



# South Coast Air Quality Management District

21865 Copley Drive, Diamond Bar, CA 91765-4182

ST-001ICE

Monitoring & Analysis Division, Source Test Engineering Branch (909) 396-2281

## Standard Source Test Protocol

for

## RECLAIM Large Sources

Document: SP-ICE-001

TESTING OF INTERNAL COMBUSTION ENGINES

SUBJECT TO

A NO<sub>x</sub> CONCENTRATION LIMIT

Revision 3  
July 7, 2000

## **1.0 Introduction**

Several standard source test protocols have been developed to assist the industry in complying with the concentration limit testing requirements of RECLAIM Rules and Regulations for large sources. Each protocol is identified with a series of numbers which correspond to a specific large source as listed in Table I of the Attachments. A protocol may be chosen for a specific large source listed in the table, or a new protocol may be submitted for review. The standard protocols are available from the District Executive Officer.

The following protocol was written specifically for testing of RECLAIM large source internal combustion engines for compliance with its established concentration limit. The protocol does not apply to large sources reclassified from major sources as a result of super compliance. The protocol contains instructions for proper source test methods and final report submittal. There are no pre-test requirements from the facility if the protocol is strictly adhered to as written. Modification of this protocol, however, may be necessary to satisfy the proper testing requirements for a particular engine. If so, the proposed modifications should be submitted for review and approval prior to testing.

## **2.0 Prior Approval of Exceptions/Certification of No Exceptions**

If there are any exceptions to the protocol, the facility must submit, in writing, all exceptions to the protocol for review and approval by the Executive Officer prior to testing.

If there are no exceptions to the standard protocol, the facility must submit with the final report a "Certification of No Exceptions," signed by a responsible facility personnel, stating that no exceptions were taken to the protocol and no modifications were made to the requirements of the protocol for the test. A blank certification form is included in the appendix.

## **3.0 Applicability**

This protocol is applicable to the concentration limit test requirements for most large source internal combustion engines, for all fuel types with stable heating value, and where adequate exhaust gas flow rate exists for proper measurement.

This standard protocol is assumed not to be applicable for sources where modification of the source or test methods is necessary for proper testing without prior approval for those modifications.

## **4.0 Test Criteria**

The concentration limit testing requires, for each fuel type, one continuous 60-minute concentration test and a three run relative accuracy audit (RAA), exhaust dry standard flow rate measurements, for F-factor calculation verification. If the source is fired on fuel other than those listed in Table 19-1 of EPA Method 19, a fuel analysis is also necessary.

There are no test requirements to establish an alternative concentration limit. Once a concentration limit has been established, one 60-minute concentration test is required to show compliance with the established concentration limit.

### **4.1 Load Conditions**

Because exceeding the facility permit concentration limit under any normal operating condition may result in notice of violation, it is recommended that the facility choose a load condition representing the highest concentration for NO<sub>x</sub> emissions. To choose an appropriate load condition, a preliminary screening<sup>1</sup> of the engine's emissions at different loads may be necessary.

The load condition should also produce sufficient exhaust gas flow for the three run RAA, or stack flow rate measurements. A preliminary velocity traverse may be necessary to confirm the acceptable testing conditions. It is recommended that the three run RAA be performed at a continuous load.

If the worst NO<sub>x</sub> emissions are at a load condition where the exhaust gas flow is too low for measurement, the three run RAA may be performed at another load condition as long as the flow meter remains linear. This method may not be acceptable for certain flow meters such as an orifice meter. If this option is chosen, the facility must show, in the final report, proof of flow meter linearity between the loads.

#### **4.2 Source Test Firm**

The source testing contractor must be currently approved to conduct the required testing necessary to satisfy the conditions of this protocol under the SCAQMD Laboratory Approval Program (LAP). The LAP was initially implemented under the RECLAIM Major Source CEMS Certification Program as a QA/QC measure, and broadened to include all RECLAIM testing, in April, 1999. For more information about this program, please contact Mr. Ramiro Gonzalez at (909) 396-2229 (e-mail rgonzalez@aqmd.gov).

The source testing contractor must meet the "no conflict of interest" requisite specified in District Rule 304(k) and provide the attached Statement of No Conflict of Interest as an Independent Testing Laboratory, completed and signed, with the final report.

(To aid in compiling the final source test report, a checklist is provided in the back of this document).

#### **4.3 Pre-test Notification to District**

Notify the Executive Officer the source test date(s) at least 15 days prior to testing. No other notification is necessary unless there are any exceptions to the standard protocol. If so, submit the exceptions in writing to the Executive Officer for review and approval prior to testing.

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<sup>1</sup> Preliminary screenings are not required and do not need to be reported. They are recommended if the equipment stack gas conditions are unknown. When prescreening, be sure and compare the corrected NO<sub>x</sub> concentrations.

## **5.0 Source Test Requirements**

For concentration limit, one NO<sub>x</sub> concentration test for a minimum of 60 minutes is required for each fuel type. Since mass emission rates are calculated from concentration limits and stack flow rates, and the stack flow rates are determined from fuel usage rates and fuel F-factors, a three run RAA is needed to verify the fuel flow meter accuracy.

Any noted Method refers to the District Source Test Methods as written in the Source Test Manual. Any exceptions from the written methods must be approved by the District prior to testing.

### **5.1 Sample and Velocity Traverses**

For stacks, or exhaust pipes, without existing sampling ports, determine the best sampling port location using SCAQMD Method 1.1. In order to satisfy Method 1.1, the exhaust pipe may need to be lengthened. If so, a temporary alteration may be made by attaching to the exhaust pipe an extension of same size and shape as the original pipe, where the connecting seam does not cause a flow disturbance and is leak free.

Traverse sampling is necessary for the determination of stack gas velocity and gas concentration. The number of traverse points must be determined in accordance with SCAQMD Method 1.1 for stacks with diameters greater than 12 inches and SCAQMD Method 1.2 for stacks with diameters 4 to 12 inches. All traverse points, as determined by Method 1.1 or 1.2, must be used for measuring both stack gas velocity and gas concentration. Single point gas sampling is permitted if the facility can demonstrate that the gaseous stratification at the sampling location is less than 10% as determined by Section 13, Chapter X of SCAQMD Source Test Manual. For gas analysis sampling using SCAQMD Method 3.1 and moisture sampling using SCAQMD Method 4.1, a single sampling point is sufficient. If the sampling location for the above is not ideal, propose a protocol for an alternative sampling location or sampling method for review and approval prior to testing.

If conditions such as negative flow and/or severe cyclonic flow exist that reduce the accuracy and precision of velocity measurements, an alternative location must be chosen where this condition does not exist, or the alternative procedure outlined in Section 5.2.1 must be used.

### **5.2 Three Run Relative Accuracy Audit**

A three run RAA is three full velocity traverses performed in conjunction with moisture and molecular weight sampling to determine the dry standard volumetric flow rate of the stack gas. The measured dry standard volumetric flow rate is then compared to that from the F-factor calculation to verify the relative accuracy of the fuel meter. It is recommended that all methods for the three run RAA be performed at the same load condition. The procedure for determining the relative accuracy of the fuel flow meter is as follows:

$$A = \frac{(C_m - C_a)}{C_m} \times 100 \% \quad (\text{Eq. 1})$$

$$C_a$$

where:

- A = accuracy of the fuel flow meter (%)
- $C_m$  = average fuel meter flow rate response (scfh)
- $C_a$  = average reference method flow rate (scfh)

The value of fuel flow meter accuracy, as defined by this equation, shall be less than or equal to 15%.

### 5.2.1 Stack Flow Rate

To determine the average stack flow rate in the stack, use one of the following methods:

Method	Description	Usage	Limitations
Method 2.1	Determination of Stack Gas Velocity and Volumetric Flow Rate	Most commonly used. For stacks greater than 12 inches in diameter and velocity head greater than 0.05 in. $H_2O$ . <sup>1</sup>	Cyclonic flow will result in inaccurate velocity measurements. <sup>2</sup>
Method 2.2	Direct Measurement of Gas Volume Through Pipes and Small Ducts	For pipes or ducts where velocity traverse cannot be performed due to physical limitations, i.e., low flow and size restrictions.	For gas temperature range of 32 to 120 °F.
Method 2.3	Determination of Gas Velocity and Volumetric Flow Rate From Small Stacks or Ducts	For velocity measurement in stacks 4 to 12 inches in diameter using a standard Pitot tube.	Standard Pitot tube may pose a problem in high moisture-laden or high particulate-laden gas streams.

<sup>1</sup> If the velocity head is below 0.05 in.  $H_2O$ , the source tester may propose an alternate method for measuring low velocity, such as, using a flow measuring device manufactured especially for low velocity. Use of such instruments must be approved prior to source testing.

<sup>2</sup> If cyclonic flow is present, perform the velocity traverse as specified in the District Source Test Manual Chapter X, Section 1.2.

The velocity traverse need not be performed simultaneously with concentration testing. If the velocity head is too low for measurement at the chosen load condition for concentration testing, the velocity traverse may be performed at a higher load as long as the fuel meter remains linear at that load. This option may not be acceptable for certain meters, such as, orifice meters. If pulsating flow is

detected during the velocity traverses, use a dampening method as described in Chapter X Section 9 of the SCAQMD Source Test Manual.

If the velocity cannot be determined by exhaust flow measurement, an alternate RAA is necessary. The acceptable alternative RAA methods are listed below. No bias adjustments are to be made to these test results.

The following sections are applicable to facility permit holders who may choose to determine the relative accuracy of the fuel flow meters by a direct comparison to a calibrated fuel flow meter instead of conducting velocity traverse reference method tests. The following general requirements apply to this alternative procedure:

- a. The alternative RAA shall be conducted by an independent testing laboratory in accordance with NIST traceable industry standards. A non-independent testing laboratory may be used if the laboratory is regulated by the California Public Utilities Commission.
- b. The results shall identify as-found and as-left accuracy of pressure and temperature corrected fuel flow rates. Perform all calculations at consistent temperature and pressure as prescribed by the applicable procedure. All fuel flow rates measured by the fuel flow meters must be converted to standard RECLAIM conditions, which are 68°F and one atmosphere pressure.
- c. The value of as-left accuracy, as defined in Eq. 2, shall be 2.5% or less.
- d. The alternative RAA must include at least one run at each of two operating loads. These operating loads must be within 10 percent of the lowest historical operating load and 60 to 100 percent of the maximum operating range of the fuel flow meter. The alternative RAA can include one run at one operating load if the testing laboratory is regulated by the California Public Utilities Commission, and is subject to a more stringent as-left accuracy, as defined in Eq. 2, than specified in Subparagraph 5.2.1(c).
- e. If the meter is bypassed during the alternative RAA, missing data procedures shall apply. The following conditions and procedures apply to specific configurations that may be employed to conduct the above mentioned alternative RAA:
  - i. Procedure 1: Fuel Flow Meters in Series

Fuel flow meter accuracy may be determined by comparing fuel flow rate from a proving meter (test meter) placed in series with the facility fuel flow meter. The proving meter may be either permanent or removable, however, it must be designed and installed in accordance with recognized industry standards. The proving meter's accuracy must be verified to NIST standards prior to series meter

proof. Calibration procedures as prescribed by 40 CFR Part 75, Appendix E and the ones cited below may be used to calibrate such fuel flow meters. The accuracy as determined by the following equation must be less than or equal to 2.5% of the upper range value of the flow meter:

$$A = |R-B| / URV \times 100 \% \quad (\text{Eq. 2})$$

where:

A	=	flow meter accuracy (%)
R	=	average of flow measurements of the proving meter at each load (scfh)
B	=	average of flow measurements of the meter being tested at each load (scfh)
URV	=	upper range value of fuel flow meter being tested (scfh)

ii. Procedure 2: Meter Swapping

The facility fuel flow meter may be swapped with a factory calibrated meter. The calibration procedures outlined in 40 CFR Part 75, Appendix E and the ones cited below may be used for this purpose. Meter calibrations shall be conducted at the flow rates given in the recognized industry standards. The recognized industry standards for calibration are as follows:

<u>Meter Type</u>	<u>Standard</u>
Diaphragm	ANSI B 109.1 or 109.2 (3rd. edition, 1992)
Rotary	ANSI B109.3 (3rd. edition, 1992)
Turbine	AGA Report No. 7 (2nd. edition, 1996)
Orifice	AGA Report No. 3, Part 1 and 2 (1990, 1991) API 14.3 GPA 8185-90

The minimum installation requirements are as follows:

<u>Meter Type</u>	<u>Standard</u>
Diaphragm	ANSI B 109.1 or 109.2, Part V
Rotary	ANSI B109.3, Part V
Turbine	AGA Report No. 7, Section 3
Orifice	AGA Report No. 3, Part 2, Section 2.6

The above calibration standards apply to both Subparagraph 5.2.1(e)(i) and Subparagraph 5.2.1(e)(ii). The above installation requirements apply only to Subparagraph 5.2.1(e)(ii). For fuel flow meters not listed above, District approved installation and calibration methods must be used.

Other methods for alternate RAA's may be proposed by the facility, where testing by the standard method is technically infeasible or would create an inordinate cost burden.

### **5.2.2 Determination of Molecular Weight of Gas**

Carbon dioxide (CO<sub>2</sub>) and O<sub>2</sub> concentrations are needed to determine the molecular weight of the exhaust gas in order to calculate the standard volumetric flow rate. Method 3.1, or any other direct measurement method as specified in Method 3.1, may be used.

If Method 100.1 is used, all testing procedures and QA/QC requirements must satisfy those as stated in the method. A single molecular weight sampling may be performed using Method 100.1 if performed simultaneously with the NO<sub>x</sub> sampling. For high O<sub>2</sub> concentration, especially when > 15%, extra care should be taken to control and monitor the accuracy and precision of the O<sub>2</sub> concentration.

### **5.2.3 Determination of Moisture**

In conjunction with the velocity traverses, conduct a single moisture sampling using Method 4.1. If low moisture is suspected (< 5%), increase the sampling time to acquire at least twice the required sample volume.

### **5.2.4 Fuel Analysis**

If the large source is fired on a fuel listed in Table 19-1 of EPA Method 19, the provided F-factor may be used. If not listed, the fuel must be analyzed for heating value. The following methods may be used for fuel analysis:

Gaseous Fuel ASTM D1945  
Refinery Fuel ASTM D1946  
Liquid Fuel ASTM D2382-88

Other ASTM methods may be used upon approval by the District.

Fuel analysis must be conducted by an independent laboratory, not the facility.

## **5.3 Determination of Nitrogen Oxides (NO<sub>x</sub>) Concentration**

The NO<sub>x</sub> concentration is to be determined by Method 100.1 using a chemiluminescent analyzer.

The sample concentration must fall within 20 to 95% of the analyzer range for at least 95% of the time. To determine the best analyzer range, a preliminary screening of the gas concentration may be necessary.

### **5.3.1 Sample conditioning Requirements for Method 100.1**

For Method 100.1 testing, proper sample conditioning is essential for representative sampling. Sample conditioning includes removal of particulate matter and moisture in the sample gas stream without removal of the pollutants of interest. Method 100.1, since it is a reference method, requires a sample conditioning system with minimal “scrubbing” effect. In particular, NO<sub>2</sub> and SO<sub>2</sub>, due to their high solubility in water, are more susceptible to scrubbing than, for example, NO or CO.

The District recommends a gas sampling system which can be used universally. The set up includes a heated 1/4 inch stainless steel probe with 50-80  $\mu$  size sintered 316 stainless steel or ceramic filter at the tip and a short (not more than 6 feet) heated Teflon line to a sample conditioning system. The temperature of the probe and the Teflon line should be maintained at about 250 °F. The conditioning system consists of a pair of standard Greenburg-Smith impingers with the stems cut to about 1 inch length from the top, immersed in a bath containing water and dry ice pellets, and immediately followed by a thermo-electric cooler or permeation drier. The gas temperature at the outlet of the impinger shall be less than 60 °F, and the gas at the drier outlet shall be maintained at a dew point less than 37 °F. If the drier cannot be directly connected to the impinger outlet then a Teflon line heated to 10 °F above the impinger outlet gas temperature can be used for connection. Another particulate filter (~ 5  $\mu$ ) should be in line immediately after the cooler/drier. **All temperatures should be measured and recorded preferably on the strip chart at least every 10 minutes.** If the moisture content of the exhaust gas is below 5% and the sample gas flow rate is less than 10 liter/minute, the impinger set-up need not be used as long as no moisture condensation occurs in the system and the conditioned sample is maintained at the required dew point.

Precaution: Never let the water in the impingers accumulate more than 1/4 of the impingers height. Do not let the water bath freeze around the impingers; it may cause cracking of glass impingers. Make sure that the thermo-electric cooler/permeation drier has adequate design capacity. A good maintenance schedule should be followed for the cooler/drier.

An example of a non-universally applicable water removal system is a refrigerated cooling coil based system. A refrigerated cooling coil system scrubs out a high percentage of the highly water soluble pollutants due to comparatively high residence time and intimate contact between the sample gases and water droplets collected on the inside wall of the coil. This type of sample conditioner is not suitable in all cases.

Other systems may be used, upon District's approval, as long as they meet the requirement for water removal immediately after separation from the gas stream and are designed to minimize water contact with the gas stream.

### **5.3.2 Instrumental Analyzer Procedures**

A general guideline for conducting Method 100.1 is included in the Appendix. The guideline is provided to clarify and emphasize some of the key points of Method 100.1 requirements.

Leak checks must be performed before and after each 60-minute concentration sampling period. Follow the leak check procedure as stated in Method 100.1.

Analyzer calibration error, system bias and linearity checks must be performed before and after each 60-minute concentration sampling period. System response time and interference response tests must be performed once, either before or after the concentration sampling.

NO<sub>2</sub> to NO converter efficiency check must be performed at the beginning of each test day. The converter efficiency check procedure is included in the Appendix.

### **5.3.3 Data Acquisition System (DAS)**

A DAS must be used to report the analyzer readings. The DAS must provide every one-minute and 15-minute averages in ppm for NO<sub>x</sub>. If CO<sub>2</sub> and O<sub>2</sub> are also analyzed by Method 100.1, the one-minute and 15-minute average data must be provided in percent concentration. The strip charts must be included in the final report as well as the DAS output.

## **5.4 Process Data**

Process data including, but not limited to, fuel usage rate, kilowatt output, and brake horsepower are to be recorded during concentration testing and each RAA. Record the fuel usage rate at least every 10 minutes during the concentration limit testing and each RAA. If the ICE is fired on more than one fuel, record the fuel usage rate for each fuel prior to the fuel mixture.

Identify each fuel meter with the make, model, serial number and ownership (ie., facility or Gas Company owned).

## **5.5 Testing In Non-Ideal Conditions**

The following is a discussion of some common non-ideal conditions and their solutions in source testing:

If there are fluctuations in the process or operating conditions, such as, changes in load, the testing may continue as long as the operating conditions are recorded to show each fluctuation. If the ICE shuts down completely or if there are severe fluctuations during testing, Method 100.1 must be repeated for a minimum of 60 continuous minutes during acceptable operating conditions. The severity of fluctuations will be determined on a case-by-case basis. If the ICE has the tendency to operate at a non-ideal condition for testing, a protocol for testing at such condition should be submitted for review and approval prior to testing.

Each RAA test must be conducted during acceptable conditions. The moisture train

may be stopped during non-ideal testing conditions and then resumed when acceptable conditions are reached.

If there are dampers or bypass stacks present, testing should be conducted as follows:

1. If excess air is frequently introduced to the exhaust stack at a variable rate, concentration and RAA testing may be performed in increments of no less than 15 continuous minutes when no excess air is introduced to the exhaust stack.
2. When all or part of the exhaust gas is frequently restricted to or bypassed from the exhaust stack, concentration and RAA testing may be performed in increments of no less than 15 continuous minutes when the total exhaust gas is routed to the exhaust stack.

**All changes in process and operating conditions and test interruptions must be noted with the beginning and ending times of each occurrence on the field data sheets.**

For multiple stacks, perform Method 100.1 for 60 minutes at each of the chosen stacks during acceptable testing conditions. Method 100.1 need not be performed simultaneously. The three-run RAA, however, must be performed simultaneously at each stack to get total flow.

If there are more than three stacks and the facility chooses not to test each stack, the test plan must be submitted for review and approval.

If no suitable testing location exists and it would be an inordinate cost burden to modify or install a stack, the facility may petition not to conduct the three-run RAA. The facility then must propose an alternate RAA method for verifying the fuel meter accuracy.

If other non-ideal testing conditions exist, the facility must submit a source test protocol for review and approval prior to testing.

When fuel contains a high concentration of CO<sub>2</sub>, the F-factor calculation must include the correction for high CO<sub>2</sub>.

## **6.0 Calculation and Reporting of Data**

The NO<sub>x</sub> concentration is to be corrected to 15% O<sub>2</sub>. Both the raw and the corrected NO<sub>x</sub> concentrations are to be included in the report summary.

The fuel flow meter relative accuracy is to be calculated by using Eq. 1 in Section 5.2.

## **7.0 Final Report**

The final report is to be submitted to the Executive Officer on or before the deadlines specified in Rule 2012.

### **7.1 Report Format**

The final report shall include, at a minimum, the following:

- I. Table of Contents
- II. Executive Summary
- III. Introduction
- IV. Equipment Description (This section shall include a statement that verifies acceptability of the reference method test location and the operating condition during the test.)
- V. Test Critique
- VI. List of Sampling and Analytical Methods Used (This section shall include a list of the test methods used. Do no include copies or descriptions of the source test methods if the methods were adhered to as written. If exceptions were made to the methods, submit only an explanation of the exceptions.)
- VII. Appendices
  - A. SCAQMD Methods 1.1-4.1 Results
  - B. SCAQMD Method 100.1 Results
  - C. Schematics of Stack Sampling Locations
  - D. Field Data Sheets - reference method and CEMS data sheets shall be compiled in separate sections
  - E. QA/QC
  - F. Certificate of No Conflict of Interest
  - G. SCAQMD Check List for Source Test Reports
  - H. Calibration Gas Certificates for the Reference Test and CEMS
  - I. Chain of Custody Information (as necessary)
  - J. Process Operating Data Including Fuel Usage During Test
  - K. Calculations for Flow Rate Using Fuel F-Factor
  - L. Disclaimer of No Exceptions to the Protocol
  - M. Additional QA/QC for Non-LAP Approved Source Test Laboratories

## A P P E N D I X

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- A. (*TABLE 1*) - Available Standard Protocols
- B. (*ATTACHMENT A*) - General Continuous Gas Monitoring Requirements
- C. (*ATTACHMENT B*) - NO<sub>2</sub> to NO Conversion Test Procedure
- D. Certificate of No Exceptions (must be completed & signed by responsible facility representative and included with initial & each subsequent tri-annual compliance report)
- E. Statement of No-Conflict-of-Interest (must be completed & signed by responsible source testing firm representative and included with initial & each subsequent tri-annual compliance report)
- F. Large Source Test Report Checklist (for personal use to assure complete source test report submittal)

**TABLE I**

<b>Protocol</b>	<b>Source</b>	<b>Fuel</b>	<b>Test Parameters</b>
SP-B-001	Boilers	Natural Gas Fuel Oil Refinery Fuel Others	Normal test conditions - measurable stack gas velocity and testable stack conditions
SP-H-001	Heaters	Natural Gas Fuel Oil Refinery Fuel Others	May pose a testing problem due to low stack gas flow rate. High oxygen concentration may pose a problem with RAA.
SP-ICE-001	Internal Combustion Engines	Natural Gas Fuel Oil Refinery Fuel Others	Stack conditions may not be ideal - pulsating flow, small stacks, no sampling ports
SP-F-001	Furnaces	Natural Gas Fuel Oil Others	May pose a testing problem due to low stack gas flow rate and changing process/operation conditions.
SP-O-001	Others - Afterburners Ovens Kilns Incinerators	Natural Gas Fuel Oil Others	(UNDER DEVELOPMENT)

**ATTACHMENT A**

**GENERAL CONTINUOUS GAS MONITORING REQUIREMENTS**

The District requires continuous gas monitoring equipment employing sample extraction and conditioning, and electronic detection, to be conducted strictly according to District Method 100.1, with the emphasis upon representativeness, documentation, and quality assurance. This includes, in part:

1. Gas analyzers must meet minimum acceptable standards for method of detection, sensitivity, noise, precision, linearity, and interference (see TABLE 100.1-1 for details). Also, the gas sample extraction and conditioning equipment (probe, filter, pump, conditioner, connective plumbing, etc., and data acquisition and logging equipment shall meet minimum acceptable specifications, as described in Method 100.1.
2. It is recommended that the entire sampling system for continuous gas monitoring instruments should be leak checked before and after each test run by evacuating the system to a minimum of 20 in. Hg vacuum, and plugging for a period of 5 minutes. The resultant loss of vacuum can not exceed 1 in. Hg during this period.
3. Calibration of all analyzers must be accomplished at zero, mid span (40-60% of full scale range), and high span (80-95% of full scale range). The lowest practicable range should be selected for monitoring, so that the measured emission values are within 20-95% of the range. If a significant amount of the data are outside of this range, the data may be rejected, depending upon the application.
4. The calibration gases must be certified according to EPA Protocol Number 1, or certified to an analytical accuracy of  $\pm 1\%$  and be NIST traceable (except cal gases used for system bias check), following EPA-600/R93/224, "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards", TABLE 2-2. Superblend or multi-component blend gas recertifications are based upon the individual component(s) with the shortest recertification date.
5. Field calibrations employing gas dilution systems (mass flow or critical orifice) must be performed in accordance with EPA Method 205, "Gas Dilution Verification Protocol", or available "Draft" SCAQMD Method, and supported with appropriate documentation. A 5-point check is required.
6. A calibration error check, and zero/span drift check must be performed before and after each test run. Calibration error must be less than  $\pm 2\%$  of the range of measurement for zero, mid, and high range calibration gases. Zero/span drift must be less than  $\pm 3\%$  of the range of measurement.
7. A system bias check must be performed before and after each test run by alternately introducing cal gases to the entire sampling system, then to the gas analyzer(s), for comparison. The difference can not exceed  $\pm 5\%$  of the analyzer range.
8. Semi-annual analyzer certifications consisting of linearity plot, calibration curve, response time, and interference response must be furnished with the other calibrations to satisfy Q/A documentational requirements.

9. NO<sub>X</sub> measurement must be performed in the NO<sub>X</sub> mode of the analyzer. An NO<sub>2</sub> to NO converter is required if NO<sub>2</sub> constitutes 5% or more of the total NO<sub>X</sub> in the sample stream, or the rule or permit condition requires "NO<sub>X</sub>" monitoring. The NO<sub>2</sub> to NO converter must be at least 90% efficient (use the NO<sub>2</sub> to NO converter efficiency procedure). The converter should be high temperature (650°C) stainless steel, if no NH<sub>3</sub> is present. If NH<sub>3</sub> is present in the sample stream, then a low temperature (350°C) molybdenum catalyst must be used in the converter. This check must be done at the beginning of the test.
10. The connective tubing from the probe to the sample conditioner must be heated above the dewpoint and the dewpoint reported. The sample conditioner must be able to maintain a dewpoint temperature of 37°F or less. (Refer to the "Sample Conditioning Requirements for Method 100.1" Addendum, for details)
11. Data recorder resolution must be at least 0.5% of the range of measurement. A data point for each contaminant/diluent monitored must be recorded at least once/minute. Analog chart recorders must have a minimum 10-inch chart width, with 100 minor divisions.
12. All facets of testing must be continuously recorded. This includes the 3-point calibration, system bias, calibration error, and zero/span drift checks, which must precede and conclude each test run.
13. All chart traces, or digital printouts, must be included in the final report and must be clearly identified as to:
  - location/source
  - operator initials
  - date/running times
  - actual test interval
  - contaminant/diluent
  - range changes
  - range of measurement
  - calibrations
  - cal gas concentration/cyl. no.
  - range of calibration
14. When more than one gas trace is shown on a chart, the individual traces must be distinguishable by color coding or some other means (original charts may be submitted, and returned following evaluation). If a gas measurement range has been "offset" from zero, or zero has been "transposed to the right side of the recorder chart, it must be clearly identified. this offset should not be more than 5-small divisions of the chart. This data must be corrected using the ratio of the offset.
15. Gaseous measurements must be conducted a minimum of 15 continuous minutes at each load or specified condition, after the readings have stabilized (RECLAIM reference method sampling requires a minimum of 30 continuous minutes at each load for RATAs). Processes having multiple exhausts exhibiting non-cyclic (i.e. steady-state) characteristics may alternatively be monitored using the above criteria. Otherwise, simultaneous sampling may be required.
16. Sampling locations not meeting the minimum site selection standards for District Method 1 must be tested for absence of stratification. (A gaseous constituent concentration profile differing more than 10% between any two monitoring points within the same cross-sectional plane of a stack or duct indicates stratification.) If stratification is present, and alternate approved site selection or modification is not possible, then special monitoring (see Chapter X of the District Source Testing Manual) will be required.



**NO<sub>2</sub> TO NO CONVERSION TEST PROCEDURE**  
(Alternative to O<sub>3</sub> Titration Method-40 CFR 50.1, Appendix F)

**1. NO<sub>x</sub> Analyzer Requirements**

- a. Full span range 0-20 ppm or 0-25 ppm
- b. Equipped with NO and NO<sub>x</sub> modes

**2. Auditing Gas Requirements**

- a. NO<sub>2</sub> in air (or N<sub>2</sub>): Use NO<sub>2</sub> in air for a stainless steel converter.
- b. Concentration of NO<sub>2</sub>: 15 to 18 ppm + 0.5 ppm (C<sub>o</sub>, ppm)
- c. Recertification: An audit gas should be recertified after six months.

**3. Calibration Gas Requirements**

- a. Concentration: NO (17 to 19 ppm) with less than 0.1 ppm NO<sub>2</sub> - High Span  
NO (10 to 13 ppm) with less than 0.1 ppm NO<sub>2</sub> - Mid Span
- b. Zero Gas: High purity N<sub>2</sub>

**4. Calibration of Analyzer:**

- a. Calibrate NO mode with the NO calibration gases.
- b. Calibrate NO<sub>x</sub> mode with the same gases without any gain adjustment.
- b1. If the analyzer is equipped with two independent gain adjusting circuits, skip 4.b., then repeat 4.a. for the NO<sub>x</sub> mode.

**5. Conversion Efficiency (CE) Test**

- a. Analyze the audit gas with NO mode. Read and standardize concentration. (C<sub>1</sub>, ppm)
- b. Analyze the audit gas with NO<sub>x</sub> mode. Read and standardize concentration. (C<sub>2</sub>, ppm)

**6. Calculation for Conversion Efficiency:**

$$\%CE = \frac{|C_2 - C_1|}{C_0} \times 100$$

**7. Criteria for Acceptability of CE**

- a. %CE must be larger than 90%.
- b. C<sub>1</sub> must be less than 5 % of total NO<sub>x</sub> (NO + NO<sub>2</sub>) in the NO<sub>2</sub> audit gas (Section 2b).

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**NOTE:** NO<sub>2</sub> audit gas concentration of higher value than what is specified in *Section 2*. may be required where NO<sub>2</sub> present in the exhaust gas being measured is greater than 30 ppm. Select the NO<sub>2</sub> gas within 10% of the expected NO<sub>2</sub> concentration in the exhaust.

**C E R T I F I C A T I O N O F N O E X C E P T I O N S F O R T E S T I N G  
R E C L A I M L A R G E S O U R C E S**

*(To be completed by responsible facility representative and included in source test report)*

**Facility ID:** \_\_\_\_\_

**Facility Name:** \_\_\_\_\_

**Equipment Address:** \_\_\_\_\_  
\_\_\_\_\_

**Equipment Tested:** \_\_\_\_\_

**Device ID:** \_\_\_\_\_

- Standard Protocol Used:**
- |   |  |
|---|--|
| <input type="checkbox"/> <b>Furnace</b> ( <i>SP-F-001</i> )                                 | <input type="checkbox"/> <b>Heater</b> ( <i>SP-H-001</i> ) |
| <input checked="" type="checkbox"/> <b>ICE</b> ( <i>SP-ICE-001</i> )                        | <input type="checkbox"/> <b>Boiler</b> ( <i>SP-B-001</i> ) |
| <input type="checkbox"/> <b>Afterburner, Kiln, Oven, or Incinerator</b> ( <i>SP-O-001</i> ) |  |

I hereby certify that no exceptions were made to the source test methods as written in the above referenced standard protocol used to source test the above referenced equipment for compliance with Rules 2012.

**Facility Representative** \_\_\_\_\_ **Date** \_\_\_\_\_  
*(SIGNATURE)*

\_\_\_\_\_ *(NAME)*

\_\_\_\_\_ *(TITLE)*

**S T A T E M E N T   O F   N O   C O N F L I C T   O F   I N T E R E S T  
A S   A N   I N D E P E N D E N T   T E S T I N G   L A B O R A T O R Y**

*(To be completed by authorized source testing firm representative and included in source test report)*

The following facility and equipment were tested by my source testing firm, and are the subjects of this Statement:

<b>Facility ID:</b>	_____	<b>Date(s) Tested:</b>	_____
<b>Facility Name:</b>	_____		
<b>Equipment Address:</b>	_____		
<b>Equipment Tested:</b>	_____		
<b>Device ID, A/N, P/N:</b>	_____		

I state, as its legally authorized representative, that the source testing firm of:

**Source Test Firm:** \_\_\_\_\_  
**Business Address:** \_\_\_\_\_  
\_\_\_\_\_

is an "Independent Testing Laboratory" as defined in ***District Rule 304(k)***:

*For the purposes of this Rule, when an independent testing laboratory is used for the purposes of establishing compliance with District rules or to obtain a District permit to operate, it must meet all of the following criteria:*

- (1) *The testing laboratory shall have no financial interest in the company or facility being tested, or in the parent company or any subsidiary thereof;*
- (2) *The company or facility being tested, or parent company or any subsidiary thereof, shall have no financial interest in the testing laboratory;*
- (3) *Any company or facility responsible for the emission of significant quantities of pollutants to the atmosphere, or parent company or any subsidiary thereof, shall have no financial interest in the testing laboratory; and*
- (4) *The testing laboratory shall not be in partnership with, own or be owned by, in part or in full, the contractor who has provided or installed equipment (basic or control), or monitoring systems, or is providing maintenance for installed equipment or monitoring systems, for the company being tested.*

Furthermore, I state that any contracts or agreements entered into by my source testing firm and the facility referenced above, or its designated contractor(s), either verbal or written, are not contingent upon the outcome of the source testing, or the source testing information provided to the SCAQMD.

**Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_

\_\_\_\_\_  
(NAME) \_\_\_\_\_ (TITLE) \_\_\_\_\_ (PHONE) \_\_\_\_\_ (DATE)

**RECLAIM RULE 2012 (j)(2) LARGE SOURCE CHECKLIST**  
**For Source Test Contractors / Facility Administrators**

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A. Company & Source Test Contractor Information:	<u>N/A</u>	<u>YES</u>
1. Source Test Contractor & Personnel Conducting Test	<input type="checkbox"/>	<input type="checkbox"/>
2. Name of Facility & Facility I.D.	<input type="checkbox"/>	<input type="checkbox"/>
3. Unit(s) Tested & Device I.D.(s)	<input type="checkbox"/>	<input type="checkbox"/>
4. "Certificate of No Exceptions" signed by Facility Administrator	<input type="checkbox"/>	<input type="checkbox"/>
5. "No Conflict of Interest" signed by Source Test Contractor	<input type="checkbox"/>	<input type="checkbox"/>
6. SCAQMD "LAP Approval" (current for test methods used)	<input type="checkbox"/>	<input type="checkbox"/>
B. Equipment, Process, & Test Information:	<u>N/A</u>	<u>YES</u>
1. Received Prior Approval from SCAQMD for any Exceptions to Protocol	<input type="checkbox"/>	<input type="checkbox"/>
1a. SCAQMD Approved Exceptions to Protocol are Included	<input type="checkbox"/>	<input type="checkbox"/>
2. Fuel Meter (also include RM fuel meter, if applicable):		
a. Make	<input type="checkbox"/>	<input type="checkbox"/>
b. Model	<input type="checkbox"/>	<input type="checkbox"/>
c. Type (orifice, etc.)	<input type="checkbox"/>	<input type="checkbox"/>
c. S/N	<input type="checkbox"/>	<input type="checkbox"/>
d. Owner	<input type="checkbox"/>	<input type="checkbox"/>
e. Operating Range	<input type="checkbox"/>	<input type="checkbox"/>
f. Unit of measurement (cfh, scfh, dscfh, etc.)	<input type="checkbox"/>	<input type="checkbox"/>
3. Field Data Sheets Provided for:		
a. Cyclonic Flow	<input type="checkbox"/>	<input type="checkbox"/>
b. Velocity Traverse	<input type="checkbox"/>	<input type="checkbox"/>
c. Moisture Train	<input type="checkbox"/>	<input type="checkbox"/>
d. Method 100.1	<input type="checkbox"/>	<input type="checkbox"/>
e. Gaseous Stratification	<input type="checkbox"/>	<input type="checkbox"/>
f. Fuel Meter Reading(s)	<input type="checkbox"/>	<input type="checkbox"/>
g. Equipment / Process Operating Parameters During Test	<input type="checkbox"/>	<input type="checkbox"/>
4. Introduction (overall description of test)	<input type="checkbox"/>	<input type="checkbox"/>
5. Equipment & Process Description	<input type="checkbox"/>	<input type="checkbox"/>
6. Process and Load Conditions During Test	<input type="checkbox"/>	<input type="checkbox"/>
7. Schematic of Sampling Stack & Port Location(s)	<input type="checkbox"/>	<input type="checkbox"/>
8. Summary of Results, Formatted for Rule Compliance	<input type="checkbox"/>	<input type="checkbox"/>
9. Test Critique	<input type="checkbox"/>	<input type="checkbox"/>
10. Strip Chart and DAS Data (all measurements & calibrations)	<input type="checkbox"/>	<input type="checkbox"/>
11. Fuel Analysis for F-Factor (if applicable)	<input type="checkbox"/>	<input type="checkbox"/>
12. Calculations for all Emission / RAA Results (intermediate data clearly shown)	<input type="checkbox"/>	<input type="checkbox"/>
C. Quality Assurance & Quality Control (QA/QC):	<u>N/A</u>	<u>YES</u>
1. Calibrations for Methods 1-4 & 100.1 Testing, Analysis, & Equipment	<input type="checkbox"/>	<input type="checkbox"/>
2. Calibration Gas Certificates (current for all testing)	<input type="checkbox"/>	<input type="checkbox"/>
3. Calibrations for Fuel Analysis (if applicable)	<input type="checkbox"/>	<input type="checkbox"/>
4. Calibrations for RM Fuel Meter (if applicable)	<input type="checkbox"/>	<input type="checkbox"/>