RULE 2012 PROTOCOL
CHAPTER 2

MAJOR SOURCES - CONTINUOUS

EMISSION MONITORING SYSTEM

(CEMS)

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Between January 1, 1994 and December 31, 1994 (Cycle 1 facilities) and between July 1, 1994 and June 30, 1995 (Cycle 2 facilities), major sources shall be allowed to use an interim reporting procedure to measure and record NOx emissions on a monthly basis according to the requirements specified in Chapter 3 "Large Sources - Continuous Process Monitoring System (CPMS)" or by extracting NO_X emission data from existing District certified continuous emissions monitoring system (CEMS). Chapter 2, Subdivision C, Paragraph 1 specifies the requirements for this interim period. On and after January 1, 1995 (Cycle 1 facilities) and July 1,1995 (Cycle 2 facilities), the Facility Permit holder of each major source shall report the daily NOx emissions by 5:00 p.m. of the following day and comply with all other applicable requirements (except Chapter 2, Subdivision C, Paragraph 1) specified in this chapter.

The Facility Permit holder of a source that is required to install CEMS may request the Executive Officer to approve an alternative monitoring device (or system components) to quantify the emissions of NO_X. The applicant shall demonstrate to the Executive Officer that the proposed alternative monitoring device is at a minimum equivalent in relative accuracy, precision, reliability, and timeliness to a CEMS for that source, according to the criteria specified in 40 CFR Part 75 Subpart E. In lieu of the criteria specified in 40 CFR Part 75 Subpart E, substitute criteria is acceptable if the applicant demonstrates to the Executive Officer that the proposed alternative monitoring device is at minimum equivalent in relative accuracy precision, reliability, and timeliness to a CEMS for that source. Upon approval by the Executive Officer, the substitute criteria shall be submitted to the federal Environmental Protection Agency as an amendment to the State Implementation Plan (SIP).

A. MEASUREMENT REQUIREMENTS

1. The Facility Permit holder of each major NO_X equipment shall install, calibrate, maintain, and operate an approved CEMS to measure and record the following:

    a. Nitrogen oxide concentrations in the gases discharged to the atmosphere from affected equipment;

    b. Oxygen concentrations, at each location where nitrogen oxide concentrations are monitored, if required for calculation of the stack gas flow rate;

    c. Stack gas volumetric flow rate. An in-stack flow meter may be used to determine mass emissions to the atmosphere from affected equipment, except:

        i. when more than one affected piece of equipment vents to the atmosphere through a single stack and there is no approvable means of determining emissions from each piece of equipment; or

ii. during periods of low flow rates when the flow rate is no longer within the applicable range of the in-stack flow meter.

d. In lieu of complying with Chapter 2, Subdivision A, Paragraph 1, Subparagraph c, the Facility Permit holder shall calculate stack gas volumetric flowrate using one of the following alternate methods:

i. Heat Input

If heat input rate is needed to determine the stack gas volumetric flow rate, the Facility Permit holder shall include in the CEMS calculations the F_d factors listed in 40 CFR Part 60, Appendix A, Method 19, Table 19-1. The Facility Permit holder shall submit data to develop F factors when alternative fuels are fired and obtain the approval of the Executive Officer for use of the F factors before firing any alternative fuel,

ii. Oxygen Mass Balance

Flow rate can be determined using oxygen mass balance as approved through a plan submitted to and approved by the Executive Officer, or

iii. Nitrogen Mass Balance

Flow rate can be determined using nitrogen mass balance as approved through a plan submitted to and approved by the Executive Officer.

The Facility Permit holder shall measure and record all variables necessary for the method chosen to calculate stack gas volumetric flowrate.

e. All applicable variables listed in Table 2-A.

f. The Facility Permit holder shall also provide any other data necessary for calculating air contaminant emission rates as determined by the Executive Officer.

g. The data generated from a monitoring system for parameters listed in subparagraphs a, b, c and d of Chapter 2, Subdivision A, Paragraph 1 shall be recorded by both (1) the remote terminal unit (RTU) and (2) strip chart recorder or electronic recorder. The RTU shall be capable of producing a printout of the stored data upon

request from the Executive Officer or designee. The strip chart recorder or alternative electronic recorder shall be located in parallel to the RTU. The strip chart recorder or alternative electronic recorder shall receive data independent of the RTU and serve as an independent tool for verifying data archived in the RTU or sent to the District Central NOx Station.

If a strip chart recorder is used, the strip chart shall have a minimum chart width of 10 inches, a readability of 0.5% of the span, and a minimum of 100 chart divisions. Alternatively, if an electronic recorder is used, the recorder shall be capable of writing data on a medium that is secure and tamper-proof. Possible media include, but are not limited to, "write-once-read-many" type or a data encryption system that does not permit encrypted data files to be altered after they have been created, without making the data inaccessible through standard vendor-provided decryption software, or without leaving traceable evidence of tampering. Also, at a minimum, the real-time sampling frequency of the electronic recorder shall be equal to or greater than the rate of data collection for the RTU. Furthermore, such recorded data shall be readily accessible upon request by the Executive Officer or designee. If software is required to access the recorded data, a copy of the software, and all subsequent revisions, shall be provided to the Executive Officer or designee at no cost. If a device is required to retrieve and provide a copy of such recorded data upon request to the Executive Officer or designee, the Facility Permit holder shall maintain and operate such a device at the facility.

The Facility Permit holder shall specify within the CEMS application, as required under Chapter 2, Subdivision A, Paragraph 2, the type of data recording system to be used in parallel to the RTU.

2. The Facility Permit holder shall by March 31, 1994 for Cycle 1 facilities and September 30, 1994 for Cycle 2 facilities, submit a CEMS plan to the Executive Officer for approval. The plan shall contain at a minimum the following items:

   a. A list of all major sources which will have CEMS installed.

   b. Details of the proposed Continuous Emission Monitors as well as the proposed flow monitors for each affected source.

   c. Details of the Quality Control/Quality Assurance Plan for the CEMS.

d. Proposed range of each CEMS and the expected concentrations of pollutants for each source.

e. Date by which purchase order for each system will be issued.

f. Construction schedule for each system, and date of completion of installation.

g. Date by which CEMS certification test protocol will be submitted to the District for approval for each system.

h. Date by which certification tests will be completed for each system.

i. Date by which certification test results will be submitted for review by the District, for each system.

j. Any other pertinent information regarding the installation and certification for each system.

If a CEMS plan is disapproved in whole or in part, the District staff will notify the Facility Permit holder in writing and the Facility Permit holder shall have 30 days from the date it receives the notice from the District to resubmit its plan.

3. The variables listed in Table 2-A shall be measured and recorded at the facility to determine mass emission and track the operation of basic and control equipment. The variables listed in Table 2-B shall be reported to the District's NO_X Central Station Computer. Alternatives indicated in Tables 2-A and 2-B indicate choices which shall be specified in the Facility Permit for that equipment.

4. As part of the Facility Permit Application review, the Executive Officer may modify the list of Facility Permit holder-selected tracking variables.

5. Data on Facility Permit holder selected variables shall be made available to the District staff upon request.

6. Source tests shall be performed by testing firms/laboratories who have received approval from the District by going through the District's laboratory approval program.

7. All Relative Accuracy Test Audits (RATA) shall be performed by testing firms/laboratories who have received approval from the District by going through the District's laboratory approval program.

B. MONITORING SYSTEMS

1. Information Required for Each 15-Minute Interval

All CEMS for affected equipment shall, at a minimum, generate and record the following data points once for each successive 15-minute period on the hour and at equally spaced intervals thereafter:

a. Nitrogen oxides concentration in the stack in units of ppmv;

b. Oxygen concentration or carbon dioxide concentration in the stack in units of percent;

c. Volumetric flow rate of stack gases in units of dry or wet standard cubic feet per hour (dscfh or wscfh). For affected equipment standard gas conditions are defined as a temperature at 68°F and one atmosphere of pressure;

d. (i) Fuel flow rates in units of standard cubic feet per hour (scfh) for gaseous fuels or pounds per hour (lb/hr) for liquid fuels if EPA Method 19 is used to calculate the stack gas volumetric flow rate, and

(ii) Fuel type;

e. Nitrogen oxide mass emission in units of lb/hour. The nitrogen oxide mass emissions is calculated according to the following:

$$e_i = a_i \times c_i \times 1.195 \times 10^{-7} \qquad \text{(Eq. 1)}$$

where:

e_i = The mass emissions of nitrogen oxides in pounds per hour.

a_i = The stack gas concentration of nitrogen oxides (ppmv).

c_i = The stack gas volumetric flow rate (scfh).

Example Calculation:

a_i = 40 ppm

c_i = 150,000 scfh

e_i = 40 x 150,000 x 1.195 x 10^{-7}

e_i = 0.72 lb/hr

When the CEMS uses the heat input rate and oxygen concentration to determine the nitrogen oxide mass emissions, the following equation shall be used to calculate the emissions of nitrogen oxides:

$$e_i = a_i \times [20.9/(20.9 - b_i)] \times 1.195 \times 10^{-7} \times \sum_{j=1}^{r} (F_{dij} \times d_{ij} \times V_{ij}) \qquad \text{(Eq. 2)}$$

where:

e_i = The mass emissions of nitrogen oxides in pounds per hour

ai = The stack gas concentration of nitrogen oxides (ppmv)

bi = The stack gas concentrations of oxygen (%)

r = The number of different types of fuel

F_{dij} = The oxygen-based dry F factor for each type of fuel, the ratio of the gas volume of the products of combustion to the heat content of the fuel (scf/106 Btu)

dij = The fuel flow rate for each type of fuel measured every 15-minute period

Vij = The higher heating value of the fuel for each type of fuel

The product (d_{ij} x V_{ij}) shall have units of millions of Btu per hour (10^6 Btu/hr).

Equation 2 may not be used in cases where enriched oxygen is used, non-fuel sources of carbon dioxide are present (e.g., lime kilns and calciners), and the oxygen content of the stack gas is 19 percent or greater.

Example Calculation:

a_i = 40 ppm

b_i = 3.5%

F_{dij} = 8710 dscf/10^6 Btu

d_{ij} = 5,000 dscf

V_{ij} = 1050 Btu/scf or 1050 mmBtu/mmscf

$$e_i = a_i \times [20.9/(20.9 - b_i)] \times 1.195 \times 10\text{-}7 \times \sum_{j=1}^{r} (F_{dij} \times d_{ij} \times V_{ij})$$

$e_i = 40 \times [20.9/(20.9 - 3.5)] \times 1.195 \times 10^{-7} \times [8710/10^6 \times 5000 \times 1050]$

e_i = 0.26 lb/hr

When the CEMS uses the heat input rate and carbon dioxide concentration to determine the nitrogen oxide mass emissions, the following equation shall be used to calculate the emissions of nitrogen oxides:

$$e_i = (a_{i/ti}) \times 100 \times 1.195 \times 10^{-7} \times \sum_{j=1}^{r} (F_{cij} \times d_{ij} \times V_{ij}) \qquad \text{(Eq. 3)}$$

where:

e_i = The mass emissions of nitrogen oxides in pounds per hour.

a_i = The stack gas concentration of nitrogen oxides (ppmv).

t_i = The stack gas concentrations of carbon dioxide (%).

r = The number of different types of fuel.

F_{cij} = The carbon dioxide-based dry F factor for each type of fuel, the ratio of the dry gas volume of carbon dioxide to the heat content of the fuel (scf/10^6 Btu).

dij = The fuel flow rate for each type of fuel measured every 15-minute period.

V_{ij} = The higher heating value of the fuel for each type of fuel.

The product (d_{ij} x V_{ij}) shall have units of millions of Btu per hour (10^6 Btu/hr).

Example Calculation:

a_i = 40 ppm

ti = 11.0%

F_{cij} = 1040 scf/10^6 Btu

dij = 5,000 dscf

Vij = 1050 Btu/scf or 1050 mmBtu/mmscf

$$ei = ai/ti \times 100 \times 1.195 \times 10^{-7} \times \sum_{j=1}^{r} (Fcij \times dij \times Vij)$$

$$ei = 40/11.0 \times 100 \times 1.195 \times 10^{-7} \times [1040 \times 5000 \times 1050 \times 10^{-6}]$$

ei = 0.24 lb/hr

f. All measurements for concentrations and stack gas flow rates, and selection of F factor shall be made on a consistent wet or dry basis.

g. CEMS status. The following status codes shall be used to report the CEMS status:

1-1 VALID DATA

2-2 CALIBRATION

3-3 OFF LINE

4-4 ALTERNATE DATA ACQUISITION (e.g., manual sampling)

5-5 OUT OF CONTROL

6-6 FUEL SWITCH (e.g., gas to oil, coke to coal)

7-7 10% RANGE (may be used to report at default 10% valid range whenever actual concentration value is below 10%)

8-8 LOWER THAN 10% RANGE (may be used to report at actual concentration value if less than 10% valid range

9-9 NON-OPERATIONAL

h. For processes in which less than 50% of emissions are caused by fuel combustion, record the Source Classification Code (SCC) for the process conducted. SCCs are listed in the State of California Air Resources Board Document "Instructions for the Emission Data System Review and Update Report, Appendix III, Source Classification Codes and EPA Emission Factors".

i. the count of valid data points collected.

j. the count of data points in excess of 95% of span range of the monitor collected.

2. Hourly Calculations

The hourly average stack gas concentrations of nitrogen oxides and oxygen, the stack gas volumetric flow rate, the fuel flow rate and the emission rate of nitrogen oxides shall be calculated for each equipment as follows:

$$A = \frac{\sum_{i=1}^{n} a_i}{n} \quad \text{(for } NO_x \text{ concentration)} \qquad \text{(Eq. 4)}$$

$$B = \frac{\sum_{I=1}^{n} b_i}{n} \quad \text{(for } O_2 \text{ concentration)} \qquad \text{(Eq. 5)}$$

$$C = \frac{\sum_{i=1}^{n} c_i}{n} \quad \text{(for stack gas volumetric flow rate)} \qquad \text{(Eq. 6)}$$

$$D_i = \frac{\sum_{i=1}^{n} d_i}{n} \quad \text{(for fuel flow rates)} \qquad \text{(Eq. 7)}$$

Calculate D for each type of fuel firing separately.

$$E_k = \frac{\sum_{i=1}^{n} e_i}{n} \quad \text{(for } NO_x \text{ emissions)} \qquad \text{(Eq. 8)}$$

All concentrations and stack gas flow rates shall be calculated on a consistent wet or dry basis.

where:

A = The hourly average stack gas concentration of nitrogen oxides (ppmv)

a_i = The measured stack gas concentrations of nitrogen oxides (ppmv)

B = The hourly average oxygen stack concentration (%)

b_i = The measured stack gas concentrations of oxygen (%)

C = The hourly average stack gas flow rate (dscfh)

c_i = The measured stack gas volumetric flow rates (dscfh)

D = The hourly average fuel flow rates, for each type of fuel (appropriate units of volumetric flow rate for each type of fuel, e.g., scfh, gal/hr, lb/hr, bbl/hr, liters/hr, etc.)

d_i = The measured fuel flow rates for each type of fuel (appropriate units of volumetric flow rate for each type of fuel, e.g., scfh, gal/hr, lb/hr, bbl/hr, etc.)

E_k = The hourly average emissions of nitrogen oxides (lb/hr)

e_i = The measured mass emissions of nitrogen oxides in pounds per hour

n = Number of valid data points during the hour

The values of A through E_k shall be recorded for each affected piece of equipment.

3. Daily Calculations

a. Daily mass emissions calculation

The daily emissions of nitrogen oxides shall be calculated and recorded for each affected NO_x source using the following procedure:

$$G = \sum_{k=1}^{N} E_k + \sum_{m=1}^{P} E_m + \sum_{o=1}^{Q} E_{st} + \sum_{r=1}^{S} E_{sh} \quad \text{(Eq. 9)}$$

where:

G = The daily emissions of nitrogen oxides (lb)

E_m = The hourly average emissions of nitrogen oxides using substitute data (see Chapter 2, Subdivision B, Paragraph 5, Subparagraph b and Chapter 2 Subdivision F)(lb/hr)

E_k = The hourly average emissions of nitrogen oxides using data recorded by CEMS (lbs/hr)

E_{st} = The hourly average emissions of nitrogen oxides during startup (lb/hr) (see Chapter 2 Subdivision G)

E_{sh} = The hourly average emissions of nitrogen oxides during shutdown (lbs/hr) (see Chapter 2 Subdivision G)

N = Number of hours of valid data (see Chapter 2, Subdivision B, Paragraph 5) from the CEMS coinciding with the source operating hours

P = Number of hours using substitute data when the source is operating

Q = The number of hours during startup period

S = The number of hours during shutdown period

and,

M = Number of hours during the day.

Note that: $M = N + P + Q + S = 24$ hours.

Example Calculation:

E_k	= 0.5 lb/hr	E_{st}	= 0 lb/hr	Q	= 0 hr
E_m	= 0.7 lb/hr	E_{sd}	= 0 lb/hr	S	= 0 hr
N	= 21 hr				
P	= 3 hr				
M	= 24 hr				

G = (0.5 lb/hr)(21 hr) + (0.7 lb/hr)(3 hr) + (0 lb/hr)(0 hr)+ (0 lb/hr)(0 hr)

G = 10.5 + 2.1 = 12.6 lb

4. Operational Requirements

The CEMS shall be operated and data recorded at all times except for CEMS breakdowns and repairs. Calibration data shall be recorded during zero and span calibration checks, and zero and span adjustments. For periods of hot standby the Facility Permit holder may enter a default value for NO_x emissions. Before using any default values the Facility Permit holder shall obtain the approval of the Executive Officer and must include in the CEMS applications or CEMS plans the estimates of NO_x emissions, the NO_x concentrations, the oxygen concentrations, and the fuel input rates or the stack gas volumetric flow rates during hot standby conditions. The Executive Officer will disapprove those emission values which do not correspond to hot standby conditions.

5. Requirements for Valid Data Points

Valid data points are data points from a CEMS which meets the requirements of Chapter 2, Subdivision B, Paragraph 13, and which is not out-of-control as defined in Attachment C - Quality Assurance and Quality Control Procedures. In addition, whenever specifically allowed by these RECLAIM rules, data points obtained by the methods specified in Chapter 2, Subdivision B, Paragraph 6 and Chapter 2, Subdivision B, Paragraph 7, are considered valid. Furthermore, a data point gathered by a certified CEMS except a zero value data point, shall not be valid unless it meets the requirements of Chapter 2, Subdivision B, Subparagraph (8)(a). A zero value data point is a data point gathered while the source is not operating and is within 5% of the span range from zero value.

a. Each CEMS and component thereof shall be capable of completing a minimum of one cycle of operation (sampling, analyzing and data recording) for each successive 15-minute interval.

b. Raw data shall be gathered from the monitors at equally spaced intervals. The Facility Permit holder shall specify, within the test report for a Relative Accuracy Test Audit of a CEMS, the frequency of data gathering in a 15-minute interval. This data gathering frequency shall remain the same throughout the period following the Relative Accuracy Test Audit until a subsequent Relative Accuracy Test Audit is conducted with a different specified frequency. The specified frequency shall be the frequency for data gathering to constitute continuous measurement.

c. All valid raw data points gathered from the monitors within a 15-minute interval shall be used to compute a 15-minute average emissions data point. If only one valid data point is gathered within a 15-minute interval, that data point shall be used as the 15-minute average emission data point. No invalid data points may be used to compute the 15-minute average emission data point. A valid 15-minute average emission data point must further be based on a minimum of one valid raw data point.

d. Except for facilities which are required to comply with 40 CFR Part 75, the following data for each 15-minute period shall be computed for each CEMS:
   i. the average emissions values,
   ii. the count of valid data points, and
   iii. the count of data points in excess of 95% of span range of the monitor.

e. All NO_x concentration, volumetric flow, and NO_x emission rate data shall be reduced to 1 hour averages. Valid hour averages shall be equally computed based on four valid 15-minute average emission data points equally spaced over each 1 hour period, commencing at 12:00 a.m., except for a maximum of four 1-hour maintenance periods in each day during which CEMS maintenance activities such as calibration, quality assurance, maintenance, or CEMS repair is conducted. During these 1-hour maintenance periods a valid hour average shall consist of at least two valid 15-minute average emission data points. A 1-hour maintenance period is defined when the operation of the CEMS is interrupted for CEMS maintenance activities at any time during any 1-hour period, and that period shall count towards the four 1-hour maintenance periods allowed regardless of the number of valid data points gathered. The CEMS shall be kept properly operational at all times unless such CEMS must be turned off for CEMS maintenance activities.

f. Failure of the CEMS to acquire the required number of valid 15-minute average emission data points within any 1-hour period shall result in the loss of such data for the entire 1-hour period and the Facility Permit holder shall record and report data by means of the data acquisition and handling system for the missing hour in accordance with the applicable procedures for substituting missing data in the Missing Data Procedures in Chapter 2 Subdivision E of this document.

6. Alternative Data Acquisition Using Reference Methods

a. When valid nitrogen oxides emission data is not collected by the permanently installed CEMS, emission rate data may be obtained using District Methods 7.1 or 100.1 (for NO_x concentration in the stack gas) in conjunction with District Methods 1.1, 2.1, 3.1, and 4.1 or by using District Methods 7.1 or 100.1 in conjunction with District Method 3.1 and EPA Method 19. For District Method 7.1 a minimum of 12 samples, equally spaced over a one-hour period, shall be taken. Each sample shall represent the five-minute period in which it was taken.

b. If the Facility Permit holder chooses to use a standby CEMS (such as in a mobile van or other configuration), to obtain alternative monitoring data at such times when the permanently installed CEMS for the affected source(s) cannot produce valid data, then the standby CEMS is subject to the following requirements:

i. Standby CEMS shall be equivalent in relative accuracy, reliability, reproducibility and timeliness to the corresponding permanently installed CEMS.

ii. The Facility Permit holder shall submit a standby CEMS plan to the District for review prior to using the standby CEMS.

iii. District acceptance of standby CEMS data shall be contingent on District approval of the plan.

iv. The use of standby CEMS shall be limited to a total of 6 months for any source(s) within a calendar year.

v. The Facility Permit holder shall notify the District within 24 hours if the standby CEMS is to be used in place of the permanently installed CEMS.

vi. During the first 30 days of standby CEMS use, the Facility Permit holder shall conduct a Certified Gas Audit (CGA) of the standby CEMS.

vii. The Facility Permit holder shall notify the District within the 30-day period if the standby CEMS shall be used longer than 30 days.

viii. After the first 30 days of using the standby CEMS , the Facility Permit holder shall conduct at least one RATA of the standby CEMS and the RATA shall be conducted within 90 days of the initial use of the standby CEMS.

ix. All RATA and certification tests shall be performed by testing firms/laboratories who have received approval from the District by going through the District's laboratory approval program.

x. Immediately prior to obtaining data from the source(s) to be monitored, the standby CEMS shall be quality assured in accordance with District Method 100.1

7. Alternative Data Acquisition Using Process Curves or Other Means

Process curves of NO_x emission rates or other alternative means of NO_x emission rate data generation may be used to obtain nitrogen oxides emission data, provided the Facility Permit holder has obtained the approval of the Executive Officer prior to using alternate means of NO_x emission rate data generation. The process curves and the alternate means of NO_x emission data generation mentioned in this paragraph shall not be used more than 72 hours per calendar month and may only be used if no CEMS data or reference method data gathered under Chapter 2, Subdivision B, Paragraph 6 is available. Process curves may be used on units which have air pollution control devices for the control of NO_x emissions provided the Facility Permit holder submits a complete list of operating conditions that characterize the permitted operation. The conditions will be specified in the Facility Permit for that equipment. The process variables specified in the Facility Permit conditions shall be monitored by the source.

8. Span Range Requirements for NOx Analyzers and O_2 Analyzers

a. Full scale span ranges for the NO_x analyzers and O_2 analyzers used as part of a stack gas volumetric flow system at each source shall be set on an individual basis. The full scale span range of the NO_x analyzers and O_2 analyzers shall be set so that all data points gathered by the CEMS lie within 10 - 95 percent of the full scale span range. However, any data points that fall below 10 percent of the full scale span range may be reported in accordance with 8(b), 8(c), or 8(d) as applicable. Missing Data Procedures as prescribed in Chapter 2, Subdivision E shall be substituted for any data points falling above 95 percent range of the full scale span range.

b. For CEMS with RECLAIM certified multiple span ranges, the Facility Permit holder shall report data that falls below 10 percent of the higher full scale span range and above 95 percent of the lower full scale span range, at the 10 percent value of the higher full scale span range.

c. In the event that any data points gathered by the CEMS fall below 10 percent of the full scale span range, the Facility Permit holder may elect to report NO_x concentrations at the 10 percent span range value.

d. In the event that any data points gathered by the CEMS fall below 10 percent of the lowest vendor guaranteed full scale span for that CEMS (defined as the lowest full scale span range that the vendor guarantees to be capable of meeting all current certification requirements of RECLAIM in Rule 2012 Protocols, Appendix A), the Facility Permit holder may elect to use the following procedures to measure and report NO_x concentrations.

i. Report all monitored concentrations that fall below 10 percent of the lowest vendor guaranteed full scale span range for that CEMS at the 10 percent lowest vendor guaranteed span range value, or

ii. Report all monitored concentrations that fall below 10 percent of the lowest vendor guaranteed full scale span range for that CEMS at the actual measured value, provided that the CEMS meets the Alternative Performance Requirements prescribed in Attachment G.

The Alternative Performance Requirements prescribed in Attachment G shall be imposed in place of the semiannual assessments as required pursuant to Attachment C (B)(2).

e. The Facility Permit holder electing to use (B)(8)(c) and (B)(8)(d)(i) to report NO_x concentrations that fall below 10 percent of full scale span range or 10 percent of the lowest vendor guaranteed full scale span range for that CEMS, shall meet the following:

i. In the event any of the specified testing requirements as prescribed in Attachment C (B)(2) are not met, the Facility Permit holder shall no longer use (B)(8)(c) or (B)(8)(d)(i) to report NO_x concentrations below 10 percent of the full scale span range until compliance is demonstrated. Missing Data Procedures specified in Chapter 2, Subdivision E shall apply retroactively from the date in which the Facility Permit holder last demonstrated compliance with Attachment C (B)(2).

ii. From September 8, 1995 to the beginning of the compliance year (January 1, 1995 for Cycle 1 and July 1, 1995 for Cycle 2), the Facility Permit holder may retroactively report concentrations that fell below 10 percent of the full scale span range at the 10 percent span range value, in lieu of using the Missing Data Procedures specified in Chapter 2, Subdivision E.

f. The Facility Permit holder electing to use (B)(8)(d)(ii) to measure and report NO_x concentrations that fall below 10 percent of the lowest vendor guaranteed full scale span range for that CEMS, shall meet the following:

i. Submit an application, with the appropriate fees, supporting documentation, and if necessary test protocols to the Executive Officer or designee in order to amend their CEMS Plan to include the selected criteria. The application shall be approved by the Executive Officer or designee prior to using (B)(8)(d)(ii).

ii. (B)(8)(d)(ii) may only be chosen after initial tests as prescribed in Attachment G are completed and demonstrate that the CEMS is capable of measuring NO_x concentrations at below 10 percent of the full scale span range.

iii. In the event any of the specified reporting and testing requirements for (B)(8)(d)(ii) as prescribed in Attachment G are not met, the Facility Permit holder shall no longer use (B)(8)(d)(ii) to measure NO_x concentrations below 10 percent of the lowest vendor guaranteed full scale span range for that CEMS until compliance with (B)(8)(d)(ii) is

demonstrated. Missing Data Procedures described in Chapter 2, Subdivision E shall apply retroactively from the date in which the Facility Permit holder last demonstrated compliance with (B)(8)(d)(ii), unless the Facility Permit holder can demonstrate compliance with Attachment C (B)(2), then the Facility Permit holder may report concentrations retroactively at the 10 percent lowest vendor guaranteed span range value and may continue to report at the 10 percent lowest vendor guaranteed span range value until compliance is demonstrated with (B)(8)(d)(ii).

iv. In the event that the NO_x concentrations are at levels such that the Facility Permit holder cannot complete the low level spike recovery test or alternative reference method test for low level concentrations pursuant to Attachment G, then the Facility Permit holder may elect to report all monitored concentrations that fall below 10 percent of the lowest vendor guaranteed full scale span range at the 10 percent lowest vendor guaranteed full scale span range value in lieu of using Missing Data Procedures..

v. Upon approval of the CEMS application to use (B)(8)(d)(ii), the Facility Permit holder may retroactively report concentrations at the 10 percent lowest vendor guaranteed span range value in lieu of using the Missing Data Procedures specified Chapter 2, Subdivision E, from the beginning of the compliance year for which the application was submitted up until the application approval date.

g. Up until July 1, 1996, Facility Permit holders whose CEMS have been provisionally or finally certified prior to September 8, 1995, and have used Missing Data Procedures as prescribed in Chapter 2, Subdivision E to report mass emissions that have been measured by the CEMS in the 10 percent to less than 20 percent of full scale span range, may report the actual concentrations measured in this range as valid data retroactively from the beginning of the current compliance year.

9. Calibration Drift Requirements

The CEMS design shall allow determination of calibration drift (both negative and positive) at zero-level (0 to 20 percent of full scale) and high-level (80 to 100 percent of full scale) values. Alternative low-level and high-level span values may be allowed with the prior written approval of the Executive Officer.

10. Relative Accuracy Requirements for Stack Gas Volumetric Flow Measurement Systems

The stack gas volumetric flow measurement system shall meet a relative accuracy requirement of being less than or equal to 15 percent of the mean value of the reference method test data in units of standard cubic feet per hour (scfh). Relative accuracy is calculated by the equations in Section 8 of 40 CFR Part 60, Appendix B, Performance Specification 2. Alternatively, for cases where the mean stack gas velocity obtained by reference method test is less than 15 feet per second, the flow relative accuracy requirement may be met if equation 9a is satisfied.

$$|d| + |cc| <= 2 \text{ feet per second} \times A \times cf \qquad \text{(Eq. 9a)}$$

Where

d = average of differences between stack gas volumetric flow measurement system reading and the corresponding reference method test data in units of standard cubic feet per hour.

cc = confidence coefficient as determined by the equations in Section 8 of 40 CFR Part 60, Appendix B, Performance Specification 2.

A = Stack cross sectional area in the plane of measurement.

cf = conversion factor to standard cubic feet per hour.

The volumetric flow measurement system shall also meet the specifications in Appendix B of these protocols. Prior to conducting a certification or re-certification test, the Facility Permit holder shall perform a flow profile study to determine the acceptability of the potential flow monitor location and to determine the number and location of flow sampling points required to obtain a representative flow value. The results of such study shall be part of the certification test report.

There shall be a minimum of nine sets of tests conducted. All data collected shall be submitted to the Executive Officer and shall be used to determine relative accuracy except data may be rejected per the technical guidance or for unusual problems and/or occurrences during testing (e.g., process upsets, CEMS malfunction, testing failure) if the number of tests exceeds nine sets. Any exclusion of data must be substantiated with appropriate documentation and is subject to approval by the Executive Officer.

In situations where the stack gas velocity is low (less than 10 ft./sec.) and the above relative accuracy procedure provides results that have a low level of accuracy and precision, the relative accuracy of the fuel flow meter may be determined according to one of the following alternatives:

a. Calibrate the facility CEMS fuel flow meter in accordance with the procedures outlined in 40 CFR Part 75, Appendix D, either in-line or off-line.

b. Calibrate a test fuel flow meter in accordance with the procedures outlined in 40 CFR Part 75, Appendix D. Use the calibrated test fuel meter to calibrate the facility CEMS fuel flow meter to the same level of accuracy and precision as in 40 CFR Part 75, Appendix D.

c. Calibrate a test fuel flow meter according to the procedure outlined in (B)(10)(b) and install this meter in line with the facility CEMS fuel flow meter and use 40 CFR Part 60, Method 19 (F-factor approach) to determine relative accuracy to the same level of accuracy as in (B)(10).

Other alternative techniques (e.g., tracer gas approach, electronic micro-manometer) may be used to determine relative accuracy of fuel flow meters where low stack volumetric flow rates exist, if these techniques are approved in writing by the District.

11. Relative Accuracy Requirements for Mass Emission Rate Measurement

The mass emission rate measurement shall meet a relative accuracy requirement of being less than or equal to 20 percent of the mean value of the reference method test data in units of lb/hr. Relative accuracy is calculated by the equations in Section 8 of 40 CFR, Part 60, Appendix B, Performance Specification 2. The emission rate measurement shall also meet the specifications in Attachment-B of this document. Alternatively, for cases where the mean NOx concentration obtained by reference test method is less than or equal to 5.0 ppm, or the mean stack gas velocity obtained by reference test method is less than 15 feet per second, the mass emission rate measurement relative accuracy requirement may be met if equation 9b is satisfied.

$$|d| + |cc| <= (c \times s \times A) \times cf \qquad \text{(Eq. 9b)}$$

Where

d = average of differences between mass emission rate determined by the CEMS and the corresponding reference method test data in units of pounds per hour.

cc = confidence coefficient as determined by the equations in Section 8 of 40 CFR Part 60, Appendix B, Performance Specification 2.

A = Stack cross sectional area in the plane of measurement.

c = 1.0 ppm or mean concentration obtained by reference test method, whichever is greater.
s = 2 feet per second or mean stack gas velocity obtained by reference test method, whichever is greater.
cf = conversion factor to pounds per hour.

There shall be a minimum of nine sets of tests conducted. All data collected shall be submitted to the Executive Officer and shall be used to determine relative accuracy except data may be rejected per the technical guidance or for unusual problems and/or occurrences during testing (e.g., process upsets, CEMS malfunction, testing failure) if the number of tests exceeds nine sets. Any exclusion of data must be substantiated with appropriate documentation and is subject to approval by the Executive Officer.

12. Relative Accuracy Requirements for Analyzers

The nitrogen oxides gas analyzers shall meet a relative accuracy requirement of being less than or equal to 20 percent of the mean value of the reference method test data in units of ppmv for nitrogen oxides. Relative accuracy is calculated by the equations in Section 8 of 40 CFR, Part 60, Appendix B, Performance Specification 2. Alternatively, for cases where the mean value of the reference method test data is less than 5 ppmv, the NOx concentration relative accuracy requirement may be met if equation 9c is satisfied.

$$|d| + |cc| <= 1.0 \text{ ppmv} \qquad \text{(Eq. 9c)}$$

Where:
d = average of differences between the NOx concentration measurement system reading and the corresponding reference method test data in units of ppmv.
cc = confidence coefficient as determined by the equations in Section 8 of 40 CFR Part 60, Appendix B, Performance Specification 2.

The oxygen and carbon dioxide gas analyzers shall meet a relative accuracy requirement of being less than or equal to 20 percent of the mean value of the reference method test data in units of volume percent. Relative accuracy is calculated by the equations in Section 8 of 40 CFR, Part 60, Appendix B, Performance Specification 2. Alternatively, for cases where the mean value of the reference method test data for oxygen or carbon dioxide concentration is less than 5.0 volume percent, the relative accuracy requirement for oxygen or carbon dioxide concentration may be met if equation 9d is satisfied.

$|d| + |cc| <= 1.0$ volume percent (Eq. 9d)

Where:

d = average of differences between the oxygen or carbon dioxide concentration measurement system reading and the corresponding reference method test data.

cc = confidence coefficient as determined by the equations in Section 8 of 40 CFR Part 60, Appendix B, Performance Specification 2.

Units using monitors with more than one span range must perform the calibration error test on all span ranges. This portion of the CEMS shall also meet the specifications in Attachment B (BIAS TEST) of these protocols.

There shall be a minimum of nine sets of tests conducted. All data collected shall be submitted to the Executive Officer and shall be used to determine relative accuracy except data may be rejected per the technical guidance or for unusual problems and/or occurrences during testing (e.g., process upsets, CEMS malfunction, testing failure) if the number of tests exceeds nine sets. Any exclusion of data must be substantiated with appropriate documentation and is subject to approval by the Executive Officer.

13. Certification

a. Provisional Approval

The Facility Permit holder of a major source shall submit, certification test results and supporting documents to the District for each CEMS within the applicable time period required by Rule 2012 to install, operate, and maintain a CEMS. The Facility Permit holder shall certify that the results show that the CEMS has met all the requirements of the protocol if its submission is after August 31, 1994. Upon receipt of the test results and the certification that the CEMS is in compliance, the District will issue a Provisional Approval. The effective date of Provisional Approval shall be the last date of source testing if the test results are submitted within 60 days from the last date of source testing. However, if the test results are submitted more than 60 days after the last date of source testing, the effective date of Provisional Approval shall be the date of submittal of the testing results. After the Provisional Approval, the Facility Permit holder shall comply with the requirements under Attachment C - Quality Assurance and Quality Control Procedures.

b. Final Certification

After the Provisional Approval, all the data measured and recorded by the CEMS will be considered valid quality assured data provided that the Executive Officer does not issue a notice of disapproval of final certification. Final certification of the CEMS will be granted if the certification test results show that the CEMS has met all the requirements of the protocol, including Subdivision B, Paragraphs 10, 11, and 12 of this Chapter.

In the case where the test results show that the CEMS does not meet all the requirements of the rule, the Executive Officer will disapprove the final certification. If this occurs, the previously considered valid data from the date of Provisional Approval shall be replaced by data as specified in subdivision (E) - Missing Data Procedures. This procedure shall be used until the time that new certification test results are submitted, and the CEMS has received final approval by the District. After the Provisional Approval, the Facility Permit holder shall comply with the requirements under Attachment C - Quality Assurance and Quality Control Procedures. Data collected by the CEMS shall not be valid unless the CEMS is demonstrated to meet the requirements under Attachment C.

c. Re-certification

The Facility Permit holder shall conduct tests to re-certify a certified CEMS whenever the CEMS is modified in accordance with paragraph (B)(16).

14. Sampling Location Requirements

Each affected piece of equipment shall have sampling locations which meet the "Guidelines for Construction of Sampling and Testing Facilities" in the District Source Test Manual. If an alternate location (not conforming to the criteria of eight duct diameters downstream and two diameters upstream from a flow disturbance) is used, the absence of flow disturbance shall be demonstrated by using the District method in the Source Test Manual, Chapter X, Section 1.4, or 40 CFR, Part 60, Appendix A, Method 1. Section 2.5 and the absence of stratification shall be demonstrated using District method in the Source Test Manual, Chapter X, Section 13.

15. Sampling Line Requirement

The CEMS sample line from the CEMS probe to the sample conditioning system shall be heated to maintain the sample temperature above the dew

point of the sample. This requirement does not apply to dilution probe systems where no sample condensation occurs.

16. Recertification Requirements

The District will reevaluate the monitoring systems at any affected piece of equipment where changes to the basic process equipment or air pollution control equipment occur, to determine the proper full span range of the monitors. Any monitor system requiring change to its full span range in order to meet the criteria in Chapter 2, Subdivision B shall be recertified according to all the specifications in Chapter 2, Subdivision B, Paragraphs 8, 10, 11, and 12, as applicable, including the relative accuracy tests, the calibration drift tests, and the calibration error tests. A new CEMS application shall be submitted for each CEMS which is reevaluated.

The recertification for any reevaluated CEMS, including existing, modified, or new CEMS, monitoring an existing or modified major source that was previously permitted under RECLAIM, shall be completed within 90 days of the start-up of the newly changed or modified equipment monitored by such CEMS. The Facility Permit holder shall calculate and report NOx emission data for the period prior to the CEMS recertification by means of the automated data acquisition and handling system according to the following procedures:

a. For any CEMS which is recertified within 90 days of start-up of the newly modified equipment, the emission data recorded by the CEMS prior to the recertification would be considered valid and shall be used for calculating and reporting NO_X emissions for the equipment it serves.

b. For any CEMS which is not recertified within 90 days of start-up of the newly modified equipment, the 90th percentile emission data (lbs per day) for the previous 90 unit operating days recorded by the CEMS prior to the recertification shall be used for calculating and reporting NO_X emissions for the equipment it serves.

17. Quality Assurance Procedures for Analyzers

The quality assurance and quality control requirements for analyzers, flow monitors, and NO_X emission rate systems are given in Attachment C (QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES) of these protocols. The quality assurance plans required by Attachment C of these protocols shall be submitted along with the CEMS certification application to the District for the approval of the Executive Officer . Source test and monitoring equipment inspection

reports required by the Protocols shall be kept on-site for at least three years. The reference method tests are those methods in Chapter 8 - Reference Methods of these protocols. Any CEMS which is deemed out-of-control by Attachment C of these protocols shall be corrected, retested by the appropriate audit procedure, and restored to in-control condition within 24 hours after being deemed out-of-control. If the CEMS is not in-control at the end of the 24-hour period, the CEMS data shall be gathered using the methods in Chapter 2, Subdivision B, Paragraph 6 and Chapter 2, Subdivision B, Paragraph 7 of these requirements or using the Missing Data Procedures in Chapter 2 Subdivision E. All data which is gathered in order to comply with Attachment C of these protocols shall be maintained for three years and be made available to the Executive Officer upon request. Any such data which is invalidated shall be identified and reasons provided for any data invalidation. The nitrogen oxides and oxygen monitors shall also meet the specifications in Attachment B (BIAS TEST) of these protocols.

18. Quality Assurance for Fuel Flow Meters

Fuel flow measuring devices used for obtaining stack flow in conjunction with F-factors shall be tested as installed for relative accuracy using reference methods to determine stack flow.

If the flow device manufacturer has a method or device that permits the fuel flow measuring device to be tested as installed for relative accuracy, the Facility Permit holder shall request approval from the Executive Officer. Approval will be granted in cases where the Facility Permit holder can demonstrate to the satisfaction of the Executive Officer that no suitable testing location exists in the exhaust stacks or ducts and that it would be an inordinate cost burden to modify the exhaust stack configuration to provide a suitable testing location. The method or device used for relative accuracy testing shall be traceable to NIST standards. This method shall be used only if natural gas, fuel oil, or other fuels can be shown, by the Facility Permit holder to have stable F-factors and gross heating values, or if the Facility Permit holder measures the F-factor and gross heating value of the fuel. A stable F-Factor is defined as not varying by more than +/-2.5% from the constant value used for F-Factor. For the fuels listed in 40 CFR 60, Appendix A, Method 19, Table 19-1, the F-Factors are assumed to be stable at the value cited in Table 19-1. Any F-Factor cited in Regulation XX shall supersede the f-Factor in Table 19-1. For fuels not listed in the citations above, but which the Facility Permit holder can demonstrate that the source-specific F-Factor meets the same stability criteria, periodic reporting of F-Factor may be accepted and the adequacy of the frequency of analyses shall be demonstrated by the facility such that the probability that any given analysis will differ from the previous analysis by more than 5% (relative to the previous analysis) is

less than 5%. Analysis records shall be maintained, including all charts and laboratory notes.

19. Calibration Gas Traceability

All calibration gases used during certification tests and quality assurance and quality control activities shall be NIST/EPA approved standard reference materials (SRM), certified reference materials (CRM), or shall be certified according to "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards," September 1997, EPA 600/R-97/121 or any subsequent version published by EPA.

20. Relative Accuracy Test Audits Report Submittal

A test report shall be submitted to the District for each semi-annual or annual assessment test of a CEMS as required under Paragraph (B)(2) of Attachment C - Quality Assurance and Quality Control Procedures. Such report shall be submitted on or before the end of the quarter following the date of a required test.

21. Concentration Stratification

a. The owner or operator shall demonstrate at the time of certification and re-certification the absence of stratification for locating a facility CEMS gas sampling probe through testing performed according to the method in Chapter X, "Non-Standard Methods and Techniques", of the District Source Testing Manual. The number of tests shall be determined as follows:

   i. A minimum of one test shall be conducted 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. A minimum of two tests shall be conducted if the equipment operates between 20 and 50 percent load range for at least 80 percent of the time; or,

   iii. A minimum of three tests shall be conducted if the equipment operates outside of the criteria in clauses (i) and (ii) above.

   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.

b. If testing demonstrates the presence of stratification, the owner or operator shall elect one of the following alternatives:

i. The owner or operator may use a single point sampling probe, 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:

I. Then the CEMS sampling probe may be located at any point within the stack except any points that are adjacent to the stack wall or adjacent to either the highest measured concentration (time normalized) or the lowest measured concentration (time normalized), or

II. 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. The owner or operator may use a single point sampling probe, if there exists a representative CEMS probe location such that all of the following criteria are met:

I. Each traverse point concentrations is within 10.0% of the average of all traverse point concentrations (time normalized), or the difference between each traverse concentration and the average of all traverse point concentrations is less than or equal to 1.0 ppm, and

II. at least one traverse point concentration, not located next to the stack or duct wall, is within 10.0% of each adjacent traverse point concentration, or the difference between each traverse point concentration and the average of all traverse point concentrations is less than or equal to 1.0 ppm, whichever is greater, and,

III. if more than one traverse point meets the criteria listed in subclause (ii)(II), the CEMS probe shall be located at (or as near as practical) the traverse point with minimum adjacent traverse point concentration

fluctuations as determined in section (ii)(II), above.

iii. The owner or operator may use a multipoint sampling probe and determine a representative multiple point sampling configuration as approved by the Executive Officer.

iv. The owner or operator may elect to modify the stack and/or CEMS sampling probe location and retest for the absence of stratification.

C. REPORTING PROCEDURES

1. Interim Reporting Procedures

a. From January 1, 1994 until December 31, 1994 (Cycle 1 facilities) and July 1, 1994 until June 30, 1995 (Cycle 2 facilities), the Facility Permit holder shall be allowed to use an interim procedure for data reporting and storage. The Facility Permit holder shall submit as part of the Facility Permit application, the methodology for interim data reporting and storage. The Facility Permit application shall be subject to the approval of the Executive Officer and shall, at a minimum, meet the requirements of Chapter 2, Subdivision C, Paragraph 1 Subparagraphs b, c, and d

b. All the data required in Chapter 2, Subdivision C, Paragraph 1, Subparagraphs c and d shall be made available to the Executive Officer.

c. For each piece of equipment the following information shall be stored on site and be made available to the Executive Officer upon request:

i. Calendar dates covered in the reporting period;

ii. Each monthly emissions (lb NO_X/month) and each hourly emissions (lb NO_X/hour);

iii. Identification of the operating hours for which a sufficient number of valid data points has not been taken, reasons for not taking sufficient data, and a description of corrective action taken;

iv. Identification of F_d factor for each type of fuel used for calculations and the type of fuel burned;

d. The following information for the entire facility shall be on a monthly basis in a format approved by the Executive Officer:

i. Calendar dates covered in the reporting period;

ii. The sum of the daily emissions (lb NO_X/day) from all NO_X RECLAIM sources.

e. All data required by Chapter 2, Subdivision C, Paragraph 1, Subparagraphs c and d shall be recorded and/or transmitted to the District in a format specified by the Executive Officer.

2. Final Reporting Procedures

a. On and after January 1, 1995 (Cycle 1 facilities) and July 1, 1995 (Cycle 2 facilities), the RTU installed at each location shall be used to electronically report total daily mass emissions of NO_x and daily status codes to the District Central NO_x Station.

b. On and after January 1, 1995 (Cycle 1 facilities) and July 1, 1995 (Cycle 2 facilities), the Facility Permit holder shall submit to the Executive Officer a Monthly Emissions Report in the manner and form specified by the Executive Officer within 15 days following the end of each calendar month.

c. On and after January 1, 1995 (Cycle 1 facilities) and July 1, 1995 (Cycle 2 facilities), all or part of the interim data storage systems shall remain as continuous backup systems.

d. An alternate backup data storage system may be implemented, upon request.

D. ALTERNATIVE PROCEDURES FOR EMISSION STACK FLOW RATE DETERMINATION

1. Multiple Sources Venting to a Common Stack

In the event that more than one source vents to a common stack, the alternative reference method for determining individual source flow rates shall use the F-factors in EPA Method 19 and the following equation:

$$c_i = [20.9/(20.9 - b_i)] \times \sum_{j=1}^{r} (F_{dij} \times d_{ij} \times V_{ij}) \qquad \text{(Eq. 10)}$$

where:

c_i = The stack gas volumetric flow rate for the individual source(scfh),

b_i = The stack gas concentration of oxygen (percent),

F_{dij} = The oxygen-based dry F factor for each type of fuel, the ratio of the dry gas volume of the products of combustion to the heat content of the fuel (scf/mm Btu)

d_{ij} = The fuel flow rate for each type of fuel for individual source measured every 15-minute period

V_{ij} = The higher heating value of the fuel for each type of fuel

The product d_{ij} x V_{ij} shall have units of millions of Btu per hour (mmBtu/hr)

The measurement of wet concentration and wet F factor shall be allowed provided that wet concentration of NO_x is measured.

Example Calculation:

b_i = 4.2 percent O_2

F_{dij} = 8710 dscf/10^6 Btu

d_{ij} = 3000 dscfh

V_{ij} = 1050 Btu/scf

c_i = [20.9/(20.9 - 4.2)] x [(8710/10^6)(3000)(1050)

c_i = 34,337 dscfh

This method may be used for applicable sources before and after the interim period mentioned in Chapter 2, Subdivision C, Paragraph 1. The orifice plates used in each affected piece of equipment vented to a common stack shall meet the requirements in Chapter 2, Subdivision D, Paragraph 2.

2. Quality Assurance for Orifice Plate Measurements

Each orifice plate used to measure the fuel gas flow rate shall be checked once every 12 months using Reference Methods. If the orifice plate cannot be checked using Reference Methods, it may be checked using other methods that can show traceability to NIST standards. If the orifice plate cannot be checked by Reference Methods or other methods that can show traceability to NIST standards, the orifice plate shall be removed from the gas supply line for an inspection once every 12 months, and the following inspection procedure shall be followed:

a. Each orifice plate shall be visually inspected for any nicks, dents, corrosion, erosion, or any other signs of damage according to the orifice plate manufacturer's specifications.

b. The diameter of each orifice shall be measured using the method recommended by the orifice plate manufacturer.

c. The flatness of the orifice plate shall be checked according to the orifice manufacturer's instructions. The departure from flatness of an orifice plate shall not exceed 0.010 inches per inch of dam height (D-d/2) along any diameter. Here, D is the inside pipe diameter, and d is the orifice diameter at its narrowest constriction.

d. The pressure gauge or other device measuring pressure drop across the orifice shall be calibrated against a manometer, and shall be replaced if it deviates by more than ±2 percent across the range.

e. The surface roughness shall be measured using the method recommended by the orifice plate manufacturer. The surface roughness of an orifice plate shall not exceed 50 microinches.

f. The upstream edge of the measuring orifice shall be square and sharp so that it shall not show a beam of light when checked with an orifice gauge.

g. In centering orifice plates, the orifice shall be concentric with the inside of the meter tube or fitting. The concentricity shall be maintained within 3 percent of the inside diameter of the tube or fitting along all diameters.

h. Any other calibration tests specified by the orifice manufacturer shall be conducted at this time.

If an orifice plate fails to meet any of the manufacturer's specifications, it shall be replaced within two weeks of the inspection.

E. MISSING DATA PROCEDURES

The following Missing Data Procedures shall be used to determine substitute data whenever a valid hour of NO_x emission data has not been obtained or recorded.

1. Procedures for Missing NO_X Concentration Data

For each equipment, whenever a valid hour of NO_X pollution concentration data has not been obtained or recorded, the Facility Permit holder shall provide substitute data using the procedures below. Alternatively, a facility may provide NO_X pollution concentration missing data using the procedure in 40 CFR Part 75 Subpart D for SO_2 emissions (in lb/hr) if the relative accuracy of the pollutant analyzer and flow measurement system during the last CEMS certification test and/or RATA are both less than 10 percent.

a. The Facility Permit holder shall calculate on a daily basis the percent data availability from the NO_X pollutant concentration monitoring analyzer according to the following procedures:

i. Calculate on a daily basis a rolling percentage of the operating hours of each equipment that each concentration monitoring system was available for the period from the date the NOx pollutant concentration monitoring analyzer was provisionally certified or 365 days prior to the current date (not counting the current day), whichever date is later, to the day previous to the current date.

ii. Record on a daily basis the percent annual concentration monitor availability using the following equation:

$$W = Y/Z \times 100\% \quad \text{(Eq.13)}$$

where:

W = the percent annual monitor availability

Y = the total operating hours for which the monitor provided quality-assured data during the period from the date the NOx pollutant concentration monitoring analyzer was provisionally certified or 365 days prior to the current date (not counting the current day), whichever date is later, to the day previous to the current date.

Z = the total operating hours of the affected piece of equipment during the period from the date the NOx pollutant concentration monitoring analyzer was provisionally certified or 365 days prior to the current date (not counting the current day), whichever date is later, to the day previous to the current date.

Example Calculation:

Y	=	1,680 hrs
Z	=	2,160 hrs
W	=	Y/Z x 100%
W	=	(1,680/2,160) x 100%
W	=	77.78 percent

b. Whenever the percent annual monitor availability is 95 percent or more, the Facility Permit holder shall calculate substitute data for each hour according to the following procedures.

i. For a missing data period less than or equal to 24 hours, substitute data shall be calculated using the 1N Procedure in Attachment A. If insufficient data is available to perform this calculation, substitute data shall be calculated pursuant to clause E(1)(b)(ii).

ii. For a missing data period greater than 24 hours, substitute data shall be calculated using the maximum hourly concentration recorded by the concentration monitor for the previous 30 days. If no emissions occurred during the previous 30 days, substitute data shall be calculated pursuant to clause E(1)(c)(i)(III).

c. i. Whenever the percent annual monitor availability is 90-percent or more but less than 95-percent, the Facility Permit holder shall calculate substitute data for each hour according to the following procedures.

I. For a missing data period of less than or equal to 3 hours, substitute data shall be calculated using the average of the recorded concentration for the hour immediately before the missing data period and the hour immediately after the missing data period. If no emissions occurred during the hour immediately before the missing data period or the hour immediately after the missing data period, substitute data shall be calculated pursuant to clause E(1)(c)(i)(II).

II. For a missing data period of more than 3 hours but less than or equal to 24 hours, substitute data shall

be calculated using the maximum hourly concentration recorded by the concentration monitor for the previous 30 days. If no emissions occurred during the previous 30 days, substitute data shall be calculated pursuant to clause E(1)(c)(i)(III).

III. For a missing data period of greater than 24 hours, substitute data shall be calculated using the maximum hourly concentration recorded by the concentration monitor for the previous 365 days. If no emissions occurred during the previous 365 days, substitute data shall be calculated pursuant to clause E(1)(c)(ii).

ii. Whenever the percent annual monitor availability is less than 90 percent, substitute data shall be calculated using the highest hourly concentration recorded during the service of the monitoring system. For the purpose of this subparagraph, service of the monitoring system shall start from the initial certification date of the analyzer or the date when a decrease in the valid range of the monitoring system is approved by the Executive Officer.

d. For missing data periods where there is no prior CEMS data available or the highest CEMS data is zero:

i. for less than or equal to 24 hours, the mass emissions shall be calculated using totalized fuel usage and the starting emission factor specified in Table 1 of Rule 2002 or any alternative emission factor used in the determination of initial allocations; or

ii. for less than or equal to 24 hours and where fuel usage is not available, the mass emissions shall be calculated using the equipment maximum rated capacity, 100 percent equipment uptime, and the starting emission factor specified in Table 1 of Rule 2002; or

iii. for greater than 24 hours, the mass emissions shall be calculated using the equipment maximum rated capacity, 100 percent equipment uptime, and the uncontrolled emission factors specified in Table 3-D. An uncontrolled emission factor is an emission factor representative of the emissions prior to any emission control equipment from the source. For equipment not specified in Table 3D, an uncontrolled emission factor can be determined based on

the starting emission factor used in the determination of initial allocations discounted by any control efficiency, or based on source test data. In determining a control efficiency, the facility permit holder may use source test data, or the default control efficiency as listed in Table 3-E.

iv. Retroactively from January 1, 1995 and ending June 30, 1995, for Cycle 1 Facility Permit holders with major NO_x sources that do not have an approved RECLAIM certified CEMS, may calculate NO_x daily mass emissions in lieu of the procedures specified in the above clauses E(1)(d)(i), E(1)(d)(ii), and E(1)(d)(iii), using (1) the emission factor specified in Table 1 of Rule 2002 or any alternative factor used in the determination of initial allocations or specified in the facility permit and (2) the totalized fuel usage or process throughput.

v. Facility Permit holders with NO_x major sources which demonstrate to the satisfaction of the Executive Officer or designee that standard equipment is not available for measuring exhaust emissions for the purpose of RECLAIM CEMS certification may submit an application by December 31, 1995 to use an alternative exhaust gas and/or pollutant concentration measuring equipment. Such equipment must employ commercially available technology, and must be demonstrated to meet all the requirements of CEMS certification. Upon approval of the application, the Facility Permit holder may calculate NO_x daily mass emissions in lieu of the procedures specified in clauses E(1)(d)(i), E(1)(d)(ii), and E(1)(d)(iii), using the alternate method of (1) the emission factor specified in the facility permit and (2) the totalized fuel usage or process throughput. Such calculation of NO_x mass emissions may be done retroactively from July 1, 1995 and ending December 31, 1997 or until the CEMS is finally certified, whichever is earlier. The alternate method of calculating mass emissions shall be applied after the proposed equipment has been approved by the Executive Officer. If the CEMS is not certified by December 31, 1997, then NO_x daily mass emissions shall be calculated by the procedures specified in clauses E(1)(d)(i), E(1)(d)(ii), and E(1)(d)(iii) retroactive to July 1, 1995.

vi. If the Facility Permit holder demonstrates that standard equipment is not available but alternative equipment is commercially available as set forth in (E)(1)(d)(v) and also

demonstrates to the satisfaction of the Executive Officer or designee that their CEMS cannot be certified because (1) there is an inordinate cost burden for flow monitoring as specified under (B)(11) and (2) that the Reference Methods, as specified in Rule 2012(j)(1) and Appendix A, cannot be applied because no suitable testing location exists in the exhaust stacks or ducts, then the Facility Permit holder may submit an alternative CEMS plan for certification by December 31, 1995. This plan must demonstrate that the proposed monitoring system complies with all other requirements of CEMS certification and is the most technically feasible in measurement accuracy. Until the alternative CEMS is certified or up until December 31, 1997, whichever is earlier, and retroactive to July 1, 1995, the Facility Permit holder may calculate NO_x daily mass emissions in lieu of the procedures specified in clauses E(1)(d)(i), E(1)(d)(ii), and E(1)(d)(iii), using the alternate method of (1) the emission factor specified in the facility permit and (2) the totalized fuel usage or process throughput. If the CEMS is not certified by December 31, 1997, then NO_x daily mass emissions shall be calculated by the procedures specified in clauses E(1)(d)(i), E(1)(d)(ii), and E(1)(d)(iii).

2. Procedures for Missing Stack Exhaust Gas Flow Rate Data

For each equipment, whenever a valid hour of stack exhaust gas flow rate data has not been obtained or recorded, the Facility Permit holder shall provide substitute data using the procedures below. Alternatively, a facility may provide stack exhaust gas flow rate data using the procedure in 40 CFR Part 75 Subpart D if the relative accuracy of the pollutant analyzer, flow measurement system, and emission rate measurement during the last CEMS certification test and/or RATA are all less than 10 percent.

a. The Facility Permit holder shall calculate on a daily basis the percent data availability from the flow monitoring system according to the following procedures:

i. Calculate on a daily basis a rolling percentage of the operating hours of each equipment that each flow monitoring system was available for the period from the date the NOx pollutant concentration monitoring analyzer was provisionally certified or 365 days prior to the current date (not counting the current day), whichever date is later, to the day previous to the current date.

ii. Record on a daily basis the percent annual flow monitor availability using the following equation:

$$W = Y/Z \times 100\% \quad \text{(Eq. 12)}$$

where:

W = the percent annual flow monitor availability

Y = the total operating hours for which the monitor provided quality-assured data during the period from the date the NOx pollutant concentration monitoring analyzer was provisionally certified or 365 days prior to the current date (not counting the current day), whichever date is later, to the day previous to the current date.

Z = the total operating hours of the affected piece of equipment during the period from the date the NOx pollutant concentration monitoring analyzer was provisionally certified or 365 days prior to the current date (not counting the current day), whichever date is later, to the day previous to the current date.

Example Calculation:

Y = 1,680 hrs

Z = 2,160 hrs

W = Y/Z x 100%

W = (1,680/2,160) x 100%

W = 77.78 percent

b. Whenever the percent annual flow monitor availability is 95 percent or more, the Facility Permit holder shall calculate substitute data for each hour according to the following procedures.

i. For a missing data period less than or equal to 24 hours, substitute data shall be calculated using the 1N Procedure in Attachment-A. If insufficient data is available to perform this calculation, substitute data shall be calculated pursuant to clause E(2)(b)(ii).

ii. For a missing data period greater than 24 hours, substitute data shall be calculated using the maximum hourly flow recorded by the flow monitor for the previous 30 days. If

no emissions occurred during the previous 30 days, substitute data shall be calculated pursuant to clause E(2)(c)(iii).

c. Whenever the percent annual flow monitor availability is 90-percent or more but less than 95-percent, the Facility Permit holder shall calculate substitute data for each hour according to the following procedures.

i. For a missing data period of less than or equal to 3 hours, substitute data shall be calculated using the average of the recorded flow rate for the hour immediately before the missing data period and the hour immediately after the missing data period. If no emissions occurred during the hour immediately before the missing data period or the hour immediately after the missing data period, substitute data shall be calculated pursuant to clause E(2)(c)(ii).

ii. For a missing data period of more than 3 hours but less than or equal to 24 hours, substitute data shall be calculated using the maximum hourly flow rate recorded by the flow monitor for the previous 30 days. If no emissions occurred during the previous 30 days, substitute data shall be calculated pursuant to clause E(2)(c)(iii).

iii. For a missing data period of greater than 24 hours, substitute data shall be calculated using the maximum hourly flow rate recorded by the flow monitor for the previous 365 days. If no emissions occurred during the previous 365 days, substitute data shall be calculated pursuant to subparagraph E(2)(d).

d. Whenever the percent annual flow monitor availability is less than 90 percent, substitute data shall be calculated using the highest hourly flow rate recorded during the service of the monitoring system. For the purpose of this subparagraph, service of the monitoring system shall start from the initial certification date of the analyzer or the date when a decrease in the valid range of the monitoring system is approved by the Executive Officer.

3. Procedures for Missing Stack Exhaust Gas Flow Rate Data and Missing NO_X Concentration Data

For each equipment, whenever a valid hour of both stack exhaust gas flow rate data and NO_X pollution concentration data have not been obtained or

recorded, the Facility Permit holder shall provide substitute data using emissions data and the procedures below.

a. The Facility Permit holder shall calculate and record on a daily basis the percent annual emission availability. The percent annual emission availability shall be equal to the lesser of the percent annual concentration monitor availability as determined in subparagraph E(1)(a) or the percent annual flow monitor availability as determined in subparagraph E(2)(a).

b. Whenever the percent annual emission availability is 95 percent or more, the Facility Permit holder shall calculate substitute data for each hour according to the following procedures.

   i. For a missing data period less than or equal to 24 hours, substitute data shall be calculated using the 1N Procedure in Attachment-A. If insufficient data is available to perform this calculation, substitute data shall be calculated pursuant to clause E(3)(b)(ii).

   ii. For a missing data period greater than 24 hours, substitute data shall be calculated using the maximum hourly emissions for the previous 30 days. If no emissions occurred during the previous 30 days, substitute data shall be calculated pursuant to clause E(3)(c)(iii).

c. Whenever the percent annual emission availability is 90-percent or more but less than 95-percent, the Facility Permit holder shall calculate substitute data for each hour according to the following procedures.

   i. For a missing data period of less than or equal to 3 hours, substitute data shall be calculated using the average of the recorded emissions for the hour immediately before the missing data period and the hour immediately after the missing data period. If no emissions occurred during the hour immediately before the missing data period or the hour immediately after the missing data period, substitute data shall be calculated pursuant to clause E(3)(c)(ii).

   ii. For a missing data period of more than 3 hours but less than or equal to 24 hours, substitute data shall be calculated using the maximum hourly emissions recorded for the previous 30 days. If no emissions occurred during the previous 30 days, substitute data shall be calculated pursuant to clause E(3)(c)(iii).

iii. For a missing data period of greater than 24 hours, substitute data shall be calculated using the maximum hourly emissions for the previous 365 days. If no emissions occurred during the previous 365 days, substitute data shall be calculated pursuant to subparagraph E(3)(d).

d. Whenever the percent annual emission availability is less than 90 percent, substitute data shall be calculated using the highest hourly emissions recorded during the service of the monitoring system. For the purpose of this subparagraph, service of the monitoring system shall start from the initial certification date of the analyzer or the date when a decrease in the valid range of the monitoring system is approved by the Executive Officer.

F. TIME-SHARING

1. Time-sharing is where an analyzer and possibly the associated sample conditioning system is used on more than one source. Time-sharing is allowed for NO_X RECLAIM sources provided the CEMS can meet the following requirements in addition to the other requirements in this document for each source that is time-shared.

2. All sources shall have mutually compatible span range(s). The span range(s) shall be able to meet the criteria in Chapter 2, Subdivision B, Paragraph 8.

3. Each source shall have a data reading period greater than or equal to 3 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 is not to be collected following a switch of sampled sources until an amount of time equal to the response time has passed.

4. The CEMS shall be able to perform and record zero and span calibrations at each source.

G. EMISSIONS DURING STARTUP OR SHUTDOWN PERIODS

The Facility Permit holder of a major source with startup or shutdown periods during which the pollutant or diluent concentrations do not fall within 10 - 95 percent of the normal operation span range(s) shall apply the following methodology; otherwise, the Facility Permit holder shall comply with Chapter 2, Subdivision E, Paragraph 1 - Missing Data Procedures:

1. During equipment startup or shutdown the Facility Permit holder shall apply the unregulated emission factor specified in Table 3-D; or

2. If the emission factors in Table 3-D do not reflect the emission factors during startup and shutdown periods, the Facility Permit holder shall propose emission factors for the approval of the Executive Officer and shall submit source test data to substantiate the proposed emission factors. The hourly average emissions during startup and shutdown periods shall be calculated and reported according to:

$$E_{st} = D_{st} \times EF_{st} \quad \text{(Eq.13)}$$

where:

E_{st} = The hourly mass emission of nitrogen oxides during startup period (lb/hr).

D_{st} The hourly average fuel flow rate for each type of fuel during startup period (mmscf/hr or mgal/hr).

EF_{st} The unregulated or Facility Permit holder-specified emission factor during startup period (lb/mmscf or lb/mgal).

$$E_{sh} = D_{sh} \times EF_{sh} \quad \text{(Eq.14)}$$

where:

E_{sh} = The hourly mass emission of nitrogen oxides during shutdown period (lb/hr).

D_{sh} = The of hourly fuel flow rate for each type of fuel during shutdown period (mmscf/hr or mgal/hr).

EF_{sh} = The unregulated or Facility Permit holder-specified emission factor during shutdown period (lb/mmscf or lb/mgal).

TABLE 2-A

MEASURED VARIABLES FOR MAJOR NO_X SOURCES

EQUIPMENT TYPE : BOILERS

EQUIPMENT	MEASURED VARIABLES
Boilers	1. Stack NO_X concentration and exhaust flow rate; OR Stack NO_X, and O_2 concentrations, and fuel flow rate; 2. Status codes; 3. Steam production rate;
Boilers with low NO_X burners	All variables identified for boilers.
Boilers with staged combustion	All variables identified for boilers.
Boilers with FGR	All variables identified for boilers; AND 4. Flue gas recirculation rate.
Boilers with SCR	All variables identified for boilers; AND 4. Ammonia injection rate; 5. Temperature of the inlet gas stream to SCR;
Boilers with SNCR	All variables identified for boilers; AND 4. Ammonia (or urea) injection rate; 5. Temperature of the inlet gas stream to SNCR;
Boilers with NSCR	All variables identified for boilers; AND 4. Natural gas (or other HC) injection rate.

TABLE 2-A (CONTINUED)

MEASURED VARIABLES FOR MAJOR NO_X SOURCES

EQUIPMENT TYPE : FURNACES

EQUIPMENT	MEASURED VARIABLES
Furnaces	1. Stack NO_x concentration and exhaust flow rate; OR Stack NO_x, and O_2 concentrations, and fuel flow rate; 2. Status codes; 3. Production rate;
Furnaces with low NO_X burners	All variables identified for furnaces.
Furnaces with combustion modification	All variables identified for furnaces.
Furnaces with SCR	All variables identified for furnaces; AND 4. Ammonia injection rate; 5. Temperature of the inlet gas stream to SCR;
Furnaces with SNCR	All variables identified for furnaces; AND 4. Ammonia (or urea) injection rate; 5. Temperature of the inlet gas stream to SNCR;

TABLE 2-A (CONTINUED)

MEASURED VARIABLES FOR MAJOR NO_X SOURCES

EQUIPMENT TYPE : OVENS

EQUIPMENT	MEASURED VARIABLES
Ovens	1. Stack NO_x concentration and exhaust flow rate; OR Stack NO_x, and O_2 concentrations, and fuel flow rate; 2. Status codes; 3. Production rate;
Ovens with low NO_X burners	All variables identified for ovens.
Ovens with combustion modification	All variables identified for ovens.
Ovens with SCR	All variables identified for ovens; AND 4. Ammonia injection rate; 5. Temperature of the inlet gas stream to SCR;
Ovens with SNCR	All variables identified for ovens; AND 4. Ammonia (or urea) injection rate; 5. Temperature of the inlet gas stream to SNCR;

TABLE 2-A (CONTINUED)

MEASURED VARIABLES FOR MAJOR NO_X SOURCES

EQUIPMENT TYPE : DRYERS

EQUIPMENT	MEASURED VARIABLES
Dryers	1. Stack NO_x concentration and exhaust flow rate; OR Stack NO_x, and O_2 concentrations, and fuel flow rate; 2. Status codes; 3. Production rate;
Dryers with low NO_X burners	All variables identified for dryers.
Dryers with combustion modification	All variables identified for dryers.
Dryers with FGR	All variables identified for dryers; AND 4. Flue gas recirculation rate.
Dryers with SCR	All variables identified for dryers; AND 4. Ammonia injection rate; 5. Temperature of the inlet gas stream to SCR;
Dryers with SNCR	All variables identified for dryers; AND 4. Ammonia (or urea) injection rate; 5. Temperature of the inlet gas stream to SNCR;
Dryers with NSCR	All variables identified for dryers; AND 4. Natural gas (or other HC) injection rate.

TABLE 2-A (CONTINUED)

MEASURED VARIABLES FOR MAJOR NO_X SOURCES

EQUIPMENT TYPE : PROCESS HEATERS

EQUIPMENT	MEASURED VARIABLES
Process heaters	1. Stack NO_x concentration and exhaust flow rate; OR Stack NO_x, and O_2 concentrations, and fuel flow rate; 2. Status codes; 3. Production rate;
Process heaters with low NO_x burners	All variables identified for process heaters.
Process heaters with combustion modification	All variables identified for process heaters.
Process heaters with FGR	All variables identified for process heaters; AND 4. Flue gas recirculation rate.
Process heaters with SCR	All variables identified for process heaters; AND 4. Ammonia injection rate; 5. Temperature of the inlet gas stream to SCR;
Process heaters with SNCR	All variables identified for process heaters; AND 4. Ammonia (or urea) injection rate; 5. Temperature of the inlet gas stream to SNCR;
Process heaters with NSCR	All variables identified for process heaters; AND 4. Natural gas (or other HC) injection rate.
Process heaters with water (or steam) injection	All variables identified for process heaters; AND 4. Water (or steam) injection rate.

TABLE 2-A (CONTINUED)

MEASURED VARIABLES FOR MAJOR NO_X SOURCES

EQUIPMENT TYPE : INCINERATORS

EQUIPMENT	MEASURED VARIABLES
Incinerators	1. Stack NO_x concentration and exhaust flow rate; OR Stack NO_x, and O_2 concentrations, and fuel flow rate; 2. Status codes; 3. Production rate;
Incinerators with SCR	All variables identified for incinerators; AND 4. Ammonia injection rate; 5. Temperature of the inlet gas stream to SCR;
Incinerators with SNCR	All variables identified for incinerators; AND 4. Ammonia (or urea) injection rate; 5. Temperature of the inlet gas stream to SNCR;

Table 2-A (CONTINUED)

MEASURED VARIABLES FOR MAJOR NO_X SOURCES

EQUIPMENT TYPE : REFINERY TAIL GAS UNITS

Refinery tail gas units	1. Stack NO_x concentration and exhaust flow rate; OR; Stack NO_x, and O_2 concentrations, and fuel flow rate; 2. Status codes; 3. Production rate;

TABLE 2-A (CONTINUED)

MEASURED VARIABLES FOR MAJOR NO_X SOURCES

EQUIPMENT TYPE : TEST CELLS

EQUIPMENT	MEASURED VARIABLES
Test cells	1. Stack NO_x concentration and exhaust flow rate; OR Stack NO_x, and O_2 concentrations, and fuel flow rate; 2. Status codes; 3. Shaft horsepower output or other measure of system output;
Test cells with SCR	All variables identified for test cells; AND 4. Ammonia injection rate; 5. Temperature of the inlet gas stream to SCR;
Test cells with Packed Chemical Scrubber	All variables identified for test cells; AND 4. Chemical injection rate.

TABLE 2-A (CONTINUED)

MEASURED VARIABLES FOR MAJOR NO_X SOURCES

EQUIPMENT TYPE : INTERNAL COMBUSTION ENGINES

EQUIPMENT	MEASURED VARIABLES
Internal combustion engines	1. Stack NO_x concentration and exhaust flow rate; OR Stack NO_x, and O_2 concentrations, and fuel flow rate; 2. Status codes; 3. Throttle setting shaft horsepower output or other measure of system output;
Internal combustion engines with combustion modification	All variables identified for internal combustion engines.
Internal combustion engines with Injection Timing Retard 4 degree	All variables identified for internal combustion engines.
Internal combustion engines with turbocharger, aftercooler, intercooler.	All variables identified for internal combustion engines.
Internal combustion engines with SCR	All variables identified for internal combustion engines; AND 4. Ammonia injection rate; 5. Temperature of the inlet gas stream to SCR;
Internal combustion engines	All variables identified for internal combustion engines; with NSCR AND 4. Natural gas (or other HC) injection rate.

TABLE 2-A (CONTINUED)

MEASURED VARIABLES FOR MAJOR NO_X SOURCES

EQUIPMENT TYPE : GAS TURBINES

EQUIPMENT	MEASURED VARIABLES
Gas turbines	1. Stack NO_x concentration and exhaust flow rate; OR Stack NO_x, and O_2 concentrations, and fuel flow rate; 2. Status codes; 3. Shaft horsepower output or other measure of system output;
Gas turbines with Water or Steam Injection	All variables identified for gas turbines; AND 4. Water or steam injection rate;
Gas turbines with SCR and Steam Injection	All variables identified for gas turbines; AND 4. Ammonia injection rate; or 5. Steam injection rate 6. Temperature of the inlet gas stream to SCR;
Gas turbines with SCR and Water Injection	All variables identified for gas turbines; AND 4. Ammonia injection rate; or 5. Water injection rate 6. Temperature of the inlet gas stream to SNCR;

TABLE 2-A (CONTINUED)

MEASURED VARIABLES FOR MAJOR NO_X SOURCES

EQUIPMENT TYPE : KILNS AND CALCINERS

EQUIPMENT	MEASURED VARIABLES
Kilns and calciners	1. Stack NO_x concentration and exhaust flow rate; OR Stack NO_x, and O_2 concentrations, and fuel flow rate; 2. Status codes; 3. Production rate;
Kilns and calciners with low NO_x burners	All variables identified for kilns and calciners.
Kilns and calciners with combustion modifications	All variables identified for kilns and calciners.
Kilns and calciners with FGR	All variables identified for kilns and calciners; AND 4. Flue gas recirculation rate.
Kilns and calciners with SCR	All variables identified for kilns and calciners; AND 4. Ammonia injection rate; 5. Temperature of the inlet gas stream to SCR;
Kilns and calciners with SNCR	All variables identified for kilns and calciners; AND 4. Ammonia (or urea) injection rate; 5. Temperature of the inlet gas stream to SNCR;
Kilns and calciners with NSCR	All variables identified for kilns and calciners; AND 4. Natural gas (or other HC) injection rate.

TABLE 2-A (CONTINUED)

MEASURED VARIABLES FOR MAJOR NO_X SOURCES

EQUIPMENT TYPE : FLUID CATALYTIC CRACKING UNITS

EQUIPMENT	MEASURED VARIABLES
FCCUs (CO Boilers)	1. Stack NO_x concentration and exhaust flow rate; OR Stack NO_x, and O_2 concentrations, and fuel flow rate; 2. Status codes; 3. Production rate;
FCCUs with combustion modifications	All variables identified for refinery tail gas units.
FCCUs with SCR	All variables identified for refinery tail gas units; AND 4. Ammonia injection rate; 5. Temperature of the inlet gas stream to SCR;
FCCUs with SNCR	All variables identified for refinery tail gas units; AND 4. Ammonia (or urea) injection rate; 5. Temperature of the inlet gas stream to SNCR;
FCCUs with NSCR	All variables identified for refinery tail gas units; AND 4. Natural gas (or other HC) injection rate.

TABLE 2-B

REPORTED VARIABLES FOR ALL MAJOR NO_X SOURCES

EQUIPMENT	REPORTED VARIABLES
All Major NO_X sources	1. Total daily mass emissions from each source; 2. Daily Status codes.