack through a breaching near the base and exits at the top. There are no obstructions to flow between the top of the breaching and stack exit.

The gas sample is removed from the stack by a stainless steel sample extraction probe. The probe is installed in the stack at an elevation of approximately 160 feet above ground level. To ensure that representative samples are obtained for analysis, the probe extends into the flue gas stream no less than 1.0 meter as measured from the stack inside wall. The sample probe is accessed from a platform that is reached via a catwalk from the adjacent boiler building.

The sample conditioning system and gas analyzers are located in the CEMS shelter, which is installed on the boiler building. The gas sample is transported from the probe to the shelter via an approximately 55 foot continuous length of 3/8-inch diameter heat-traced Teflon® sample line. The sample line is heated to a temperature of 310 degrees Fahrenheit or higher in order to maintain the sample above the water and acid dew points. Once inside the shelter, the sample passes through a heated filter assembly prior to entering the FTIR analyzer.

A diagram illustrating the CEMS monitoring and stack testing locations is included as Figure 2.

Figure 2 Sampling Locations
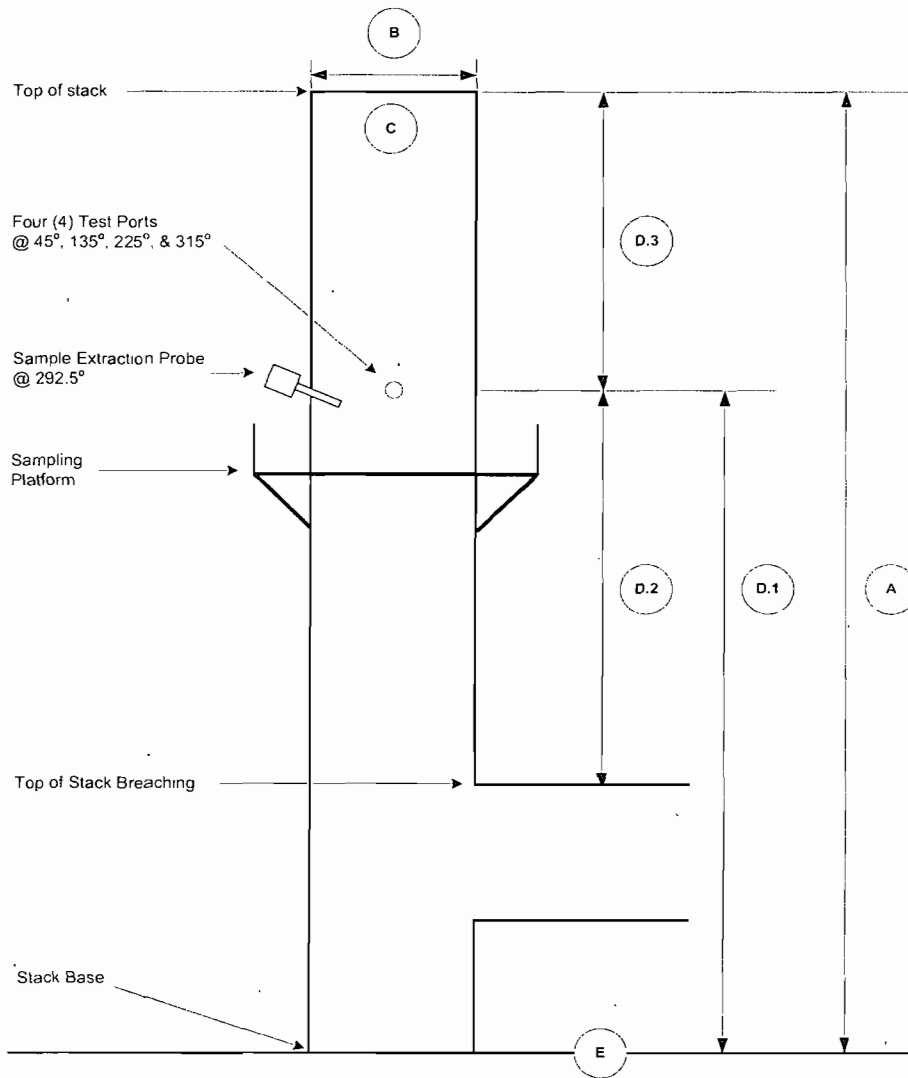
Figure 2 Dimensions	Feet – Inches	Stack Diameters[1]
A. Stack height above grade	230' – 0"	
B. Stack inside diameter at test port	11' – 11.5"	
C. Inside cross sectional area at test port and flue exit	112.3 ft²	
D. CEMS sample probe and test port elevation:		
1. Above grade	160' – 10.5"	
2. Above last disturbance	108' – 2"	9.0
3. Prior to stack exit	69' – 1.5"	5.8
E. Stack base elevation above mean sea level	187' – 1.5"	

[1]   The measurement location must be at least two stack diameters downstream from the nearest flow disturbance (D.2) and at least a half diameter upstream from the effluent exhaust (D.3).

5. DATA ACQUISTION AND HANDLING SYSTEM

The CEMS is provided with a data acquisition and handling system (DAHS) to provide automated data monitoring and management capabilities to the CEMS. The DAHS consists of two primary hardware components: a system controller, which provides timing and control of the sampling system in addition to performing limited data processing and short term data storage; and a personal computer (PC), which does more complete data processing and long term data storage as well as report generation. A data flow diagram is displayed in Figure 3 that shows the overall design of the DAHS. A description of the DAHS is provided in the following paragraphs.

CEMS system control functions are provided by a programmable logic controller (PLC). The PLC, which is housed in the CEMS shelter, performs the following minimum functions:

- Controls automatic and manually-initiated calibration of the gas analyzers and sample probe purging.
- Provides probe, sample conditioning system, and analyzer alarming functions.
- Shuts off sample flow to the analyzers when a failure of the sample conditioning system is detected.
- Assigns status to the analyzer data (valid, invalid, zero check, span check, malfunction, etc.).
- Performs first-level calculations (I.e., one-minute averages) and formats analyzer data packets for retrieval by the DAHS.
- Provides a 7-day data buffer (minimum) during periods when the DAHS PC is not available and automatically logs this data to the PC upon recovery.

The digital outputs of the CEMS instruments and certain plant process data from the plant distributed control system (DCS) are initially transmitted to the PLC in real time (every 10 seconds) and converted to one-minute averages. Following initial storage and processing by the PLC this data is communicated to the DAHS PC via an Ethernet connection. One-minute averages are the basic unit used by the DAHS to build 15-minute and 1-hour block averages data averages in accordance with Appendix CEMS, Condition 14 of the AC Permit.

The DAHS utilizes software developed by Trace Environmental Systems, Inc. running on a Windows™ platform. The Trace software, called *Das2000*, is version number 7.23 and is utilized for operator interface, data entry/storage, report generation, and data display. The DAHS will indicate any occurrence of specification limit exceedances or CEMS operational problems. Reports are generated as necessary in the required format for submittal to the applicable regulatory agencies. These reports may be produced in either hard copy or electronic format.

5.1 Data Calculations and Reporting Procedures

Mass emission calculations are performed using equations from 40 CFR Part 75 Appendix F.

5.1.1 HCl and HF Calculations

The HCl and HF mass emission rate will be calculated by utilizing the measured pollutant concentration and stack flow rate in accordance with Equation F-1 from Part 75 Appendix F as follows:

$$E_h = K \times C_h \times Q_h$$

Where,

E_h = Hourly HCl or HF mass emission rate during unit operation, lb/hr.

K = 1.4900 × 10^{-7} for HCl or 0.820 × 10^{-7} for HF, (lb/scf)/ppm.

C_h = Hourly average HCl or HF concentration during unit operation, stack moisture basis, ppm.

Q_h = Hourly average volumetric flow rate during unit operation, stack moisture basis, scfh.

Annual mass emissions of HCl and HF are calculated in tons per year as 12-month rolling totals, with total emissions recalculated at the end of each calendar month. Emissions are calculated using Equation F-3 from Part 75 Appendix F as follows:

$$E_q = \sum_{h=1}^{n} E_h \times t_h / 2000$$

Where,

E_q = Total HCl or HF mass emissions for the previous 12 calendar months, tons.

E_h = Hourly HCl or HF mass emission rate, lb/hr.

t_h = Unit operating time, hour or fraction of an hour.

n = Number of hourly HCl or HF emissions values during the previous 12 calendar months.

2000 = Conversion of 2000 lb per ton.

5.2 Data Capture Requirements

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

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

Failure to acquire the minimum number of data points for calculation of an hourly average will result in the failure to obtain a valid hour of data and the loss of such component data for the entire hour. An hourly average HCl or HF emission rate in lb/hr is valid only if both the pollutant and stack flow monitor acquire the minimum number of data points.

5.3   DAHS Verification Test Results

The facility will test the HCl/HF mass emission formula listed in Section 5.1.1 above as part of the CEMS certification program. This will be accomplished by substituting pollutant concentration and stack flow from a single hour of unit operations into the formula and comparing the results to that calculated by the DAHS. This approach is similar to that for the formula verification test that is part of the CEMS initial certification requirements under §40 CFR 75.20(c)(10)(i). A hard copy of the results will be included in the CEMS certification report.

Figure 3 DAHS Data Flow Diagram

Control Room

Data Export/ Import

Keyboard — **User Input**

Data Backup
External Hard Disk

REMOTE USERS
Notebook

Internet Connection

TRACE *Das2000* DAHS

LCD Monitor

DAHS PC

PAPER REPORTS
Excess Emissions
CEMS Downtime
Permit Reports

Ethernet

SYSTEM CONTROLLER
Allen-Bradley ControlLogix
PLC

Local PC

INSTRUMENTS
HCl/HF Analyzer
Stack Flow
Process Data

CEMS Shelter

6. QUALITY ASSURANCE AND QUALITY CONTROL PROGRAMS

6.1   Quality Assurance Procedures

Quality Assurance procedures assess the quality of the CEMS data by estimating accuracy. When assessment indicates that data quality is inadequate, control procedures are implemented until data quality is acceptable. Acceptable QA assessments are generally identified in Appendix F of 40 CFR 60. These procedures provide uniformity in the reporting and evaluation of the data quality. In addition, Section 3 Conditions 13.d and 13.e of the AC Permit provide an option to follow the QA procedures in EPA Other Test Method (OTM) 23. GREC has elected to utilize this optional approach for ongoing QA/QC of the HCl and HF CEMS. A copy of the specific version of OTM 23 that GREC will be following can be found in Appendix A of this Plan.

One area where GREC will deviate from the Quality Assurance (QA) and Quality Control (QC) procedures in OTM 23 is for conducting calibrations of the HF CEMS. Daily, quarterly, and annual tests involving the use of calibration gas will not apply to the HF CEMS. Instead, calibration of the HF CEMS will be accomplished using an alternate procedure that has been approved by FDEP. The HF CEMS will still be subject to a requirement for an annual RATA.

The need for an alternative procedure is based on the fact that HF is a highly toxic gas, is difficult to obtain from commercially available sources, and is not stable for long periods of time. Instead of calibrating with standard gas bottles, HF will be calibrated using synthetic (or calculated) spectra. Instrument specific variables (ILS) are obtained from a gas spectrum of another gas (in this case HCl) on the instrument to be calibrated. Gas specific data comes from the HITRAN line parameter database. The MALT5 software program calculates spectra at specific concentrations using the data above to generate spectra that looks very similar to spectra that would come out of the instrument. This spectra is then used to calibrate the instrument utilizing partial least squares. Appendix C to this Plan contains a detailed description of this HITRAN calibration method that will be followed by GREC. FDEP's approval of this alternate procedure is provided in Appendix D.

Table 6-1 below summarizes all routine QA and QC tests that will be performed on the HCl CEMS, the frequency of testing, and the associated pass criteria. Additional details regarding these tests are provided in the sections listed in the first column of the table.

Table 6-1 Summary of CEMS QA/QC Tests

OTM 23 Section	Test	Frequency	Applicable Component(s)	Pass Criteria
4.2.1	Calibration Drift Check	Daily	HCl	Calibration error ≤ 5% of span[1]
4.2.2	Absolute Calibration Audit	Quarterly[2]	HCl	Mean difference ≤ 5% of span at all three test levels
4.2.3.1	Seven-Day Drift Test[2]	Annually	HCl	Calibration error ≤ 5% of span for seven consecutive unit operating days
4.2.3.2	Relative Accuracy Determination[3]	Annually	HCl, HF	Relative accuracy (RA) does not exceed: a) 20% of the mean value; or b) 10% RA in units of the standard; or c) 5 ppm absolute difference

[1] CEMS is out of control when calibration drift exceeds two times the calibration drift specification (i.e., calibration error > 10% of span.)

[2] Except during calendar quarters when the annual accuracy test audit is performed.

[3] This test is considered part of the annual accuracy test audit.

6.2 Quality Control Programs

The QC program encompasses a variety of policies, specifications, standards and corrective measures that are conducted to provide quality data on a continuing basis. This program is developed to assure that QC activities are performed. The following categories constitute a framework of important control steps that reside in the QA/QC program:

1. QA/QC Manuals
2. Operation Checks (daily checks, observations, and adjustments)
3. Routine Maintenance (periodic preventive maintenance)
4. Performance Audits
5. Corrective Maintenance

Each of the categories is described in further detail below.

6.3 QA/QC Manuals

GREC will prepare a QA/QC Plan for the HCl/HF CEMS. This section describes the recommended content for such plans. The GREC QA/QC Plan will follow these recommendations and will also conform with the the QA requirements of OTM 23.

The QA/QC manual or plan contains the collection of written procedures which describe in detail the complete, step-by-step procedures, operation checks, routine maintenance, performance audits, and corrective maintenance. This manual is composed of a set of standard operating procedures (SOPs), CEM system descriptions, QA/QC activities, reporting requirements and other relevant information that is developed to ensure a properly functioning CEMS and activities to bring a malfunctioning (out of

control) CEMS back to functioning properly. At a minimum, the QA/QC Plan includes detailed procedures for the following:

1.   Calibration of the CEMS
2.   Calibration drift 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

A well prepared QA/QC manual has specific, customized protocols for each monitoring system so that if necessary, plant personnel unfamiliar with a particular system would be able to perform required activities until more proficient technicians become available. The manual should also address reporting and recordkeeping time frames, how data is used to determine compliance, where manually entered data records are kept, and settings (such as sample flow rate, chiller temperatures, etc.) to name a few examples.

The plan is kept on site in a format that is accessible and available for inspection. The QA/QC manual may be kept in electronic format as long as it is readily available for inspection upon request. The QA/QC Plan is a "living" document and as such it may require revisions when SOPs change for various reasons, new regulations are issued, new monitors are installed or replaced, etc.

6.3.1   Operation checks

Operation checks are performed on a routine basis to ensure that the equipment is operating correctly. These procedures can include daily zero and upscale calibration checks, checks of reference signals from control panels, and checks of flow rates, pressures, chiller temperatures, and vacuum levels.

The HCl CEMS zero-level and high-level drift will be checked once daily in accordance with Section 4.2.1 of OTM 23. The calibration drift shall not exceed 5% of the instrument span. Zero-level and high-level calibration drifts will be adjusted, at a minimum, whenever the 24-hour zero-level drift exceeds this limit.

Typically, the CEMS operator or vendor will determine which operation checks shall be performed daily and establish a QC check list that compares a day's readings with the established ranges for those parameters that ensure proper operation. Adjustments are made when deemed necessary. By keeping a record of adjustments made to the CEMS, numerous adjustments could be tracked and would be a good indicator of a possible problem that should be corrected. The QA/QC manual includes procedures on how to perform daily checks, such as the calibration drift assessment and when the CEMS has been determined to be out-of-control. Adjustment procedures that are customized and analyzer specific may help to ensure that corrective actions are taken on a consistent basis.

6.3.2 Routine maintenance

Routine maintenance is performed at regular intervals according to the manufacturer's recommended schedule. Activities include the replacement of filters, lamps, motor bearings, or other parts. Depending on the system, the replacement and check intervals may vary from 30 days to a year or more. This does not include activities in which a major component of the monitoring system is replaced and that may significantly affect the ability of the system to accurately measure or record the concentration, stack gas volumetric flow rate, emission rate, percentage moisture, or opacity. A monthly or quarterly maintenance check sheet should be used to accomplish this quality assurance check.

6.3.3 Performance audits

Performance audits provide a check of the system's operation, identify problems and characterize the need to improve preventive maintenance schedules/procedures, or alert the operator to the need for corrective maintenance. Performance audits are generally conducted once every calendar quarter. A performance audit under OTM 23 consists of one of the following:

1.   Quarterly absolute calibration audit
2.   Annual accuracy test audit

An accuracy test audit will be conducted at least once every four calendar quarters in accordance with Section 4.2.3 of OTM 23. An absolute calibration audit is performed during each of the remaining quarters in accordance with Section 4.2.2 of OTM 23.

The quarterly absolute calibration audit will follow the calibration error procedure outlined in Section 4.1.7 of OTM 22. The HCl CEMS will be challenged three non-consecutive times with zero level, mid-level, and high-level gases. The cylinder gases will be certified gases (EPA Protocol 1 gases are not available for HCl). The calibration gases will be injected into the sample system as close to the sampling probe as practical and will pass through all CEMS components used during normal monitoring. The absolute difference between the instrument response and the reference value (certified gas) will be calculated after each injection and the resulting three differences will be averaged to determine the calibration error at each measurement point. Results of the absolute calibration audit are acceptable if the calibration error for each of the three levels does not exceed 5% of span.

The annual accuracy audit of the CEMS will consist of a seven day calibration drift test (HCl only) followed by a relative accuracy test audit (HCl and HF). Procedures for performing the seven day calibration drift test and relative accuracy test audit (RATA) are the same as those utilized for initial certification of the CEMS (see sections 8.6 and 8.9 of this Plan) and are described in Section 4.2.3 of OTM 23. It should be noted

All calculations associated with both the seven day calibration drift test and RATA are performed using the applicable equations in Section 5.2 of OTM 23. Results of the drift test are acceptable if both the daily zero-level drift and calibration drift do not exceed 5 percent of the span of the instrument. Results of the RATA are acceptable if:

- The RA does not exceed 20% of the mean value of the reference method test data, or
- The RA does not exceed 10% RA in terms of the emission standard (ppmv, dry), or
- The absolute difference between the mean reference value and the mean CEMS value is less than 5 ppm.

The QA/QC manual describes in detail how to perform each of the performance audits for the HCl CEMS. The criterion for excessive inaccuracy for each type of performance audit is explained and the manual addresses what corrective action should be taken if a specific test is failed. If an outside vendor performs the audit, a copy of their procedures for conducting the audit will be included in the QA/QC Plan.

6.3.4   Corrective Maintenance

Corrective maintenance is performed to bring the monitoring system into operation after the breakdown in the system occurs. The QA/QC manual identifies probable scenarios for a malfunctioning CEMS and a program of corrective actions to resolve those problems. After corrective action has been taken, the QA/QC manual directs the user to perform the appropriate QC checks to ensure that the CEMS is back under control. Section 9.1 and Appendix E of this Plan address diagnostic and recertification test requirements that may be triggered by performing certain corrective maintenance activities. Out of control periods associated with corrective maintenance are logged and reported with the required quarterly report.

6.3.5   Out of Control Periods

The CEMS will be considered out of control if the zero-level (low-level) or high level calibration drift exceeds two times the applicable calibration drift specification (i.e. the calibration drift is greater than ± 10% of span.) In addition, the CEMS will also be considered out of control if the CEMS fails the quarterly absolute calibration audit or the annual accuracy test audit.

When the CEMS is out of control, GREC will take necessary corrective action and conduct retesting until the performance requirements are below the applicable criteria.

The out of control period begins immediately after the failed drift test or audit. The out of control period ends immediately following the successful completion of required procedures associated with the failure of the audit test. During the out of control period the data generated by the CEMS may not be used for compliance purposes.

6.3.6   Adjustment of Span and Range as Corrective Action

For each affected CEMS, it may become necessary to make a periodic evaluation of the span and range values of each pollutant monitor and make any necessary span and range adjustments. Span and range adjustments may be required, for example, as a result of changes in the fuel supply, changes in the manner of operation of the unit, or installation or removal of emission controls. Data recorded during short term, non-representative operating conditions are not included when evaluating whether to adjust span and range. Frequent full-scale exceedances of range may also require adjustment of the

span and range. This may not be necessary if the exceedances were caused by monitor out-of-control periods.

If frequent full-scale exceedances (more than 20 percent of unit operating time) occur, then it is necessary to reevaluate the appropriateness of the low range and make adjustments as necessary. GREC will report any CEMS range changes to the FDEP accompanied by information demonstrating the need for such adjustments and the rationale and calculations for the new values that will be used.

7. REPORTING AND RECORDKEEPING

Within 30 days following the end of each calendar quarter, GREC will submit a report to the FDEP summarizing HCl and HF emissions including periods of startups, shutdowns, malfunctions, as well as CEMS monitor availability statistics for the previous quarter. This report will also summarize emissions of other pollutants (NO_x, SO_2, CO, and opacity) that are not covered by this CEMS Operations Plan. Quarterly emission reports will be provided in a format consistent with that shown in Appendix CTR of the AC permit.

In addition to the quarterly emissions summary, GREC will also prepare a quarterly Data Assessment Report (DAR) in accordance with Section 7 of 40 CFR 60, Appendix F. The DAR summarizes the results of calibration drift assessments performed during the previous quarter, as well as the results of any cylinder gas audits or RATAs that were performed. The DAR must be submitted to the FDEP semiannually.

7.1 QA/QC Manual Record Retention

As per 62-4.160(14)(b), F.A.C., the owner or operator of any affected unit must maintain for each affected unit a file of all measurements, data, reports and other information required by permit and/or guidance manual at the source in a form suitable for inspection for at least three years from the date of each record. This will allow an inspector to confirm emission calculations and that any data manually entered into the system is correct and that its value is based on sound scientific principles.

GREC will retain all records of measurements, data, reports and other information associated with the HCl and HF CEMS for at least five years from the date of each record. The purpose of the longer retention time is to assure compliance with records retention requirements of other applicable regulations such as those under Title V of the federal Clean Air Act.

7.2 Downtime and Monitor Availability

Each quarterly emissions report discussed in Section 7 above will contain a summary of CEMS monitoring availability. The facility will strive to maintain a minimum HCl/HF monitor availability of 95 percent for each calendar quarter in which the unit operated for more than 760 hours. In the event the applicable availability is not achieved, GREC will provide the FDEP with a report identifying the problems in achieving the required availability and a plan of corrective actions that will be taken to achieve 95% availability. GREC will implement the corrective actions within the next calendar quarter. Monitor availability for each calendar quarter will be calculated in accordance with 40 CFR 60.7(d) as follows:

$$Availability = \frac{TSOT - CMS}{TSOT} \times 100\%$$

Where,

Availability = Percentage of time monitor was functioning properly (%)

TSOT = Total Source Operating Time (whole hours)

CMS = CEMS Downtime (whole hours)

For purposes of the above calculation, periods of time where the monitor is functioning properly but is unable to collect data while conducting a mandated QA/QC activity such as a calibration error test, RATA, or CGA will not be counted as CEMS downtime provided that the validation criteria of 40 CFR §60.13(h)(2)(iii) are met.

8. CERTIFICATION TEST PROTOCOL

Certification testing for the HCl/HF CEMS poses a special challenge because FTIR technology has not commonly been utilized in continuous monitoring applications. Additional challenges are posed due to the low expected flue gas concentration of HCl and HF. The initial certification test procedures described in the following sections generally follow the procedures described in Section 4.1 of EPA Method OTM 22. . A copy of the specific version of OTM 22 that GREC will be following can be found in Appendix B of this Plan.

FDEP has approved a petition from GREC (see Appendix D of this Plan) allowing the facility to utilize an alternate method to perform daily calibrations and quarterly calibration audits of the HF CEMS. Details concerning this alternate method can be found in Section 6.3.1 and Appendix C of this Plan. The need for an alternative method is based on the fact that HF is a highly toxic gas, is difficult to obtain from commercially available sources, and is not stable for long periods of time. Therefore, the following initial certification tests involving the use of certified calibration gases will not be performed on the HF CEMS: calibration drift check (Section 8.3), seven day calibration drift test (Section 8.6), calibration error test (Section 8.7), and system response time test (Section 8.8).

Table 8-1 below summarizes the OTM 22 certification tests, applicable components, and associated pass criteria. Additional details are provided in the sections listed in the first column.

Table 8-1 Summary of Initial CEMS Certification Tests

OTM 22 Section	Test	Applicable Component(s)	Pass Criteria
8.1	Pretest Preparation	HCl, HF	Operate CEMS for ≥ 168 hours and perform preliminary testing
8.2	Data Recorder Scale Check	HCl, HF	CEMS capable of measuring all expected pollutant concentrations as well as the applicable emission limit.
8.3	Calibration Drift Check	HCl	CEMS capable of performing a calibration check
8.4	Installation and Measurement Location Check	HCl, HF	Measurement locations consistent with all applicable OTM 22 recommendations
8.5	Stratification Test	HCl, HF	Stratification ≤ 10% at any point > 1.0 meter from the stack wall
8.6	Seven Day Calibration Drift Test	HCl	Calibration error ≤ 5% of span for seven consecutive unit operating days
8.7	Calibration Error Test	HCl	Mean difference ≤ 5% of span at all three test levels
8.8	System Response Time	HCl	Response time ≤ 2.0 minutes to achieve 95 percent of the final stable value

OTM 22 Section	Test	Applicable Component(s)	Pass Criteria
8.9	CEMS Accuracy Test	HCl, HF	Relative accuracy (RA) does not exceed: a) 20% of the mean value; or b) 10% RA in units of the standard; or c) 5 ppm absolute difference

8.1 Pretest Preparation

Section 4.1.2 of OTM 22 recommends that the source operate the CEMS for a period of time prior to initiating performance specification (i.e., certification) testing. It also recommends that during this time the source *"conduct daily checks of the zero and high-level drift, conduct a calibration error test, and conduct a calibration drift check to verify that the instrument is functioning properly."* Prior to the start of certification testing, GREC will operate the CEMS for at least 168 hours and perform the recommended preliminary testing for HCl.

8.2 Data Recorder Scale Check

Section 4.1.2 of OTM 22 requires that a data recorder check be performed. The purpose of this check is to confirm that the CEMS operating range (zero to span) and the range of the data recorder encompasses both the response of the CEMS for all expected pollutant concentrations as well as the applicable emission limit. Information is presented in Section 3.3 of this Plan describing the rationale behind the range selections for HCl and HF.

8.3 Calibration Drift Check

Section 4.1.3 of OTM 22 requires that HCL CEMS be capable of performing a calibration check at least once per day. Certified gases must be used to perform the zero and high-level drift checks. The allowable concentration ranges for these gases is summarized in Table 8-2 below. Following installation, GREC will assure that the CEMS performs the daily calibrations and properly records the results.

Table 8-2 Daily Calibration Gas Cylinder Summary

Component	Zero-Level Concentration (0 to 30% of span)	Mid-Level Concentration (30 to 50% of span)	High-Level Concentration (50 to 100% of span)
HCl	0 to 15 ppm	Not Applicable	25 to 50 ppm
HF	Not Applicable	Not Applicable	Not Applicable

In accordance with OTM 22 recommendations, GREC plans to use certified gas with a minimum analytical accuracy of ±5% for the daily calibrations. A copy of the supplier's certificate of analysis

obtained for each gas cylinder. It should be noted that OTM 22 does not require the use of EPA Protocol gas as defined in Section 5.14 of 40 CFR 75 Appendix F for any certification testing.

8.4   Installation and Measurement Location Check

Section 4.1.4 of OTM 22 specifies sampling location criteria for both the HCl CEMS probe and the reference method test probe. As indicated in Figure 2, the HCL CEMS probe will be installed at a location that is consistent with all applicable OTM 22 recommendations, including:

- Downstream of all pollution control equipment;
- At a location where the HCl is representative or can be corrected so as to be representative of total emissions from the BFB boiler;
- At least two equivalent diameters downstream from the nearest flow disturbance;
- At least a half equivalent diameter upstream from the exhaust; and
- Probe extends into the flue gas stream no less than 1.0 meter as measured from the stack inside wall.

Reference method samples will be drawn from the stack utilizing test ports that are located in close proximity to the CEMS probe as shown in Figure 2. The reference method location criteria are similar to those for the CEMS probe: two diameters downstream from the nearest flow disturbance and at least a half equivalent diameter upstream from the exhaust. Therefore, the reference method sampling location will also meet the OTM 22 requirements. Additional details regarding the reference method sampling location are provided in the RATA test protocol provided by the independent test contractor (see Appendix F of this Plan).

8.5   Stratification Test

Section 4.1.5 of OTM 22 requires that a stratification test be conducted in order to verify that excess stratification of the target pollutant does not exist at the sampling point of the monitoring system.

An independent test contractor will perform the stratification test prior to conducting the CEMS accuracy test. The BFB boiler and associated pollution control systems will be operating normally during the test. A minimum of 12 sampling points will be used, with 6 sampling points along each of the two traverse lines. The location of traverse points will be determined in accordance EPA Method 1 [40 CFR 60 Appendix A]. Additional details regarding the stratification test are provided in the RATA test protocol provided by the independent test contractor (see Appendix F of this Plan).

Results of the stratification test are acceptable if stratification in the stack, at the measurement location, is than or equal to 10 percent between the average concentration in the stack and the concentration at any point more than 1.0 meter from the stack wall. Stratification is calculated using Equation 9 in OTM 22.

8.6   Seven Day Calibration Drift Test

A seven day calibration drift test will be conducted on the HCl CEMS in accordance with Section 4.1.6 of OTM 22. The purpose of this test is to evaluate the accuracy and stability of a gas monitor's calibration over an extended period of unit operation.

The test is performed once per day at 24-hour intervals for seven consecutive unit operating days. Each day during the calibration drift test period, the HCl CEMS will be challenged once at each of two gas concentration levels (normally zero and high-level) while the unit operating normally. The calibration gas need not be EPA Protocol gas. Calibration gas will be introduced at a connection on the sampling probe so that it passes through all filters, scrubbers, conditioners, and other monitor components used during normal sampling and through as much of the sampling probe as is practical. The nominal concentrations of HCl audit gases for the 7-day calibration error test are provided in Table 8-2.

No manual or automatic adjustments will be made to the analyzers either prior to or during each of the seven daily calibration drift checks. Manual or automatic adjustments to the analyzer settings are permitted provided they are made after taking measurements at both the zero and high-level concentrations for that day. If automatic adjustments are made by the analyzer, the test will be performed in a manner that will determine and record the extent of the adjustments.

Results of the seven day calibration error test are acceptable if the calibration error does not deviate from the reference value of either the zero or high-level calibration gas by more than 5 percent of the span of the instrument. Calibration drift is calculated using Equation 1 in OTM 22.

8.7   Calibration Error Test

A calibration error test will be performed on the HCl CEMS in accordance with Section 4.1.7 of OTM 22. The purpose of this test is to verify that the response of a gas monitor is linear across its range.

The calibration error test procedure involves challenging the CEMS three times using certified HCl gases at each of three gas concentration levels (low, mid, and high). The allowable concentration ranges for these gases is summarized in

Table 8-3 below. The calibration gas need not be EPA Protocol gas. Calibration gas will be introduced at a connection on the sampling probe so that it passes through all filters, scrubbers, conditioners, and other monitor components used during normal sampling and through as much of the sampling probe as is practical. The difference between the instrument response and the reference value (certified gas) will be calculated after each injection and the resulting three differences will be averaged to determine the CE at each measurement point.

Table 8-3 Calibration Error Test Cylinder Gas Summary

Component	Zero-Level Concentration (0 to 30% of span)	Mid-Level Concentration (30 to 50% of span)	High-Level Concentration (50 to 100% of span)
HCl	0 to 15 ppm	15 to 25 ppm	25 to 50 ppm
HF	Not Applicable	Not Applicable	Not Applicable

Results of the calibration error test are acceptable if the mean difference between the CEMS and the reference values, at all three test levels, is no greater than 5 percent of span. Calibration error is calculated using Equation 2 in OTM 22.

8.8   System Response Time

A system response time test will be performed on the HCl CEMS in accordance with Section 4.1.8 of OTM 22. The purpose of this test is to determine whether a gas monitoring system is capable of completing at least one cycle of sampling, analyzing and data recording within a maximum time limitation.

The system response time test procedure involves determining both the downscale and upscale response time. The test starts with the analyzer measuring a zero-level calibration gas. When the system output has stabilized (no change greater than 1 percent of full scale for 30 seconds), a high-level gas is injected at the sampling probe. The time it takes for 95.0 percent of the step change to be achieved between the stable zero-level value and the stable ending high-level gas reading is recorded as the upscale cycle time. This process is repeated, starting with the high-level gas and subsequently injecting the zero-level calibration gas, to determine the downscale cycle time. These steps are repeated three times and the mean upscale and downscale response times are calculated. The slower or longer of the two means is recorded as the system response time.

Results of the system response time are acceptable if the HCl CEMS response time does not exceed 2.0 minutes to achieve 95 percent of the final stable value.

8.9   CEMS Accuracy Test

Section 4.1.9 of OTM 22 requires that the facility conduct a CEMS accuracy test as part of the initial certification testing. The method provides two options for satisfying this requirement: a relative accuracy test audit (RATA), or dynamic spiking. GREC has chosen the RATA option for both the HCl and HF CEMS. The RATA will be performed on-site by an independent test contractor, which will also be responsible for completing quality assurance checks and the final test report. Details regarding this test are provided in the following sections.

8.9.1   Relative Accuracy Test Audit

The independent test contractor will perform an initial RATA for the HCl and HF monitoring systems in accordance with Section 4.1.9.1 of OTM 22. In accordance with OTM 22, either EPA Method 26 or 26A from 40 CFR 60 Appendix A will be utilized as the reference method for both HCl and HF. These are impinger-based methods in which analysis of the sample is performed at an off-site laboratory. Consequently, the RATA results will not be known for several days or weeks following completion of onsite testing. Future RATAs may be conducted by following EPA Method 320 and an FTIR analyzer as the reference method in order to provide for real-time results of the test.

During RATA testing the unit will operate at its normal level and combust its primary fuel. The RATA will be completed within a period of 168 consecutive unit operating hours from the start of testing. For each RATA test run, the measurements from the monitors will be compared against corresponding reference method values. The paired data will be tabulated in a table and the relative accuracy test results calculated. A minimum of nine sets of paired monitor data and reference method test data will be performed. If more than nine sets of paired data are collected, a maximum of three sets of test results will be rejected, as long as the total number of test results is greater than or equal to nine. All data, including any rejected paired runs will be reported. Additional details regarding the test procedures are provided in the RATA test protocol in Appendix F of this Plan. If changes are made to the RATA test protocol, a revised protocol will be provided. Additionally, a final protocol will be submitted to the Department prior to certification testing

Section 8.9.3 of this Plan discusses how relative accuracy (RA) of the CEMS will be calculated. Results of the RATA are acceptable if:

- The RA does not exceed 20% of the mean value of the reference method test data, or
- The RA does not exceed 10% RA in terms of the emission standard (ppmv, dry), or
- The absolute difference between the mean reference value and the mean CEMS value is less than 5 ppm.

8.9.2   Correlation of Data

The reference method tests must be conducted in such a way that they will yield results that can be correlated to the CEMS. It will be confirmed that the monitoring system and reference test method test results are on a consistent moisture, temperature, and diluent concentration basis. Response times of the emission monitoring system will be compared with the reference method measurements to ensure comparison of simultaneous measurements.

8.9.3   Relative Accuracy Test Audit Equations

The independent test contractor will perform RATA calculations according to the procedures in Section 5.2 of OTM 22. Specifically, the following equations will be used:

- Equations 3 and 4 - Mean difference between the reference method and CEMS values
- Equations 5 and 6 - Relative accuracy
- Equation 7 - Confidence coefficient

- Equation 8 - Standard deviation

The mean difference between the reference method and CEMS values will be calculated in units of parts per million by volume on a wet basis. The GREC permit limits for HCl and HF are expressed in pounds per hour (lb/hr). The stack flow monitor, which provides the other measurement component used in the mass emissions calculation, will be subject to a separate RATA in accordance with the requirements of 40 CFR Part 75.

In addition to the above equations, the independent test contractor may perform additional calculations as part of the RATA. Refer to the RATA test protocol in Appendix F of this Plan for details regarding all calculations that will be performed as part of this test. If changes are made to the RATA test protocol, a revised protocol will be provided. Additionally, a final protocol will be submitted to the Department prior to certification testing

8.10 Certification Test Reports

Upon completion of the test program and an internal review of the results, a final test report will be submitted to the FDEP, both to the applicable district and to the Emissions Measurement Section located in Tallahassee. The final test report will include the following:
- All certification test results and calculations
- Field test data of the following:
  - Stratification Test
  - Seven day calibration drift test
  - Calibration error test
  - System Response time
  - RATA
- Calibration data
- QA check results
- Calibration gas values, gas certificates of analysis
- Stack information
- Unit process data
- Narrative discussion of the test program (including test method procedures)

9. MISCELLANEOUS

9.1 Component Change Out and Diagnostic Testing

Whenever GREC makes a replacement, modification, or change in the certified CEMS that may significantly affect the ability of the system to accurately measure or record the HCl or HF concentration, or any parameter deemed critical to the calculation of HCL/HF emissions, facility may be required to conduct a CEMS performance evaluation. This CEMS performance evaluation may take one of two forms: recertification or diagnostic testing.

Recertification would require that GREC conduct all of the tests that were performed during the initial test. Generally, this would include a RATA as well as a calibration. Diagnostic testing would forego the RATA for less rigorous testing that ensures the continued proper operation of the monitoring system.

Appendix E contains a list developed by the FDEP of common events that would trigger diagnostic and/or recertification testing. For events that are not on this list GREC will contact the FDEP for guidance.

9.2 Compliance Testing and RATA's

For sources that have CEMS and that must conduct annual performance testing for pollutants that are monitored, instead of requiring two separate tests, one for compliance demonstration and the other for the RATA, a source may elect to combine both the compliance testing and the RATAs. Generally there are two options in which this may be done: (1) Use the compliance testing data, comprised of three runs of at least 63 minutes each to satisfy the RATA requirement; or (2) Use the RATA data, comprised of nine 21-minute runs, to satisfy the compliance testing requirements. In each case the tester, prior to conducting the tests, should inform the compliance authority of their intent to conduct both tests at the same time.

9.3 Missing Data, Bias Adjustment Factors and Compliance

The HCl and HF mass emission limits for GREC are expressed in units of pounds per hour (lb/hr) and tons per year (tpy). The HCL and HF CEMS takes wet-basis concentration measurements in units of parts per million by volume (ppmvw). In order to calculate lb/hr mass emissions, the stack volumetric flow rate must also be measured. Missing hourly data for either set of measurements—pollutant concentration or stack flow—makes it impossible to calculate the HCl and/or HF mass emission rate during that hour. Missing data during a period when a monitor is down and the emission unit is operating results in underreporting of tpy emissions. Condition 22 of Appendix CEMS to the GREC AC Permit directs the owner or operator to account for emissions during missing data hours using site-specific data to generate a reasonable estimate of the 1-hour block average. GREC will develop a missing data policy to implement this requirement. The policy will describe the method used to assure that tpy emissions are not underreported, and will include any calculations that are utilized.

The stack volumetric flow monitor is subject to requirements of 40 CFR Part 75 including the missing data substitution and bias adjustment provisions of this regulation. For purposes of demonstrating compliance with the AC Permit limits, GREC will not utilize substitute data values derived from the missing data procedures in Subpart D of part 75, nor will the flow data have been bias-adjusted according to the procedures of part 75. GREC will record non-adjusted CEMS data and maintain these records onsite for use in compliance demonstrations. Like all records and pertinent data, these data will maintained in a form suitable for inspection and retained for five years.

9.4   Flow Monitors

The CEMS at GREC includes a stack flow monitor. Stack flow measurements are used in conjunction with HCl and HF concentration measurements to calculate pollutant mass emission rates in pounds per hour and tons per year. These values are used to demonstrate compliance with permit limits that are expressed in these units. The stack flow monitor is not addressed in this CEMS Operations Plan because it is subject to the monitoring requirements in 40 CFR Part 75 and, consequently, it is adequately addressed in the 40 CFR Part 75 CEMS Monitoring Plan as well as the Part 75 QA/QC Plan.

APPENDIX A
EPA Other Test Method 23

PROCEDURE DD: QUALITY CONTROL AND QUALITY ASSURANCE REQUIREMENTS FOR HYDROCHLORIC ACID CONTINUOUS EMISSION MONITORING SYSTEMS AT STATIONARY SOURCES

Lilly

October 2006
Revision: 2.0

EXECUTIVE SUMMARY

Procedure DD outlines the continuing quality control and quality assurance requirements for a hydrochloric acid (HCl) continuous emission monitoring system (CEMS). Procedure DD provides the procedures and performance criteria for daily checks of the high-level and zero-level drift. This procedure also provides the procedures and performance criteria for quarterly absolute calibration audits as well as annual accuracy audits.

1.1 REVISION 1.0

This revision was part of the T149 alternative Monitoring Petition, and was approved by the Office of Air Quality and Standards in January of 2006.

1.2 REVISON 2.0

This revision is an update of the original Procedure DD document, October, 2006. The following are key updates in revision 2.0:

1. Recommendation that all HCL QA gases be certified with a minimum tolerance of 5%

2. Recommendation that a site specific dynamic spiking protocol be used, and, the dynamic spiking protocol would contain the detailed test procedure(s).

3. Discussion for the use of quantitative introduction of the HCL calibration gas and subsequent total flow measurement as method for determining the reference HCL concentration during each test run.

4. Updated the dynamic spiking overview section for easier flow of information

5. Updated the equations to include percent relative standard deviation and the calculation for the reference HCL concentration when using quantitative introduction of the HCL calibration gas with subsequent total flow measurement.

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Table 1. Ongoing Quality Assurance/Quality Control Calibration Gas Ranges

Figure 1. Dynamic Spiking Overview

2.0   USING PROCEDURE DD

2.1   WHAT IS THE PURPOSE AND APPLICABILITY OF PROCEDURE DD?

The purpose of Procedure DD is to establish the minimum requirements for quality control (QC) and quality assurance (QA) procedures for the HCl CEMS.   These quality control and quality assurance procedures are in place to ensure the accuracy and validity of the data reported by the HCl CEMS for emission compliance purposes.   Any HCl CEMS used for reporting purposes to the Environmental Protection Agency (EPA), state, or local environmental agencies must comply with Procedure DD immediately after the completion of the performance specification test outlined in Performance Specification Z^I.

2.2   WHAT ARE THE BASIC REQUIREMENTS OF PROCEDURE DD?

Procedure DD includes procedures and performance criteria for conducting daily calibration drift tests,, quarterly absolute calibration audits, and annual accuracy determinations.   Procedure DD also covers the requirements and timelines associated with periods when the HCl is out of control.

2.3   WHAT SPECIAL DEFINITIONS APPLY TO PROCEDURE DD?

Calibration Drift: The difference in the CEMS output readings from the established reference value after a stated period of operation during which no unscheduled maintenance or adjustment took place.

Calibration Error: The mean difference between the concentration indicated by the CEMS and the known concentration generated by a calibration source at three levels when the entire CEMS, including the sampling interface is challenged.   A CE test is performed to document the accuracy and linearity of the CEMS over the entire measurement range.

Centroidal Area: means a concentric area that is geometrically similar to the stack or duct cross section and is no greater than 1 percent of the stack or duct cross-sectional area.

Continuous Emission Monitoring System: means the total equipment required for the determination of a gas concentration or emission rate.   The sample interface, pollutant analyzer, diluent analyzer, and data recorder are the major subsystems of the CEMS.

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Correlation Coefficient: determines the extent of a linear relationship between two fields over a given period of time.

Data Recorder: The portion of the CEMS that provides a record of analyzer output, flags which indicate normal operation, and flags indicating abnormal operation. The data recorder may record other pertinent data such as effluent flow rates, and various instrument temperatures.

Diluent Analyzer: means that portion of the CEMS that senses the diluent gas (i.e. O_2) and generates an output proportional to the gas concentration.

Dynamic Spiking: a procedure used to document the accuracy, precision, and bias of the monitoring system by quantitatively spiking a certified gas into the pollutant gas stream.

High-Level Drift: means the absolute difference between a high-level calibration gas and the monitor response, in units of the applicable standard.

Instrument Measurement Range: The range of HCl concentrations the instrument can reliably measure from the lowest concentration to the highest.

Intercept: value of the Y variable when the X variable is equal to zero-level.

Linear Regression: a methodology used to find a formula that can be used to relate two variables that are linearly related.

Path Sampling CEMS: A CEMS that samples the source effluent along a path greater than 10 percent of the equivalent diameter of the stack or duct cross section.

Point Sampling CEMS: A CEMS that samples the source effluent at a single point.

Pollutant Analyzer: means that portion of the CEMS that senses the pollutant gas and generates an output proportional to the gas concentration.

Relative Accuracy (RA): means the absolute mean difference between the gas concentration or emission rate determined by the CEMS and the value determined by the Reference Method (RM), plus

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the 2.5 percent error confidence coefficient of a series of tests, divided by the mean of the RM tests or the applicable emission limit.

Response Time: The time interval between the start of a step change in the system input and when the pollutant analyzer output reached 95% of the final value.

Sample Interface: The portion of the CEMS used for one or more of the following: sample acquisition, sample transport, sample conditioning, or protection of the monitor from the effects of stack gas.

Slope: The rate of change of Y relative to the change in X.

Zero-level-level drift: means the absolute difference between a high-level calibration gas and the monitor response, in units of the applicable standard.

3.0   INTERFERENCES, SAFETY, AND EQUIPMENT REQUIREMENTS

3.1   WHAT DO I NEED TO KNOW TO ENSURE THE SAFETY OF PERSONS USING PROCEDURE DD?

People using Procedure DD may be exposed to hazardous material, operational hazards, and hazardous site conditions. Procedure DD does not address all the safety issues associated with its use. It is your responsibility to ensure the safety of persons using Procedure DD. Some helpful references may include the CEMS manual, the CEMS manufacturer, other reference methods, and on-site safety regulations.

3.2   WHAT EQUIPMENT AND SUPPLIES DO I NEED?

3.2.1   Equipment for the CEMS

1.   **Sample Extraction System:** This portion of the CEMS must present a sample of source effluent to the sampling module that is directly representative or can be corrected so as to be representative of source. The sample extraction system typically consists of a sample probe and a heated umbilical line.

2.   **Pressure Regulation Module:** The pressure regulation module is designed to remove both free particulates and water-soluble aerosols from the gas stream prior to analysis by the sampling module. This module also provides a sample gas to the analyzer at a constant pressure (optional).

3.   **Analyzer module:** The portion of the CEMS that quantitates stack gas concentrations of HCl.

4.   **Diluent Module:** This portion of the CEMS quantifies stack gas concentrations of oxygen or CO_2. For systems with a multi-component analyzer, the same analyzer quantifies the concentration of all measured analytes.

5.   **System Controller:** This portion of the CEMS provides control of the analyzer, sample probe, pressure regulation module and the sample interface.

6.   **Data recorder:** Your HCl CEMS must be able to record HCl concentrations and instrument status signals (flags).

3.3   WHAT REGENTS AND STANDARDS DO I NEED?

3.3.1 Reference Gases, Gas Cells, or Optical Filters

See Table 1 for calibration gas concentration ranges.

4.0 QUALITY CONTROL, CALIBRATION AND STANDARDIZATION

4.1 WHAT QUALITY CONTROL MEASURES ARE REQUIRED BY PROCEDURE DD?

You must develop and implement a quality control program that, at a minimum includes detailed written procedures for all of the following activities.

1. Procedures for performing drift checks on a daily basis, including but not limited to, zero-level drift, high-level drift, and sample volume measurement drift (when applicable).

2. Procedures and methods of adjusting the HCl CEMS in response to the results of the drift checks.

3. Preventative maintenance of the HCl CEMS.

4. Data recording, calculations, and reporting.

5. Procedures for required audits, including absolute calibration audits and accuracy audits.

6. Procedures for adjusting your CEMS based on audit results.

7. A program of corrective action and stack operation procedures in case of a CEMS malfunction and an out of control period.

You are required to keep written documentation of your QA/QC procedures on record and available for inspection for the life of the CEMS or until you are no longer subject to the requirements of this procedure. If you fail two consecutive audits you must revise your QA/QC procedures.

4.2 WHAT CALIBRATION CHECKS AND AUDIT PROCEDURES MUST I PERFORM FOR MY HCL CEMS?

Ongoing quality control will include daily calibration drift tests, quarterly absolute calibration audits, and annual accuracy test audits, which are discussed below:

4.2.1 Daily Calibration Drift Checks

The zero-level and high-level drift shall be checked once daily. The calibration gas concentration (certified gas) ranges are provided in Table 1. To determine the zero-level drift or calibration drift, introduce to the CEMS the reference gases, gas cells, or optical filters (these need not be certified) for the zero-level and high-level values. Record the CEMS response and subtract this value from the reference value. The calibration drift shall not exceed 5% of the instrument span. Zero-level and high-level calibration drifts shall be adjusted, at a minimum, whenever the 24-hour zero-level drift exceeds the limits of the calibration

drift specification. The amount of excess zero-level and high-level drift measured at the 24-hour interval checks will be recorded.

4.2.2 Quarterly Absolute Calibration Audit (Calibration Error Test)

The quarterly Absolute Calibration Audit will follow the Calibration Error procedure outlined in Performance Specification Z. The HCl CEMS shall be challenged three non-consecutive times with zero-level, mid-level, and high-level certified gases. The cylinder gases will be certified gases (EPA Protocol 1 gases are not available for HCl). The calibration gases will be injected into the sample system as close to the sampling probe as practical and will pass through all CEMS components used during normal monitoring. The absolute difference between the instrument response and the reference value (certified gas) will be calculated after each injection and the resulting three differences will be averaged to determine the calibration error at each measurement point. The calibration error for each of the three levels will not exceed 5% of span.

An absolute calibration audit will be performed quarterly, except during the quarter the annual accuracy is performed.

4.2.3 Annual Accuracy Test Audit

The annual accuracy audit of the HCl CEMS will consist of a calibration drift test (seven day drift) and an accuracy determination by performing either a relative accuracy determination, or by dynamic spiking.

4.2.3.1 Seven-Day Drift Test (seven day drift)

Prior to the start of the accuracy test (either the Relative Accuracy or Dynamic Spiking) you must perform a calibration drift test for a period of seven consecutive days. The seven-day calibration drift test must be conducted when the facility is under normal operations. During the calibration drift test period you must determine the magnitude of the zero-level calibration drift and the high-level calibration drift at least once each day. During the stability tests, no adjustments or calibrations may be made to the CEMS. If periodic automatic or manual adjustments are made to the CEMS zero-level and calibration settings, conduct the CD test immediately before these adjustments, or conduct it in such a way that the CD can be determined. The zero-level and high-level drift each must be less than 5% of the instrument span for each of seven consecutive days.

4.2.3.2 Relative Accuracy Determination

The relative accuracy determination will be conducted while the affected facility is operating during normal operation, or as specified in an applicable subpart.

Reference Methods (RM). Unless otherwise specified in an applicable subpart of the regulations, Methods 26 or 26A, or their approved alternatives, are the reference methods for HCl. Other reference methods for moisture, oxygen, etc. may be necessary.

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Sampling Strategy for RM Tests. Conduct the RM tests in such a way that they will yield results representative of the emissions from the source and can be correlated to the CEMS data. It is preferable to conduct the diluent (if applicable), moisture (if needed), and pollutant measurements simultaneously. However, diluent and moisture measurements that are taken within an hour of the pollutant measurements may be used to calculate dry pollutant concentration and emission rates. In order to correlate the CEMS and RM data properly, note the beginning and end of each RM test period of each run (including the exact time of day) on the CEMS chart recordings or other permanent record of output. For integrated samples make a sample traverse of at least 21 minutes, sampling for an equal time at each traverse point.

Number of RM Tests. Conduct a minimum of nine sets of all necessary RM test runs.

NOTE: More than nine sets of RM tests may be performed. If this option is chosen, a maximum of three sets of the test results may be rejected so long as the total number of test results used to determine the RA is greater than or equal to nine. However, all data must be reported, including the rejected data.

Correlation of RM and CEMS Data. Correlate the CEMS and the RM test data as to the time and duration by first determining from the CEMS final output (the one used for reporting) the integrated average pollutant concentration or emission rate for each pollutant RM test period. Consider system response time, if important, and confirm that the pair of results are on a consistent moisture, temperature, and diluent concentration basis. Then, compare each integrated CEMS value against the corresponding average RM value. If the RM has an integrated sampling technique, make a direct comparison of the RM results and CEMS integrated average value.

Calculate the mean difference between the RM and CEMS values in the units of the emission standard, the standard deviation, the confidence coefficient, and the relative accuracy according to the calculations in Section 4.0. The RA of the CEMS must not be greater than 20% of the mean value of the reference method (RM) test data, or not greater than 10% in terms of the emission standard (ppmv, dry), or have an absolute difference of less than 5 ppmv between the mean reference value and the mean CEMS value.

4.2.3.3 Dynamic Spiking

Dynamic spiking can be used in lieu of the Relative Accuracy Determination as an alternative method for documenting the accuracy, precision, and bias of the HCl CEMS. This section provides an overview of a typical dynamic spiking procedure. A site specific dynamic spiking protocol, which provides detailed steps of the actual procedure, is required. Figure 1 provides an overview of a typical dynamic spiking arrangement.

While the HCl CEMS is sampling flue gas, HCl reference gas is introduced into the CEMS sample interface by using a mass flow controller (or equivalent). The target ratio of actual flue gas to the HCl

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reference gas is 9:1, but must be kept at a minimum ratio of 1:1. The HCl concentration is quantitated by the HCl CEMS.

Certified HCL calibration gas is spiked at a minimum of three levels (low, mid, high) through the HCL CEMS measurement range. For each test level, a minimum of 30, one minute averaged HCL values are collected. The percent relative standard deviation, for each data set, should not exceed 20%. Table 1 provides guidance on the HCL concentrations for the low, mid, and high test runs.

Several methods exist to calculate the dynamically spiked HCL concentration (represents the reference HCL concentration). Two common methods are: (1) Use of an element of opportunity and (2) Quantitative introduction of the HCL calibration gas with total flow measurement. Other methods may be used; however, a site specific protocol should document the procedure(s) used.

An element of opportunity can be used to calculate the dynamically spiked HCl concentration (represents the reference HCl concentration). The element of opportunity can either be be an analyte, which would normally be present in the flue gas at steady concentrations, or total flow through the system. Examples of prospective analytes which could be used as elements of opportunity are O_2, NOx. SO_2, CO_2, or moisture. The analyte(s) is measured using a certified reference CEMS, separate from the HCL CEMS.

Total flow through the system may also be used as an element of opportunity to calculate the dynamically spiked HCL concentration. Examples the total flow measurement are the use of a calibrated laminar flow element, or use of a tracer gas with subsequent downstream measurement (for example: hydrocarbon tracer gas with subsequent calibrated GC measurement downstream).

Regardless of the element of opportunity, It is recommended that the element of opportunity data set, for each test level (low, mid, high) have a relative percent standard deviation less than or equal to 20%.

Quantitatively introducing the HCL calibration gas, and, measuring the total flow is another method for documenting the dilution, and subsequent theoretical value of the HCL concentration spiked for each test run. Use of this method requires documenting the quantitative introduction of HCL gas into the system; such as a method 205 procedure or similiar protocol.

It is important to compensate the HCl reference concentration for any background HCl present in the flue gas. The HCl concentration of the flue gas (baseline HCL) shall be determined prior to each spiking trial. The baseline HCl concentration is based upon a series of at least 10, one-minute averaged data points. Baseline data must be collected immediately prior to each test run. The data points must include the HCl concentration, element of opportunity concentration(s) and/or the total flow. A site-specific standard operating procedure for the HCL dynamic spiking is required.

Linear regression is used to establish the accuracy, precision, and bias of the HCl CEMS. The criteria for the HCl dynamic spiking are:

1. The correlation coefficient (r) must be greater than or equal to 0.90

2. The slope must be 1.0, +/- 0.15

3. The Intercept must be equal to or less than 15% of the instrument span

5.0 PERFORMANCE CRITERIA AND CALCULATIONS

5.1 WHAT ARE THE PERFORMANCE CRITERIA FOR MY HCL CEMS?

You must demonstrate that your HCl CEMS has adequate stability, precision, accuracy, response time and data reporting capabilities to determine if your facility is in compliance with HCl emission standards or operating permit limits as specified in applicable regulations or permits. You will demonstrate this capacity by showing that your HCl CEMS meets the following performance criteria.

5.1.1 Daily Calibration Check Criteria

The daily zero-level drift or calibration drift each shall not exceed 5% of span. The calculations are provided in Section 4.2.2.

5.1.2 Quarterly Absolute Audit

The absolute mean difference between the CEMS and the reference values, at all three test points, must be no greater than 5% of span. The calculations are provided in Section 4.2.3.

5.1.3 Relative Accuracy

The RA of the CEMS must not be greater than 20% of the mean value of the reference method (RM) test data, or not greater than 10% in terms of the emission standard (ppmv, dry), or have an absolute difference of less than 5 ppmv between the mean reference value and the mean CEMS value. The calculations are provided in Sections 4.2.5 - 4.2.7.

5.1.4 Dynamic Spiking

Dynamically spiking may be used in lieu of a Relative Accuracy Test as a means to document the accuracy, precision, and bias of the HCl CEMS.

The criteria for the HCl dynamic spiking is (1) The correlation coefficient, r, must be greater than or equal to 0.90 (2) The slope must be 1.0, +/- 0.15 (3) The Intercept must be equal to or less than 15% of the instrument span.

The calculations are provided in Section 4.2.8.

5.1.4.1 Out of Control

The HCl CEMS will be considered out of control if the zero-level (low-level) or high level calibration drift exceeds two times the applicable calibration drift specification (i.e. the calibration drift is greater than ± 10

% of span.) In addition, the HCl CEMS will also be considered out of control if the CEMS fails the quarterly absolute calibration audit or the annual accuracy test audit.

When the CEMS is out of control, the owner or operator shall take the necessary corrective action and shall repeat all necessary tests, which indicate that the system is out of control. The owner or operator shall take corrective action and conduct retesting until the performance requirements are below the applicable criteria.

The out of control period begins immediately after the failed drift test or audit. The out of control period ends immediately following the successful completion of required procedures associated with the failure of the audit test. During the out of control period you may not use the data generated by the HCl CEMS for compliance purposes.

5.2   WHAT CALCULATIONS, EQUATIONS, AND DATA ANALYSES ARE NEEDED?

5.2.1   Daily Upscale and Zero Drift

$$CD = (|R - A|/S) * 100 \qquad \textbf{(Equation 1)}$$

where:

CD = Percent calibration drift (%),

R = Reference value of zero or high level calibration gas introduced into the monitoring system (ppmv),

A = Actual monitor response to calibration gas (ppmv),

S = Span of the instrument (ppmv).

5.2.2   Calibration Error

$$CE = |d_{avg}/S| * 100 \qquad \textbf{(Equation 2)}$$

where:

CE = Percent calibration error (%),

d_{avg} = Mean difference between CEMS response and the known reference gas (ppmv),

S   =   Span of the monitor (ppmv).

5.2.3 Mean Difference

Calculate the arithmetic mean difference as follows:

$$d_{avg} = \frac{1}{n}\sum d_i \qquad \text{(Equation 3)}$$

where :

d_{avg} =   Arithmetic mean of differences

n =   Number of data sets

di =   difference of each data set

And

$$d_i = x_i - y_i \qquad \text{(Equation 4)}$$

where:

x_i =   Value at data set x

yi =   Value at data set y

5.2.4 Relative Accuracy

The RA for the monitors will be calculated using the least restrictive of equation 6 or equation 7:

RA   = $(|d_{avg}| + |CC|)$ **(Equation 5)**

or

RA   = $((|d_{avg}| + |CC|) / TM_{avg}) * 100$ **(Equation 6)**

where:

RA   =   Relative accuracy, either percent or ppmv or % absolute,

d_{avg} =   Arithmetic mean of differences between value measured by the installed CEMS and the reference method,

CC   = ·Confidence coefficient,

TM$_{avg}$ =   Average value measured by the reference test method monitors.

5.2.5   Confidence Coefficient

The confidence coefficient will be calculated using equation 8:

$$CC = t_{0.975} * (S_d / (n^{1/2}))$$ **(Equation 7)**

where:

CC   = Confidence coefficient,

$t_{0.975}$ = t-value obtained from Table 2.1 in Performance Specification 2, 40 CFR Part 60 Appendix B

5.2.6   Standard Deviation (of Differences)

S$_d$ = Standard deviation of differences measured between the installed CEMS and the reference methods calculated using equation 8:

$$S_d = \left[\frac{\sum_{i=1}^{n} d_i^2 - \left(\frac{\sum_{i=1}^{n} d_i}{n} \right)^2}{n-1} \right]^{1/2}$$ **(Equation 8)**

where: n = Number of values in this data set.

5.2.7   Stratification

The value, at each traverse point, is compared to the average value for all sampling points to determine the percent stratification using the following equation:

$$S = \left| C_i - C_{ave} \right| * 100\%$$ **(Equation 9)**

where:

S = percent stratification

C_i =· concentration or velocity at sampling point i

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$$C_{ave} = \text{average concentration or velocity at all sampling points}$$

5.2.8   Baseline data

5.2.8.1   HCL CEMS data

The baseline HCL concentration is measured prior to each dynamic spiking run. For each baseline HCL data set, calculate the average, in ppm, using equation 10.

Calculate the arithmetic mean of a data set as follows:

$$\bar{x} = \frac{1}{n} \sum x_i$$ (Equation 10)

where :

$\bar{x}$	=	Arithmetic mean
n	=	Number of data points
x_i	=	Value of each data point

5.2.8.2   Element of Opportunity Data

The element of opportunity data set is acquired prior to each dynamic spiking test run, simultaneous to the baseline HCL concentration data set. For each element of opportunity, calculate the average value using equation 10.

5.2.8.3   Flow via dilution

When using dilution of a measured analyte (such as a hydrocarbon with subsequent GC measurement) as an indicator of total flow, calculate the total flow, in liters per minute using equation 11.

Calculate the total flow as follows:

$$Tflow = \frac{(Analtye - spike)*Tflow}{(Analyte - measured)}$$ (Equation 11)

Tflow = Total flow through the system in lpm

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Analyte-Spike = Concentration of Spiked Analyte (ppm)

Analyte-measured = Measurement, downstream, of spiked Analyte (ppm)

Calculate the average flow value, for the data set, using equation 10.

5.2.9   Dynamic Spiking Test run data

5.2.9.1   HCL CEMS data

For each dynamic spiking test run, calculate the average and percent relative standard deviation of the data set using equations 10 and 12, respectively.

Calculate the percent standard deviation as follows:

$$PRS_d = \frac{\left[\dfrac{\sum_{i=1}^{n} d_i^2 - \left(\dfrac{\sum_{i=1}^{n} d_i}{n} \right)^2}{n-1} \right]^{1/2}}{\bar{x}}$$
(Equation 12)

Where:

PRS_d = Percent Relative Standard Deviation of the data set

$\bar{x}$ =   Arithmetic mean

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5.2.9.2 Element of Opportunity data

For each dynamic spiking test run, calculate the average and percent relative standard deviation of the data set using equations 10 and 12, respectively. If using total flow as a means to determine the reference HCL calibration gas concentration, use equation 11 to calculate the total flow prior to determining the average and percent relative standard deviation of the data set.

5.2.10 Reference HCL concentration calculations

5.2.10.1 Element of opportunity to calculate reference HCL concentration

Equation 13 is used to calculate the reference HCL concentration for a given dynamic spiking test run.

$$\text{HCl}_{ref} = 1 - \frac{Opp - post_{avg}}{Opp - pre_{avg}} * CalGas + BaselineHCl \qquad \textbf{(Equation 13)}$$

where:

$Opp\text{-}post_{avg}$ = average reference element of opportunity value during dynamic spiking test run

$Opp\text{-}pre_{avg}$ = average reference element of opportunity value during baseline test run

$CalGas$ = HCl calibration gas concentration

Baseline HCl = CEMS HCl average baseline value

5.2.10.2 Quantitative HCL calibration gas introduction and total flow to calculate reference HCL concentration

When using the quantitative introduction of calibration gas and total system flow to calculation the reference HCL concentration for a given dynamic spiking test run, use equation 14. Equation 11 is used to calculate the total system flow.

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$$HCl_{ref} = \frac{Cflow_{avg}}{Tflow_{avg}} * CalGas + BaselineHCl \qquad \text{(Equation 14)}$$

Where:

HCl $_{ref}$ = Reference HCl value for run "X"

Cflow = Average calibration HCL gas flow rate into system (lpm)

Tflow = Average Total System Flow during run (lpm)

CalGas = HCl calibration gas concentration

Baseline HCl = CEMS HCl average baseline value

5.2.11 Linear Regression

Linear regression is used to calculate the accuracy, precision, and bias of the HCL CEMS. For each dynamic spiking test run, plot the HCL CEMS reference value, Xaxis, versus the HCL measured value, Y axis. Determine the correlation coefficient (r), the slope, and the intercept using equations 15-18.

$$\hat{y} = b_o + b_1 x \qquad \text{(Equation 15)}$$

where:

b_o =   The y intercept

b_1 =   The slope

The intercept is calculated according to the following equation:

$$b_o = \bar{y} - b_1 \bar{x} \qquad \text{(Equation 16)}$$

where:

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i$$

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$$\bar{y} = \frac{1}{n}\sum_{i=1}^{n} y_i$$

The slope of the line is calculated according to equation below:

$$b_1 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n}(x_i - \bar{x})^2} \qquad \textbf{(Equation 17)}$$

The linear correlation coefficient is calculated according to the following equation.

$$r^2 = \frac{\left(\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})\right)^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2} \qquad \textbf{(Equation 18)}$$

5.3 CRITERIA FOR ACCEPTANCE

The criteria for the HCl dynamic spiking is:

- The correlation coefficient, r, must be greater than or equal to 0.90

- The slope must be 1.0, +/- 0.15

- The Intercept must be equal to or less than 15% of the instrument span.

At a minimum, the data set must meet the correlation coefficient. If this is not met, the dynamic spiking procedure must be repeated until the correlation coefficient criteria are met. If the HCl CEMS has met the correlation coefficient requirement, but does not meet either the slope, or intercept criteria, a bias exists and a correction factor must be applied to the HCl CEMS for data collection. The equations to determine the corrected value are provided in Section 5.4. The correction factor must be applied to the HCl CEMS one-minute average data until a new dynamic spiking procedure indicates the specific bias no longer exists, or, a different correction factor (bias) is indicated.

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5.4 BIAS CORRECTION

If the HCl CEMS fails to meet both the slope and intercept criteria, the following correction factor must be applied to the one-minute average HCl data:

$$C^C = \frac{y_i - b_0}{b_1}$$ **(Equation 19)**

Where:

C^C = corrected CEMS HCL concentration

y_i = CEMS reported HCL concentration

b_0 = the intercept of the least squares linear regression line

b_1 = the slope of the least squares linear regression line

b). If the HCl CEMS fails to meet the slope criteria, but meets the intercept criteria, the following correction factor must be applied to the one-minute average HCl data:

$$C^C = \frac{y_i}{b_1}$$ **(Equation 20)**

c). If the HCl CEMS fails to meet the intercept criteria, but meets the slope criteria, the following correction factor must be applied to the one-minute average HCl data:

$$C^C = y_i - b_0$$ **(Equation 21)**

6.0 OTHER REQUIREMENTS AND INFORMATION

6.1 DATA RECORDING AND REPORTING

In general, all data and records associated with the HCl CEMS must be retained for 5 years. At a minimum, at least 2 years of data and records must be readily available at the site. The balance of the records may be retained offsite.

HCl CEMS calibration drift tests and audit results shall be reported at intervals specified in the applicable regulation.

6.2 WHAT POLLUTION PREVENTION PROCEDURES MUST I FOLLOW? [RESERVED]

6.3 WHAT REFERENCE TABLES AND FIGURES ARE RELEVANT TO PROCEDURE DD?

Table 1. Ongoing Quality Assurance/Quality Control Calibration Gas Ranges

Figure 1. Dynamic Spiking Overview

Table 1. Ongoing Quality Assurance/Quality Control Calibration Gas Ranges

Test	Units	HCl Calibration Gas Concentrations [a]		
		Zero-level	Mid-Level	High-Level
Daily Calibration Drift	% of Span	0-30	NA	50-100
Absolute Calibration Audit	% of Span	0-29	30-49	50-100
Dynamic Spiking	% of Span	0-50	25-75	50-100

[a]A copy of the supplier's certificate of analysis must be provided for each gas cylinder. Calibration gases do not need to be Protocol 1 gases. It is recommended that the calibration gases, for all QA, have a minimum tolerance of 5%.

Figure 1. Typical Dynamic Spiking Apparatus

Dynamic Spiking Apparatus

Sample Probe

Heated line inside
sample umbillical

Heated sample line

Flue Gas

•Heated Filter
• Pressure Control
•Laminar Flow
Element

Calibration Manifold
(Mass flow meters)

900-1000 ppm HCL in N2

HCL
CEMS

Gas
Conditioner

Reference
Measurement(s)
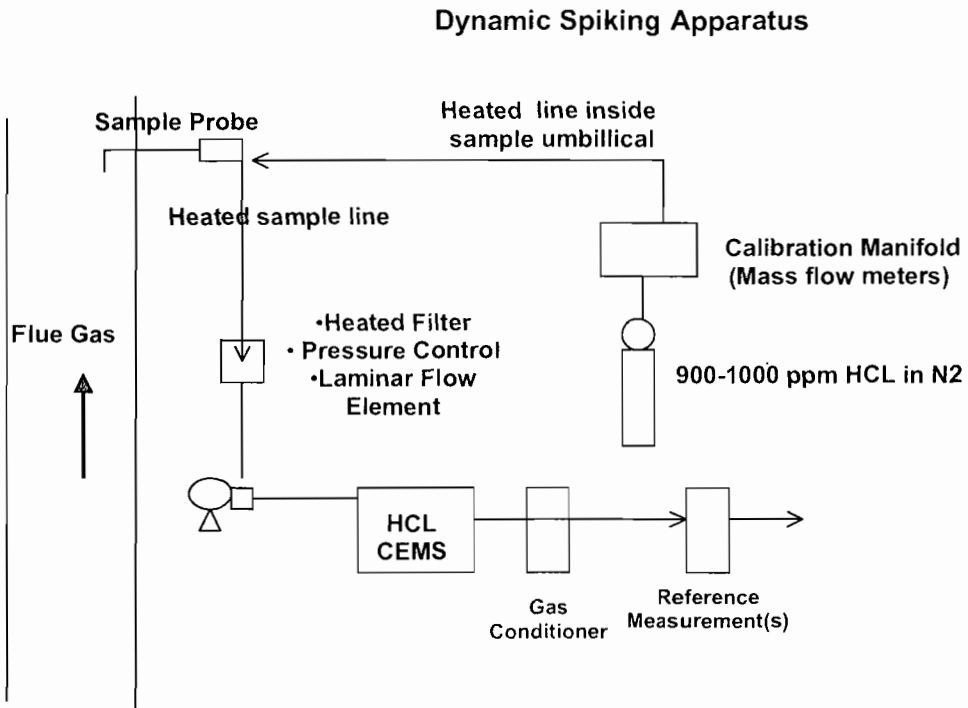
7.0 RELEVANT REFERENCES

I. Performance Specification Z: Specifications and Test Procedures for Hydrochloric Acid Continuous Emission Monitoring Systems at Stationary Sources. 2005.

II. Dynamic Spiking Protocol: Test procedure for dynamic spiking of the Eli Lilly Ecochem HCL CEMS, 2006.

APPENDIX B
EPA Other Test Method 22

PERFORMANCE SPECIFICATION Z:
SPECIFICATIONS AND TEST PROCEDURES FOR HCl CONTINUOUS EMISSION MONITORING SYSTEMS AT STATIONARY SOURCES

Lilly

Revision 2.0
October, 2006

EXECUTIVE SUMMARY

This performance specification describes the criteria that a hydrochloric acid (HCl) continuous emission monitoring system (CEMS) must meet to be considered valid for EPA compliance and/or other regulatory applications. Each HCl CEMS must meet the criteria for accuracy, stability, and instrumental response laid out in this document. In addition, each HCl CEMS must meet the installation requirements in PS-Z.

REVISION HISTORY

1.1   REVISION 1.0

This document was part of the T149 Alternative Monitoring Petition, and was approved by the Office of Air Quality and Standards in January of 2006

1.2   REVISION 2.0

This revision is an update of the original Procedure Z document, October 2006. The following are key updates in revision 2.0:

1. Recommendation that all HCL QA gases be certified with a minimum tolerance of 5%

2. Recommendation that a site specific dynamic spiking protocol be used and, the dynamic spiking protocol would contain the detailed test procedure(s).

3. Discussion for the use of quantitative introduction of the HCL calibration gas and subsequent total flow measurement as method for determining the reference HCL concentration during each test run.

4. Updated the dynamic spiking overview section for easier flow of information

5. Updated the equations to include percent relative standard deviation and the calculation for the reference HCL concentration when using quantitative introduction of the HCL calibration gas with subsequent total flow measurement.

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Table 1. Performance Specification Test Calibration Gas Ranges

Figure 1. Dynamic Spiking Overview

2.0 USING PERFORMANCE SPECIFICATION Z

2.1 WHAT IS THE PURPOSE AND APPLICABILITY OF PERFORMANCE SPECIFICATION Z?

The purpose of Performance Specification Z (PS-Z) is to establish the initial performance requirements for evaluating the acceptability of a HCl CEMS. Such applications may include, (1) instrument, method or procedure calibration, and (2) evaluation or certification for initial acceptance.

2.1.1 Application

This specification is for evaluating the acceptability of a HCl CEMS at the time of installation and during periodic quality assurance checks. PS-Z applies to you if you will be using a HCl CEMS to demonstrate compliance with a regulatory HCl or HCl/Cl_2 emission standard.

2.1.2 Measurement Capabilities

The HCl CEMS must be capable of measuring HCl concentrations in the units of the applicable standard or in units that can be converted to units of the applicable standard.

2.1.3 Other Monitoring

If your HCl CEMS is capable of reporting the HCl concentration in the units of the existing regulation, no additional monitoring is necessary. If your HCl CEMS does not report concentrations, in the units of the existing standard, then other monitoring (e.g., oxygen, temperature, and pressure) are necessary to convert the units reported by your CEMS to the units of the standard.

2.2 WHAT WILL BE DISCUSSED IN PS-Z?

PS-Z covers two basic topics: (1) the instrument requirements for an HCl CEMS and (2) the requirements that each HCl CEMS must meet during the performance specification test.

2.2.1 Instrument Requirements

The HCl CEMS must be able to accurately report concentrations of HCl in stack effluent. It may do so by extracting a representative sample (path or point sampling may be used if the sample is representative) of stack effluent and analyzing the effluent to provide an output proportional to the HCl concentration. The CEMS operating range (zero to span) should encompass the response of the HCl CEMS for all expected HCl concentrations, including the applicable emission limit. The CEMS must have a system response time that is less than or equal to two minutes. Finally, the instrument or operator must be able to perform daily calibration drift tests, quarterly calibration error tests, and annual accuracy tests.

2.2.2   Performance Specification Test

The purpose of the performance specification test is to establish the accuracy, precision, bias, and system response time of the HCl CEMS. Specifically, the following will be either tested or documented as part of the performance specification test requirements listed in Sections 3.0 and 4.0 of this document: (1) data recorder scale, (2) daily calibration drift, (3) installation and measurement location, (4) calibration drift test, (5) calibration error test, (6) system response time, (7) stratification test, (8) accuracy determination.

2.3   WHAT ARE THE INSTALLATION AND PRE-PERFORMANCE SPECIFICATION TEST REQUIREMENTS?

2.3.1   Installation Requirements

The sampling location of the HCl CEMS should be downstream of all pollution control equipment at a position where the HCl concentration is directly representative or can be corrected so as to be representative of total emissions from the stationary source. It is recommended that the sampling location be at least two equivalent diameters downstream of the nearest control devices, point of pollution generation, bend, or other point at which a change in pollutant concentration or flow disturbance may occur. The sampling location is also recommended to be at least a half equivalent diameter upstream from the exhaust or control device. The equivalent diameter is calculated according 40 CFR Part 60, Appendix A, Method 1, Section 2.1[1].

Either point or path sampling may be used. For point sampling the measurement point should be no less than 1.0 meter from the stack or duct wall or located over the centroidal area of the stack or duct cross section. For a path sampling CEMS the effective measurement path should be (1) totally within the inner area bounded by a line 1.0 meter from the stack or duct wall, or (2) have at least 70 percent of the path within the inner 50 percent of the stack diameter or duct cross section, or (3) be centrally located over any part of the centroidal area.

The sample collection and instrumental analyzer portions of your HCl CEMS may be located any distance from the sampling point provided the transmission efficiency from the sampling point to the sample collection point can be determined and meets the criteria outlined later in this performance specification. It is also recommended that the sampling probe for the HCl CEMS be located at point without stratification (section 3.1.5).

2.3.2 Reference Method Measurement Location

You must select, as appropriate, an accessible reference method (RM) measurement point at least two equivalent diameters downstream from the nearest control device, the point of pollutant generation, or other point at which a change in the pollutant concentration or emission rate may occur, and at least a half equivalent diameter upstream from the effluent exhaust or control device. When pollutant concentration changes are due solely to diluent leakage (*e.g.*, air heater leakages) and pollutants and diluents are simultaneously measured at the same location, a half diameter may be used in lieu of two equivalent diameters. The CEMS and RM locations need not be the same. If dynamic spiking is employed to determine the system accuracy, bias, and precision, the spiking of the calibration gas must encompass the sampling system of the HCL CEMS.

2.3.2.1 Reference Method Traverse Points

Select traverse points that assure acquisition of representative samples over the stack or duct cross-section. The minimum requirements are as follows: Establish a "measurement line" that passes through the centroidal area and in the direction of any expected stratification. If this line interferes with the CEMS measurements, displace the line up to 30 cm (12 in.) (or 5 percent of the equivalent diameter of the cross section, whichever is less) from the centroidal area. Locate three traverse points at 16.7, 50.0, and 83.3 percent of the measurement line. If the measurement line is longer than 2.4 meters (7.8 ft) and pollutant stratification is not expected, the three traverse points may be located on the line at 0.4, 1.2, and 2.0 meters from the stack or duct wall. This option must not be used after wet scrubbers or at points where two streams with different pollutant concentrations are combined.

Other traverse points may be selected, provided that they can be shown to the satisfaction of the Administrator to provide a representative sample over the stack or duct cross section. Conduct all necessary RM tests within 3 cm (1.2 in.) of the traverse points, but no closer than 3 cm (1.2 in.) to the stack or duct wall.

2.4 WHAT SPECIAL DEFINITIONS APPLY TO PS-Z?

Calibration Drift: The difference in the CEMS output readings from the established reference value after a stated period of operation during which no unscheduled maintenance or adjustment took place.

Calibration Error: The mean difference between the concentration indicated by the CEMS and the known concentration generated by a calibration source at three levels when the entire CEMS, including the sampling interface is challenged. A CE test is performed to document the accuracy and linearity of the CEMS over the entire measurement range.

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Centroidal Area: means a concentric area that is geometrically similar to the stack or duct cross section and is no greater than 1 percent of the stack or duct cross-sectional area.

Continuous Emission Monitoring System: means the total equipment required for the determination of a gas concentration or emission rate. The sample interface, pollutant analyzer, diluent analyzer, and data recorder are the major subsystems of the CEMS.

Correlation Coefficient: determines the extent of a linear relationship between two fields over a given period of time.

Data Recorder: The portion of the CEMS that provides a record of analyzer output, flags which indicate normal operation, and flags indicating abnormal operation. The data recorder may record other pertinent data such as effluent flow rates, and various instrument temperatures.

Diluent Analyzer: means that portion of the CEMS that senses the diluent gas (i.e. O_2) and generates an output proportional to the gas concentration.

Dynamic Spiking: a procedure used to document the accuracy, precision, and bias of the monitoring system by quantitatively spiking a certified gas into the pollutant gas stream.

High-level drift: means the absolute difference between a high-level calibration gas and the monitor response, in units of the applicable standard.

Instrument Measurement Range: The range of HCl concentrations the instrument can reliably measure from the lowest concentration to the highest.

Intercept: value of the Y variable when the X variable is equal to zero.

Linear Regression: a methodology used to find a formula that can be used to relate two variables that are linearly related.

Path Sampling CEMS: A CEMS that samples the source effluent along a path greater than 10 percent of the equivalent diameter of the stack or duct cross section.

Point Sampling CEMS: A CEMS that samples the source effluent at a single point.

Pollutant Analyzer: means that portion of the CEMS that senses the pollutant gas and generates an output proportional to the gas concentration.

Relative Accuracy (RA): means the absolute mean difference between the gas concentration or emission rate determined by the CEMS and the value determined by the Reference Method (RM), plus the 2.5 percent error confidence coefficient of a series of tests, divided by the mean of the RM tests or the applicable emission limit.

Response Time: The time interval between the start of a step change in the system input and when the pollutant analyzer output reached 95% of the final value.

Sample Interface: The portion of the CEMS used for one or more of the following: sample acquisition, sample transport, sample conditioning, or protection of the monitor from the effects of stack gas.

Slope: The rate of change of Y relative to the change in X.

Stratification: means the change in effluent concentration in a duct, over time when comparing a reference measurement (centroid of duct) to traversed sampling concentrations.

Zero drift: means the absolute difference between a high-level calibration gas and the monitor response, in units of the applicable standard.

3.0 INTERFERENCES, SAFETY, AND EQUIPMENT REQUIREMENTS

3.1 WHAT DO I NEED TO KNOW TO ENSURE THE SAFETY OF PERSONS USING PS-Z?

People using PS-Z may be exposed to hazardous material, operational hazards, and hazardous site conditions. PS-Z does not address all the safety issues associated with its use. It is your responsibility to ensure the safety of persons using PS-Z. Some helpful references may include the CEMS manual, the CEMS manufacturer, other reference methods, and on-site safety regulations.

3.2 WHAT EQUIPMENT AND SUPPLIES DO I NEED?

3.2.1 Equipment for the CEMS

1. **Sample Extraction System:** This portion of the CEMS must present a sample of source effluent to the sampling module that is directly representative or can be corrected so as to be representative of source. The sample extraction system typically consists of a sample probe and a heated umbilical line.

2. **Pressure Regulation Module:** The pressure regulation module is designed to remove both free particulates and water-soluble aerosols from the gas stream prior to analysis by the sampling module. This module also provides a sample gas to the analyzer at a constant pressure (optional).

3. **Analysis module:** The portion of the CEMS that quantitates stack gas concentrations of HCl.

4. **Diluent Module:** This portion of the CEMS quantifies stack gas concentrations of oxygen or CO_2. For systems with a multi-component analyzer, the same analyzer quantifies the concentration of all measured analytes.

5. **System Controller:** This portion of the CEMS provides control of the analyzer, sample probe, pressure regulation module and the sample interface.

6. **Data recorder:** Your HCl CEMS must be able to record HCl concentrations and instrument status signals (flags).

3.2.2 Equipment Specifications

The CEMS data recorder output range must include zero and a high-level value. The range of the data recorder and the measurement range of the HCl CEMS will be documented. The high-level value is chosen by the source owner or operator and is defined as follows:

For an HCl CEMS installed to measure controlled emissions or emissions that are in compliance with an applicable regulation, the high-level value should be at least 1.5 times the emission standard level and encompass the HCl concentration levels expected by the process.

The CEMS design should also allow the determination of calibration drift at the zero and high-level values. In special cases, the Administrator may approve a single-point calibration-drift determination.

3.3   WHAT REGENTS AND STANDARDS DO I NEED?

3.3.1   Reference Gases, Gas Cells, or Optical Filters

See Table 1 for reference gas concentration ranges.

4.0 PERFORMANCE EVALUATION PROCEDURES AND REPORTING

4.1 WHAT IS THE PURPOSE OF THE PERFORMANCE SPECIFICATION TESTS AND WHAT IS REQUIRED TO PERFORM THE TESTS?

The purpose of the performance specification tests is to determine the accuracy, precision, bias, and system response time of the HCl CEMS.

4.1.1 Pretest Preparation

Prior to the start of your initial performance specification tests, you must be sure that the HCl CEMS is installed according to the specifications laid out in this document. After installing the HCl CEMS, it is recommended you use the CEMS for a period of time to familiarize yourself with its operation. It is also recommend that you conduct daily checks of the zero and high-level drift, conduct a calibration error test, and conduct a calibration drift check to verify that the instrument is functioning properly. When you are confident that the instrument is performing satisfactorily it is time to prepare for the performance specification tests.

4.1.2 Data Recorder Scale Check

The range of the data recorder and the measurement range of the HCl CEMS will be documented. The CEMS operating range (zero to span) and the range of the data recorder should encompass both the response of the HCl CEMS for all expected HCl concentrations and the applicable emission limit.

4.1.3 Calibration Drift Check

The HCL CEMS must perform a calibration check at least once per day. Certified gases must be used to perform the zero and high-level drift checks. All data will be recorded.

4.1.4 Installation and Measurement Location Check

The installation location of the HCL CEMS must adhere to section 1.3.1 of this document. In addition, the location of any reference method testing must adhere to section 1.3.2 of this document.

4.1.5 Stratification Test

The stratification test must be conducted when the facility is operating during normal operation. The purpose of this test is to verify that excess stratification of the target pollutant does not exist at the sampling point of the monitoring system.

To determine whether effluent stratification exists, a dual probe system should be used to determine the average effluent concentration while measurements at each traverse point are being made. One probe,

located at the stack or duct centroid, is used as a stationary reference point to indicate change in the effluent concentration over time. The second probe is used for sampling at the traverse points specified in Method 1. The traverse points are sampled for five minutes at each point. You may test for stratification at the HCl CEMS sampling point by using either velocity tests as described in Method 2", HCl concentrations using Methods 26 or 26A, or an acceptable alternative (i.e. CO or Nox) A minimum of 12 sampling points will be used, with 6 sampling points along each of the two traverses.

4.1.6 Seven-day Calibration Drift Test

The seven-day calibration drift test must be conducted when the facility is operating during normal operation. The purpose of this test is to verify that the instrument operation is stable. During the calibration drift test period you must determine the magnitude of the zero calibration drift and the high-level calibration drift at least once each day. During the stability tests no adjustments or calibrations may be made to the CEMS. If periodic automatic or manual adjustments are made to the CEMS zero and high-level calibration settings, conduct the CD test immediately before these adjustments, or conduct it in such a way that the CD may also be determined.

The calibration drift will be determined at the zero and high-level value of the HCl CEMS. Introduce to the CEMS the reference gases, gas cells, or optical filters (these need not be certified) for the zero and high level values. Record the CEMS response and subtract this value from the reference value. The calibration gas concentrations are provided in Table 1.

4.1.7 Calibration Error

The HCL CEMS will be challenged three non-consecutive times with zero, mid-level, and high-level certified HCL gases (Table 1). The cylinder gases need not be EPA Protocol 1 gases. The calibration gases will be injected into the sample system as close to the sampling probe outlet as practical and will pass through all CEMS components used during normal monitoring. The difference between the instrument response and the reference value (certified gas) will be calculated after each injection and the resulting three differences will be averaged to determine the CE at each measurement point.

4.1.8 System Response Time

Introduce zero gas into the analyzer. When the system output has stabilized (no change greater than 1 percent of full scale for 30 sec), introduce an upscale calibration gas and wait for a stable value. Record the time (upscale response time) required to reach 95 percent of the final stable value. Next, reintroduce the zero gas and wait for a stable reading before recording the response time (downscale response time). Repeat the entire procedure three times and determine the mean upscale and downscale response times. The slower or longer of the two means is the system response time.

Calibration gas ranges for the response time test are provided in Table 1. If using a multi-component analyzer, the response time can be based on any analyte measured by the CEMS.

4.1.9 CEMS Accuracy

The accuracy of the HCl CEMS shall be determined by performing either a relative accuracy determination or by dynamic spiking.

4.1.9.1 Relative Accuracy (RA)

Conduct the RA test while the affected facility is operating during normal operation, or as specified in an applicable subpart. The RA test may be conducted during the CD test period.

Reference Methods (RM). Unless otherwise specified in an applicable subpart of the regulations, Methods 26 or 26A, or their approved alternatives, are the reference methods for HCl. Other reference methods for moisture, oxygen, etc. may be necessary.

Sampling Strategy for RM Tests. Conduct the RM tests in such a way that they will yield results representative of the emissions from the source and can be correlated to the CEMS data. It is preferable to conduct the diluent (if applicable), moisture (if needed), and pollutant measurements simultaneously. However, diluent and moisture measurements that are taken within an hour of the pollutant measurements may be used to calculate dry pollutant concentration and emission rates. In order to correlate the CEMS and RM data properly, note the beginning and end of each RM test period of each run (including the exact time of day) on the CEMS chart recordings or other permanent record of output. For integrated samples make a sample traverse of at least 21 minutes, sampling for an equal time at each traverse point.

Number of RM Tests. Conduct a minimum of nine sets of all necessary RM test runs.

NOTE: More than nine sets of RM tests may be performed. If this option is chosen, a maximum of three sets of the test results may be rejected so long as the total number of test results used to determine the RA is greater than or equal to nine. However, all data must be reported, including the rejected data.

Correlation of RM and CEMS Data. Correlate the CEMS and the RM test data as to the time and duration by first determining from the CEMS final output (the one used for reporting) the integrated average pollutant concentration or emission rate for each pollutant RM test period. Consider system response time, if important, and confirm that the pair of results are on a consistent moisture, temperature, and diluent concentration basis. Then, compare each integrated CEMS value against the corresponding average RM value. If the RM has an integrated sampling technique, make a direct comparison of the RM results and CEMS integrated average value.

Calculate the mean difference between the RM and CEMS values in the units of the emission standard, the standard deviation, the confidence coefficient, and the relative accuracy according to the procedures in Section 4.0.

4.1.9.2 Dynamic Spiking

Dynamic spiking can be used in lieu of the Relative Accuracy Determination as an alternative method for documenting the accuracy, precision, and bias of the HCl CEMS. This section provides an overview of a typical dynamic spiking procedure. A site specific dynamic spiking protocol, which provides detailed steps of the actual procedure, is required. Figure 1 provides an overview of a typical dynamic spiking arrangement.

While the HCl CEMS is sampling flue gas, HCl reference gas is introduced into the CEMS sample interface by using a mass flow controller (or equivalent). The target ratio of actual flue gas to the HCl reference gas is 9:1, but must be kept at a minimum ratio of 1:1. The HCl concentration is quantitated by the HCl CEMS.

Certified HCL calibration gas is spiked at a minimum of three levels (low, mid, high) through the HCL CEMS measurement range. For each test level, a minimum of 30, one minute averaged HCL values are collected. The percent relative standard deviation, for each data set, should not exceed 20%. Table 1 provides guidance on the HCL concentrations for the low, mid, and high test runs.

Several methods exist to calculate the dynamically spiked HCL concentration (represents the reference HCL concentration). Two common methods are: (1) Use of an element of opportunity and (2) Quantitative introduction of the HCL calibration gas with total flow measurement. Other methods may be used; however, a site specific protocol should document the procedure(s) used.

An element of opportunity can be used to calculate the dynamically spiked HCl concentration (represents the reference HCl concentration). The element of opportunity can either be be an analyte, which would normally be present in the flue gas at steady concentrations, or total flow through the system. Examples of prospective analytes which could be used as elements of opportunity are O_2, NOx, SO_2, CO_2, or moisture. The analyte(s) is measured using a certified reference CEMS, separate from the HCL CEMS.

Total flow through the system may also be used as an element of opportunity to calculate the dynamically spiked HCL concentration. Examples the total flow measurement are the use of a calibrated laminar flow element, or use of a tracer gas with subsequent downstream measurement (for example: hydrocarbon tracer gas with subsequent calibrated GC measurement downstream).

Regardless of the element of opportunity, it is recommended that the element of opportunity data set, for each test level (low, mid, high) have a relative percent standard deviation less than or equal to 20%.

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Quantitatively introducing the HCL calibration gas, and, measuring the total flow is another method for documenting the dilution, and subsequent theoretical value of the HCL concentration spiked for each test run. Use of this method requires documenting the quantitative introduction of HCL gas into the system; such as a method 205 procedure or similar protocol.

It is important to compensate the HCl reference concentration(s) for any background HCL present in the flue gas. The HCl concentration of the flue gas (baseline HCL) shall be determined prior to each spiking trial. The baseline HCl concentration is based upon a series of at least 10, one-minute averaged data points. Baseline data must be collected immediately prior to each test run. The data points must include the HCl concentration, element of opportunity concentration(s) and/or the total flow. A site-specific standard operating procedure for the HCL dynamic spiking is required.

Linear regression is used to establish the accuracy, precision, and bias of the HCl CEMS. The criteria for the HCl dynamic spiking are:

1.   The correlation coefficient (r) must be greater than or equal to 0.90

2.   The slope must be 1.0, +/- 0.15

3.   The Intercept must be equal to or less than 15% of the instrument span

4.2   HOW DO I REPORT THE RESULTS OF THE INITIAL PERFORMANCE SPECIFICATION TEST?

Summarize the results of the calibration drift, calibration error, response time, stratification, and accuracy tests in tabular form. Include all data sheets, calculations, and records of CEMS measurements necessary to substantiate the performance of the CEMS and any other devices or methods (e.g., method 26A). The CEMS measurements shall be reported to the agency in units of ppmv, on a dry basis.

5.0 PERFORMANCE CRITERIA AND CALCULATIONS

5.1 WHAT ARE THE PERFORMANCE CRITERIA FOR MY HCL CEMS?

You must demonstrate that your HCl CEMS has adequate precision, accuracy, system response time and data reporting capabilities to determine if your facility is in compliance with HCl emission standards or operating permit limits as specified in applicable regulations or permits. You will demonstrate this capacity by showing that your HCl CEMS meets the following performance criteria.

5.1.1 Data Recorder Scale

The measurement range of the HCL CEMS, and the data recorder scale, must encompass the expected HCL concentrations as well as the applicable emission limit.

5.1.2 Calibration Drift

The daily zero and high-level calibration drift is 5% of the instrument span. Zero and high-level calibration drifts shall be adjusted, at a minimum, whenever the 24-hour zero drift exceeds the limits of the calibration drift specification. The amount of excess zero and high-level drift measured at the 24-hour interval checks will be recorded. Section 4.2 provides the equations for calculating the zero and high-level calibration drifts.

5.1.3 Installation and Measurement Location

The installation requirements and measurement location of the HCL CEMS will meet the specifications outlined in section 3.1.1 and 3.1.2 of this document.

5.1.4 Stratification Test

The stratification in the stack or duct, at the measurement location, must be less than or equal to a 10 percent between the average concentration in the duct or stack and the concentration at any point more than 1.0 meter form the duct or stack wall. Section 4.2.2 provides the equation for calculating the stratification of the stack or duct.

5.1.5 Seven-day Calibration Drift Test Criteria

The daily zero and high-level drift each must be less than 5% of the instrument span for seven consecutive days. See Section 4.2.2 for the equations used to determine the zero and high-level drift.

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5.1.6 Calibration Error Test

The mean difference between the CEMS and the reference values, at all three test levels, must be no greater than 5% of span. See Section 4.2.3 for the equation used to determine the calibration error.

5.1.7 Response Time Test

The CEMS response time shall not exceed 2.0 min to achieve 95 percent of the final stable value. If using a multi-component analyzer, the response time can be based on any analyte measured by the CEMS.

5.1.8 Relative Accuracy

The RA of the CEMS must not be greater than 20% of the mean value of the reference method (RM) test data, or not greater than 10% in terms of the emission standard (ppmv, dry), or have an absolute difference of less than 5 ppmv between the mean reference value and the mean CEMS value. See Section 4.2.5 for the equations used to determine the relative accuracy of your CEMS.

5.1.9 Dynamic Spiking

Dynamically spiking may be used in lieu of a relative accuracy test as a means to document the accuracy, precision, and bias of the HCl CEMS.

The criteria for the HCl dynamic spiking is:

- The correlation coefficient, r, must be greater than or equal to 0.90

- The slope must be 1.0, +/- 0.15

- The Intercept must be equal to or less than 15% of the instrument span.

See Section 4.2.8 for equations to determine the linear correlation coefficient, the slope and the intercept.

At a minimum, the data set must meet the correlation coefficient. If this is not met, the dynamic spiking procedure must be repeated until the correlation coefficient criteria is met. If the HCl CEMS has met the correlation coefficient requirement, but does not meet either the slope, or intercept criteria, a bias exists and a correction factor must be applied to the HCl CEMS for data collection. The equations to determine the corrected value are provided in Section 4.2.8.1. The correction factor must be applied to the HCl CEMS one-minute average data until a new dynamic spiking procedure indicates the specific bias no longer exists, or, a different correction factor (bias) is indicated.

5.2   WHAT CALCULATIONS, EQUATIONS, AND DATA ANALYSES ARE NEEDED?

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5.2.1 Daily Upscale and Zero Drift

$$CD = (|R - A| / S) * 100 \qquad \text{(Equation 1)}$$

where:

CD $=$ Percent calibration drift (%),

R $=$ Reference value of zero or high level calibration gas introduced into the monitoring system (ppmv),

A $=$ Actual monitor response to calibration gas (ppmv),

S. $=$ Span of the instrument (ppmv).

5.2.2 Calibration Error

$$CE = |d_{avg} / S| * 100 \qquad \text{(Equation 2)}$$

where:

CE $=$ Percent calibration error (%),

d_{avg} $=$ Mean difference between CEMS response and the known reference gas (ppmv),

S $=$ Span of the monitor (ppmv).

5.2.3 Mean Difference

Calculate the arithmetic mean difference as follows:

$$d_{avg} = \frac{1}{n} \sum d_i \qquad \text{(Equation 3)}$$

where :

d_{avg} $=$ Arithmetic mean of differences

n $=$ Number of data sets

d_i $=$ difference of each data set

And

$$d_i = x_i - y_i \qquad \qquad \textbf{(Equation 4)}$$

where:

x_i =   Value at data set x

y_i =   Value at data set y

5.2.4 Relative Accuracy

The RA for the monitors will be calculated using the least restrictive of equation 6 or equation 7:

$$RA = (|d_{avg}| + |CC|) \qquad \qquad \textbf{(Equation 5)}$$

or

$$RA = ((|d_{avg}| + |CC|) / TM_{avg}) * 100 \qquad \qquad \textbf{(Equation 6)}$$

where:

RA   =   Relative accuracy, either percent or ppmv or % absolute,

d_{avg} =   Arithmetic mean of differences between value measured by the installed CEMS and the reference method,

CC   =   Confidence coefficient,

TM_{avg} =   Average value measured by the reference test method monitors.

5.2.5 Confidence Coefficient

The confidence coefficient will be calculated using equation 8:

$$CC = t_{0.975} * (S_d / (n^{\frac{1}{2}})) \qquad \qquad \textbf{(Equation 7)}$$

where:

CC   =   Confidence coefficient,

$t_{0.975}$ =   t-value obtained from Table 2.1 in Performance Specification 2, 40 CFR Part 60 Appendix B

5.2.6 Standard Deviation (of Differences)

S_d = Standard deviation of differences measured between the installed CEMS and the reference methods calculated using equation 8:

$$S_d = \left[\frac{\sum\limits_{i=1}^{n} d_i^2 - \left(\dfrac{\sum_{i=1}^{n} d_i}{n} \right)^2}{n-1} \right]^{1/2}$$ (Equation 8)

where: n = Number of values in this data set.

5.2.7 Stratification

The value, at each traverse point, is compared to the average value for all sampling points to determine the percent stratification using the following equation:

$$S = |C_i - C_{ave}| * 100\%$$ (Equation 9)

where:

S = percent stratification

C_i = concentration or velocity at sampling point i

C_{ave} = average concentration or velocity at all sampling points

5.2.8 Baseline data

5.2.8.1 HCL CEMS data

The baseline HCL concentration is measured prior to each dynamic spiking run. For each baseline HCL data set, calculate the average, in ppm, using equation 10.

Calculate the arithmetic mean of a data set as follows:

$$\bar{x} = \frac{1}{n} \sum x_i$$ (Equation 10)

where :

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$$\overline{x} \quad = \quad \text{Arithmetic mean}$$

$$n \quad , \quad = \quad \text{Number of data points}$$

$$x_i \quad = \quad \text{Value of each data point}$$

5.2.8.2 Element of Opportunity Data

The element of opportunity data set is acquired prior to each dynamic spiking test run, simultaneous to the baseline HCL concentration data set. For each element of opportunity, calculate the average value using equation 10.

5.2.8.3 Flow via dilution

When using dilution of a measured analyte (such as a hydrocarbon with subsequent GC measurement) as an indicator of total flow, calculate the total flow, in liters per minute using equation 11.

Calculate the total flow as follows:

$$\text{Tflow} = \frac{(Analtye - spike)*Tflow}{(Analyte - measured)} \qquad \textbf{(Equation 11)}$$

Tflow = Total flow through the system in lpm

Analyte-Spike = Concentration of Spiked Analyte (ppm)

Analyte-measured = Measurement, downstream, of spiked Analyte (ppm)

Calculate the average flow value, for the data set, using equation 10.

5.2.9 Dynamic Spiking Test run data

5.2.9.1 HCL CEMS data

For each dynamic spiking test run, calculate the average and percent relative standard deviation of the data set using equations 10 and 12, respectively.

Calculate the percent standard deviation as follows:

$$PRS_d = \frac{\left[\dfrac{\sum_{i=1}^{n} d_i^2 - \left(\dfrac{\sum_{i=1}^{n} d_i}{n}\right)^2}{n-1}\right]^{1/2}}{\overline{x}}$$

(Equation 12)

Where:

PRS_d = Percent Relative Standard Deviation of the data set

$\overline{x}$ = Arithmetic mean

5.2.9.2 Element of Opportunity data

For each dynamic spiking test run, calculate the average and percent relative standard deviation of the data set using equations 10 and 12, respectively. If using total flow as a means to determine the reference HCL calibration gas concentration, use equation 11 to calculate the total flow prior to determining the average and percent relative standard deviation of the data set.

5.2.10 Reference HCL concentration calculations

5.2.10.1 Element of opportunity to calculate reference HCL concentration

Equation 13 is used to calculate the reference HCL concentration for a given dynamic spiking test run.

$$HCl_{ref} = 1 - \frac{Opp - post_{avg}}{Opp - pre_{avg}} * CalGas + BaselineHCl \qquad \textbf{(Equation 13)}$$

where:

        Opp-post $_{avg}$ = average reference element of opportunity value during dynamic spiking test run

        Opp-pre $_{avg}$ = average reference element of opportunity value during baseline test run

        CalGas = HCl calibration gas concentration

        Baseline HCl = CEMS HCl average baseline value

5.2.10.2 Quantitative HCL calibration gas introduction and total flow to calculate reference HCL concentration

When using the quantitative introduction of calibration gas and total system flow to calculation the reference HCL concentration for a given dynamic spiking test run, use equation 14. Equation 11 is used to calculate the total system flow.

$$HCl_{ref} = \frac{Cflow_{avg}}{Tflow_{avg}} * CalGas + BaselineHCl \qquad \textbf{(Equation 14)}$$

Where:

        HCl $_{ref}$ = Reference HCl value for run "X"

        Cflow = Average calibration HCL gas flow rate into system (lpm)

        Tflow = Average Total System Flow during run (lpm)

        CalGas = HCl calibration gas concentration

        Baseline HCl = CEMS HCl average baseline value

5.2.11 Linear Regression

Linear regression is used to calculate the accuracy, precision, and bias of the HCL CEMS. For each dynamic spiking test run, plot the HCL CEMS reference value, X axis, versus the HCL measured value, Y axis. Determine the correlation coefficient (r), the slope, and the intercept using equations 15-18.

$$\hat{y} = b_o + b_1 x \qquad \text{(Equation 15)}$$

where:

b_o = The y intercept

b_1 = The slope

The intercept is calculated according to the following equation:

$$b_o = \bar{y} - b_1 \bar{x} \qquad \text{(Equation 16)}$$

where:

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i$$

$$\bar{y} = \frac{1}{n} \sum_{i=1}^{n} y_i$$

The slope of the line is calculated according to equation below:

$$b_1 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n}(x_i - \bar{x})^2} \qquad \text{(Equation 17)}$$

The linear correlation coefficient is calculated according to the following equation.

$$r^2 = \frac{\left(\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})\right)^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}$$

(Equation 18)

5.3   CRITERIA FOR ACCEPTANCE

The criteria for the HCl dynamic spiking is:

- ·The correlation coefficient, r, must be greater than or equal to 0.90

- The slope must be 1.0, +/- 0.15

- The Intercept must be equal to or less than 15% of the instrument span.

At a minimum, the data set must meet the correlation coefficient. If this is not met, the dynamic spiking procedure must be repeated until the correlation coefficient criteria are met. If the HCl CEMS has met the correlation coefficient requirement, but does not meet either the slope, or intercept criteria, a bias exists and a correction factor must be applied to the HCl CEMS for data collection. The equations to determine the corrected value are provided in Section 5.4. The correction factor must be applied to the HCl CEMS one-minute average data until a new dynamic spiking procedure indicates the specific bias no longer exists, or, a different correction factor (bias) is indicated.

5.4   BIAS CORRECTION

If the HCl CEMS fails to meet both the slope and intercept criteria, the following correction factor must be applied to the one-minute average HCl data:

$$C^C = \frac{y_i - b_0}{b_1}$$ **(Equation 19)**

Where:

C^C = corrected CEMS HCL concentration

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y_i = CEMS reported HCL concentration

b_0 = the intercept of the least squares linear regression line

b_1 = the slope of the least squares linear regression line

b). If the HCI CEMS fails to meet the slope criteria, but meets the intercept criteria, the following correction factor must be applied to the one-minute average HCI data:

$$C^C = \frac{y_i}{b_1}$$ **(Equation 20)**

c). If the HCI CEMS fails to meet the intercept criteria, but meets the slope criteria, the following correction factor must be applied to the one-minute average HCI data:

$$C^C = y_i - b_0$$ **(Equation 21)**

6.0   OTHER REQUIREMENTS AND INFORMATION

6.1   WHAT QUALITY CONTROL MEASURES ARE REQUIRED?

Ongoing quality control will include daily calibration drift tests, quarterly calibration error audits (absolute calibration audit), and annual accuracy test audits. Specific procedures and performance criteria are included in Procedure DD: Quality Control and Quality Assurance Requirements for Hydrochloric Acid Continuous Emission Monitoring Systems at Stationary Sources.

6.2   WHAT CALIBRATION AND STANDARDIZATION PROCEDURES MUST I PERFORM?

Refer to your CEMS owner's manual and manufacturer to determine what calibration and standardization procedures are required for your HCI CEMS.

6.3   WHAT POLLUTION PREVENTION PROCEDURES MUST I FOLLOW? [RESERVED]

Table 1. Performance Specification Test Calibration Gas Ranges

Test	Units	HCl Calibration Gas Concentrations [a]		
		Zero	Mid-Level	High-Level
Calibration Drift and Response Time Test [b]	% of Span	0-30	NA	50-100
Calibration Error Test	% of Span	0-30	30-50	50-100
Dynamic Spiking	% of Span	0-50	25-75	50-100

[a]A copy of the supplier's certificate of analysis must be provided for each gas cylinder. Calibration gases do not need to be Protocol 1 gases. It is recommended that the calibration gases, for all QA, have a minimum tolerance of 5%.

[b]If conducting the response time using a multi-component analyzer, the response time test can be based on any measured analyte.

Figure 1. Typical Dynamic Spiking Apparatus

Typical Dynamic Spiking Apparatus
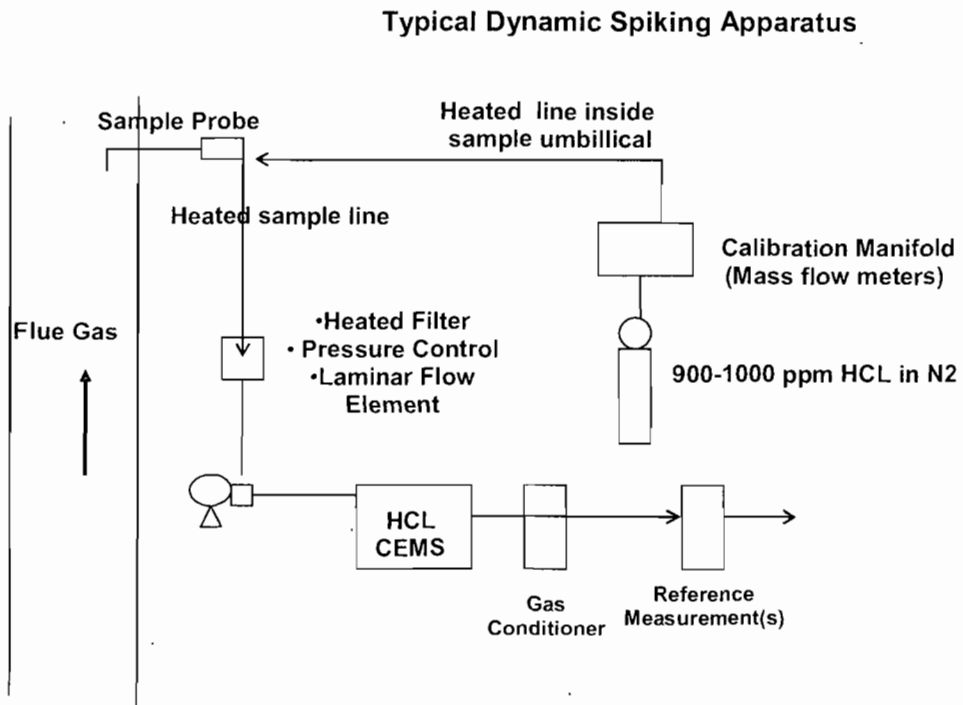
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APPENDIX C
HITRAN Calibration Method

HITRAN Calibration Method

California Analytical Instruments, Inc.

Hydrogen Fluoride Calibration Note

Background

Hydrogen Fluoride (HF) is a highly toxic gas and is very difficult to get from commercially available sources. When available the gas accuracy is very poor and not stable for long periods of time. So instead of calibrating with standard gas bottles, HF is calibrated using synthetic (or calculated) spectra. Instrument specific variables (ILS) are obtained from a gas spectrum of another gas on the instrument to be calibrated. Gas specific data comes from the HITRAN line parameter database. MALT5 is a program that calculates spectra at specific concentrations using the data above to generate spectra that looks very similar to spectra that would come out of the instrument. This spectra is then used to calibrate the instrument utilizing partial least squares.

Technical Details

MALT5 is a program for the simulation and fitting of infrared spectra, particularly targeted at gas phase FTIR spectra.

• In simulation mode, MALT calculates the transmission, absorbance or emission spectrum of a gas mixture, convolved with the instrument line shape (ILS) of the measuring instrument. The sample may consist of more than one absorbing layer with different layers having different composition, temperature and pressure (for example a multi-layer atmosphere, or mixture of absorbers contained in a sample cell plus the air-path external to the cell).
• In fitting mode, a measured spectrum is fitted by iteratively recalculating the spectrum until the mean-squared residual between the measured spectrum and calculated spectra is minimized.
Spectrum calculations are normally based on the HITRAN line parameter database; HITRAN provides a listing of the line positions, strengths, widths, pressure shifts and temperature dependences of absorption lines for a wide range of gases (see www.hitran.com). MALT calculates the "true" absorption coefficients (cross sections) for each included molecule at the desired temperature and pressure from these line parameter data, and simulates the measured spectrum by scaling and adding the absorption coefficients, converting to transmission, and convolving the transmission spectrum with the appropriate ILS. For gases for which line parameter data are not available, quantitative library reference spectra can be used as the basis for the absorption coefficients provided they have been recorded at resolution higher than that of the sample spectrum. Two good sources of suitable quantitative reference spectra are the PNNL and NIST libraries (https://secure.pnl.gov/nsd/nsd.nsf/ Welcome), see also Sharpe, S.W., T.J. Johnson, R.L. Sams, P.M. Chu, G.C. Rhoderick, and P.A. Johnson, Gas phase databases for quantitative infrared spectroscopy, Applied Spectroscopy, 58 (12), 1452-1461, 2004.
For further detail of the spectrum calculation, see Griffith, D.W.T., Synthetic calibration and quantitative

APPENDIX D
Approved Petition for Alternate HF Calibration Procedures

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

In the matter of:)   Permit No.: 0010131-001-AC
)
Gainesville Renewable Energy Center, LLC   )
Woody Biomass Power Plant   )
)
Petitioner   )   File No.: 12-B-AP

ORDER ON REQUEST
FOR
ALTERNATE PROCEDURES AND REQUIREMENTS

Pursuant to Rule 62-297.620, Florida Administrative Code (F.A.C.), Trace Environmental Systems, Inc. (Petitioner), a Continuous Emissions Monitoring System (CEMS) subcontractor representing Gainesville Renewable Energy Center (GREC), LLC has petitioned for approval of an alternate sampling procedure for calibration of the Hydrogen Fluoride (HF) parameter of the CEMS. Petitioner has requested approval to allow HF parameters calibrated using synthetic spectra in lieu of calibrating with cylinder gas bottles as specified in GREC's Air Construction Permit No. 0010131-001-AC.

Having considered Petitioner's written request and all supporting documentation, the following Findings of Fact, Conclusions of Law, and Order are entered:

FINDINGS OF FACT

1. On December 14, 2011 the Department of Environmental Protection (Department) received Petitioner's request for approval of an alternative sampling procedure to satisfy the requirements in their Air Construction Permit No. 0010131-001-AC. According to the Petitioner's permit the HF CEMS shall be certified pursuant to 40 CFR 60, Appendix B, Performance Specification 15, EPA Method OTM 22 or alternative specifications approved by the Department. Quality assurance procedures shall conform to the requirements of 40 CFR 60, Appendix F, EPA Method OTM 23 or alternative procedures approved by the Department. The RATA tests required for the HF monitor shall be performed using EPA Method 26 or 26A as detailed in Appendix A of 40 CFR 60 or by Method 320 as detailed in Appendix A of 40 CFR 63. The HF monitor span values shall be set, considering the allowable methods of operation and corresponding emission standards. Approval of specific initial performance specifications and quality assurance and control procedures must be provided to the Department prior to installation and operation of the CEM system.

2. HF is a highly toxic gas and is very difficult to acquire low concentrations from commercially available sources. When cylinder gas bottles are available the gas accuracy is poor and not stable for long periods of time, typically less than six months. Therefore, due to safety hazards and the fact that HF is unstable California Analytical Instruments (CAI) does not recommend the use of calibration gases for the HF parameter.

3. The Department acknowledges CAI's concern over the highly toxic nature of the HF cylinder gas bottles and the availability of the calibration gas. Vendor provided cylinder gas bottles are not NIST Standard as specified in Performance Specification 15, but the HF parameters can be calibrated with calibration gases measured with a NIST traceable method which would qualify as best available technology.

4. The Department recognizes HF is highly reactive and quality assurance activities are a challenge. Although, without the cylinder gas challenge specified in GREC's permit the Department does not have reasonable assurance the sample has gone from probe to instrument cell without reactivity loss along the umbilical line. The cylinder gas challenge calibrates the analyzer within a range that typically mimics the facility's emissions during normal operation, including startup, shutdown and malfunctions. For GREC the range on the HF parameter has been designated at 50 parts per million (ppm) which is the lowest gas concentration vendors can provide. To calibrate CAI's CEMS, the span of the instrument would be set below the designated range and therefore cylinder gas bottles required to calibrate this instrument setting would be below 50 ppm. Increasing the range on the instrument to accurately calibrate the high span would not benefit the facility or regulators, therefore HF cylinder gases are unattainable for such low emitting facilities.

5. GREC will be performing an initial relative accuracy test audit (RATA) on the CAI's FTIR monitor upon unit startup. This test audit compares emission data from the facility's analyzer to an independent analyzer measuring the same parameters. This initial accuracy test should provide the Department assurance the facility's HF parameter is accurately recording emission data.

6. Trace Environmental Systems, Inc. informed the Department GREC will be measuring both HCl and HF independently, using an FTIR analyzer from CAI. CAI indicated their method for calibrating the HF analyzer does not involve the direct reading of calibration gases as specified in the facility's permit but instead is determined analytically (calculated spectra).

7. Instrument specific variables are obtained from a gas spectrum of another gas (HCl) to be calibrated on the instrument. Gas specific HF data comes from the HITRAN line parameter database. MALT5 is a program that calculates spectra at specific concentrations using data to generate spectra that looks very similar to spectra that the instrument would produce. This spectra is then used to calibrate the instrument utilizing partial least squares.

8. MALT5 is a program for the simulation and fitting of infrared spectra. In the simulation mode, MALT calculates the transmission, absorbance or emission spectrum of a gas mixture, convolved with the instrument line shape of the measuring instrument. In the fitting mode, a measured spectrum is fitted by iteratively recalculating the spectrum until the mean-squared residual between the measured spectrum and calculated spectra is minimized. Spectrum calculations are normally based on the HITRAN line parameter database. For gases for which line parameter data are not available, quantitative library reference spectra can be used as the basis for the absorption coefficients. Two sources of suitable quantitative reference spectra are the PNNL and NIST libraries.

9. CAI provided a white paper which explains the calibration method of the FTIR analyzer being used for the HF parameter.

CONCLUSIONS OF LAW

1. The Department has jurisdiction to consider Petitioner's request pursuant to Section 403.061, Florida Statutes (F.S.), and Rule 62-297.620, F.A.C.

2. Petitioner has provided reasonable assurance that the MALT5 alternate sampling procedure is necessary and will provide reasonable assurance of compliance with applicable requirements of Gainesville Renewable Energy Center, LLC's Air Construction Permit sited above. The Department's conclusion is based upon review and knowledge of instrumental analysis, discussion with EPA's Emission Measurement Center (EMC), and professional experience.

ORDER

Having considered Petitioner's written request and supporting documentation, it is hereby ordered that:

1. Petitioner may use the MALT5 method as described in CAI's white paper for calibrating the HF parameter to comply with the quality assurance and quality control procedural requirements specified in GREC's permit.

2. This Order shall not abrogate Petitioner's obligation to comply with any periodic monitoring requirements established pursuant to the provisions of the Federal Clean Air Act (42 USC 1857, et seq) as amended in 1990.

3. The Petitioner shall incorporate this order into the permit at the next opening for revision or renewal. The approved alternate procedure must be identified in the public notice for the permitting action.

4. If an application to incorporate this order into the permit at the next opening for revision or renewal is not made, this order shall expire on January 27, 2017.

5. When incorporated into the permit, this order shall remain in effect until the underlying rule requirement for this order is modified or changed. At that time the Petitioner shall submit a new request, if required, in accordance with Rule 62-297.620, F.A.C., "Exceptions and Approval of Alternate Procedures and Requirements," to the Office of Permitting and Compliance.

PETITION FOR ADMINISTRATIVE REVIEW

The Department's Proposed Agency Action will become final upon expiration of the petition period described below unless a timely petition for an Administrative Hearing is filed pursuant to Sections 120.569 and 120.57 F.S., before the deadline for filing a petition. The procedures for petitioning for a hearing are set forth below.

. A person whose substantial interests are affected by the Proposed Agency Action may petition for an Administrative Proceeding (hearing) under Sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida, 32399-3000. Petitions filed by the permit applicant or any of the parties listed below must be filed within 21 days of receipt of this Notice of Intent. Petitions filed by any persons other than those

entitled to written notice under Section 120.60(3) of the Florida Statutes must be filed within 21 days of publication of the Public Notice or within 21 days of receipt of this notice, whichever occurs first. Under Section 120.60(3), however, any person who asked the Department for Notice of Agency Action may file a petition within 21 days of receipt of that notice, regardless of the date of publication. A petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an Administrative Determination (hearing) under Sections 120.569 and 120.57 F.S., or to intervene in this proceeding and participate as a party to it. Any subsequent intervention will be only at the approval of the presiding officer upon the filing of a Motion in Compliance with Rule 28-106.205 of the Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

(a) The name and address of each agency affected and each agency's file or identification number, if known;

(b) The name, address, and telephone number of the petitioner, the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the agency determination;

(c) A statement of how and when petitioner received notice of the agency action or proposed action; .

(d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;

(e) A concise statement of the ultimate facts alleged, including the specific facts the petitioner contends warrant reversal or modification of the agency's proposed action;

(f) A statement of the specific rules or statutes the petitioner contends require reversal or modification of the agency's proposed action; and

(g) A statement of the relief sought by the petitioner, stating precisely the action petitioner wishes the agency to take with respect to the agency's proposed action.

A petition that does not dispute the material facts upon which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301

Because the Administrative Hearing process is designed to formulate Final Agency Action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation is not available in this proceeding.

NOTICE OF APPEAL RIGHTS

Any party to this order has the right to seek judicial review of it under Section 120.68 of the Florida Statutes, by filing a notice of appeal under Rule 9.110 of the Florida rules of Appellate Procedure with the clerk of the Department of Environmental Protection in the Office of General Counsel, Mail

Station 35, 3900 Commonwealth Boulevard, Tallahassee, Florida, 32399-3000, and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice must be filed within 30 days after this order is filed with the clerk of the Department.

DONE AND ORDERED this _____ day of _____, 2012 in Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Jeffery F. Koerner, P.E.
Program Administrator
Office of Permitting and Compliance
Division of Air Resource Management
Mail Station 5505
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400
(850) 717-9000

Clerk Stamp

FILING AND ACKNOWLEDGMENT
FILED, on this date, pursuant to §120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

_____   _____
(Clerk)   (Date)

APPENDIX E
FDEP Recertification and Diagnostic Test Policy

Section A:

Recertification and Diagnostic Test Policy for Dry-Extractive CEMS					
Description of Event	Event	RATA	Calibration	Submit	Comments
Permanently replace NOx, SO2, O2, or CO2 analyzer with like kind analyzer.	R	X	X	X	Permanent replace of an analyzer is a recertification event, and thus all tests are required.
Permanently replace NOx, SO2, O2, or CO2 analyzer with new analyzer that is not a like-kind analyzer.	R	X	X	X	Permanent replace of an analyzer is a recertification event, and thus all tests are required.
Replace or repair any of the following components:					
Photomultiplier	D		X	A	
Lamp	D		X	A	
Internal analyzer particulate filter	D		X	A	
Analyzer vacuum pump	D		X	A	For repair or replacement of major components not listed here (e.g., major components of new technologies or monitoring technology not addressed in this policy), contact FDEP for a case-by-case determination.
Capillary tube	D		X	A	
Ozone generator	D		X	A	
Reaction chamber	D		X	A	
NO2 converter	D		X	A	
Ozonator dryer	D		X	A	
Sample Cell	D		X	A	
Optical filters	D		X	A	
Replace or repair circuit board	D		X	A	
Replace, repair or perform routine maintenance on a minor analyzer component, including, but not limited to:					
PMT base	D		X		For repair or replacement of other minor components that are not listed here perform a diagnostic calibration error test. We recommend that each facility develop its own list of major and minor components and document this list within their QA/QC plan. If there is any uncertainty whether a component is major or minor, contact FDEP for a case-by-case determination.
O-rings	D		X		
Optical windows	D		X		
High voltage power supply	D		X		
Zero air scrubber	D		X		
Thermistor	D		X		
Reaction chamber heater	D		X		
Photomultiplier cooler	D		X		
Photomultiplier cooler fins	D		X		
DC power supply	D		X		

Recertification and Diagnostic Test Policy for Dry-Extractive CEMS					
Description of Event	Event	RATA	Calibration	Submit	**Comments**
Valve	D		X		
Display	D		X		
Replace or repair signal wiring in CEMS shelter	D		X		
Replace or repair sample tubing in CEMS shelter	D		X		Recommends performing both a pressure and vacuum leak check.
Replace or repair vacuum pump or pressure pump (not the analyzer pumps)			X		Recommends that a leak check be performed also.
Replace or repair moisture removal system (chiller)			X		Recommends performing both a pressure and vacuum leak check.
Replace CEMS probe (same probe length and location)	D		X		Recommends performing both a pressure and vacuum leak check.
Change probe length and/or location	R	X	X	X	A probe location change is a recertification event.
Routine probe filter maintenance (e.g. clean or replace coarse filter).	D		X		
Permanently replace umbilical line.	D	X	X	X	Recommends performing both a pressure and vacuum leak check. Bias may be introduced into the system when an umbilical line is replace, a RATA is therefore necessary.
Replace probe heater or sample line heaters	D		X		
Change from extractive CEMS to in-situ CEMS	R	X	X	X	Permanent replacement of the system is a recertification event, thus all tests are required.
Change from extractive CEMS to dilution CEMS	R	X	X	X	Permanent replacement of the system is a recertification event, thus all tests are required

"R" means recertification event and "D" means diagnostic test event.
"X" means that this test is required, or notification must be submitted
"A" means that the facility need not submit notification to the Department, but instead should document such repairs or replacements and keep such documentation on site in a form suitable for inspection.

Diagnostic Test Policy for DAHS						
Description of Event	Event	Formula	RATA	Calibration	Submit	**Comments**
Replace entire DAHS (i.e. different vendor).	D	X		X	X	
Upgrade DAHS using existing hardware, same equations and algorithms to calculate emissions data	D	X			X	(3)
Change or insert new temperature, pressure, or molecular weight correction algorithms[4] in DAHS, for dilution systems.	D		X	X	X	DEP recommends these types of changes be made immediately prior to the RATAs for affected systems
Change or insert mathematical algorithm[4] in DAHS, for correcting measured NO concentration to total NOx	D		X	X	X	DEP recommends these types of changes be made immediately prior to the RATAs for affected systems

"R" means recertification event and "D" means diagnostic test event.
"X" means that this test is required or that notification must be submitted.
(3) Perform a formula verification and missing data routine verification (if missing data is used): Emission and heat input rate formulas must be verified at each unit or stack location. The results of these checks must be kept on-site in a format suitable for inspection.
(4) Contact DEP to discuss the appropriate diagnostic tests if other types of mathematical algorithms are changed or inserted in the DAHS.

APPENDIX F
Relative Accuracy Test Audit Protocol