

**KERN COUNTY AIR POLLUTION CONTROL DISTRICT**

**GUIDELINES  
FOR  
COMPLIANCE TEST REPORTS**

**KERN COUNTY AIR POLLUTION CONTROL DISTRICT  
2700 "M" Street, Suite 290  
Bakersfield, CA 93301**

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## **Section 1 Introduction**

Emissions testing is required by the Kern County Air Pollution Control District (KCAPCD), hereafter referred to as "the District", to determine the types and amount of pollutants emitted by various emission sources. Information gathered from source tests is used for planning, issuing permit, evaluating control systems, and enforcing emission limitations. For these purposes, source tests must yield data in which the District has confidence, and this is achieved by establishing test procedures and quality assurance programs that produce consistent test data that is complete, representative, precise, accurate, and traceable.

The purpose of this manual is to standardize the test procedure to be used for each test program. Additional requirements for accepted test methods are sometimes required; however, in no case should testing be less stringent than that required by the applicable EPA, CARB, ASTM, or other referenced test method.

The District reserves the right to stipulate more stringent test requirements or modify the procedures to suit individual source testing objectives to obtain quality data.

**Compliance is to be demonstrated at maximum permitted operating condition (i.e. worst case conditions). If tested at lesser rate, permit will limit operations to conditions during testing.**

## Section 2 Selection of a Source Test Contractor

The majority of test programs are performed by independent source test consultants contracted by source operator. The District may elect to contract the source test and be reimbursed by the source operator under special circumstances, including non-performance by the permit holder.

When selecting a contractor, the type of test, type of process and any special sampling conditions should be considered. Consider selection of a contractor who has experience in the same or similar type of process and test requirements.

Cal-EPA conducts a certification program for independent source test contractors. To qualify for certification, a consultant must be equipped to conduct both the sampling and analysis required within each method for which certification is sought (i.e. consultant cannot use outside lab. to analyze sample). In granting certification, the state reviews the following in relation to the method requirements: lab and equipment; data obtained during a prior test; understanding of method requirements; and quality assurance/quality control measures. The purpose of the certification is to permit a source to use an independent contractor which can audit results obtained by the state's own testing personnel.

For District required source testing, Cal-EPA certification is not required. As the test methods are varied and require specialized equipment, many contractors do not perform both the sampling and analysis of the data, hence they are not eligible for certification regardless of the quality of work they perform. In absence of other knowledge, use of certified source test contractors by an operator does however provide an indication that a consultant has met state standards with respect to a test method.

### **Section 3 Source Test Planning**

Rule 108.1 requires the District to be notified 30 days prior to any compliance testing, and the operator shall submit a source test plan for District approval a minimum of 15 days prior to source sampling.

"Source Test Plan" must be approved by District in writing prior to any test date. The minimum information required to be in a Source Test Protocol is outlined below in Section 3.3

#### **Sampling Site Location**

##### **Port Location and Port Specifications:**

Sample port location and number of ports must meet requirements of EPA Method 1 Sample and Velocity Traverses for Stationary Sources and CARB Standard Procedures for Stationary Emission Monitoring and Testing.

Sample port must be Schedule 40 NPT pipe, at least 3 inches in diameter, welded approximately flush to the inside of the stack wall and protruding about 3 in. from the outer wall of the stack or duct. Cap or plug is necessary to close the port. If static pressure within the stack is above 10 inches of H<sub>2</sub>O or if highly toxic gases are present, a minimum 4 in. gate valve and packing gland should be attached to port to fit the probe.

It is best to contact source tester to determine specific needs of their equipment.

#### **Platform Specifications**

Working platform for source testing should be at least 3 feet wide and capable of supporting at least 2 people plus one hundreds pounds of equipment. It should also conform to all applicable OSHA regulations. Electrical power (115 V, 30 A) should be available within 100 feet of the platform.

#### **Sample Properties**

The parameters of the gas stream to be sampled should be assessed. Parameters such as temperature, flow rate, static pressure, particulate grain-loading, moisture content, and potentially hazardous gases will affect the safety and sampling strategies of the source test. Selection of proper equipment and test methods to suit the sample matrix is critical to the success and safety of the test program.

## **Source Test Plan**

### **Example Table of Contents**

**Cover Page:** include information shown on Page 11.

**Cover Letter:** Signed by permit holder authorizing testing per attached protocol.

- 1.0 Introduction:** Include applicable information as shown on Page 12.
- 2.0 Emission Source Information**
  - 2.1 Facility Description**
  - 2.2 Process Information**
  - 2.3 Emission Source Description**
- 3.0 Source Test Program Description**
  - 3.1 Testing Contractor**
  - 3.2 Program Organization**
  - 3.3 Program Objectives**
- 4.0 Source Testing Procedures**
  - 4.1 Instrumentation and Equipment Description**
  - 4.2 Test Methods**
  - 4.3 Analytical Methods**
- 5.0 Quality Assurance and Quality Control Procedures**
  - 5.1 Sampling Protocol**
  - 5.2 Equipment Calibration and Maintenance**
  - 5.3 Instrument Calibration and Maintenance**
  - 5.4 Data Validation**
  - 5.5 Internal Audits and Corrective Action**
  - 5.6 Documentation**

## **Source Test Plan Description**

### **2.1 Facility Description**

Description of facility including all process equipment rates relevant to the equipment to be tested.

### **2.2 Process Description**

Description of process including process rate expected during testing, fuel type and rate during test. Please note that source is to be operated at maximum permitted conditions (i.e. worst case conditions). If unit/source is tested at lower rate, permit will limit operation to conditions during testing.

If process is of cyclic or batch type, test program must be adjusted to ensure a representative sample. Please include discussion of applicability of time period chosen to be sampled.

### **2.3 Emission Source Description**

Diagram of stack showing sampling ports, platform and adjacent duct work is required. Also, diagram showing location of sampling port from nearest upstream/downstream flow disturbances and the stack diameter.

### **3.1 Testing Contractor**

Identify testing contractor, including name, address and phone number of project manager and describe any prior project experience. If analysis will be performed by outside lab(s), include applicable information on lab(s).

### **3.2 Program Organization**

Organizational chart showing general organization, delegation of authority, names and duties of personnel involved.

### **3.3 Program Objectives**

Objectives of test program must be discussed and shall include the following information:

- Load (percent of design capacity) or range of loads at which equipment will operate during testing;
- Testing must be performed at full load, unless District and operator agree that permitted load does not occur under normal operations. If agreed, calculation to determine emissions at full permitted load must be provided;
- Proposed source test date(s);
- Expected date of Source Test Report submittal to District. Rule 108.1 requires submittal within 60 days of completion of field testing.

### **4.1 Instrumentation and Equipment Description**

This section must provide description and diagrams of at least the following items:

- Emissions monitoring and sampling system;
- Sample probes and filter ovens, including probe liner material, probe temperature and length, and filter material and temperature;
- Impinger trains and associated glassware including sample bottles and any specialized glassware cleaning procedures and including methods/products used to prevent leaks;
- Pump/gas meter modules;
- Laboratory instruments
- All materials which come in contact with either the sample or calibration gas must be constructed of stainless steel, teflon, or inert materials (i.e. glass)

## **4.2 Test Methods**

Specify test method to be used for each parameter to be tested. Table which summarizes source, test method, sample time, expected sample volume, number of runs, and minimum level of detection considering equipment to be on-site shall be submitted.

Include a brief description of each method and referenced method of determining fuel rate or process rate (if applicable). If testing deviates from method this must be discussed here otherwise testing is to be conducted strictly according to referenced method. Copies of field data forms and calculation procedures must also be included.

## **4.3 Analytical Method**

Description of sample recovery and analysis procedures. If method requires specific timing between sampling, recovery, and analysis please state this here. Identify analytical instruments, materials, associated equipment, and personnel involved. Detailed description of EPA or CARB analytical procedures is required. Discuss use of standards and blanks in analyses. Include copies of analytical forms.

### **5.1 Sampling Protocol**

Description of sample collection procedures, sample labelling, handling, control, preservation, analysis, and storage.

### **5.2 Equipment Calibration and Maintenance**

Description of sampling equipment calibration and preventive maintenance procedures. include manufacturer's name, model number, specifications, certified accuracy of all calibration equipment, and date of certification. Sampling equipment to be calibrated includes: pitot tubes, thermocouple, magnhelic gauges, dry gas meter, dry gas meter orifices, barometer, balances, and probe nozzles.

### **5.3 Instrument Calibration and Maintenance**

Description of procedures for calibrating instrumental emission monitors and any preventive maintenance performed on these instruments. Specify calibration materials including supplier and guaranteed accuracy, stability of calibration gas and NBS traceability. Specify percent of range at which instruments will be calibrated.

### **5.4 Data Validation**

Specific data validation procedures must be outlined in this section.

### **5.5 Internal Audits and Corrective Action**

Description of internal audit and corrective action procedures instituted by test contractor

to ensure quality of the data collected.

### **5.6 Documentation**

Description of formal system used for document control and record keeping as it applies to field data, e.g. generating, checking, inventory and archiving of supporting documentation.

## Section 4 Source Test Report

### Example Outline

Include each of the following items.

1. Cover Page per example on Page 11
2. Cover Letter
  - Endorsement by project manager
  - Endorsement by operator
  - Proof of approval of Source Test Protocol and test methods by District
3. Introduction per example on Page 12
4. Summary of Results
  - Complete Summary of Source Test Results tables shown on Pages 13. In each square give results of each run and test run average;
  - Process data, as related to determination of compliance and determination of maximum operational conditions;
  - Discussion of error, both real and apparent.
5. Facility and Emission Source Operation
  - Process description and number of units;
6. Sampling and Analysis Procedures
  - Sampling port location and dimension cross-section;
  - Sampling point description, including labeling system (cross-section of stack with sample port location);
  - Sampling train description (diagram)
  - Description of sampling and analytical procedures which deviated from KCAPCD accepted test methods or approved source test protocol and justification for deviation.

7. **Methods and Calculations**

- Use prescribed method equations;
- Show step-by-step calculation of one test run;
- Include methods, descriptions and equations;
- Include all raw data and lab data specified for method

8. **Quality Assurance**

- Include all calibrations prescribed in method being used;
- Measure and record amounts of rinse material used during sample rinsing
- Record sample system bias, response time and leak check test results
- Equipment calibration sheets for dry gas meters, pitot tubes, nozzles, magnehelic gauges, etc.
- Calibration gas certification data sheets

9. **Appendix**

- **Data Submittal:**
  - Data Summaries per Attachment I
  - Continuous Methods Data per Attachment II
  - All strip charts
- Chain of Custody data sheets
- Lab QA/QC
- Lab statement of qualification
- Process operation data, fuel rates, process rates obtained from operator
- Source test log documenting times of source test events
- Related correspondence

**COVER PAGE**

**Client Name**

**Client Address**

**Telephone**

**Test Site\***

**Consultant's Report Number**

**Consultant Name**

**Consultant Address**

**Telephone**

**Prepared By:**

**Verified By:**

**Test Purpose\*\***

**Date(s) of Test(s)**

**Test Submittal Date**

**KCAPCD Permit Number(s)**

\* Address, and Unit(s) Tested

\*\* Initial, Annual, KCAPCD and/or EPA, Engineering Research, etc.

## **I. Introduction**

Include the following:

- Test Date
- Consultant Company
- Client Company
- Site description, including unit sizes, manufactures, control equipment
- Name(s) of Test Team Member(s)
- Name(s) of KCAPCD observer(s)
- Name(s) of client company representative(s)
- Pollutants tested, methods, number of test runs
- Fuel type and rate during test
- Process rate during test and max. capacity of unit/process tested
- If batch process, discuss applicability of time period chosen to sample if less than time for one complete batch

**SUMMARY OF SOURCE TEST RESULTS**

Company: \_\_\_\_\_ APCD # \_\_\_\_\_ Test

Date: \_\_\_\_\_ Unit # \_\_\_\_\_

**EMISSIONS**

|                              | gr/scf | @2% CO <sub>2</sub> | PPMv | 3% O <sub>2</sub> | lb/hr | lb/MMBTU        | Other |
|------------------------------|--------|---------------------|------|-------------------|-------|-----------------|-------|
| Particulate                  |        |                     |      |                   |       |                 |       |
| Mean:                        |        |                     |      |                   |       |                 |       |
| Sulfate                      |        |                     |      |                   |       | Mean, a Sulfur  |       |
| Mean:                        |        |                     |      |                   |       |                 |       |
| SO <sub>2</sub> (wet)        |        |                     |      |                   |       | Mean, as Sulfur |       |
| Mean:                        |        |                     |      |                   |       |                 |       |
| NOx as NO <sub>2</sub> (dry) |        |                     |      |                   |       |                 |       |
| Mean:                        |        |                     |      |                   |       |                 |       |
| VOC                          |        |                     |      |                   |       |                 |       |
| Mean:                        |        |                     |      |                   |       |                 |       |
| CO                           |        |                     |      |                   |       |                 |       |
| Mean:                        |        |                     |      |                   |       |                 |       |

Emissions to be reported at Kern County Standard Conditions  
29.92" Hg and 60 °F

Comments:

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For Kern County Use Only:

**SUMMARY OF SOURCE TEST RESULTS FOR EPA**

Company: \_\_\_\_\_ Permit Number: \_\_\_\_\_

Unit Number or Name: \_\_\_\_\_ Location: \_\_\_\_\_

| <u>Pollutant/Other</u>     | <u>Test Method</u> | <u>Test Date</u> | <u>Emission/Other*</u> |                     |
|----------------------------|--------------------|------------------|------------------------|---------------------|
|                            |                    |                  | <u>Test Results</u>    | <u>Permit Limit</u> |
| Particulates               | _____              | _____            | _____                  | _____               |
| Sulfur Dioxide             | _____              | _____            | _____                  | _____               |
| NOx as NO <sub>2</sub>     | _____              | _____            | _____                  | _____               |
| Hydrocarbons<br>as Methane | _____              | _____            | _____                  | _____               |
| Sulfur Content             | _____              | _____            | _____                  | _____               |
| Fuel Usage                 | _____              | _____            | _____                  | _____               |
| Excess Oxygen              | _____              | _____            | _____                  | _____               |

\*Emissions/Other should be at EPA standard conditions (68°F and 29.92 inches of Hg) and in units of EPA's permit.

Prepared By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

## Reporting Units

Report in the following units on the summary of results:

(Equipment under KCAPCD Rule 422 reports emission limits according to the CFR, Title 40, Part 60.)

| <u>Process</u>            | <u>Pollutant</u>                                   | <u>Reporting Units</u>                                |                          |
|---------------------------|--|---|--------------------------|
|                           |  | <u>Emissions</u>                                      | <u>Emission Factors*</u> |
| General                   | "Sulfur Compounds"<br>(Report as SO <sub>2</sub> ) | ppm (wet)   | None                     |
| General                   | PM <sub>10</sub> ***                               | gr/scf, lb/hr   | None                     |
| Portland Cement<br>Plants | PM <sub>10</sub> ***                               | gr/scf, lb/hr   | lb/produced ton          |
| Fuel Burning<br>Equipment | PM <sub>10</sub> ***                               | gr/scf, lb/hr<br>gr/scr @ 12% CO <sub>2</sub>         | None                     |
|                           | Sulfates   | gr/scf, lb/hr<br>gr/scr @ 12% CO <sub>2</sub>         | lb/MMBTU                 |
|                           | SO <sub>2</sub>                                    | ppm (wet), lb/hr                                      | lb/MMBTU<br>as Sulfur    |
|                           | NO <sub>x</sub>                                    | ppm (dry), lb/hr<br>ppm (dry), @ 3% O <sub>2</sub> ** | lb/MMBTU                 |
|                           | CO   | ppm (dry), lb/hr                                      | None                     |
|                           | VOC  | ppm (dry), lb/hr<br>(as methane)                      | None                     |

\* Calculate lb/MMBTU emission factors from the mean of gr/dscf or ppm (dry) for all test runs.

\*\* Report NO<sub>x</sub> ppm (dry) @ 15% O<sub>2</sub> for gas turbines.

\*\*\* If PM only is measured, it will count as PM<sub>10</sub>.

# KERN COUNTY AIR POLLUTION CONTROL DISTRICT

## SOURCE TEST REQUIREMENTS

Fuel Analysis - Percent C,H,N,O,S, Specific Gravity or API Gravity, Gross Calorific Value.

| <u>Parameter</u>  | <u>Recommended Test Method</u>                                    | <u>Number of Tests or Minimum Test Duration</u>               |   |   |
|---|---|---|---|---|
|   |   | <u>Kern Cty Initial</u>                                       | <u>Kern Cty Annual</u>  | <u>EPA Permit Initial or Annual</u>                           |
| Sampling Point  | EPA 1 or 1A   |   |   |   |
| Stack Gas Flow Rate                                     | EPA 2, 2A or 2C   |   |   |   |
| O <sub>2</sub> , CO <sub>2</sub> , Dry Molecular Weight | EPA 3, 3A or CARB 100   |   |   |   |
| Moisture Content  | EPA 4 and 5   |   |   |   |
| Particulate   | EPA 5   | 3-Min 1hr Runs  | 3-Min 1hr Runs  | 3-Min 1hr Runs  |
| Particulate(PM <sub>10</sub> )                          | CARB 201A<br>CARB 501 w/EPA 5                                     | 3 Runs  | 3 Runs  | 3 Runs  |
| Sulfate   | EPA 8   | 3 Runs  | 3 Runs  | 3 Runs  |
| Sulfur Dioxide  | EPA 6, or<br>EPA 8, or<br>EPA 6C, or<br>BAST 19A or<br>CARB 1-100 | 6 Runs<br>3 Runs<br>3 1-hr Runs<br>3 1-hr Runs<br>3 1-hr Runs | 4 Runs<br>3 Runs<br>3 1-hr Runs<br>3 1-hr Runs<br>3 1-hr Runs | 6 Runs<br>3 Runs<br>3 (40 min.)<br>3 (40 min.)<br>3 (40 min.) |
| Nitrogen Dioxide  | EPA 7, or<br>EPA 7E, or<br>EPA 20, or<br>CARB 100                 | 12 Flasks<br>3 1-hr Runs<br>3 1-hr Runs<br>3 1-hr Runs        | 12 Flasks<br>3 1-hr Runs<br>3 1-hr Runs<br>3 1-hr Runs        | 12 Flasks<br>3 (40 min.)<br>3 (40 min.)<br>3 (40 min.)        |
| Carbon Monoxide   | CARB 100  | Min 2hrs  | Min 2hrs  | 3 (40 min.)   |
| Volatile Organic Compounds                              | EPA 18 &<br>CARB 410A*,or<br>EPA 25A                              | 3 Samples<br>3-1hr Runs                                       | 3 Samples<br>3-1hr Runs                                       | 3 Samples<br>3-1hr Runs                                       |

BAST - Bay Area Source Test, CARB - California Air Resources Board, EPA - Environmental Protection Agency.

Process requiring extensive run times may request approval to use lesser number of runs.

Gas turbines which use water injection NOx control and which have an input rating at peak load greater than or equal to 10 MMBTU/hr must test initially at multiple load conditions (base, peak, and two loads in between) to determine acceptable water to fuel ratios at various loads.

\*- C<sub>1</sub> - C<sub>6</sub> plus BTEX (Unless permit requires additional volatile components)

## REFERENCE METHODS

To be followed in addition to reference methods.

### Method 2:

#### Pitot Tubes:

Calibrate according to Section 4 (once every six months) unless physical damage apparent.

Record intercomponent spacings; if they have changed, restore original spacings or recalibrate the assembly

If calibration is done, record for three runs (once ever four weeks):

$\Delta$  std.,  $\Delta p$ ,  $C_p(s)$ ,  $C_p(A)$ ,  $C_p(B)$ ,  $(C_p(s) - C_p(B))$ ,  
 $(C_p(s) - C_p(A))$ ,  $\delta$ , permanent identification #, date,  $C_p$ .

**Note:** For calibrated pitot tubes, do not use the pitot tube unless  $\delta$  A and  $\delta$  B are both  $\leq$  to 0.01 and  $C_p(A) - C_p(B) \leq 0.01$  as defined in the method.

**Temperature Gauges:** (once every six months) unless damage apparent.  
Calibrate against a mercury-in-glass thermometer.

**Note:** The temperature data is valid only if the calibrated gauge agrees to within 1.5% with the reference gauge.

### Method 3:

Record three trial values of the dry molecular weight in g/g-mole

- Note:**
- 1) If integrated Method 3 sampling is used for molecular weight determination, the integrated bag sample is required to be taken simultaneously with, and for the same total length of time as, the particulate run.
  - 2) The three dry molecular weight trials shall differ from their mean by no more than 0.3 g/g-mole.

## Method 5 and CARB 201A:

Probe Nozzle: (once every six months unless damage apparent)

Record the permanent nozzle I.D. number. Nozzle shall be permanently and uniquely identified.

Record three inside diameter values to the nearest 0.10 mm.

Note: Do not use the nozzle if the difference between the high and low diameter values exceeds 0.1 mm.

Glass lined probe and glass nozzle is preferred but stainless steel is acceptable.

Pitot tube: See Method 2

Metering System:

Initial calibration of dry gas meter (once every six months).

After test series, post test calibration is required by performing three calibration runs according to Section 5.3.2 of Method 5 and record data.

- Note: 1) If the coefficients before and after a test series differ by more than 5%, use the coefficient which gives the lower sample volume, or void the test series.
- 2) Maintain a sample rate within 10% of isokinetic.

Probe Heater: (once every six months)

Record the calibration data for the procedure shown in APTD-0576, or, if applicable, include data showing that the calibration curves of APTD-0576 were used, and that the probe heater was constructed according to APTD-0581.

Temperature Gauges: (once every six months)

Show calibration according to Method 2, Section 4.3.

Barometer: (as needed)

Show calibration against a mercury barometer.

Positive Leak Check: (before initial field use)

Record metering system pressure and pressure drop due to leakage.

## Method 6:

Metering System: (once every six months)

Calibrate and check calibration according to Section 5 of Method 6 and report data. Post test calibration is required at end of test series.

Temperature Gauges: (once every six months)

Calibrate against mercury-in-glass thermometers and record data.

Barometer: (as needed)

Show calibration against a mercury barometer.

## Method 8:

Calibrate according to Method 5.

## VOLATILE ORGANIC COMPOUNDS

Sampling procedure must follow EPA Method 18 and CARB 410A or EPA 25A

Results shall be expressed as lbs-CH<sub>4</sub>/hr for methane and non-methane VOC's.

When using Method 18, quantitative analysis of C<sub>1</sub>-C<sub>6</sub> plus CARB 410A for benzene, toluene, ethylbenzene, and xylene (BTEX) shall be performed and reported.

Calibration check shall be performed at the beginning and end of the analysis day with results not differing by more than 5%.

Quantification of all VOC's shall be made by electronic or other suitable integration of the area under each peak. Peak height should not be used owing to potential for large error.

## GENERAL REQUIREMENTS

### Sampling

Sample Conditioning system shall provide dry, particulate free gas flow to the instruments.

All materials which come in contact with either the sample or calibration gas must be constructed of teflon, stainless steel, or inert materials (i.e. glass).

Cooling/drying systems shall not allow bubbling of gases through water. Condensation shall not be allowed in sample lines.

### Leak-Check

Leak checks shall be performed as prescribed in reference method at beginning and end of each test run. If leak exceed method limit, use of leak correction requires approval by Control Officer.

### Velocity Traverse

Sampling points, stack gas flowrates, and O<sub>2</sub>, CO<sub>2</sub> and dry molecular weight shall be determined in accordance with EPA Methods 1 or 1A, 2 or 2C, and 3, 3A or CARB 100.

## KERN COUNTY CONTINUOUS MONITORING

To be followed in addition to reference methods  
All instruments must meet detection limits of approved method.

### Multipoint Calibration

Perform a multipoint calibration and stability test on all continuous monitors once every three months. Use a zero gas and three calibration gases.

Include the calibration data in at least one report and reference the date of the latest calibration in all other reports.

### Calibration Gases

1. Label with the cylinder number, mean concentration, and last analysis date.
2. Calibration gases are considered usable for period shown on Table 2-2 and discussed on Page 2-6 of protocol entitled "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards".
3. Provide certification of gases in the source test report.
4. Span NO<sub>x</sub>, SO<sub>2</sub> and CO monitors with an NBS-traceable gas and zero with z-grade nitrogen or a span gas.
5. Span gases for NO<sub>x</sub>, SO<sub>2</sub> and CO monitors must have a concentration as close as possible to the pollutant emissions.
6. Span O<sub>2</sub> and CO<sub>2</sub> monitors with a gas certified to  $\pm 2$  percent and zero with z-grade N<sub>2</sub> or a span gas. (Ambient air may be used to span O<sub>2</sub> monitors).

### Ranges

The combination of monitor and recorder ranges shall be such that the span generally occupies at least 20% of the chart space. If the range must be changed because the pollutant concentration changes, indicate clearly on the chart which system was changed. Span and zero in the new range.

### Zero and Span Calibrations

Before and after each test run, zero and span all monitors used.

Unless method requires more stringent span drift, span drift limit (span minus zero) is  $\pm 10\%$  of the ranges for all ranges and gases. Drifts beyond  $\pm 10\%$  will invalidate the test run. Drifts beyond  $\pm 5\%$  must be corrected as shown on page 32.

The zero calibration point must be offset on the strip chart so that zero drift can be accurately determined.

### Marking Strip Charts

Mark the zero and span values read and adjustments made, time intervals, the range gradations, the beginning and end of test runs and the gas cylinder numbers for all emissions measured. If the original charts are not included, clearly label or color-code the recorder for each emission on the strip chart copy. Document the systems check(s) on the strip chart.

### Systems Calibration

A systems calibration must be performed for NO<sub>x</sub>, SO<sub>x</sub> and CO on each test day according method prescribed.

## MINIMUM REQUIRED RAW DATA

### General Data:

United Tested  
Test Date  
Operators  
Stack Dimensions  
Barometric Pressure  
Run Number

### Method 1 & 2:

Cross Sectional Area  
Pitot Tube ID Number  
Pitot Coefficient  
Last Date Pitot Calibrated  
Traverse Point Number  
Ts, Pg,  $\Delta p$   
Rotation Angles if necessary  
Final Leak Rate, Vacuum  
Static Pressure  
Stack Gas Dry Molecular Wt.  
Moisture Percent

### Method 3:

Dry molecular Wt. Determination  
% CO<sub>2</sub> % O<sub>2</sub>  
Avg Dry Molecular Wt. Trials

### Method 4:

Initial Clock Time  
Sampling Duration per point  
Stack Temperature  
Pressure differential across orifice meter  
Dry gas meter reading at ea pt  
Gas sample temp., meter., in-out  
Gas temp. leaving condenser or last impinger  
Leak Rate  
Moisture content from tables for saturated gas streams or streams containing water droplets  
Initial & final impinger volumes  
Initial & final silica get wts.

### Method 5/8:

Dry gas meter factor  
Nozzle diameter  
Moisture percent  
Gas analysis - % O<sub>2</sub>, % CO<sub>2</sub>  
Initial clock time  
Sampling duration per pt  
Uncorrected gas volume  
Orifice Meter  $\Delta H$   
Pump Vacuum  
Gas sample temp., meter, in-out  
Stack Temperature  
Velocity Head,  $\Delta p$   
Probe temperature  
Gas temp., leaving condenser or last impinger  
Gas sample molecular wt.  
Leak Rate, Vacuum  
Percent Isokinetic  
Assumed moisture percent  
Dry gas meter reading at ea pt.  
Sampling duration per pt.  
Pitot leak check  
Purge time (Method 8)  
Initial & final impinger volumes (weights for Method 8)  
Initial & final silica get wts.

### Method 6:

Dry gas meter factor  
Corrected gas sample volume  
Gas sample temp., meter, in-out  
Test duration  
Purge Time, 15 min. at sampling rate  
Record the following data every five minutes:  
Dry gas meter volume, temp.  
Temp. at impinger outlet  
Sample volume  
Sample rate  
Leak Rate:  $\leq 2\%$  of avg. sampling rate

(Standard continuous methods are sufficient for cogeneration equipment tests - EPA 6,7,8, BAST 13-A, BAST 19-A, and CARB 1-100)

Method 20:

- % O<sub>2</sub> for eight or more points at which lowest O<sub>2</sub> concentration found
- Sampling time
- O<sub>2</sub>, NO<sub>x</sub> concentrations
- Ambient temperature, humidity & pressure
- Fuel flow rate
- Fuel analysis
- Pre and post-test zero and calibration data
- Interference responses for CO, CO<sub>2</sub>, SO<sub>3</sub> & O<sub>3</sub> or per manufacturer's specifications
- NO<sub>2</sub> to NO conversion efficiency (before moisture removal)

Method 7:

- Leak Check
- Volume of flask & valve
- Flask temperature
- Barometric pressure
- Internal flask pressure

Method 10:

- Calibration data
- Volume fraction of CO<sub>2</sub> removal in Ascarite (or measured in orsat)
- CO concentration, dry

Method 18:

- Calibration data
- Sampling rate
- Test duration
- Source temperature
- Ambient temperature

## MINIMUM REQUIRED LAB ANALYSIS DATA

### Lab Analysis Procedure for Sulfuric Acid Mist

#### Method 5/8

Both front and back half of sample train are to be analyzed and reported.

Please adhere to the following procedure when analyzing the back half of the sampling train:

1. Use a glass fiber filter between the IPA and peroxide impingers as specified in EPA Method Eight. If filter clogging becomes a problem, an empty impinger may be placed in front of the filter.
2. After sampling and purging, remove this filter and place it in a sintered glass filtering funnel over a clean filtering Erlenmeyer flask. Wash the filter with at least 50 ml of deionized water of 80% IPA and quantitatively transfer the filtrate from the filtering Erlenmeyer flask to the flask containing the contents of the IPA (first) impinger.
3. Proceed with the gravimetric analysis for particulate and the titrimetric analysis for sulfate.

#### Method 4:

Volume of water collected in impingers and silica gel.

#### Method 5:

Amount of water lost during transport

Acetone blank volume

Acetone wash volume

Acetone blank concentration

Acetone wash blank

Volume of water collected in impingers, final and initial

Volume of water collected in silica gel, final and initial

Weight of particulate collected - final weight, tare weight and weight gain for each container

Weight of acetone blank

#### Method 6:

Normality of titrant

Volume of titrant used for sample

Volume of titrant used for blank

Aliquot ratio (total volume of solution in which the SO<sub>2</sub> sample is contained/volume of sample aliquot titrated)

Hydrogen peroxide blank concentration

Hydrogen peroxide blank volume

Distilled water wash volume

Distilled water concentration

Amount of liquid lost during transport

#### Method 8:

Same as Method 5.

## Analysis of Fuel Samples

### Fuel Oil Sample:

- Sample description and location

- Constituents

Carbon

Hydrogen

Oxygen

Nitrogen

Sulfur

- BTU/lb:

- Specific Gravity:

**ATTACHMENT I. DATA SUMMARIES**

## A. Field Data Summary

This form is required for Kern County use. Other forms may be used to present the data on the following pages.

|                 | Station                                       |       |       |
|-----------------|---|-------|-------|
|                 | Run#  |       |       |
| V1c             | - Volume of water collected, ml               | _____ | _____ |
| Vm              | - Gas volume, meter cond., dcf                | _____ | _____ |
| Y               | - Meter calibration factor                    | _____ | _____ |
| Pbar            | - Barometric pressure, in Hg.                 | _____ | _____ |
| Pg              | - Stack static pressure, in H <sub>2</sub> O  | _____ | _____ |
| ΔH              | - Avg meter press. diff., in H <sub>2</sub> O | _____ | _____ |
| Tm              | - Absolute meter temperature, °R              | _____ | _____ |
| Vm(std)         | - Standard sample gas vol, dscf               | _____ | _____ |
| Bws             | - Water vapor part in gas stream              | _____ | _____ |
| CO <sub>2</sub> | - Dry concentration, volume %                 | _____ | _____ |
| O <sub>2</sub>  | - Dry concentration, volume %                 | _____ | _____ |
| Md              | - Mol wt stack gas, dry, g/gmole              | _____ | _____ |
| Ms              | - Mol wt stack gas, wet, g/gmole              | _____ | _____ |
| Cp              | - Pitot tube coeff., dimensionless            | _____ | _____ |
| Δp              | - Avg of square roots of each Ap              | _____ | _____ |
| Ts              | - Absolute stack temperature, °R              | _____ | _____ |
| A               | - Area of stack, square feet                  | _____ | _____ |
| Qstd            | - Volumetric flowrate, dscfm                  | _____ | _____ |
| An              | - Area of nozzle, square feet                 | _____ | _____ |
| e               | - Sampling time, minutes                      | _____ | _____ |
| I               | - Isokinetic variation, percent               | _____ | _____ |



**C. Sulfate Data**

$N_{BaCl_2} =$  \_\_\_\_\_

| <u>Run #</u> | <u>Sample</u> | <u>Aliquot (ml)</u> |                 | <u>grains</u> | <u>gr/dscf</u> | <u>gr/scf</u> | <u>lb/hr</u> | <u>gr/scf</u><br><u>@ 12% CO<sub>2</sub></u> |
|--------------|---------------|---------------------|-----------------|---------------|----------------|---------------|--------------|--|
|              |               | <u>Vsoln/Va</u>     | <u>Vt - Vtb</u> |               |                |               |              |  |
| _____        | Nozzle-Probe  | _____               | _____           | _____         |                |               |              |  |
|              | Filters       | _____               | _____           | _____         |                |               |              |  |
|              | Condensibles  | _____               | _____           | _____         |                |               |              |  |
|              |               |                     | Total =         | _____         | _____          | _____         | _____        | _____  |
| _____        | Nozzle-Probe  | _____               | _____           | _____         |                |               |              |  |
|              | Filters       | _____               | _____           | _____         |                |               |              |  |
|              | Condensibles  | _____               | _____           | _____         |                |               |              |  |
|              |               |                     | Total =         | _____         | _____          | _____         | _____        | _____  |
| _____        | Nozzle-Probe  | _____               | _____           | _____         |                |               |              |  |
|              | Filters       | _____               | _____           | _____         |                |               |              |  |
|              | Condensibles  | _____               | _____           | _____         |                |               |              |  |
|              |               |                     | Total =         | _____         | _____          | _____         | _____        | _____  |



**G. Continuous Monitor Data**

**Nitrogen Dioxide**

| <u>Run</u> | <u>% O2</u> | <u>Corrected<br/>ppm (dry)</u> | <u>Corrected<br/>ppm (dry)<br/>@ 3% O2</u> | <u>lb/hr</u> |
|------------|-------------|--------------------------------|--|--------------|
| _____      | _____       | _____                          | _____                                      | _____        |
| _____      | _____       | _____                          | _____                                      | _____        |
| _____      | _____       | _____                          | _____                                      | _____        |
| _____      | _____       | _____                          | _____                                      | _____        |

**Sulfur Dioxide**

| <u>Run #</u> | <u>ppm (dry)</u> | <u>ppm (wet)</u> | <u>ppm (dry)</u> | <u>lb/hr</u> |
|--------------|------------------|------------------|------------------|--------------|
| _____        | _____            | _____            | _____            | _____        |
| _____        | _____            | _____            | _____            | _____        |
| _____        | _____            | _____            | _____            | _____        |
| _____        | _____            | _____            | _____            | _____        |

**Carbon Monoxide**

| <u>Run #</u> | <u>Corrected<br/>ppm (dry)</u> | <u>lb/hr</u> |
|--------------|--------------------------------|--------------|
| _____        | _____                          | _____        |
| _____        | _____                          | _____        |
| _____        | _____                          | _____        |
| _____        | _____                          | _____        |

## EMISSION FACTOR CALCULATIONS

$$F = 10^6 [(3.64) (\%H) + (1.53) (\%C) + (0.57) (\%S) + (0.14) (\%N) - (0.46) (\%O)] / \text{GCV} \\ = \text{dscf/MMBTU}$$

Where GCV = gross calorific value of fuel combusted, BTU/lb

$$F_{60^\circ\text{F}} = F_{68^\circ\text{F}} \times 0.985$$

### General Pollutant lb/MMBTU Equation

$$E = (F_{60^\circ\text{F}}) (C) \frac{20.9}{(20.9 - \%O_2 \text{ of C})}$$

Where:

E = lb/MMBTU

$F_{60^\circ\text{F}}$  = "F" factor @ 60°F

C = Concentration of Pollutant, lb/dscf

### Sulfur Emission Factor

$$E = (F_{60^\circ\text{F}}) (C_{\text{SO}_2})/x \frac{20.9}{(20.9 - \%O_2 \text{ of C})} = \text{lb}_s/\text{MMBTU}$$

Where  $x = 32.06_{\text{MW,S}}/64.06_{\text{MW,SO}_2}$

$$E = (F_{60^\circ\text{F}}) (C_{\text{H}_2\text{SO}_4}/y) \frac{20.9}{(20.9 - \%O_2 \text{ of C})}$$

Where  $y = 98.08_{\text{MW,H}_2\text{SO}_4} / 32.06_{\text{MW,S}}$

**ATTACHMENT II. CONTINUOUS METHODS DATA**

**A. Calibration and Correction Data**

| <u>%O2</u> | <u>Zero Reading</u> | <u>Span Reading</u> | <u>Span Gas Value</u> |
|------------|---------------------|---------------------|-----------------------|
| Run #1     | _____               | _____               | _____                 |
| Run #2     | _____               | _____               | _____                 |
| Run #3     | _____               | _____               | _____                 |

| <u>C02</u> | <u>Zero Reading</u> | <u>Span Reading</u> | <u>Span Gas Value</u> |
|------------|---------------------|---------------------|-----------------------|
| Run #1     | _____               | _____               | _____                 |
| Run #2     | _____               | _____               | _____                 |
| Run #3     | _____               | _____               | _____                 |

| <u>ppmCO</u> | <u>Zero Reading</u> | <u>Span Reading</u> | <u>Span Gas Value</u> |
|--------------|---------------------|---------------------|-----------------------|
| Run #1       | _____               | _____               | _____                 |
| Run #2       | _____               | _____               | _____                 |
| Run #3       | _____               | _____               | _____                 |

| <u>ppmSO2</u> | <u>Zero Reading</u> | <u>Span Reading</u> | <u>Span Gas Value</u> |
|---------------|---------------------|---------------------|-----------------------|
| Run #1        | _____               | _____               | _____                 |
| Run #2        | _____               | _____               | _____                 |
| Run #3        | _____               | _____               | _____                 |

| <u>ppmNOx</u> | <u>Zero Reading</u> | <u>Span Reading</u> | <u>Span Gas Value</u> |
|---------------|---------------------|---------------------|-----------------------|
| Run #1        | _____               | _____               | _____                 |
| Run #2        | _____               | _____               | _____                 |
| Run #3        | _____               | _____               | _____                 |

## B. Excess Drift Corrections

Other calculation methods may apply.

Divide each hour's test run into ten minute intervals and apply zero and span corrections to the midpoint of each interval.

### Example

Span Gas Value = 95 ppm, Range = 250  
Zero Drift = 6ppm, Span Drift = 21ppm  
Actual Span Drift = Span - Zero = 21-6 = 15ppm

Span Percent Difference =  
(Initial Span - Final, Actual Span) / (Initial Span)  
= (95 - 110) / (95) = (-) 15.8%

Zero Drift Factor - 6ppm/6 intervals - 1 ppm/interval  
Span Drift Factor = (-)15.8%/6 intervals = (-)2.63%/interval

| <u>(min)</u> | <u>Uncorrected<br/>Concentration</u> | <u>Zero<br/>Corrected</u> | <u>Span<br/>Corrected</u>                 |
|--------------|--------------------------------------|---------------------------|---|
| 0 -10        | 103                                  | -0.5 = 102.5;             | $102.5 + (- 0.0132 \times 102.5) = 101.2$ |
| 10-20        | 110                                  | -1.5 = 108.5;             | $108.5 + (- 0.0395 \times 108.5) = 104.2$ |
| 20-30        | 104                                  | -2.5 = 101.5;             | $101.5 + (- 0.0658 \times 101.5) = 94.8$  |
| 30-40        | 115                                  | -3.5 = 111.5;             | $111.5 + (- 0.0921 \times 111.5) = 101.2$ |
| 40-50        | 130                                  | -4.5 = 125.5;             | $125.5 + (- 0.1184 \times 125.5) = 110.6$ |
| 50-60        | 105                                  | -5.5 = 99.5;              | $99.5 + (- 0.1447 \times 99.5) = 85.1$    |

If the test run span drift (absolute value of span minus zero) measured before any physical pen adjustment is less than or equal to 5% of the range, corrections for drift need not be made.