(Adopted May 14, 1999)(Amended May 4, 2012)

RULE 218.1 CONTINUOUS EMISSION MONITORING PERFORMANCE SPECIFICATIONS

(a) Definitions

(1) ANALYZER - the part of the continuous emission monitoring system (CEMS) that analyzes the appropriate gaseous constituents of the conditioned gaseous sample or measures stack gas volumetric flow and fuel flow rates, as applicable.

(A) Contaminant Analyzer - the part of the CEMS that detects the air contaminant concentrations and represents those concentrations in a signal output.

(B) Diluent Analyzer - the part of the CEMS that detects oxygen, carbon dioxide or other diluent gas concentrations as represents those concentrations in a signal output.

(C) Fuel Flowmeter - the part of the CEMS that detects the parameters of all essential measurement sub-systems (e.g., temperature, pressure, differential pressure, frequency, gas density, gas composition, heating value) and generates signal outputs which are a function of the fuel flow rate and all essential measurement sub-system parameters.

(D) Stack Flowmeter - the part of the CEMS that detects the parameters from all essential measurement sub-systems (e.g., temperature, static and atmospheric pressure, gas density, gas composition, molecular weight, gas moisture content) and generates signal outputs which are a function of the stack gas volumetric flow rate and all essential measurement sub-system parameters.

(2) CALIBRATION - a procedure performed to ensure that the CEMS accurately measures and records the concentration of the specific air contaminant or diluent gas, flow rate and other parameters necessary to generate the required data, as evidenced by calibration checks and achieved by periodic manual or automatic adjustment.

(3) CALIBRATION CHECK - a procedure performed to determine CEMS response to a given gaseous compound concentration by means of

injecting a certified calibration gas mixture into the CEMS as close to the probe tip as practical.

(4) CALIBRATION DRIFT (CD) - change in the CEMS output or response over a specific period of normal continuous operation when the air contaminant or diluent gas concentration at the time of the measurements is the same known upscale value. CD is expressed as the sum of the absolute value of the mean difference and the absolute value of the confidence coefficient of a series of tests, to the full span range, expressed as a percentage as follows:

$$CD = \frac{\left|\bar{d}\right| + \left|CC\right|}{FSR} \times 100$$

Where:

FSR = Full span range

$\left|CC\right|$ = Absolute value of the 95% confidence coefficient

$\left|\bar{d}\right|$ = Absolute value of the mean difference. The mean difference, $\bar{d}$, is calculated as:

$$\bar{d} = \frac{1}{n}\sum_{i=1}^{n} d_i$$

Where:

$\sum_{i=1}^{n} d_i$ = Algebraic sum of the individual differences d_i

n = Number of data points

d_i = The difference between the paired response values of the monitoring system

(5) CALIBRATION ERROR (CE)

(A) CALIBRATION ERROR, as applicable to Section (c), "Standards for Existing CEMS" - the ratio of the difference between the air contaminant or diluent gas concentration indicated by the CEMS and the known concentration of the calibration gas, to the known concentration of the calibration gas. CE is calculated as the ratio of the sum of the absolute values of the mean difference and the 95

percent confidence coefficient of a series of tests, to the gas concentration, expressed as a percentage, as follows:

$$CE = \frac{\left|\bar{d}\right| + \left|CC\right|}{C} \times 100$$

Where:

C = Calibration gas concentration

$\left|CC\right|$ = Absolute value of the 95% confidence coefficient

$\left|\bar{d}\right|$ = Absolute value of the mean difference. The mean difference is calculated as:

$$\bar{d} = \frac{1}{n}\sum_{i=1}^{n} d_i$$

Where:

$\sum_{i=1}^{n} d_i$ = Algebraic sum of the individual differences d_i

n = Number of data pairs

d_i = The difference between the paired monitoring system response value and the known gas concentration or the equivalent rating of the reference method value, both in units of the applicable standard

(B) CALIBRATION ERROR, as applicable to Section (b), "Standards for New or Modified CEMS" - the ratio of the absolute value of the difference between the air contaminant or diluent gas concentration indicated by the CEMS and the known concentration of the calibration gas, to the full span range, expressed as a percentage, as follows.

$$CE = \frac{\left|C - A\right|}{FSR} \times 100$$

Where:

C = Calibration gas concentration

A = Actual response or the concentration indicated by the monitoring system

FSR = Full span range of the instrument

(6) CEMS AVAILABILITY PERCENTAGE - a percentage calculated as the ratio of the total unit operating hours for which the CEMS provided quality-assured data, to the source total unit operating hours during a specified period, excluding periods of calibration, maintenance, repair, or audit**,** up to a maximum of 40 hours per month.

(7) CERTIFIED CEMS - a CEMS installed, tested, operated, maintained, and calibrated according to the applicable requirements of Rules 218 and 218.1; that has met the applicable performance specifications of Rule 218.1 and, has received written approval and conditions thereto applying, from the Executive Officer.

(8) CERTIFIED GAS MIXTURE - a gas mixture manufactured, analyzed and certified in accordance with the "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards" - EPA-600/R97/121, September 1997 Revision (EPA Traceability Protocol) or any subsequent version published by EPA. This definition incorporates by reference EPA Protocol.

(9) CONFIDENCE COEFFICIENT (CC) - the 2.5 percent error confidence coefficient for the 95 percent confidence interval of a series of tests. The CC is calculated as follows:

$$CC = t_{0.975}\frac{S_d}{\sqrt{n}}$$

Where:

S_d = Standard deviation

n = Number of data in a series of tests

$t_{0.975}$ = t-value (see Table of t-Values below)

Table of t-Values*

n	$t_{0.975}$	n	$t_{0.975}$	n	$t_{0.975}$
2	12.706	7	2.447	12	2.201
3	4.303	8	2.365	13	2.179
4	3.182	9	2.306	14	2.160
5	2.776	10	2.262	15	2.145
6	2.571	11	2.228	16	2.131

* The t-values in this table are already corrected for n-1 degrees of freedom. Use n equal to the number of data points.

(10) CONTINUOUS EMISSION MONITORING SYSTEM (CEMS) - the total combined equipment and systems required to continuously determine air contaminants and diluent gas concentrations and/or mass emission rate of a source effluent (as applicable). The CEMS consists of three major subsystems: sampling interface, analyzer and data acquisition system.

(11) CONTINUOUS MONITORING - a monitoring in which a minimum of one measurement (e.g., concentration, mass emission, flow rate) is taken and recorded each minute.

(12) DATA ACQUISITION SYSTEM (DAS) - the part of the CEMS that processes data generated by the analyzer and records the results, thus creating a permanent record of the output signal in terms of concentration, flow rate, and any other applicable parameter necessary to generate the required data in units of applicable standard. The DAS consists of all equipment such as a computer required to convert the original recorded values to any values required for reporting.

(13) DILUENT GAS - a gas present in a calibration gas mixture or in source emissions that is present in quantities significantly larger than the air contaminant.

(14) FULL SPAN RANGE - the full range of values or data display output that a monitor component is calibrated to measure.

(15**)** LINEARITY ERROR (LE) - the percentage error in linearity expressed in terms of the ratio of the absolute value of the difference between the reference value and the mean CEMS response value, to the reference value. LE is calculated as follows:

$$LE = \frac{\left|R - \overline{C}\right|}{R} \times 100$$

Where:

$\overline{C}$ = Mean of the CEMS response values

R = Certified gas concentration as reference value

(16) MODIFICATION REQUIRING RECERTIFICATION - any change to the basic equipment, control equipment, contaminant concentration, interfering substances, or CEMS that is deemed by the Executive Officer

to have a potential for adversely affecting the ability of the CEMS to provide accurate, precise and timely data representative of the stack emissions for which the CEMS (or SCEMS) is required.

(17) NINETY-FIVE PERCENT CONFIDENCE INTERVAL - the statistical estimation denoting a range of values which is expected to include a true value with a 95 percent probability.

(18) OPERATIONAL PERIOD - a minimum period of 168 continuous hours during which the CEMS shall operate, according to the manufacturer's written performance and equipment specifications, without unscheduled maintenance, repair, or adjustment.

(19) QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PLAN - a written document in which the specific procedures for the operation, calibration and maintenance of a certified CEMS are described in detail, including additional quality assurance assessments and the corrective action system. The purpose of this plan is to ensure that the CEMS generates, collects and reports valid data that is precise, accurate, complete, and of a quality that meets the requirements, performance specifications, and standards of Rules 218 and 218.1.

(20) REFERENCE METHOD (RM) - the official test method employed by the District to determine compliance with the rules or permit conditions. A list of reference methods is identified in Table 1.

(21) RELATIVE ACCURACY (RA) - the absolute mean difference between the gas concentration or emission rate determined by the CEMS and the value determined by the RM plus 2.5 percent error of confidence coefficient of a series of tests, divided by the mean of the RM tests.

(22) RELATIVE ACCURACY AUDIT (RAA) - the RA test expressed in terms of the ratio of the relative difference between the mean reference method value and the mean CEMS response value, to the mean value determined by the reference method or applicable standard for concentration, flow or mass emission rate. Unless otherwise specified, RAA shall have the same specifications and requirements as the Relative Accuracy Test Audit (RATA), except that the RAA shall require a minimum of three data sets. When a rule requires a correction of the air contaminant concentration to a specific O_2 or CO_2 concentration, the RA requirement shall apply to the corrected concentration value. The RA of a RAA data set is calculated and expressed as a percentage as follows:

$$RA = \frac{\bar{r} - \overline{RM}}{\overline{RM}} \times 100$$

Where:

$\overline{RM}$ = Mean of the values determined by the reference method or applicable standard

$\bar{r}$ = Mean of the CEMS response values

(23) RELATIVE ACCURACY TEST AUDIT (RATA) - the RA test expressed in terms of the ratio of the sum of the absolute mean difference between the CEMS-generated data and the value determined by the applicable reference method or applicable standard and the absolute confidence coefficient, to the mean of the reference method or applicable standard value for concentration, flow or mass emission rate. When a rule requires a correction of the air contaminant concentration to a specific O_2 or CO_2 concentration, the relative accuracy requirement shall apply to the corrected concentration value. The RA of a RATA data set is calculated and expressed as a percentage as follows:

$$RA = \frac{\left|\bar{d}\right| + \left|\overline{CC}\right|}{\overline{RM}} \times 100$$

Where:

$\left|\bar{d}\right|$ = Absolute value of the mean difference

$|CC|$ = Absolute value of the 95% confidence coefficient

$\overline{RM}$ = Average RM value or applicable standard

The arithmetic mean of the difference, d, of a set of data is calculated as follows:

$$\bar{d} = \frac{1}{n}\sum_{i=1}^{n} d_i$$

Where:

$\sum_{i=1}^{n} d_i$ = Algebraic sum of the individual differences d_i

d_i = The difference between the reference method value and CEMS value, both in units of the applicable standard

n = Number of data points

(24) RESPONSE TIME - the time interval from a step change in the air contaminant or gas diluent concentration to the time when 95 percent of the corresponding final value is reached as displayed on the CEMS data recorder or acquisition system. The response time is determined by introducing a certified gas mixture into the CEMS upstream of the sampling interface and as close to the probe inlet as practicable.

(25) ROUTINE MAINTENANCE - preventive evaluation and repair (if necessary) of CEMS performed at specified intervals to preclude system failure. Routine maintenance may be performed as recommended by the manufacturer or a documented standard operating procedure determined through operating experience and approved by the Executive Officer. Repairs to a malfunctioning system are excluded from this definition.

(26) SAMPLING INTERFACE - that part of the CEMS that performs sample acquisition using one or more of the following operations: extraction, physical/chemical separation, transportation or conditioning of a representative sample from a designated source.

(27) SEMI-CONTINUOUS EMISSION MONITORING SYSTEM (SCEMS) - the total combined equipment and systems required to semi-continuously determine air contaminants and diluent gas concentrations and/or mass emission rate of a source effluent (as applicable). The SCEMS consists of three major subsystems: sampling interface, analyzer and data acquisition system. This class of monitoring includes but is not limited to gas chromatography, integrated sensitized tape analyzer, other sample integration based technologies, and time-shared CEMS.

(28) SYSTEM BIAS - the difference between the gas concentrations exhibited by the CEMS when a calibration gas is introduced at a location upstream of the sampling interface, and as close to the sampling probe inlet as practicable, and when the same calibration gas is introduced directly to the analyzer.

(29) SYSTEM FAILURE - inability of the CEMS to meet the requirements of Rule 218.1.

(30) TIME-SHARING - a monitoring technique where an analyzer and possibly the associated sample conditioning system is used on more than one source.

(31) ZERO CHECK- a procedure performed to determine the response of the CEMS to a given zero gas standard by means of injecting the zero gas into the CEMS as close to the probe tip as practical.

(32) ZERO DRIFT (ZD) is the change in the monitoring system output/response over a stated period of time of normal continuous operation when the air contaminant or diluent gas concentration at the time of the measurements is zero. The values for ZD shall be expressed as the ratio of the sum of the absolute value of the mean of the difference between paired instrument response values and the absolute value of the CC, to the full span range, calculated as a percentage as follows:

$$ZD = \frac{\left|\bar{d}\right| + \left|CC\right|}{S} \times 100$$

Where:

S = Full span range

$|CC|$ = Absolute value of the confidence coefficient

$\left|\bar{d}\right|$ = Absolute value of the mean difference. The mean difference is calculated as:

$$\left|\bar{d}\right| = \frac{1}{n}\sum_{i=1}^{n} d_i$$

Where:

$\sum_{i=1}^{n} d_i$ = Algebraic sum of the individual differences d_i

n = Number of data pairs

d_i = The difference between a pair of instrument response values

(33) ZERO GAS - a gas containing less than a specified amount of the contaminant or diluent gas which, when periodically injected into the CEMS, is used to check CEMS' response to the absence of the air contaminant or diluent gas.

(b) Standards for New or Modified CEMS

In order to be a Certified CEMS, a CEMS subject to the provisions of Rule 218 Sections (c)(1), (d)(1)(C), (d)(1)(D)(i), (d)(2)(C) and (d)(2)(D), as applicable, shall meet the operational requirements, performance specifications, and standards as follows:

(1) Pre-Certification Testing Requirements for New or Modified CEMS Before any certification or relative accuracy test is performed, the CEMS shall meet the following standards:

(A) CEMS Location

The CEMS shall be installed at a location that enables measurements of air contaminant and diluent gas concentration, and flow rates can be made which are representative of the stack emissions of the source.

(B) Sampling Location

The monitoring system sampling probe tip and the reference method sampling port locations shall be determined according to District Method 1.1. The monitoring sampling probe shall be located where a sample may be obtained which is representative of the source emissions. Each probe shall not interfere with the other when in use. Other locations may be chosen subject to a written approval of the Executive Officer. If an alternate location is chosen which does not conform with District Method 1.1, the absence of flow disturbance shall be demonstrated using the District method in the source Test Manual, Chapter X, Section 1.4 - "Alternative Site Selection Method", or 40 CFR, Part 60, Appendix A, Method 1, Section 2.5 - "Alternative Measurement Site Selection Procedure", and, the absence of stratification shall be demonstrated using the District method in the source Test Manual, Chapter X, Section 13 - "Determination of Gaseous Constituent Stratification". Alternatives to sampling site selection in the presence of stratification are presented in Rule 218.1(b)(3)(C)(ii).

(C) Full Span Range (FSR)

(i) The FSR for mass emission rate, air contaminant, diluent and flow analyzers shall be set such that all data points are within 10 to 95 percent of the range.

(ii) For air contaminant monitors, the FSR shall be set between 150 and 200 percent of the concentration limit as specified in the applicable rule or permit condition. The FSR may be set at a value other than that specified, but no lower than 120 percent, provided that the CEMS owner or operator

demonstrates to the satisfaction of the Executive Officer that the FSR will not be exceeded. Such demonstrations may include, but not limited to, historical emissions data, historical process information, and historical operational information. A written approval from the Executive Officer shall be obtained before the FSR may be modified outside of the 150 to 200 percent of the concentration limit.

(iii) For air contaminant monitors, a multiple-span-range may be required to satisfy the provisions of Sections C(i) and (ii) above in situations where the normal concentration of the air contaminant emitted is significantly less than the allowable concentration limit. The CEMS shall have the capability to automatically change from one range to the other as appropriate to the monitor's measured concentration.

(iv) For diluent monitors, the FSR shall be set such that the full range of oxygen and carbon dioxide concentrations can be measured. The FSR shall be set at 25.0 percent O_2 (maximum) and 1.0 percent CO_2 (minimum) concentrations, or at a value approved by the Executive Officer.

(v) Should any data points fall below 10 percent of the FSR, those data points shall be reported according the following, as applicable:

(I) For CEMS with certified multiple span ranges, the owner shall report data that falls below 10.0 percent of the higher FSR and above 95 percent of the lower FSR, at the 10.0 percent value of the higher FSR,

(II) In the event that any of the data points gathered by the CEMS fall below 10.0 percent of the FSR, the owner or operator may elect to report the contaminant concentrations at the 10.0 percent FSR value, or,

(III) In the event that any data points gathered fall below 10.0 percent of the lowest vendor guaranteed FSR for that CEMS (defined as the lowest FSR that the

vendor guarantees to be capable of meeting all current certification requirements of Rule 218 and Rule 218.1, as applicable) the owner or operator may elect to use the following to measure and report contaminant concentrations:

(a) Report data at 10.0 percent FSR value, or,

(b) Report data at actual measured value, provided that the CEMS meets the Supplemental and Alternative Performance Requirements in Attachment A.

(vi) Should any data points fall above 95 percent of FSR, the value shall be invalid for quantification and the CEMS shall be considered unavailable for the purposes of determining CEMS availability percentage. All excursions above 95 percent of FSR and the duration of these excursions shall be reported in the CEMS summary report as prescribed under Rule 218(f).

(D) Strip Chart Recorder

(i) For CEMS where the strip chart recorder is used as the only means of data recording, the strip chart shall have a minimum width of at least 10 inches, a readability of 0.5% of the span, and a minimum of 100 chart divisions.

(ii) For CEMS where the strip chart recorder is used as a back-up system or for recording data from only a single parameter, a strip chart of lesser size than specified in Section (D)(i) above, may be proposed in the application.

(iii) For CEMS equipped with multiple-span ranges, the chart recorder shall have the capability to automatically change span, as appropriate.

(E) Data Acquisition System (DAS)

(i) The DAS shall maintain all recorded data in accordance with Rule 218, Section (e).

(ii) For CEMS, DAS shall acquire data from monitored parameters at least once every minute.

(iii) For SCEMS, DAS shall acquire data from monitored parameters at least once every 15 minutes.

(iv) DAS acquisition rate shall be set at a constant rate such that the data points are equally spaced.

(v) All valid data points shall be used to determine compliance with applicable limit(s), and, for certification testing and RATA(s).

(vi) DAS sample acquisition rate during certification and RATA(s) shall be the same as the DAS sample acquisition rate during normal CEMS, or SCEMS, operation.

(F) Operational Period

The operational period before any certification tests shall be a minimum of 168 continuous hours.

(2) Certification Requirements and Performance Specifications for New or Modified CEMS

Rule 218(c)(1) provides that a series of certification tests shall be performed to demonstrate the acceptability of CEMS performance. The requirements and specifications in conducting initial certification tests follow:

(A) Calibration Error (CE) Testing

The 24-Hour CE test shall be performed at the low and high ranges, namely 0 to 20 and 80 to 100 percent of FSR, respectively. CE specifications shall be less than or equal to:

(i) 2.5 percent of the FSR for all analyzers, and

(ii) 3.0 percent of the FRS of the analyzer, for flow monitors, when an electronic calibration check is applicable.

The 24-hour CE test shall be performed once each day as close to 24-hour intervals as practicable, with a total of eight (8) consecutive tests performed. The CE specifications shall not be exceeded on any of the tests during the entire testing period.

(B) Analyzer Enclosure

(i) The analyzer shall be contained in an environmentally controlled enclosure. An alarm and recording device shall be incorporated into the system to alert the operator to make corrective action should the analyzer exceed the manufacturer’s recommended specifications for temperature drift.

(ii) Alternatively, the owner or operator of the CEMS may choose to perform the 2-hour CE tests in-lieu of meeting the analyzer enclosure requirement in Section(b)(2)(B)(i). The 2-hour CE test shall be performed once every two hours as close to 2-hour intervals as practicable, with total of thirteen consecutive tests performed. The 2-hr CE test shall be performed when ambient temperature is expected to vary diurnally at least 30^{o}F. The test shall be performed at the low and high ranges of FSR, namely 0 to 20 and 80 to 100 percent, respectively. The specifications in Sections (b)(2)(A)(i) and (ii) shall apply to 2-hour CE.

(iii) The owner or operator of the CEMS may qualify for an exemption from Section(b)(2)(B)(i) to provide environmental controls for the analyzer enclosure by demonstrating, to the satisfaction of the Executive Officer, that the CEMS is located:

(I) In a geographic area where seasonal high and low temperatures do not exceed the operational temperature specifications for the analyzer,

(II) In a geographic area where monthly maximum temperature variation is less than 30^{o}F for all months of the year, and

(III) The CEMS is located in a site that is protected from radiation and convection heating sources.

(C) Relative Accuracy

RATA shall be performed for raw contaminant concentration, and if applicable, for corrected concentration, emission rate, O_2 concentration, CO_2 concentration analyzers, and stack and fuel flow monitors. There shall be a minimum of nine sets of test data generated. If the number of tests exceeds nine sets, data may be discarded if it is identified as an outlier by the technical guidance set forth by the Executive Officer, or for valid reasons (e.g., process upsets, CEMS malfunction, etc.) which must be substantiated with appropriate documentation and subject to approval by the Executive Officer. All data collected shall be submitted to the Executive Officer.

The CEMS shall meet the following RA performance specifications:

(i) Less than or equal to 20.0 percent of the mean value of the reference method for pollutant concentrations, or the de-minimus concentration as follows, whichever is greater:

Pollutant	De minimus Concentration
NOx	1.0 ppm
SO_2	2.0 ppm
CO	2.0 ppm
Reduced Sulfur Compounds	4.0 ppm

(ii) Less than or equal to 10.0 percent of the mean value of the reference method for diluent concentrations, or the de minimus value of 1.0 percent O_2, whichever is greater.

(iii) Less than or equal to 15.0 percent of the mean value of the reference method for flow monitors, or the de minimus value equivalent to a calculated volumetric flow rate based on 2 feet per second stack gas velocity for cases where the mean stack gas velocity obtained by the reference method test is less than 15 feet per second.

(iv) Less than or equal to 20.0 percent of the mean value of the reference method for mass emission rates, or the de minimus value equivalent to a calculated mass emission rate based on 2 feet per second stack gas velocity for cases where the mean stack gas velocity obtained by the reference method test is less than 15 feet per second.

The relative accuracy requirement may be met if the average of the differences between the CEMS measured data and the reference method test data plus the confidence coefficient is less than or equal to the relative accuracy de minimus value.

(3) Relative Accuracy Test Requirements for New or Modified CEMS

Within fourteen days of, or during all relative accuracy tests, the CEMS shall meet the following requirements, except those that may be waived as allowed in Rule 218.1, Section (b)(4)(C):

(A) Response Time

The response time for CO CEMS shall not exceed 1.5 minutes except where there is a technical limitation, in which case the response time shall be 5 minutes. The response time for all other CEMS and flow monitors, as applicable, shall not exceed 5 minutes.

(B) Calibration Error

The CE testing requirements are specified in Section (b)(2)(A).

(C) Concentration Stratification

(i) The owner or operator shall demonstrate the absence of stratification through testing performed according to the method in Chapter X, Section 13 - "Non-Standard Methods and Techniques", of the District Source Testing Manual. The number of tests shall be determined as follows:

(I) Test(s) shall be conducted at one load level if the owner or operator demonstrates to the satisfaction of the Executive Officer that the equipment operates within a 20 percent load range for at least 80 percent of the time;

(II) Test(s) shall be conducted at two different load levels if the owner or operator demonstrates to the satisfaction of the Executive Officer that the equipment operates within a 50 percent load range for at least 80 percent of the time; or,

(III) Test(s) shall be conducted at three different load levels if the equipment operates outside of the criteria in Sections (b)(3)(C)(i)(I) and (II).

The absence of stratification is considered verified if the difference between the highest measured concentration (time normalized) and the lowest measured concentration (time normalized) divided by the average measured concentration (time normalized), when expressed as a percentage, is less than or equal to 10 percent. Upon verification of the absence of stratification, the owner or operator may position the CEMS sampling probe at any point

within the stack with the exception of those points that are adjacent to the stack wall. The CEMS sampling probe should be located in the stack at least one-third of the stack diameter. The RM for RATA may be conducted at a single point within the stack that is not adjacent to the stack wall and does not interfere with the sampling and the operation of the facility CEMS.

(ii) Should testing demonstrate the presence of stratification, the owner or operator may elect one of the following alternatives:

(I) If the stratification is greater than 10 percent but the difference between the highest measured concentration (time normalized) and the lowest measured concentration (time normalized) is less than or equal to 1.0 ppmv:

(a) Then the CEMS sampling probe may be located at any point within the stack except any points that is adjacent to the stack or adjacent to the highest measured concentration (time normalized) and the lowest measured concentration (time normalized), or

(b) If it is not possible to avoid using a point adjacent to either the highest measured concentration (time normalized) or the lowest measured concentration (time normalized), then locate the CEMS sampling probe such that the placement minimizes the difference between the concentration at the proposed probe location and the concentration at the point of highest measured concentration (time normalized) or the lowest measured concentration (time normalized).

(II) Determine a representative CEMS probe location such that the following criteria are met:

(a) all traverse point concentrations are within 10.0% of the average of all traverse point concentrations (time normalized), or, the difference is less than or equal to 1.0 ppm, whichever is greater, and

(b) there exists at least one traverse point concentration (Xr), not located next to the stack or duct wall, that is less than or equal to 10.0% each adjacent traverse point concentration of Xr, or the difference is less than or equal to 1.0 ppm, whichever is greater, and,

(c) the CEMS probe is located at (or as near as practical) Xr with minimum adjacent traverse point concentration fluctuations as determined in section (ii)(II)(b), above.

(III) Determine a representative multiple point sampling configuration as approved by the Executive Officer, following the guidance document by Emission Measurement Technical Information Center, "Evaluation Procedure for Multi-Hole Sample Probes" (EMTIC GD-031)

(IV) Modify the stack and/or CEMS sampling probe location and retest for the absence of stratification.

(D) Cyclonic Flow

The owner or operator shall perform tests to verify the absence of cyclonic flow for the CEMS and reference method sampling probes. The cyclonic flow test shall be required when measuring mass emission rates and shall be performed according to the District method in the Source Test Manual, Chapter X: Non-Standard Methods and Techniques following the testing conditions of Section (3)(C)(i)(I), (II) or (III), as applicable.

(E) Interference

The owner or operator shall perform tests to verify the absence of sampling, analytical and flow interference, as applicable.

(F) Linearity Error

LE tests shall be performed at the low, middle and high ranges of concentration, namely 20 to 30, 50 to 60, and 80 to 100 percent. Each calibration gas shall be introduced into the CEMS three times. The same gas shall not be used twice in succession. LE shall be less than or equal to 5.0 percent of the calibration gas concentration.

(G) Multiple -Span-Range

For CEMS that have multiple- span range, all certification tests shall be performed at the lowest range. Except for RA and interference tests, all other certification tests shall be performed on other ranges.

(4) Operational Requirements and Performance Specifications for New or Modified CEMS

After final approval, the CEMS shall be subsequently operated and maintained according to the following requirements and specifications:

(A) 24-Hour CE

CE tests shall be performed once each day as close to 24 hour intervals as practicable at the low (0 to 20 percent) and high (80 to 100 percent) ranges of concentration. However, CE tests are not required on any day when the underlying equipment is not operated. CE test results which are greater than the limits specified in Sections (b)(2)(A)(i) and (ii), but less than or equal to 5.0 percent of the full span range shall be addressed by QA/QC Plan remediation. The CEMS shall be deemed out-of-control during such period when any CE test result is greater than the specified limits and greater than 5.0 percent of the full span range, until the CE test meets the specifications. All data generated by the CEMS during an out-of-control period shall be deemed invalid but shall not be deleted or excluded from the records or database.

(B) System Bias Test

A system bias shall be conducted every 12 months in conjunction with relative accuracy audit required under Rule 218.1 Section

(b)(4)(C). The CEMS system bias shall not exceed ± 5.0 percent of the full span range for contaminant analyzers. In addition, the owner or operator shall include in the facility QA/QC Plan, criteria for excessive drift (e.g. control limits on cumulative drift) and appropriate diagnostic techniques to identify sources of analyzer drift and system bias when control limits are exceeded.

(C) Relative Accuracy Testing

RATA and RAA, as applicable, shall be performed at least once every 12 months. The test shall be completed annually no later than the end of the calendar quarter in which the date of the original certification test was performed. During any relative accuracy tests after CEMS certification, the owner or operator may request a waiver from stratification, cyclonic flow, and/or interference requirements in Sections (b)(3)(C), (D) and (E), respectively, by submitting to the Executive Officer, for approval, any applicable documentation or previous test or historical data that meets the stratification, cyclonic flow, and/or interference requirements.

(D) Cylinder Gas Audit (CGA)

A CGA shall be performed every calendar quarter but in no more than three quarters in succession. The CGA shall be conducted according to the provisions of 40 CFR 60, Appendix F. The audit gases shall be according to the certification requirements of Rule 218.1.

(E) The Executive Officer may require recertification of the CEMS if the annual availability percentage is below 95 percent. Annual CEMS availability percentage calculations will be based on the year ending on the last day of the calendar quarter in which the CEMS was originally certified.

(F) The owner or operator of a CEMS that requires moisture correction in reporting flow and concentration shall measure and monitor moisture in the stack gas used for emission data calculations in accordance with the written technical guidance document set forth by the Executive Officer. Alternatively, with Executive Officer approval, for equipment whose moisture source is only from fuel combustion, the operator may calculate the moisture content using

fuel properties and ambient air humidity data or, for processes that saturate the exhaust gas with moisture, such as a wet scrubber system, the operator may use the saturation temperature for moisture content data.

(c) Standards for Existing CEMS

In order to be a Certified CEMS, a CEMS subject to the provisions of Rule 218 Sections (d)(1) and (d)(2), shall meet the following operational requirements and performance specifications, and the standards of Rule 218.1 Section (d):

(1) Performance Specifications for Existing Gaseous Air Contaminant CEMS

	Parameter	Specifications
(A)	Operational Period	Greater than or equal to 168 hours
(B)	Calibration Error	Less than or equal to 5 percent of the calibration gas value
(C)	Response Time	Less than or equal to 10 minutes
(D)	Zero Drift (2-hour)	Less than or equal to 2 percent of FSR
(E)	Zero Drift (24-hour)	Less than or equal to 2 percent of FSR
(F)	Calibration Drift (2-hour)	Less than or equal to 2 percent of FSR
(G)	Calibration Drift (24-hour)	Less than or equal to 2.5 percent of FSR.
(H)	Relative Accuracy	Less than or equal to 20 percent of the mean value of the RM test data, or, less than or equal to 10 percent of the allowed concentration, whichever is greater

(2) Performance Specifications for Existing Diluent Gas CEMS

	Parameter	Specifications
(A)	Operational Period	Greater than or equal to 168 hours
(B)	Calibration Error	Less than or equal to 5 percent of the calibration gas value
(C)	Response Time	Less than or equal to 10 minutes

(D)	Zero Drift (2-hour)	Less than or equal to 0.4 percent CO_2 or O_2
(E)	Zero Drift (24-hour)	Less than or equal to 0.5 percent CO_2 or O_2
(F)	Calibration Drift (2-hour)	Less than or equal to 0.4 percent CO_2 or O_2
(G)	Calibration Drift (24 hour)	Less than or equal to 0.5 percent CO_2 or O_2

(3) Full Span Range for Existing CEMS

The instrument FSR shall be equivalent to approximately 200 percent of the concentration limit as specified in the applicable rule, or at a value approved by the Executive Officer. Oxygen and carbon dioxide instrument full span readings shall be such that the full range of concentrations encountered can be measured.

(4) Cycle of Operation for Existing CEMS

The CEMS shall complete a minimum of one cycle of operation (sampling, analyzing and data recording), for each successive 15 minute period.

(d) Standards, Specifications and Requirements for New, Modified and Existing CEMS:

(1) Calibration Gas

(A) Calibration gas mixtures, as defined in Rule218.1 (a)(8), shall be manufactured, analyzed and certified in accordance with the “EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards” - EPA-600/R97/121, September 1997 Revision (EPA Protocol). The certification period and recertification requirements, as applicable, shall be according to the EPA Protocol.

(B) For gas calibration standards not explicitly covered by the EPA Protocol, the CEMS owner or operator shall submit the gas manufacturer's alternative certification protocol for the specific compound or compounds.

(i) The procedures of the EPA Protocol shall be used for gas calibration standards not explicitly covered therein, except that the gas manufacturer must identify a recertificaton

period and submit data documenting the applicability of this period. The gas manufacturer may submit alternative performance standards for certification and recertification, based on supporting technical data also provided by the manufacturer. This alternative shall be subject to the approval of Executive Officer.

(ii) If there is no existing National Institute of Standards and Technology (NIST) standard for the measured parameter, the gas manufacturer may submit an alternative reference standard and the supporting technical data that define the stability, accuracy, and precision of the alternative reference standard. This alternative shall be subject to the approval of Executive Officer.

(iii) The CEMS owner or operator may submit an alternative protocol to the EPA Protocol, provided that the CEMS owner or operator demonstrates through supporting technical data that the procedures therein are not applicable to the constituent in the calibration gas standard being certified. This alternative shall be subject to the approval of Executive Officer.

(C) Compressed and/or filtered air, such as instrument air, may also be used in lieu of oxygen span gas provided that the CEMS owner or operator demonstrates, to the satisfaction of the Executive Officer, that it is of equivalent quality to the calibration gas standards above. As part of such documentation, the owner or operator shall include in their QA/QC plan the process or operation in producing such compressed and/or filtered air and periodically checking that compressed air and/or filtered air continues to meet the calibration gas standards.

(2) Zero Gas

Zero gases used shall meet the following criteria:

(A) For gaseous air contaminant monitors, the zero gas shall be certified by the manufacturer to contain no more than 0.1 ppm of the air contaminant analyzed by the subject monitor or 1.0 percent of the applicable standard, whichever is less.

(B) For carbon monoxide monitors, the zero gas shall be certified by the manufacturer to contain less than 0.5 ppm carbon monoxide or 1.0 percent of the applicable standard, whichever is less.

(C) For carbon dioxide and oxygen monitors, the zero gas shall be certified by the manufacturer to contain less than 1.0 ppm carbon dioxide or oxygen.

(D) Compressed and/or filtered air, such as instrument air, may also be used in lieu of zero gas provided that the CEMS owner or operator demonstrates, to the satisfaction of the Executive Officer, that it is of equivalent quality to the above zero gas standards. As part of such documentation, the owner or operator shall include in their QA/QC plan the process or operation in producing such compressed and/or filtered air and periodically checking that compressed air and/or filtered air continues to meet the zero gas standards.

(3) Automatic Calibration Data

If automatic adjustments to the monitor settings are made, conduct the calibration tests in a way that the magnitude of the adjustments can be determined and recorded.

(4) F-Factors

The owner or operator shall use in the CEMS calculations the Fd factors listed in 40 CFR Part 60, Appendix A, Method 19, Table 19-1, as applicable. When alternative fuels are fired, the owner or operator shall submit data to develop Fd factors and obtain Executive Officer approval.

(5) NO_2 to NO Conversion Efficiency

The conversion efficiency tests shall be conducted according to the requirements of District Method 100.1. The value for the NO_2 gas shall be greater than or equal to the maximum expected or recorded NO_2 and greater than or equal to 20 percent of the FSR.

(e) Time-Sharing Requirements

A time-shared CEMS for which an application is submitted after [date of adoption] shall meet all of the performance specifications as well as the following requirements:

(1) All sources shall have mutually compatible range(s) of air contaminant gases at all times.

(2) Each source shall have a data-reading period, at a minimum, equal to three times the longest response time of the system. For shared systems the response time is measured at the input or probe at each source. A demonstration of response time for each source shall be made during certification testing. Data are not to be collected following a switch of sample sources until a period of time equal to one response time has passed.

(3) The CEMS shall be capable of performing and recording zero and span calibrations at each source, including the calibration factors and correction values before and after every automatic calibration.

Table 1
REFERENCE METHODS
RULE 218.1

District Method 1.1 - Sample and Velocity Traverses for Stationary Sources

District Method 1.2 - Sample and Velocity Traverses for Stationary Sources with Small Stack or Ducts

District Method 2.1 - Determination of Stack Gas Velocity and Volumetric Flow Rate (S-type Pitot tube)

District Method 2.2 - Direct Measurement of Gas Volume through Pipes and Small Ducts

District Method 2.3 - Determination of Gas Velocity and Volumetric Flow Rate from Small Stacks or Ducts

District Method 3.1 - Gas Analysis for Dry Molecular Weight and Excess Air

District Method 4.1 - Determination of Moisture Content in Stack Gases

District Method 6.1 - Determination of Sulfuric Acid and Sulfur Oxides from Stationary Sources

District Method 7.1 - Determination of Nitrogen Oxide Emissions for Stationary Sources

District Method 100.1 - Instrumental Analyzer Procedures for Continuous Gaseous Emission Sampling

District Method 307.91 - Determination of Sulfur in a Gaseous Matrix

EPA Method 6 - Determination of Sulfur Dioxide Emissions from Stationary Sources

EPA Method 19 - Determination of Sulfur Dioxide Removal Efficiency and Particulate, Sulfur Dioxide and Nitrogen Oxides Emission Rates from Electric Utility Steam Generator (40 CFR Part 60 Appendix A)

ASTM D4294 – 03 Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy-Dispersive X-Ray Fluorescence Spectrometry

ASTM D2622 – 05 Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry

ATTACHMENT A

SUPPLEMENTAL AND ALTERNATIVE CEMS PERFORMANCE REQUIREMENTS

A. Applicability of Supplemental and Alternative Performance Requirements

The CEMS operator who elects (or who may be required) to measure concentrations that fall below 10 percent of the lowest vendor guaranteed full scale span range, shall satisfy the performance requirements as specified in Table A-1 listed below.

TABLE A-1
Alternative Performance Requirement(s)

CEMS Certified per Rule 218.1 Yes or No	Performance Requirement(s)			
	LLSR/BFD	HLSR/BFD	LLR/BFD	LLCE
Yes	x		+	x
No	x	x	+	x

1. + (plus) denotes an additional performance requirement that shall be conducted if the mandatory performance requirement(s) cannot be met.

2. If the concentration of the CEMS is such that the specifications for the low level spike recovery/bias factor determination cannot be met, the Facility Permit holder shall conduct a low level RATA/bias factor determination.

3. Abbreviations used in this Attachment are:

   Low Level Spike Recovery/Bias Factor Determination (LLSR/BFD)
   High Level Spike Recovery/Bias Factor Determination (HLSR/BFD)
   Low Level RATA/Bias Factor Determination (LLR/BFD)
   Low Level Calibration Error (LLCE)
   Relative Accuracy Test Audit (RATA)
   Relative Accuracy (RA)
   National Institute of Standards Traceability (NIST)

B. Test Definitions, Performance Specifications and Test Procedures

This section explains in detail how each performance requirement is to be conducted.

1. Low Level Calibration Error
   The low level calibration error test is defined as challenging the CEMS (from probe to monitor) with certified calibration gases (e.g., NO in N2) at three levels

in the 0-20 percent full span range. Since certified gas mixtures or standards may not be available at the concentrations required for this test, gas dilution systems may be used, with District approval, if they are used according to either District or EPA protocols as specified in Rule 218.1, for the verification of gas dilution systems in the field. The CEMS high-level calibration gas may be diluted for the purpose of conducting the low level calibration error test.

a. Performance Specifications
Introduce pollutant concentrations at approximately the 20 percent, 10 percent, and 5 percent of full span levels through the normal CEMS calibration system. No low level calibration error shall exceed 2.5 percent of full scale span.

b. Testing Procedures
   i. Perform a standard zero/span check; if zero or span check exceeds 2.5 percent full span, adjust monitor and redo zero/span check.

   ii. After zero/span check allow the CEMS to sample stack gas for at least 15 minutes.

   iii. Introduce any of the low level calibration error standards through the CEMS calibration system.

   iv. Read the CEMS response to the calibration gas starting no later than three system response times after introducing the calibration gas; the CEMS response shall be averaged for at least three response times and for no longer than six response times.

   v. After the low level calibration error check allow the CEMS to sample stack gas for at least 15 minutes.

   vi. Repeat steps iii through v until all three low level calibration error checks are complete.

   vii. Conduct post test calibration and zero checks.

2. Spike Recovery and Bias Factor Determinations
Spiking is defined as introducing known concentrations of the pollutant of interest (e.g., gas standard to contain a mixture of NO and NO2 is representative of the ratio of NO and NO2 in stack gas) and an appropriate non-reactive, non-condensable and non-soluble tracer gas from a single cylinder (EPA Protocol as specified in Rule 218.1 or NIST traceable to 2 percent analytical accuracy if no EPA Protocol is available) near the probe and upstream of any sample conditioning systems, at a flow rate not to exceed 10 percent of the total sample gas flow rate. The purpose of the 10 percent limitation is to ensure that the gas matrix (water, CO2, particulates, interferences) is essentially the same as the

stack gas alone. The tracer gas is monitored in real time and the ratio of the monitored concentration to the certified concentration in the cylinder is the dilution factor. The expected pollutant concentration (dilution factor times the certified pollutant concentration in the cylinder) is compared to the monitored pollutant concentration.

3. High Level Spike Recovery/Bias Factor Determination
The high level spike recovery/bias factor determination is used when it is technologically not possible to certify the CEMS per the standard Rule 218.1 requirements. The spiking facility/interface shall be a permanently installed part of the CEMS sample acquisition system and accessible to the Executive Officer as well as the CEMS operator.

   a. Performance Specifications
   The CEMS shall demonstrate a RA $\leq$ 20 percent, where the spike value is used in place of the reference method in the normal RA calculation, as described below.
   b. Testing Procedures
      i. Spike the sample to the CEMS with a calibration standard containing the pollutant of interest and CO or other non-soluble, non-reacting alternative tracer gas (alternative tracer gas) at a flow rate not to exceed 10 percent of the CEMS sampling flow rate and of such concentrations as to produce an expected 40-80 percent of full scale span for the pollutant of interest and a quantifiable concentration of CO (or alternative tracer gas) that is at least a factor of 10 higher than expected in the unspiked stack gas. The calibration standards for both pollutants of interest and CO (or alternative tracer gas) must meet Rule 218.1 requirements

      ii. Monitor the CO (or alternative tracer gas) using an appropriate continuous (or semi-continuous if necessary) monitor meeting the requirements of Method 100.1 and all data falling within the 10-95 percent full scale span, and preferably within 30-70 percent full scale span.

      iii. Alternate spiked sample gas and unspiked sample gas for a total of nine runs of spiked sample gas and ten runs of unspiked sample gas. Sampling times should be sufficiently long to mitigate response time and averaging effects.

      iv. For each run, the average CEMS reading must be between 40 percent full scale span and 80 percent full scale span. If not, adjust spiking as necessary and continue runs, but expected spike must represent at least 50 percent of the total pollutant value read by the CEMS.

v. Calculate the spike recovery for both the pollutant and the CO (or alternative tracer gas) for each run by first averaging the pre- and post-spike values for each run and subtracting that value from the spiked value to yield nine values for recovered spikes.

vi. Using the CO (or alternative tracer gas) spike recovery values for each run and the certified CO (or alternative tracer gas) concentration, calculate the dilution ratio for each run. Multiply the certified pollutant concentration by the dilution factor for each run to determine the expected diluted pollutant concentrations. Using the expected diluted concentrations as the "reference method" value, calculate the Relative Accuracy. The RA shall be $\leq$ 20 percent.

4. Low Level Spike Recovery/Bias Factor Determination

The low-level spike recovery/bias factor determination is used to determine if a significant bias exists at concentrations near the 10 percent full scale span level. The spiking facility/interface shall be a permanently installed part of the CEMS sample acquisition system and accessible to the Executive Officer staff as well as the CEMS operator.

a. Performance Specifications

There are no pass/fail criteria with respect to the magnitude of the percent relative accuracy. There are performance criteria for the range of concentration on the CEMS the extent to which the spike must be greater than the background pollutant level.

b. Testing Procedures

i. Spike the sample to the CEMS with a calibration standard containing the pollutant of interest and CO or other non-soluble, non-reacting alternative tracer gas (alternative tracer gas) at a flow rate not to exceed 10 percent of the CEMS sampling flow rate and of such concentrations as to produce an expected 10-25 percent of full scale span for the pollutant of interest and a quantifiable concentration of CO (or alternative tracer gas) that is at least a factor of 10 higher than expected in the unspiked stack gas. The calibration standards for both pollutants of interest and CO (or alternative tracer gas) must meet Rule 218.1 requirements.

ii. Monitor the CO (or alternative tracer gas) using an appropriate continuous (or semi-continuous if necessary) monitor meeting the requirements of Method 100.1 and all data falling within the 10-95 percent full scale span, and preferably within 30-70 percent full scale span.

iii. Alternate spiked sample gas and unspiked sample gas for a total of nine runs of spiked sample gas and ten runs of unspiked sample gas.

Sampling times should be sufficiently long to mitigate response time and averaging effects.

iv. For each run, the average CEMS reading must be below 25 percent full scale span and > 10 percent full scale span. If not, adjust spiking as necessary and continue runs; but expected spike must represent at least 50 percent of the total pollutant value read by the CEMS.

v. Calculate the spike recovery for both the pollutant and the CO (or alternative tracer gas) for each run by first averaging the pre- and post-spike values for each run and subtracting that value from the spiked value to yield nine values for recovered spikes.

vi. Using the CO (or alternative tracer gas) spike recovery values for each run and the certified CO (or alternative tracer gas) concentration, calculate the dilution ratio for each run. Multiply the certified pollutant concentration by the dilution factor for each run to determine the expected diluted pollutant concentrations. Using the expected diluted concentrations as the "reference method" value, calculate the Relative Accuracy as specified in Rule 218.1. If the average difference is less than the confidence coefficient then no low level bias factor is applied. If the average difference is greater than the confidence coefficient and the average expected spike is less than the average CEMS measured spike, then no low level bias factor is applied. If the average difference is greater than the confidence coefficient and the average expected spike is greater than the average CEMS measured spike, then a low level bias factor equal to the absolute value of the average difference is added to data reported at or below the 10 percent of full scale span.

5. <u>Low Level RATA/Bias Factor Determination using Enhanced Reference Method 6.1</u>

A low level RATA/bias factor determination is designed to determine if there exists a statistically significant bias at low level concentrations. It consists of nine test runs that measure the stack concentration and the CEMS concentration concurrently.

a. Performance Specifications

There are no pass/fail criteria with respect to the magnitude of the percent relative accuracy. There are performance criteria for the special RATA with respect to the reference method and range of concentration on the CEMS.

b. Testing Procedures

The reference method for the low level RATA/bias factor determination is Method 100.1

i. Perform a minimum of nine runs of low level RATA for CEMS versus the reference method at actual levels (unspiked).

ii. The full scale span range for the reference method shall be such that all data falls with 20 - 95 percent of full scale span range.

iii. The reference method shall meet all Method 100.1 performance criteria.

iv. Calculate the average difference (d = CEMS - reference method, ppm) and confidence coefficient (cc = statistical calculated, ppm).

v. If $d > 0$ then the bias = 0 ppm; if $d < 0$ and $|d| > cc$ then bias = d; if $d < 0$ and $|d| < cc$ then bias = 0 ppm.

C. Testing Frequency

For each CEMS, perform the aforementioned performance requirements once a year thereafter. These annual assessments shall be completed within six months of the end of the calendar quarter in which the CEMS was originally certified.