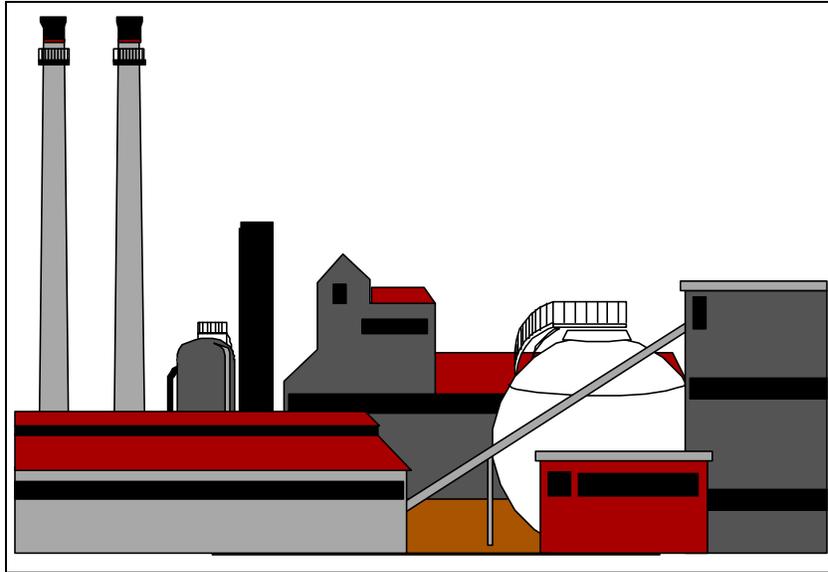


**MONTANA SOURCE TEST PROTOCOL AND
PROCEDURES MANUAL**



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SECTION 1. INTRODUCTION

Emission source testing is required by the Montana Department of Health and Environmental Sciences, Air Quality Bureau, hereinafter "the department," to determine the types and amount of air pollutants emitted by various emission sources. Information gathered from source tests is used for planning, issuing permits, evaluating control systems, updating emission inventories, establishing permit fees and enforcing emission limitations. For these purposes, emission source tests must yield data in which the department and the source have confidence. Confidence in the data is achieved by establishing test procedures and quality assurance programs that strive to produce consistent test data that is complete, representative, precise, accurate and traceable.

The purpose of this manual is to standardize the test procedures to be used for each test program. This manual identifies those methods and procedures which satisfy the department's requirements for complete, representative, precise, accurate and traceable data gathering for source testing. Additional requirements for accepted test methods are included to increase the quality of the data. This manual also provides the tester with criteria by which the testing will be judged.

The test methods and requirements contained herein are current as of the date of issuance. Changes to this manual will follow the appropriate rule making procedures. However, the department may approve alternate test requirements or procedures to suit individual sources or testing objectives, or to obtain quality data.

SECTION 2. SOURCE TEST PLANNING

Planning of a source test program, or even a single source test, is essential in ensuring complete, representative, precise, accurate and traceable data. A "Source Test Protocol" must be approved by the department prior to any test date. The minimum information required to be in a Source Test Protocol is outlined in Section 2.1 of this manual. A Source Test Protocol for every source test or source test program must be submitted to the department by the source operator, a minimum of 25 working days (unless otherwise specified) prior to the proposed test or the beginning of the source test program date, for approval by the department. Failure of the department to notify a source of acceptance of the protocol within the 25 working days shall be deemed approval of the Source Test Protocol. For sources subject to a source testing program a Source Test Protocol document shall be submitted once every five (5) years, provided the subsequent source testing is conducted by the same entity and there are no deviations from the original protocol. Any proposed changes to the source test protocol must be submitted to the department for review. Confirmation

of the test date is required a minimum of three (3) working days prior to the source test.

2.1 Source Test Protocol

The Source Test Protocol submitted to the department for approval must include the information listed in Section 2.1 as a minimum requirement.

Submitting a Source Test Protocol which is complete and satisfies all the department test plan requirements will alleviate unnecessary delays in the approval of the Source Test Protocol.

When submitting the protocol, use the format and section numbering system which is outlined in Table 2.1, Example Table of Contents; i.e., 1.0 for the Introduction, 2.0 for the Emission Source Information.

2.1.1 Introduction

This section must state the facility name and operator, location, permit number(s), emission source(s) to be tested, and a brief comment on the objectives of the source test.

2.1.2 Emission Source Information

2.1.2.1 Facility Description

A description of the facility must be provided including all process equipment operating ranges relevant to the equipment to be tested. Also include a brief description of each major process and associated equipment. Important parameters to include are: process type, process rates, control equipment, and fuel type (if any).

2.1.2.2 Process Information

A block flow diagram and description of the process to be tested is required. Include all major components and air pollution control equipment. Include all process equipment maximum rates, normal and average process rates, fuel types, fuel feed rates and operating hours. If the process is a batch type, provide information on the duration and number of batches per day. Any information required to be submitted, that has been declared confidential under

the appropriate procedures, may be referenced or submitted separately. Process rates during testing must be at specific conditions that are representative of maximum operating capacity or maximum permitted operating capacity, unless otherwise agreed upon by the department and the source.

2.1.2.3 Emission Source Description

A diagram of the stack showing sampling ports, platform and adjacent duct work is required. The sampling site should be identified clearly in the diagram showing location of the sampling port from the nearest upstream/downstream flow disturbances and the stack diameter. A description of the stack gas must be provided, including velocity, temperature, pressures, moisture content, and approximate particulate grain loading and composition. A discussion of safety considerations including any special equipment required by the facility operator, is also necessary.

2.1.3 Source Test Program Description

2.1.3.1 Testing Contractor

Identify the testing contractor, including the name, address, and phone number of the project manager, and discuss prior project experience (if applicable).

2.1.3.2 Test Program Organization

An organizational chart must be included showing general organization, delegation of authority, names and duties of all personnel involved. A discussion must be provided to include the qualifications of all personnel involved in relation to the duties assigned to them. This includes personnel involved in sampling, analysis, quality control, data reduction and program management.

2.1.3.3 Test Program Objectives

The objectives of the test program must be discussed in detail and shall include (as a minimum) the following information:

- a. Applicable rules, permit conditions or agreements;
- b. Applicable emission limits;

- c. Process or equipment operating conditions during the testing;
- d. Emission control device operating conditions during testing;
- e. The operating range (percent of design capacity) at which the equipment will operate during the testing;

Note: Process rates during testing must be at specific conditions that are representative of maximum operating capacity or maximum permitted capacity, unless otherwise agreed upon by the department and the source.

- f. Discussion of how the proposed test program will fulfill the requirements of applicable rules, permit conditions, and agreements;
- g. Proposed source test date(s);
- h. Expected date of source test report submittal to the department. The source test report is required to be submitted to the department within sixty (60) days of test completion, unless otherwise specified. Applicants should review their specific permit conditions, or other applicable testing requirements, for required submittal dates.

2.1.4 Source Testing Procedures

2.1.4.1 Instrumentation and Equipment Description

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

- a. Emission monitors and sampling systems;
- b. Sample probes and filter ovens, including probe liner material, probe temperature and length, and filter material and filter temperature;
- c. Impinger trains and associated glassware, including sample bottles and any specialized glassware cleaning procedures;
- d. Pump/gas meter modules;
- e. Laboratory instruments.

2.1.4.2 Test Methods

This section must specify the test method to be used for each parameter to be tested. A table summarizing the sources and the test method for each parameter to be tested must be included (See Section 3 of this manual). Include a brief description of each method; this shall include as a minimum the method number, the title and the reference where a detailed description of the method can be found. Specify the number of replicates and duration of sampling for each parameter. Include methods to determine fuel rate or process rate (if applicable). Copies of field data forms and calculation procedures must also be included.

2.1.4.3 Analytical Methods

A description of sample recovery and analysis procedures must be provided. Identify analytical instruments, materials, associated equipment and personnel involved. A detailed description of any deviation from routine EPA analytical procedures is required. Discuss the use of standards and blanks in the analyses. Include copies of all analytical forms.

2.1.4.4 Sampling Site Location

In selecting a sampling site, every attempt should be made to obtain the most representative sample from the source being tested. Siting criteria is described in EPA Reference Method 1 for ducts with equivalent diameters of 12 inches or greater. Siting criteria for small diameter ducts (less than 12 inches but greater than 4 inches) is described in EPA Reference Method 1A.

If the criteria of EPA Method 1 cannot be met, a sample site can be qualified for use by confirming the absence of cyclonic flow using the procedures in EPA Reference Method 1, Section 2.4. However, the department may require qualification of the site by using the alternate procedures in EPA Reference Method 1, Section 2.5, under special circumstances.

2.1.4.5 Sample Matrix

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 such as CO and H₂S will affect

both the safety and sampling strategies of the source test. The selection of proper equipment and test methods to suit the sample matrix is critical to the success and safety of the program.

2.1.5.0 Quality Assurance and Quality Control (QA/QC) Procedures

2.1.5.1 Sampling Procedure

A description of the sampling procedure is required which includes procedures for sample collection, sample labeling, sample handling, sample control, sample preservation, analysis and storage. Include copies of chain-of-custody forms and sample labels. Section 6 of this document provides general minimum guidelines for chain-of-custody procedures.

2.1.5.2 Equipment Calibration and Maintenance

A description of sampling equipment calibration and preventive maintenance procedures are required and must include personnel, materials and equipment involved in calibration and maintenance.

Include manufacturer's name, model number, specifications, certified accuracy of all calibration equipment and date of certification. The sampling equipment to be calibrated includes, but is not limited to, the following items:

- a. Pitot tubes;
- b. Thermocouple;
- c. Magnehelic gauges;
- d. Dry gas meters;
- e. Dry gas meter orifice(s);
- f. Barometer;
- g. Balances;
- h. Probe nozzles.

Copies of standard forms for all calibration operations and preventative maintenance must be included. A summary of equipment calibrations, including calibration factors and dates of calibration, and equipment maintenance schedules must be available to the department representative during the testing.

2.1.5.3 Instrument Calibration and Maintenance

This section must contain procedures for calibrating instrumental emission monitors and any preventive maintenance performed on these instruments. Include a

diagram of calibration gas flow through the sampling system. Specify calibration materials including supplier and guaranteed accuracy, stability of the calibration gas and National Bureau of Standards (NBS) traceability. Specify the percent of range (span) at which the instruments will be calibrated. Include a brief description of multipoint and probe-tip calibrations. Copies of standard forms for all calibration operations and preventive maintenance must be included.

2.1.5.4 Data Validation

Data validation procedures must be outlined in this section and should include the following:

- a. Data validation and editing procedures;
- b. Type of personnel performing data validation;
- c. Sources of validation information used by data editors;
- d. Specific validation procedures for each source test method.

2.1.5.5 Internal Audits and Corrective Action

A description of internal audit and corrective action procedures instituted by the test contractor to ensure quality of the data collected shall be included in this section of the report.

2.1.5.6 Documentation

A description of the formal system used in document control and recordkeeping as it applies to field data (e.g., generating, checking, inventory and archiving of supporting documentation) shall be included in this section of the report. Document control as it pertains to distribution and revision of the Source Test Protocol and source test reports should also be covered.

2.1.6 Source Test Report

2.1.6.1 Report Format

A sample table of contents for a generalized source test report must be provided. Include a brief description of the contents of each section. Include, as a minimum, the data

in Table 5.1. Note the final report submitted to the department after the completion of the source test must be signed by the source test project manager and by the person responsible for its review (quality assurance officer or supervisor).

2.1.6.2 Data Reduction Procedures/Methods

Description of data reduction procedures should include example calculations and formulas for each test method. The standard conditions used by Montana Air Quality Bureau are 29.92 inches of mercury ("Hg) and 68°F.

TABLE 2.1

Source Test Protocol: Example Table of Contents
(Minimum Requirements)

Cover: must include the name of the source; Air Quality Permit number(s) (if applicable); name of testing firm; name of emission source(s) tested; date of source test.

Endorsement Page: must include a signature page for endorsement by source representative and endorsement by the testing project manager. A cover letter transmitting the same information will also be acceptable to the department.

- 1.0 Introduction
- 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 Test Program Organization
 - 3.3 Test Program Objectives
- 4.0 Source Testing Procedures
 - 4.1 Instrumentation and Equipment Description
 - 4.2 Test Methods
 - 4.3 Analytical Methods
 - 4.4 Sampling Site Location
 - 4.5 Sample Matrix
- 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
- 6.0 Source Test Report
 - 6.1 Report Format
 - 6.2 Data Reduction Procedures/Methods

SECTION 3. SOURCE TEST PROCEDURES

Source test parameters, acceptable methods and alternate methods are included in, but not limited to, Table 3.1. The parameters, acceptable methods, alternate methods and additional requirements are discussed in detail below. Alternate methods require written approval by the department. Items listed under "additional requirements" are important considerations that may be unique to the department or contained within the test method. Unless otherwise specified, follow the EPA Quality Assurance Handbook, EPA 600\4-77-027b, as revised.

3.1 Sampling Point Determination

3.1.1 Application: Sampling points for cross-stack sampling. EPA Methods 2, 4, 5, 8, 12, 13A, 13B, 17, 20, 201, 201A, 202.

3.1.2 Acceptable Method: EPA Method 1 for stack diameters greater than or equal to 12 inches. EPA Method 1A for stack diameters between 4 and 12 inches.

3.1.3 Additional requirements:

Absence of cyclonic flow must be verified if the stack configuration is conducive to cyclonic flow. If significant cyclonic flow is detected ($\alpha > 20E$), the stack configuration (flow straightening vanes or stack extensions) or sampling site must be altered. If alteration is not possible, stack flow rates must be calculated or an alternative procedure for determining stack flow must be used.

3.2 Determination of Stack Gas Velocity and Volumetric Flow Rate

3.2.1 Application: All testing where mass emission rates are desired or isokinetic sampling is required.

3.2.2 Acceptable Method: EPA Method 2 or EPA Method 2C (for stack diameters of less than 12 inches).

3.2.3 Alternate Method: EPA Method 2A for direct measurement of gas volume through pipes and small ducts; EPA Method 2B for determination of exhaust gas volume flow from gasoline vapor incinerators; EPA Method 2D for measurement of gas volumetric flow rate in small ducts.

3.2.4 Additional Requirements:

- a. Pitot tubes must be constructed as per EPA Method 2, Section 2. Pitot tubes must be calibrated no more than 60 days prior to field use and no more than 60 days after testing is completed.
- b. If a pressure-sensing instrument other than an inclined manometer is used, it shall be calibrated as per EPA Method 2, Section 2.2, at intervals of every sixty days.
- c. The pressure-sensing instrument should be chosen such that the delta P reads at least 10% of full scale.
- d. Unacceptable sampling conditions:
 - (1) If the stack gas flow is cyclonic or highly irregular (wide velocity changes or pulsations) or the stack diameter is less than four inches, an alternate method must be used.
 - (2) If the average pressure differential (delta P) of the sample points is less than 0.03 inches of water, an alternate method must be used. An acceptable alternate method is fuel rate measurement, fuel analysis and calculation of a measurement dry oxygen-based F factor as per EPA Method 19, Section 2.1. The F factor is multiplied by the heat input rate (MMBTU/Hr) and corrected for excess oxygen to calculate the flow rate.
- e. For combustion sources with stacks less than 4 inches in diameter, the flow rate must be calculated from fuel use (heat input rate). The fuel metering system must be calibrated within 30 days of the test.

3.3 Gas analysis for CO₂, O₂ and Dry Molecular Weight

- 3.3.1 Application: Calculation of excess air or dilution. Determination of dry molecular weight for stack gas velocity calculations.
- 3.3.2 Acceptable Method: EPA Method 3 or EPA Method 3B for the determination of emission rate correction factor or excess air.

3.3.3 Alternate Method: EPA Method 3A, for instrumental analyzer procedure, when rapid changes in the CO₂ and O₂ concentration may occur.

3.4 Determination of Moisture Content

3.4.1 Application: Determining the moisture content of the stack gas.

3.4.2 Acceptable Method: EPA Method 4 or combined with particulate measurement methods.

3.4.3 Alternate Method: If the stack is cool and dry (less than 2% moisture by volume), the moisture content may be calculated using wet bulb/dry bulb gas temperatures and psychrometric table.

3.4.4 Additional Requirements:

- a. The approximation method as per EPA Method 4, Section 3 shall be used only to estimate the moisture content of the stack prior to isokinetic sampling.
- b. In saturated or droplet-laden gas streams, two determinations of moisture content must be made, one calculated from the saturation temperature of the stack gas and another measured by impinger analysis. The lower of these two values shall be considered correct.
- c. Minimum 20 DSCF sample volume per test.

3.5 Determination of Particulate Emissions

3.5.1 Application: Particulate emissions determination in gas streams for air contaminant sources.

3.5.2 Acceptable Method: EPA Method 5 or method specified in applicable subpart.

3.5.3 Additional Requirements:

- a. The dry gas meter must be calibrated as per EPA Method 5, Section 5.3, at no more than 60 days

prior to field use and no more than 60 days after testing is completed.

- b. The minimum sampling run time is 60 minutes and the minimum sampling volume is 31.8 dscf unless sampling run times and sampling volumes are specified in an applicable subpart of the NSPS regulations, 40 CFR Part 60.
- c. Determination of condensible particulate emissions may be required. See Section 3.7

3.6 Determination of PM-10 Emissions

- 3.6.1 Application: Determination of particulate less than 10 microns in diameter.
- 3.6.2 Acceptable Methods: EPA Method 201A with impinger analysis.
- 3.6.3 Alternate Method: EPA Method 201 with impinger analysis.
- 3.6.4 Additional Requirements:
 - a. The entire train liquid catch, unless other analyses are to be performed on the sample, shall be evaporated at a temperature of 105°C +/- 10°C (220°F +/- 10°F) at ambient pressure. The net weight of this "back-half" particulate fraction shall be added to the filter and wash fraction weights. If other methods are combined with the particulate determination, only a known major portion of the impinger catch will be evaporated rather than the entire impinger catch.
 - b. The dry gas meter must be calibrated as per EPA Method 5, Section 5.3, at no more than 60 days prior to field use and no more than 60 days after testing is completed.
 - c. An impinger solution blank analysis must be performed on the distilled water source (each lot number). The impinger solution must contain less than 0.001 percent residue by weight.

d. The minimum sampling run time is 60 minutes and the minimum volume is 31.8 DSCF.

e. PM-10 sampling tests with percent isokinetic outside 100 +/- 20% range shall invalidate the test

3.7 Determination of Condensible Particulate Emissions in "Back Half" of Sampling Train (Impinger Train)

3.7.1 Application: Where requested or required by the department for assessment of condensible particulate emissions.

3.7.2 Acceptable Method: EPA Method 5 with impinger analysis.

3.7.3 Alternative Method: EPA Methods 17, 201, 201A, or 202 (for condensible portion).

3.7.4 Additional Requirements:

a. The entire train liquid catch, unless other analyses are to be performed on the sample, shall be evaporated at a temperature of 105EC +/- 10EC (220EF +/- 10EF) at ambient pressure. The net weight of this "back-half" particulate fraction shall be reported as "back-half" particulate or may be added to the filter and wash fraction weights, to determine total particulate emissions. If other methods are combined with the particulate determination, only a known major portion of the impinger catch will be evaporated rather than the entire impinger catch.

b. The dry gas meter must be calibrated as per EPA Method 5, Section 5.3, at no more than 60 days prior to field use and no more than 60 days after testing is completed.

c. An impinger solution blank analysis must be performed on the distilled water source (each lot number). The impinger solution must contain less than 0.001 percent residue by weight.

d. The minimum sampling run time is 60 minutes and the minimum volume is 31.8 DSCF.

e. Particulate sampling tests with percent isokinetic outside 100 +/- 10% range shall invalidate the test.

f. If Method 201 or 201A is being used to determine total particulate, the percent isokinetic range must be within 100 +/- 10%.

3.8 Determination of Sulfur Dioxide Emissions

3.8.1 Application: Sulfur dioxide emissions determination.

3.8.2 Acceptable Method: EPA Method 6 and 6C (Instrumental Method).

3.8.3 Alternate Method: EPA Method 6A and 6B.

3.8.4 Additional Requirements:

a. If the expected SO₂ concentration is above 2000 ppmv, use 6% H₂O₂ in water for the absorbing solution.

b. Large impingers may be used for SO₂ sampling.

c. The sampling times and volumes must meet the requirements of the applicable subpart of the NSPS Regulations, 40 CFR Part 60.

d. If instrumental methods are used, Section 3.9.4 of this manual must be followed.

3.9 Determination of Oxides of Nitrogen Emissions

3.9.1 Application: Oxides of nitrogen emissions determination.

3.9.2 Acceptable Method: EPA Method 7 and 7E (Instrumental Method).

3.9.3 Alternate Method: EPA Method 7A, 7B, 7C, 7D, and 20.

3.9.4 Additional Requirements:

- a. For instrumental method sampling, EPA Protocol I or NBS-traceable calibration gases are required. The instrument range must be selected such that the emission standard is at least 30 percent of the range. The high calibration gas concentration must be 80-100% of the instrument range setting. Calibration and sampling must be conducted using the same instrument range setting.
- b. A strip chart recorder is required such that a continuous trace of the pollutant concentration is obtained. The recorder must be adjusted to obtain a 5-10 percent zero offset. The maximum strip chart data reduction averaging interval is ten (10) minutes. The chart recorder must be readable to 0.5 percent of full scale. These requirements of paragraph (b) may be waived by the Montana Air Quality Bureau if an automated data acquisition system is used.
- c. The sampling times and volumes must meet the requirements of the applicable subpart of the NSPS regulations, 40 CFR Part 60. If not specified, the source must obtain three grab samples per run every 10 to 15 minutes for a total of three runs.

3.10 Determination of Sulfuric Acid Mist and Sulfur Dioxide Emissions

- 3.10.1 Application: Determination of particulate sulfur (H_2SO_4 mist) and gaseous sulfur (SO_2 , SO_3) emissions. Sulfates may also be quantified.
- 3.10.2 Acceptable Methods: EPA Method 8.
- 3.10.3 Alternate Methods: Currently none.
- 3.10.4 Additional Requirements:
 - a. EPA Method 8 may be combined with EPA Method 5.
 - b. Sulfates may also be quantified if this method is combined with Method 5. Total sulfate is the sum of the sulfates found in the probe wash and

particulate filter and the H₂SO₄ found in the first impinger. The procedure for sulfate analysis of the probe wash and the filter must be ion chromatography or titration as per EPA Method 8 with the addition of sample conditioning. Sample conditioning must be done with an ion-exchange resin column or equivalent method to remove cation interference prior to titration.

- c. The sampling times and volumes must meet the requirements of the applicable subpart of the NSPS Regulations, 40 CFR Part 60.

3.11 Determination of Opacity

- 3.11.1 Application: Determination of opacity from emission sources.
- 3.11.2 Acceptable Method: EPA Method 9.
- 3.11.3 Alternate Methods: EPA Alternate Method 1 (LIDAR)EPA Method 22.

3.12 Determination of Carbon Monoxide Emissions

- 3.12.1 Application: Carbon monoxide emissions determination.
- 3.12.2 Acceptable Method: EPA Method 10 and 10B.
- 3.12.3 Alternate Method: EPA Method 10A.
- 3.12.4 Additional Requirements:
 - a. For instrumental method sampling, EPA Protocol I or NBS-traceable calibration gases are required. The instrument range must be selected such that the emission standard is at least 30 percent of the range. The high calibration gas concentration must be at least 60% of the instrument range. Calibration and sampling must be conducted using the same instrument range setting.
 - b. A strip chart recorder is required such that a continuous trace of the pollutant concentration is obtained. The recorder must be adjusted to obtain

a 5-10 percent zero offset. The maximum strip chart data reduction averaging interval is ten (10) minutes. The chart recorder must be readable to 0.5 percent of full scale. These requirements may be waived by the Montana Air Quality Bureau if an automated data acquisition system is used.

3.13 Determination of Hydrogen Sulfide Emissions

3.13.1 Application: H₂S concentration determination.

3.13.2 Acceptable Method: EPA Method 11.

3.13.3 Alternate Method: Currently none.

3.14 Determination of Lead Emissions

3.14.1 Application: Lead (Pb) emissions determination.

3.14.2 Acceptable Method: EPA Method 12.

3.14.3 Alternate Method: Currently none.

3.14.4 Additional Requirement:

May be conducted with EPA Method 5.

3.15 Determination of Fluoride Emissions

3.15.1 Application: Fluoride emission determinations.

3.15.2 Acceptable Method: EPA Method 13A and 13B.

3.15.3 Alternate Method: Currently none.

3.16 Determination of Total Reduced Sulfur Emissions.

3.16.1 Application: Total reduced sulfur emission determination.

3.16.2 Acceptable Method: EPA Methods 15, 16A and 16B.

3.16.3 Alternate Method: EPA Methods 15A and 16.

3.17 Determination of Hydrocarbon Emissions

- 3.17.1 Application: Determination of hydrocarbon concentration.
- 3.17.2 Acceptable Method: EPA Methods 18 and 25.
- 3.17.3 Alternate Method: EPA Methods 25A and 25B.

3.18 Determination of Sulfur Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxides Emission Rates.

- 3.18.1 Application: (a) Determine particulate matter, sulfur dioxide, and nitrogen oxides emission rates. (b) Determine sulfur removal efficiency based on fuel sampling.
- 3.18.2 Acceptable Method: EPA Method 19.
- 3.18.3 Alternate Method: Currently none.
- 3.18.4 Additional Requirements:

- a. If a source has no feasible method of determining fuel feed rates, use this method for determining heat input rates in million BTUs per hour. Heat input equals the standard volumetric flow rate times the 0% excess air correction factor divided by the dry basis oxygen based F-factor.

$$\text{Heat Input (MMBTU/HR)} = \frac{\text{VMSTD(dscf/hr)} \times 20.9 - \text{O}_2\%}{F_d(\text{dscf/MMBTU})}$$

TABLE 3.1

List of Test Methods

<u>Section</u>	<u>Parameter</u>	<u>Acceptable Method</u>	<u>Alternate Method</u>
3.1	Sampling Point Determination	EPA Method 1; EPA Method 1A	---
3.2	Stack Gas Flow Rate	EPA Method 2; EPA Method 2C	EPA Methods 2A, 2B, 2D
3.3	O ₂ , CO ₂ , Dry Molecular Weight	EPA Method 3	EPA Method 3A, 3B
3.4	Moisture Content	EPA Method 4 EPA Method 5	Wet bulb/dry bulb
3.5	Total Particulate	EPA Method 5	EPA Methods 5A,5B, 5D 5E, 5F, 5G, 5H, 17
3.6	PM-10	EPA Method 201A with Impinger Analysis	EPA Method 201 with Impinger Analysis
3.7	Condensable Particulate	EPA Method 5 with Impinger Analysis	EPA Methods 17, 201, 201A, 202
3.8	SO ₂	EPA Methods 6 EPA Method 6C	EPA Methods 6A, 6B
3.9	Nitrogen Oxides	EPA Method 7 EPA Method 7E	EPA Methods 7A, 7B, 7C, 7D, 20
3.10	Sulfuric Acid Mist and SO ₂	EPA Method 8	---
3.11	Opacity	EPA Method 9	EPA Alternate Method 1 (LIDAR) EPA Method 22
3.12	Carbon Monoxide	EPA Method 10	EPA Methods 10A,10B
3.13	Hydrogen Sulfide	EPA Method 11	---
3.14	Lead	EPA Method 12	---
3.15	Fluoride	EPA Method 13A	---

		EPA Method 13B	
3.16	Total Reduced Sulfur	EPA Methods 15, 16A, and 16B	EPA Methods 15A and 16
3.17	Hydrocarbon (VOC)	EPA Method 18 and EPA Method 25	EPA Methods 25A, 25B
3.18	SO ₂ Removal Efficiency & Pollutant Mass Rates	EPA Method 19	---

NOTE: Alternate methods require written approval by the department on a case-by-case basis.

SECTION 4. SOURCE TEST VALIDATION

A source test report must be determined to be valid by the department prior to the acceptance of any source test data. This data will be evaluated by the following criteria.

4.1 Test Invalidation Criteria

- 4.1.1 Application: All source test determinations may be invalidated by an observer on-site or upon test report review. The observer will attempt to notify the tester of any potential invalidations prior to leaving the test site. However, the observer is not obligated to determine the validity of the test on-site. The department will notify the source, within 90 days of receipt of the source test report, of the compliance status of the facility tested. Failure of the department to notify the source shall be deemed acceptance of the source test report.
- 4.1.2 Major Sample Loss or Alteration
 - a. Post-test leak rate greater than allowed. There is no post-test leak rate allowed for instrument methods.
 - b. Spillage of sample.
 - c. Filter disruption (holes or tears).
 - d. Any event or process that causes sample loss.
 - e. Sample contamination.
- 4.1.3 Sampling Errors
 - a. Isokinetic rate out of range.
 - b. Improper sampling equipment.
 - c. Improper sampling procedure.
 - d. Any procedure or piece of equipment that does not conform to the test method requirements.
 - e. Samples collected during non-representative

process operating conditions.

4.1.4 Analysis Errors

- a. Any reagent or procedure that does not conform to the test method requirements.
- b. Any analysis technique (if not cleared prior to use) that does not conform to the test method requirements.

NOTE: The above list does not represent a complete listing of the errors that may invalidate a test. The department may decide to accept or reject source test results based upon these criteria or other criteria not presented here.

SECTION 5. SOURCE TEST REPORT

A source test report must be submitted to the department within 60 days of completion of a source test, unless otherwise stated in a specific permit or order. Table 5.1 contains a suggested format and minimum data requirements for inclusion in the source test report. The source test report may incorporate by reference any material previously submitted to the department in the Source Test Protocol or subsequent correspondence with the department.

TABLE 5.1

Minimum Source Test Report Format Requirements

1. Cover
 - a. Company name and Montana Air Quality Permit number (if applicable).
 - b. Name of the consulting company performing the source test.
 - c. Name of facility and emission sources tested.
 - d. Date of test.
2. Signature Page or Cover Letter
 - a. Endorsement by project manager.
 - b. Endorsement by authorized company representative.
 - c. Written approval by the department of the source test plan and test methods.
3. Introduction
 - a. Test purpose: offset source, compliance with permit limits, etc.
 - b. Emission source details: geographic location, emission sources tested, process type, etc.
 - c. Description of air pollution control equipment, number of years in service.
 - d. Test dates.
 - e. Pollutants tested, methods used, number of runs.
 - f. Names of observers: industry, agency, and consultant, (include titles).
4. Summary of Results
 - a. Emission results - Results must be reported in the same units as any applicable emission limitation.
 - (1) Each test run.

- (2) Test run average for each determination.
 - (3) Comparison with previous emission tests in similar units.
- b. Process data, as related to determination of compliance; i.e., process weight (throughput), % of maximum, type and amount of fuel, type of control equipment.
- c. Discussion of errors, both real and apparent.
- 5. Facility and Emission Source Operation
 - a. Process description and number of units (streams).
 - b. Process and flow equipment diagram.
 - c. Representativeness of raw materials and products.
 - d. Any specially required operation demonstrated.
 - e. Control system description: type, model, years in service, expected performance, maintenance schedule, operational problems (if any).
- 6. Sampling and Analysis Procedures
 - a. Sampling port location and dimension cross-section (diagram of stack).
 - b. Sampling point description, including labeling system (cross-section of stack with sample point location).
 - c. Sampling train description (diagram).
 - d. Description of sampling procedures which deviated from accepted test methods or approved source test plans, and justifications for the deviations.
 - e. Description of analytical procedures which deviated from accepted sample analysis methods, and justifications for the deviations.
- 7. Methods and Calculations
 - a. Use equations described in the applicable test methods.

- b. Show a step-by-step complete calculation of one test run.
- c. Include any deviations from applicable calculations or test methods.
- d. Include methods, descriptions and equations.
- e. Diagram of sampling equipment.

8. Quality Assurance

- a. Equipment calibration data sheets: for dry gas meters, pitot tubes, nozzles and magnehelic gauges, etc.
- b. Calibration gas certification data sheets (if applicable).
- c. Impinger solution blanks (if required).
- d. Acetone and water residue blanks (if required).
- e. Instrument linearity data (multipoint calibration).
- f. NO analyzer NO₂-to-NO converter performance test.
- g. Instrument calibration error results.
- h. Sample system bias, response time and leak check test results.
- i. Measure and record amounts of rinse material used during sample rinsing, so accurate values of blank residues may be deducted from test results.

9. Appendices

- a. Raw field data.
 - (1) Photocopies of all original field data sheets. (Originals must be written in ink).
 - (2) Photocopies of all strip charts for instruments.
- b. Laboratory report(s).
 - (1) Photocopies of original data sheets.

- (2) Chain-of-custody data sheets.
 - (3) Analytical methods description.
 - (4) Lab QA/QC (including impinger, acetone, and water residue blanks).
 - (5) Laboratory statement of qualifications.
- c. Raw production, signed by plant official: process operational data-fuel rates, process rates.
 - d. Source test log documenting times of source test events.
 - e. All project participants and titles.
 - f. Related correspondence.

SECTION 6. CHAIN-OF-CUSTODY

The primary objective of the chain-of-custody procedures is to create an accurate written record (see Figure 6.1 for an example chain-of-custody form) that can be used to trace the possession and handling of the sample from the moment of its collection through its analysis and submittal to show compliance. Although physical samples are not collected for all methods, general minimum guidelines for chain-of-custody and shipping of samples are listed below.

- a. Samples should be packed properly to prevent breakage or leakage. The shipping container should be sealed or locked so that any evidence of tampering may be readily detected. Use of tamper-proof evidence tape is recommended.
- b. Every sample must be accompanied by either a chain-of-custody tag or chain-of-custody record that has been completed, signed and dated.
- c. The responsibility for proper packaging, labeling and transferring of possession of the sample lies with the person taking it.
- d. All sample shipments must be accompanied by the chain-of-custody record and other pertinent forms. A copy of these forms should be retained by the originator. Also, all receipts associated with the shipment should be retained.
- e. When transferring possession of samples, the transferee must sign and record the date and time on the chain-of-custody record (see Figure 6.1 for an example). In general, custody transfers are made for each sample, although samples may be transferred as a group, if desired. Each person who takes custody must fill in the appropriate section of the chain-of-custody record.

Figure 6.1

Example Chain-of-Custody Record

Person Sampling: _____

Date: _____ Time: _____ am/pm

Facility Sampled: _____

Facility Location: _____

Sampling Location: _____

Sample Type: Grab () Composite ()

Comments and/or
Observations: _____

Container I.D. _____

Samples Split? Yes () No ()

Observers:	Name	Affiliation/Title
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Time/Date	Released	Rec'd	Name	Affiliation/ Title	Comments
_____	()	()	_____	_____	_____
_____	()	()	_____	_____	_____
_____	()	()	_____	_____	_____
_____	()	()	_____	_____	_____