State of Oregon Department of Environmental Quality

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DEQ Source Sampling Manual
DEQ Continuous Monitoring Manual

Air Quality Program

Source Sampling Manual

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DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

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Executive Summary

DEQ's Source Sampling Manual provides the procedures and test methods for conducting source sampling (i.e., stack testing) at facilities regulated by DEQ. The manual includes procedures for notifying DEQ of testing projects; preparing and obtaining approval of source test plans prior to conducting the testing; and preparing source test reports after the testing is completed. The manual identifies established sampling methods that are approved for source sampling projects, as well as procedures for obtaining approval for modifications or alternatives to the methods. Most of the sampling methods are federal methods that have been incorporated by reference. However, there are several test methods that are unique to DEQ. The Source Sampling Manual was first written in 1976 with revisions in 1979, 1981, 1992, 2015 and 2018. The Source Sampling Manual is included in Oregon's State Implementation Plan.

1.0 INTRODUCTION

1.1. PURPOSE AND SCOPE

This manual has been prepared by the Oregon Department of Environmental Quality (DEQ) for the purpose of delineating practices for the measurement and sampling of exhaust gas streams originating from point sources in accordance with Oregon Administrative Rules. Within this document, the references to *permit* signify either an Air Contaminant Discharge Permit (ACDP) or an Oregon Title V Operating Permit, both issued by the State of Oregon.

This manual applies to DEQ personnel, testing contractors, and permittees. Collectively, with permit requirements and promulgated sampling guidance documents, it outlines source sampling techniques approved by DEQ for use in conducting stationary source emissions testing. Unless otherwise specified in an Oregon Administrative Rule, permit, or DEQ letter, these general requirements must be followed when conducting source testing in Oregon. If there is a conflict with a permit or rule and this manual, the permit or rule will take precedence.

This 2018 revision of the Source Sampling Manual, Volume I, supersedes all previous versions of this manual.

1.2. APPLICABILITY

The procedures specified in this manual are standard requirements for measuring point source emissions under normal circumstances. Methods or techniques not cited in this manual may be approved on a case-by-case basis.

The measurement of point source emissions (i.e. stack testing) is conducted to determine the quantity, concentration, or destruction/removal of a specific pollutant or pollutants being emitted into the atmosphere by a regulated or non-regulated source.

This manual references test methods published by DEQ, EPA, and other agencies or organizations.

2.0 SOURCE SAMPLING GENERAL REQUIREMENTS

2.1. TESTING DEADLINES FOR CONDUCTING SOURCE SAMPLING

2.1.a. Identifying Regulation(s)

The deadlines for conducting source sampling projects may be established by any or all of the following:

- Air Contaminant Discharge Permit;
- Oregon Title V Operating Permit;
- Chapter 340 of Oregon Administrative Rules;

- Title 40 of Code of Federal Regulations; or
- Enforcement document (e.g., Mutual Agreement Order).

2.1.b. Time Extensions

For sampling projects conducted to meet federal & state requirements, regulatory provisions to extend testing deadlines are limited and take into account the circumstances contributing to the delay. Failure to test a source by the required deadline may violate federal or state rule and may result in enforcement actions.

2.2. DEPARTMENT NOTIFICATION

DEQ must be notified of all source sampling projects that are required by DEQ, including federal requirements that have been delegated to DEQ by the Environmental Protection Agency (EPA). Unless specified by rule or by permit condition, DEQ must receive notification at least 30 days in advance of the source test date. Notification may be submitted electronically or by hardcopy, and accompanied by a source test plan.

In addition, DEQ must be notified of all source sampling projects that are not required by DEQ if test results are relied upon in permitting a source, used as evidence in an enforcement case, or used to demonstrate compliance with non-delegated federal requirements.

2.3. SOURCE TEST PLAN

A source test plan must be approved by DEQ in advance of all source sampling projects that are required by DEQ, including federal requirements delegated to DEQ by EPA. If not otherwise specified by rule or permit condition, DEQ must be provided at least 30 days to review and approve source test plans. For routine testing programs, the permit or rule often specifies 15 days notice. Conversely, particularly complex source testing programs may require 45 days or more for protocol approval. The source test plan may be prepared by the source owner, operator, or consultant representing the owner or operator. The source test plan will be reviewed by the DEQ or by an agent representing DEQ.

A source test plan must include, as a minimum, the information stipulated by Table A-1 in Appendix A. The source test plan should *not* include a copy of the published sampling method unless specifically requested by the regulating authority. In addition, sample system diagrams should *not* be included within the source test plan unless the proposed schematic deviates from published methodology.

2.4. MODIFICATIONS/ALTERNATIVES TO METHODS OR PROCEDURES

2.4.a. Testing Projects Required by DEQ

All modifications and/or alternatives to testing methods or procedures that are performed to satisfy DEQ testing requirements must receive approval from DEQ prior to their use in the field. When possible, these requests are to be addressed within the Source Test Plan.

If the need for testing modifications or alterations to the approved Source Test Plan is discovered during field activities, approval must first be obtained from the observing Department representative. If a DEQ representative is not on site during field activities, approval from any DEQ Source Test Coordinator or other DEQ representative may be obtained. Changes not acknowledged by the DEQ could be basis for invalidating an entire test run and potentially the entire testing program. Documentation of any deviations must be incorporated in the source test report and include an evaluation of the impact of the deviation on the test data.

2.4.b. Testing Projects Required by Federal Regulations

For all testing projects performed to satisfy federal testing requirements (e.g. NSPS, NESHAP), approval for modifications and alterations of federal testing requirements must follow the procedures outlined in the Emission Measurement Center Guideline Document GD-022R3. As per this guideline, minor changes to test methods and procedures may be approved by DEQ personnel. All other changes must be approved by EPA.

Minor change to a test method is a modification to a federally enforceable test method that (a) does not decrease the stringency of the emission limitation or standard; (b) has no national significance (e.g., does not affect implementation of the applicable regulation for other affected sources, does not set a national precedent, and individually does not result in a revision to the test method); and (c) is site-specific, made to reflect or accommodate the operational characteristics, physical constraints, or safety concerns of an affected source. Examples of minor changes to a test procedure are:

- Modified sampling traverse or location to avoid interference from an obstruction in the stack,
- Increasing the sampling time or volume,
- Use of additional impingers for a high moisture situation,
- Accepting particulate emission results for a test run that was conducted with a lower than specified temperature,
- Substitution of a material in the sampling train that has been demonstrated to be more inert for the sample matrix, and
- Changes in recovery and analytical techniques such as a change in QA/QC requirements needed to adjust for analysis of a certain sample matrix.

(Per memo from John S. Seitz, Director OAQPS, *Delegation of 40 CFR Part 63 General Provisions Authorities to State and Local Air Pollution Control Agencies,* Attachment 1, July 10, 1998)

2.5. SAMPLE REPLICATES

Unless otherwise specified by permit, State rule, federal regulation, or Department letter, each source test must consist of at least three (3) test runs and the emission results reported for each run individually and as the arithmetic average of all valid test runs. If for reasons beyond the control of the permittee (e.g., forced shutdown, extreme meteorological conditions, failure of an irreplaceable portion of the sample train) a test run is invalidated and cannot be replaced by a valid test run, DEQ may consider accepting two (2) test runs for demonstrating compliance with the emission limit or standard. However, all test runs, including those deemed invalid, are to be included in the test report.

2.6. SAMPLE POSTPONEMENTS & STOPPAGES

It is acceptable to postpone a scheduled test or suspend a test in progress if the discontinuation is due to equipment failure beyond the facility's control, construction delays beyond the facility's control, severe meteorological conditions, and situations that would jeopardize the safety of the testing contractors and/or operators. If the test is underway, the permittee should make every effort to complete the test run. All recoverable test information (process & sample data) must be available for DEQ review.

It is unacceptable to postpone or suspend a test run in progress if it is discontinued because the source is not able to comply with an emission limit, verify an existing emission factor, or comply with a control equipment performance standard. The permittee must provide DEQ written documentation explaining the reasons for the postponement or stoppage, and any data collected prior to the stoppage . DEQ will review the documentation and all available stack test data to determine if a violation occurred.

2.7. TEST DURATION & SAMPLE VOLUMES

2.7.a. General Duration & Volume Requirements

Unless otherwise specified by permit, state rule, federal regulation, or Department letter, each source test must be a minimum of one (1) hour long. For criteria pollutants (PM, PM_{10}, $PM_{2.5}$, SO_x, NO_x, CO, & VOCs) measured utilizing wet-chemistry methods, the sample volume must be sufficient to ensure a minimum In-Stack Detection Limit (ISDL) of one-half (1/2) the emission standard. Refer to Section 2.8 of this manual for the definition and calculation of ISDL.

Unless otherwise specified by rule, permit condition, or source test plan approval letter, all toxic air contaminants and hazardous air pollutants (HAPs) sampling programs must ensure adequate sample volumes so that the mass recovered is at least five (5) times the limit of detection for the analytical method chosen. Alternatively, the ISDL must be less than or equal to one-fifth (1/5) the emission standard.

For purposes of this section, "emission standard" refers to emission limits (other than Plant Site Emission Limits), emission factor(s), and/or destruction and removal efficiencies.

2.7.b. DEQ Methods Specific Duration & Volume Requirements

For DEQ Methods 5 & 7, the minimum sample volume must be the greater of 31.8 dry standard cubic feet (dscf) or sufficient to ensure a minimum In-Stack Detection Limit (ISDL) of one-half (1/2) the emission standard. In addition, the minimum sample duration must be 60 minutes.

For DEQ Method 8 (high volume sampler), the minimum sample volume must be the greater of 150 dry standard cubic feet (dscf) or sufficient to ensure a minimum In-Stack Detection Limit of one-half (1/2) the emission standard. In addition, the minimum sample duration must be 15 minutes.

2.8. IN-STACK DETECTION LIMIT

2.8.a. General In-Stack Detection Limit (ISDL)

In general practice, the In-Stack Detection Limit (ISDL) is defined as follows:

$$ISDL = \frac{AxB}{C}$$

Where:

ISDL = In-Stack detection limit
A = Analytical detection limit for analyte (e.g., pollutant) in a sample matrix (e.g., solution, filter, resin)
B = Quantity of sample matrix (e.g. milliliters of solution)
C = Volume of stack gas sampled

Example:

For an HCl sample with the following characteristics:

A = 1 ug (HCl) per ml of solution;
B = 300 mls of sample solution; and
C = 1 dscm of exhaust gas (C) drawn through the sample solution.

The ISDL in ug/dscm would be calculated as follows:

ISDL = (A x B)/C
ISDL = (1 ug/ml x 300 ml)/1 dscm
ISDL = <u>300 ug/dscm</u>

2.8.b. ISDL for Particulate Measurement Methods

When calculating the ISDL for particulate sampling methods, the analytical detection limits (A) are:

- 7 mg for ODEQ Methods 5 & 7 (total particulate),
- 3 mg for EPA Methods 5, 5A, 5B, 5D, 5E, 5F, & 17 (filterable particulate),
- 4 mg for EPA Method 202 (condensable particulate), and
- 100 mg for ODEQ Method 8 (high volume sampler-filterable particulate).

Additionally, when calculating the ISDL for the above particulate sampling methods, the quantity of sample matrix (character "B" in equation) equals "1 sample train".

2.8.c. ISDL for Instrumental Monitoring Reference Methods

The ISDL for continuous emission monitoring (CEM) reference methods (i.e., 3A, 6C, 16C, 7E, 10, 20, & 25A), is equal to the sensitivity of the instrumentation, which is two percent (2%) of the span value (as per the CEMS Methods).

2.8.d. ISDL Expressed on a Mass Rate or Process Rate Basis

If the emission standard is expressed on a mass rate basis, a representative flow and/or process rate is to be applied in conjunction with the ISDL (on a concentration basis) to obtain a value expressed in comparable units.

2.9. REPRESENTATIVE TESTING CONDITIONS

For demonstrating compliance with an emission standard, the stack test must successfully demonstrate that a facility is capable of complying with the applicable standard under all normal operating conditions. Therefore, an owner or operator should conduct the source test while operating under typical worst-case conditions that generate the highest emissions. During the compliance demonstration, new or modified equipment should operate at levels that equal or exceed ninety-percent (90%) of the design capacity. For existing equipment, emission units should operate at levels that equal or exceed ninety-percent (90%) of normal maximum operating rates. Furthermore, the process material(s) and fuel(s) that generate the highest emissions for the pollutant(s) being tested should be used during the testing. Operating requirements for performance tests are often specified by State or federal rule, or by permit condition.

When verifying or determining an emission factor, the stack test must generate an emission factor that represents normal emissions for the operating condition tested. Multiple testing projects may be required for sources that experience variations in process, have frequent start-ups and shut-downs, use multiple fuel combinations, utilize numerous process materials, or manufacture diverse products.

Whether sampling to demonstrate compliance, to establish an emission factor, or to support an toxic air contaminant risk assessment, it is imperative to describe in detail the proposed process conditions within the Source Test Plan. Refer to Section 2.3 and Appendix A of this manual for Source Test Plan requirements.

2.10. SIGNIFICANT FIGURES & ROUNDING PROCEDURES

2.10.a. Significant Figures

All federal emission standards have at least two (2) significant figures but no more than three (3) (Memorandum from William G. Lawton and John S. Seitz to New Source Performance Standards/National Emission Standards for Hazardous Pollutants Compliance Contacts, subject “Performance Test Calculation Guidelines”, June 6, 1990). For example, 0.04 gr/dscf is considered to be 0.040 gr/dscf and 90 mg/dscm is considered to be 90. mg/dscm.

Generally, DEQ emission standards have at least two (2) significant figures. However, the number of significant figures for DEQ standards are defined by the standards themselves. For example, 40 lbs/hr is considered to be 40. lbs/hr and 0.1 gr/dscf does not include additional significant figures.

It is imperative to maintain an appropriate number of significant figures within the intermediate calculations to minimize the discrepancy of results due to rounding inconsistencies. In general, at least five (5) significant figures should be retained throughout the intermediate calculations.

2.10.b. Rounding Procedures

The procedure for rounding of a figure or a result may mean the difference between demonstrating compliance or demonstrating a violation. Based on the routine specified by the American Society for Testing and Materials (ASTM, Standard for Metric Practice E 380) the following procedure must be used:

> *If the first digit to be discarded is less than five (5), the last digit retained should not be changed. When the first digit discarded is greater than five (5), or if it is a five (5) followed by at least one digit other than zero (0), the last figure retained should be increased by one unit. When the first digit discarded is exactly five, followed only by zeros (0s), the last digit retained should be rounded upward if it is an odd number, but no adjustment made if it is an even number.*

For example, if the emission standard is 0.040 gr/dscf, then 0.040341 would be rounded to 0.040, 0.040615 would be rounded to 0.041, 0.040500 would be rounded to 0.040, and 0.041500 would be rounded to 0.042 (note that five significant figures were retained prior to rounding).

2.11. REPORTING & RECORDKEEPING

2.11.a. Report Content & Format

At a minimum, the content of the source sampling report must be consistent with the requirements outlined in Table A-2 in Appendix A. DEQ recognizes that the presentation and format of the reports will vary between sampling projects and testing contractors. However, the report must comprehensively include all essential information and maintain sufficient detail to satisfactorily communicate the test objectives and results.

To conserve storage space and natural resources, all test reports should be published utilizing both-sides of each page. In addition, each page of the report body and of the appendices is to be numbered for ease of reference. Refer to Section 2.11.b. for information on the Source Test Audit Report.

2.11.b. Source Test Audit Report (STAR)

A Source Testing Audit Report (STAR) is required for all testing required by DEQ. Like test reports, the submittal of the STAR is the responsibility of the owner or operator. DEQ may not accept test reports that do not include the STAR or if the submitted STAR is incomplete or inaccurate. Refer to the document, *"Guidelines for Completing Source Testing Audit Report"* for more details regarding the STAR. Contact a DEQ Source Test Coordinator to receive instructions on how to obtain the most current STAR forms.

2.11.c. Reporting Results that are below the In-Stack Detection Limits

Emission tests occasionally yield results that are below the in-stack detection limit (ISDL) for a given pollutant. These data frequently provide important information, depending on the purpose of the test and if the tester extracted an adequate sample volume (see Section 2.7). Therefore, unless otherwise stated by method, rule, or permit, the following reporting procedures are to be followed when results from replicate tests are below the in-stack detection limit. Substitution at less than the

ISDL may be used in Cleaner Air Oregon risk assessments conducted under OAR 340 division 245 if approved by DEQ.

- Each test replicate that is below the ISDL should be reported as less than (<) the detection limit value (e.g., <0.14). If the test replicate is included in a multi-run test series, the ISDL value is used when calculating the numerical average.
- Label the average result as less than (<) if the numerical average of a test series includes at least one test replicate below the ISDL.

Several groups of toxic air contaminants are generally reported as the sum of the individual compounds (or elements) within that group. For example, the individual dioxin/furan compounds (or 'congeners') specified in the test method are summed using toxicity factors and reported as a single value (i.e., 2,3,7,8-TCDD Equivalents). The corresponding emission limits and/or emission factors are also expressed as 2,3,7,8-TCDD Equivalents. If any of the individual congeners are reported as 'below the detection limit' for a given test result, the contribution of that congener to the 2,3,7,8-TCDD Equivalent value shall be calculated as 0.5 x the detection limit. The 2,3,7,8-TCDD Equivalent value is a 'composite result' of the individual dioxin/furan compounds in a given sample. Although this TCDD Equivalent value may contain non-detectable quantities, the value is reported as a quantity (i.e., not a '< DL' value).

Other groups of compounds that present similar reporting complexities are polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), Total Organic Hazardous Air Pollutants (OHAPs), and Total Selected Metals (TSM). A specific regulation, method, or permit condition may dictate other calculation procedures to be followed in combining non-detectable with measured quantities within a composite result; these shall take precedent over the above-described approach.

2.11.d. Report Submittal

Unless otherwise specified by rule or permit, one (1) bound copy of the source test report must be submitted to the regional Source Test Coordinator within 30 days following the field work. Requests for extensions will be evaluated by DEQ on a case- by-case basis. An electronic version of the report can also be submitted in addition to the bound copy.

2.11.e. Recordkeeping

All documentation of sampling equipment calibrations and analytical results should be maintained for a minimum of five years.

In general, the unanalyzed portions (aliquots) of the source test samples must be preserved up to the maximum holding times as specified by method. Sample filters gravimetrically analyzed for particulate matter are to be archived for a minimum of 6 months. However, sample archiving specifications pertaining to laboratory glassware is left to the discretion of the analyzing laboratory and the testing contractor.

3.0 SAMPLING METHODS

3.1. ESTABLISHED SAMPLING METHODS

Established sampling methods for various pollutants are listed within Appendix B of this manual. These methods have historically been accepted by DEQ and originate from various governmental agencies and organizations. This list is not all-inclusive and may not reflect current method updates. The use of a listed method is not automatically approved by DEQ. Instead, written DEQ approval is required prior to all testing projects that are executed to satisfy state or federal testing requirements. Refer to Sections 2.2 & 2.3 of this manual for notification and source test plan requirements.

Generally, DEQ sampling methods (ODEQ Methods) or EPA methods (promulgated, alternative, & conditional) are preferable for conducting a testing program. In some cases, utilizing methods published by other public agencies and organizations are often valid and more desirable, but must be evaluated cautiously to ensure that the test requirements established by rule or permit are satisfied.

3.2. DEQ SOURCE SAMPLING METHODS

DEQ test methods are presented in Appendix C of this manual. These methods do not encompass all the provisions and procedures critical to their successful use. Persons performing these methods must have a comprehensive understanding of the physical sciences, have ample experience utilizing the testing equipment, and have a thorough knowledge of the sources to which they are applied.

DEQ test methods should only be applied to sampling situations that are consistent with their applicability. A careful and thorough evaluation of the applicability of each method to a specific testing condition is strongly recommended. Modifications or alterations to DEQ test methods must receive approval from DEQ prior to their utilization within the testing program. Refer to Section 2.4 of this manual for requirements pertaining to modifications to methods or procedures.

There are multiple references to EPA test methods within the Oregon Source Sampling Manual and test methods. The EPA methods are incorporated into this manual by reference as of the date they were published in the CFR, as shown below. Sampling provisions and procedures published within the most up-to-date revisions to the CFR may be incorporated into the testing program if approved by the administrator.

EPA Methods incorporated by reference:

Methods 1 through 30B: 40 CFR, Part 60, Appendix A, July 2012
Methods 201 through 207: 40 CFR Part 52, Appendix M, July 2012
Methods 301 through 323: 40 CFR Part 63, Appendix A, July 2012
EPA Publication SW-846, Third Edition

3.3. Quality Assurance Requirements

Quality assurance , including minimum calibration requirements are typically specified within each test method. DEQ test methods often refer to EPA test methods for quality assurance procedures The calibration requirements for Oregon DEQ Methods 4, 5, 7, & 8 are summarized within Appendix D. Where inconsistencies exist, quality assurance requirements specified by method or by regulation supersede those presented within Appendix D.

APPENDIX A

SOURCE TEST PLAN
&
TEST REPORT
REQUIREMENTS

MINIMUM SOURCE TEST PLAN REQUIREMENTS

DEQ does not require that source test plans adhere to a specific format, but the information listed in Table A-1 must be included (as applicable). In addition, the following statements must be included in the test plan:

- Sampling replicate(s) will not be accepted if separated by a time duration of twenty-four (24) hours or more, unless prior authorization is granted by DEQ.

- All compliance source tests must be performed while the emission unit(s) are operating at normal maximum operating rates. Unless defined by permit condition or applicable rule, normal maximum operating rate is defined as the 90th percentile of the average hourly operating rates during a 12 month period immediately preceding the source test. Rates not in agreement with those stipulated in the Air Contaminant Discharge Permit can result in rejection of the test data. Imposed process limitations could also result from operating at atypical rates during the compliance demonstration.

- The DEQ must be notified of any changes in the source test plan and/or the specified methods prior to testing. Significant changes not acknowledged by the DEQ could be the basis for invalidating a test run and potentially the entire testing program. Documentation of any deviations must include an evaluation of the impact of the deviation on the test data.

- Method-specific quality assurance/quality control (QA/QC) procedures must be performed to ensure that the data is valid for determining source compliance. Documentation of the procedures and results shall be presented in the source test report for review. Omission of this critical information will result in rejection of the data, requiring a retest.

- Only regular operating staff may adjust the combustion system or production process and emission control parameters during the source performance tests and within two (2) hours prior to the tests. Any operating adjustments made during the source performance tests, which are a result of consultation during the tests with source testing personnel, equipment vendors or consultants, may render the source performance test invalid.

- Source test reports must be submitted to DEQ within thirty (30) days of the test dates, unless another deadline has been stipulated, either by permit condition, or by DEQ written approval.

Table A-1

SOURCE TEST PLAN REQUIREMENTS

Item #	Description	Explanatory Notes
1	Facility Identification	- Facility Name; - Facility Address; - Permit Number (and source number if under General Permit); - Emission Unit(s) included within proposed testing project
2	Facility Personnel	Name, address, phone number(s) and e-mail for: - Project Manager - On-site Contact (if different than Project Manager)
3	Testing Contractor Personnel	Name, physical address, phone number(s) and e-mail for: - Project Manager - Site Personnel (Team Leader, Technicians) - Laboratory Support
4	Project Purpose	- Specify purpose of project (compliance, emission factor verification, applicability study, etc.) - Specify permit condition or rule initiating project - Specify applicable compliance limits and emission factors
5	Schedule	- Specify testing dates for each unit tested - Specify starting times (approximate) for each test day
6	Source Description	Description of the emission unit(s), including the following: - Narrative of the emission source (system type, manufacturer, date installed, capacity, configuration, fuel type, etc.) - Narrative of the pollution control device (system type, manufacturer, date installed, configuration, etc.) - Narrative of the sample locations (where in system, distances to disturbances, duct configuration, etc.)
7	Pollutant(s) Measured	Specify the following for each pollutant measured: - Pollutant (CO, PM, Formaldehyde, etc.) - Reporting unit for each pollutant (ppmdv, lbs/hr, lbs/ton, etc.)
8	Test Methods	Include the following for each test method proposed: - Method reference number (e.g., EPA 1, ODEQ 7); - Copy of method (only if requested by DEQ); - Quantifiable or detectable limits for each pollutant
9	Sampling Replicates	- Specify the number of sample replicates for each method on each emission unit; - Specify the duration of each sample replicate for each method.
10	Production and Process Information	- List the parameters to be recorded - Specify the frequency of measurements and recordings - Specify how each parameter is measured (manual, instrument, etc.)

11	Pollution Control Device Information	- List the parameters to be recorded - Specify the frequency of measurements and recordings - Specify how each parameter is measured (manual, instrument, etc.)
		-
12	Fuel Sampling and Analysis	- Specify how sample(s) will be collected (include references to established procedures such as ASTM, if applicable) - Specify frequency of collection - Specify the type of analysis, the analytical procedure, and the analytical laboratory
13	Other Test Method Considerations	Include in the test plan a brief discussion of: - Applicability of proposed test methods - Any and all proposed method modifications/deviations, including modifications/deviations to QA/QC activities - Any foreseeable problems with sample recovery - Any known errors in the proposed method(s) - Simultaneous testing (multiple parameters or methods) - Multiple exhaust points of the source (if applicable) - Possible method interferences - Cyclonic flow measurements (if applicable) - Stratification measurements
14	Other Process Considerations	Include in the test plan a brief discussion of: - Target process rate(s) and how it compares to day-to-day operations and the unit's rated capacity - Product (e.g., type, size, specie, etc.) - Potential process variability (i.e., continuous, cyclical, etc.) - Whether the proposed test conditions represent worst-case conditions with respect to emissions

MINIMUM SOURCE TEST REPORT REQUIREMENTS

The DEQ does not require that test reports adhere to a specific format, but the information listed in Table A-2 (below) needs to be included (as applicable). Reports shall be organized in a clear and logical fashion to promote correctness and accuracy.

Table A-2

SOURCE TEST REPORT REQUIREMENTS

Item#	Description	Explanatory Notes
1	Facility Identification	- Facility Name - Facility Address - Permit Number (and source number if under General Permit) - Emission Unit(s) included within the testing project
2	Facility Personnel	Name, address, phone number(s) and e-mail for: - Project Manager - On-site Contact (if different than Project Manager)
3	Testing Contractor Personnel	Name, physical address, phone number(s) and e-mail for: - Project Manager - Site Personnel (Team Leader, Technicians) - Laboratory Support
4	Project Purpose	- Specify purpose of project (compliance, emission factor verification, applicability study, etc.) - Specify permit condition or rule initiating project - Specify applicable compliance limits and emission factors
5	Schedule	- Specify testing dates for each unit tested - Specify starting and ending times for each test run
6	Source Description	Description of the emission unit(s), including the following: - Narrative of the emission source (system type, manufacturer, date installed, capacity, configuration, fuel type, etc.) - Stack height above the ground - Orientation of the exhaust (vertical, horizontal, etc.) - Narrative of the pollution control device (system type, manufacturer, date installed, configuration, etc.) - Narrative of the sample locations (where in system, distances to disturbances, duct configuration, etc.)
7	Process & Pollution Control Operating Rates & Settings	Operating rates and parameters, including the following: - Process rates for each run on each emission unit - Process characteristics for each test run (temperature, process time, size, species, pressures, settings, fuel characteristics, etc.) - Pollution control device parameters for each test run (temperature, pressure drop, water injection rate, voltage, settings, etc.)

		- Description of process changes and interruptions that occurred during testing.
8	Pollutant(s) Measured	Discuss the following for each pollutant measured: - Specie (CO, PM, Formaldehyde, Opacity, etc.) - Reporting unit for each specie (ppmdv, lbs/hr, lbs/ton, etc.)
9	Test Methods	Include the following for each test method: - Method reference number (e.g., EPA 1, ODEQ 7) - Discuss deviations from published methods and their impact on test results
10	Summary of Results	- One summary table for each emission unit (when possible) - List individual run results and average (when possible) - Include applicable emission standard, factor, or compliance limit
11	Supporting Sampling Information	- Spreadsheets & electronic data records - Field data sheets, notes, and forms - Equipment calibration documentation (field & laboratory equipment) - Example calculations - Sampling equipment description - Pre-test procedure documentation (stratification, cyclonic, etc.)
12	Laboratory Analysis	- Electronic data records - Data sheets, notes, and forms - Analytical detection limit for each constituent - Applicable analytical QA/QC information - Chain of custody
13	Supporting Process & Pollution Control Information	- Electronic generated output (if applicable) - Log sheets and forms - Operating capacity - 90% Percentile 12 Month Operating Analysis (existing sources)
14	Source Test Audit Report	- Complete for each test method and emission unit - Complete certification form
15	Test Correspondence	- Test plan - Test plan approval correspondence - Approval for method deviations - Applicable permit excerpts that pertain to testing requirements, emission limits, and emission factors

APPENDIX B

LISTING OF
SOURCE SAMPLING
METHODS

ALPHABETICALLY BY
POLLUTANT OR STACK
PARAMETER

ESTABLISHED SAMPLING METHODS

POLLUTANT OR STACK PARAMETER	TEST METHOD	COMMENTS
Ammonia	EPA CTM-027, BAAQMD ST-1B, EPA 320,	Method depends on isokinetic requirements
Carbon Dioxide (CO_2)	EPA 3, EPA 3A, EPA 3B	
Carbon Monoxide	EPA 10	
Chloride (Total)	EPA 26A, EPA 26 SW846-0050	
Dioxins & Furans	EPA 23, SW846-23a	
Formaldehyde	NCASI 98.01,NCASI 99.02, NCASI A105.1, EPA 316, EPA 320, EPA 323	Method depends on source type, isokinetic and ISDL requirements.
Gaseous Organics	EPA 18	Not applicable for high molecular weight compounds or for compounds with very low vapor pressure at stack or instrument conditions.
Hydrogen Chloride, Hydrogen Halide and Halogens	EPA 26, EPA 26A, SW846-0050, EPA 321	Use EPA 26A when isokinetic sampling is required. EPA 321 utilizes FTIR and is specific to Portland Cement Kilns
Methanol	EPA 308, NCASI 98.01, NCASI 99.02 NCASI A105.1	Methods may also be applicable to phenol with approval
Moisture Content	EPA 4, ODEQ 4	
Molecular Weight	EPA 3, EPA 3A, EPA 3B	
Metals	EPA 29, SW846-0060	Includes: Antimony, Arsenic, Barium, Beryllium, Cadmium, Total Chromium, Cobalt, Copper, Lead, Manganese, Mercury, Nickel, Phosphorus, Selenium, Silver, Thallium, Zinc.
Nitrogen Oxides	EPA 7E, EPA 20	
Nonmethane Organic Compounds (NMOC)	EPA 25, EPA 25C, BAAQMD ST-7, SCAQMD 25.3, EPA CTM-042	EPA 25 subject to interference by H_2O and CO_2. ST-7 applicable for compounds that respond well to FID. 25.3 for low concentration sources. EPA 25C for LFG. CTM-042 for bakeries.
Opacity	EPA 9, EPA ALT Method 082	ALT 082 when pre-approved by DEQ
Oxygen	EPA 3, EPA 3A, EPA 3B	
Particulate Matter-Filterable	EPA 5, EPA 5A, EPA 5B, EPA 5D, EPA 5E, EPA 5F, EPA 5i, EPA 17, Modified DEQ 5, DEQ 8	ODEQ 8 acceptable under limited conditions EPA 5i for low level particulate
Particulate Matter - Total	ODEQ 5, ODEQ 7, EPA 5/202	
Particulate Matter - ≤10um	EPA 201A/202	

Particulate Matter-<2.5um	EPA 201A/202	
Phenol	NCASI 98.01, NCASI 99.02, EPA 18, NCASI A105.1	
Sulfur Dioxide	EPA 6, EPA 6C, EPA 8	EPA 8 also measures sulfuric acid mist
Total Enclosure	EPA 204	Use for determining capture efficiency.
Total Hydrocarbons	EPA 25A, EPA 18	Applicable to alkanes, alkenes, and aromatic hydrocarbons. EPA 25A has a fractional response to many other organic compounds.
Total Reduced Sulfur	EPA 16, EPA 16A, EPA 16C	
Velocity and Volumetric Flow Rate	EPA 2, EPA 2A, EPA 2C, EPA 2E, EPA 2F, EPA 2G, EPA 2H	EPA 2 if duct ≥12” in diameter EPA 2A if duct < 12” in diameter
Volatile Organic Compounds by FTIR	EPA 320	Analyzes for specific defined VOCs
Volatile Organic Compounds-Uncharacterized	EPA 25, EPA 25A, EPA 25B	Total VOC’s reported on an equivalent basis (i.e. “as propane”)
Volatile Organic Compounds by GC	EPA 18, EPA CTM-028	Analyzes for specific defined VOCs. EPA 18 not applicable for high molecular weight compounds or for compounds with very low vapor pressure at stack or instrument conditions. CTM-028 direct interface.

APPENDIX C

OREGON DEQ
SOURCE SAMPLING
METHODS

C-4: Oregon Method 4 (moisture)
C-5: Oregon Method 5 (PM)
C-7: Oregon Method 7 (PM)
C-8: Oregon Method 8 (PM, High Volume)

SUB-APPENDIX C-4

OREGON DEQ
SOURCE SAMPLING
METHOD 4

Oregon Method 4

State of Oregon
Department of Environmental Quality
Source Sampling Method 4

Determination of Moisture Content of Stack Gases (Alternate Method)

1. **Principle.** Under certain conditions, the quantity of water vapor in the gas stream can be determined by measuring the wet-bulb and dry-bulb temperatures of the gaseous fluid.

2. **Applicability**. This method is applicable for the determination of the moisture content of the sample stream when EPA Method 4 is not suitable or when rigid moisture content measurements are not essential to the success of the testing program.

3. **Procedure.**

   3.1 Measure the dry bulb temperature in the conventional way using either a thermometer or thermocouple.

   3.2 Wrap the end of the temperature-measuring device in a cloth sock soaked with water. Insert the sock and temperature-measuring device into the flowing gas stream and allow the temperature to reach a steady state value. Caution: after the water on the sock has evaporated, the temperature will rise to the dry bulb temperature. (Refer to Figure 4-1). The wet bulb temperature must be taken while the sock is saturated with moisture.

   3.3 Apply the wet bulb readings to Table 4-1 to determine the water vapor pressure in the gas stream. Then use the dry bulb reading and equation 4.4-1 to determine the approximate water vapor content. In lieu of using Table 4-1, equation 4.4-2 may be utilized to determine the vapor pressure at saturation if the wet bulb temperature is less than 175^{o}F.

   3.4 Alternately, if the barometric pressure is 29.92 ± 0.5 inches of mercury (in. Hg) apply the wet bulb and dry bulb readings to a standard psychrometric chart and determine the approximate water vapor content.

4. **Interferences and Calculations**

   4.1 Wet-bulb temperature readings may be affected by other gas stream components that ionize when dissolved in water (e.g., salts, acids, bases) or hydrocarbon compounds, particularly water-soluble solvents. The effect of these components on the wet-bulb temperature is usually negligible. However, should any of the above compounds exist at levels that cause inaccurate wet-bulb readings, the tester must utilize an alternative approach to determine moisture.

   4.2 The wet depression temperature is dependent on the total pressure (i.e., barometric pressure ± static pressure) in the gas stream. Moisture concentrations that are obtained from a psychometric chart are reliable only if the gas stream is at, or near, 1 atmosphere pressure (i.e., 29.92 in. Hg ± 0.5 in. Hg). For other pressure conditions, the tester must use Equation 4.4-1 to calculate the gas stream moisture content.

4.3 Additionally, the following conditions can lead to difficulties:

4.3.a. Very high dry bulb temperature (in excess of 500° F).
4.3.b. Very high or very low gas velocities.
4.3.c. High concentrations of particulate matter which may adhere to the wet sock.

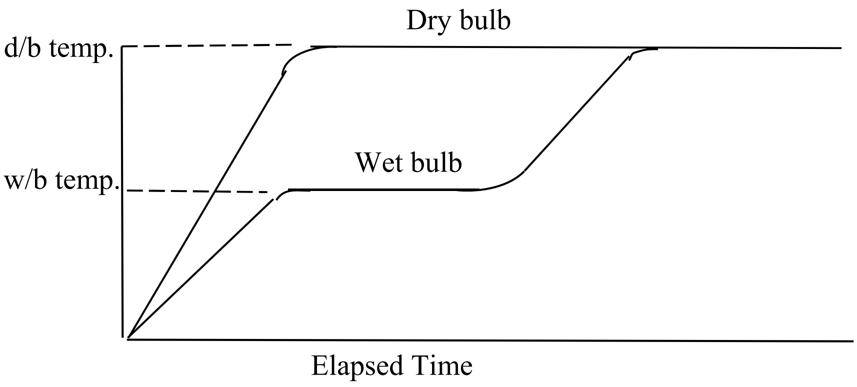

Figure 4-1

4.4 Moisture Equation:

$$H_2O = \frac{e'' - \dfrac{(P_s - e'')(t_d - t_w)}{2800 - (1.3t_w)}}{P_s} x100 \qquad (Eq.\ 4.4\text{-}1)$$

where:

e" = Vapor pressure of H_2O at t_w, in. Hg (See Table 4-1)
P_s = Exhaust gas pressure (absolute), in. Hg
t_d = Dry bulb temperature, °F
t_w = Wet bulb temperature, °F

TABLE 4-1: VAPOR PRESSURE OF WATER AT SATURATION* (Inches of Mercury)

Wet Bulb Temperature (°F)	0	1	2	3	4	5	6	7	8	9
-20	0.0126	0.0119	0.0112	0.0106	0.0100	0.0095	0.0089	0.0084	0.0080	0.0075
-10	0.0222	0.0209	0.0190	0.0187	0.0176	0.0168	0.0158	0.0150	0.0142	0.0134
-0	0.0376	0.0359	0.0339	0.0324	0.0306	0.0289	0.0275	0.0259	0.0247	0.0233
0	0.0376	0.0398	0.0417	0.0441	0.0463	0.0489	0.0517	0.0541	0.0571	0.0598
10	0.0631	0.0660	0.0696	0.0728	0.0768	0.0810	0.0846	0.0892	0.0932	0.0982
20	0.1025	0.1080	0.1127	0.1186	0.1248	0.1302	0.1370	0.1429	0.1502	0.1567
30	0.1647	0.1716	0.1803	0.1878	0.1955	0.2035	0.2118	0.2203	0.2292	0.2383
40	0.2478	0.2576	0.2677	0.2782	0.2891	0.300	0.3120	0.3240	0.3364	0.3493
50	0.3626	0.3764	0.3906	0.4052	0.4203	0.4359	0.4520	0.4586	0.4858	0.5035
60	0.5218	0.5407	0.5601	0.5802	0.6009	0.6222	0.6442	0.6669	0.6903	0.7144
70	0.7392	0.7648	0.7912	0.8183	0.8462	0.8750	0.9046	0.9352	0.9666	0.9989
80	1.032	1.066	1.102	1.138	1.175	1.213	1.253	1.293	1.335	1.378
90	1.422	1.467	1.513	1.561	1.610	1.660	1.712	1.765	1.819	1.875
100	1.932	1.992	2.052	2.114	2.178	2.243	2.310	2.379	2.449	2.521
110	2.596	2.672	2.749	2.829	2.911	2.995	3.081	3.169	3.259	3.351
120	3.446	3.543	3.642	3.744	3.848	3.954	4.063	4.174	4.89	4.406
130	4.525	4.647	4.772	4.900	5.031	5.165	5.302	5.442	5.585	5.732
140	5.881	6.034	6.190	6.350	6.513	6.680	6.850	7.024	7.202	7.384
150	7.569	7.759	7.952	8.150	8.351	8.557	8.767	8.981	9.200	9.424
160	9.652	9.885	10.12	10.36	10.61	10.86	11.12	11.38	11.65	11.92
170	12.20	12.48	12.77	13.07	13.37	13.67	13.98	14.30	14.62	14.96
180	15.29	15.63	15.98	16.34	16.70	17.07	17.44	17.82	18.21	18.61
190	19.01	19.42	19.84	20.27	20.70	21.14	21.59	22.05	22.52	22.99
200	23.47	23.96	24.46	24.97	25.48	26.00	26.53	27.07	27.62	28.18
210	28.75	29.33	29.92	30.52	31.13	31.75	32.38	33.02	33.67	34.33
220	35.00	35.68	36.37	37.07	37.78	38.50	39.24	39.99	40.75	41.52
230	42.31	43.11	43.92	44.74	45.57	46.41	47.27	48.18	49.03	49.93
240	50.84	51.76	52.70	53.65	54.62	55.60	56.60	57.61	58.63	59.67

*Methods for Determination of Velocity, Volume, Dust, and Mist Content of Gases, Bulletin WP-50, Western Precipitation Corp., Los Angeles, CA

The following equation can be substituted for the above table for determining vapor pressures (e") from measured wet bulb (t_w) temperatures:

$$e'' = 0.1805 \times e^{\left[\frac{(17.27 \times (t_w - 32))}{(t_w + 395)}\right]} \qquad \text{(Eq. 4.4-2)}$$

SUB-APPENDIX C-5

OREGON DEQ
SOURCE SAMPLING
METHOD 5

Oregon Method 5

State of Oregon
Department of Environmental Quality
Source Sampling Method 5

Sampling Particulate Emissions from Stationary Sources

1.0 Principle and Applicability

1.1 **Principle.** Particulate matter including condensable aerosols are withdrawn isokinetically from a flowing gas stream. Filterable particulate matter is determined gravimetrically after removal of combined water. Condensable particulate matter is determined gravimetrically after extraction with an organic solvent and evaporation.

1.2 **Applicability.** This method is applicable to the determination of particulate emissions from stationary sources except those sources for which specified sampling methods have been devised and are on file with DEQ.

2.0 **Acceptability.** Results of this method will be accepted as demonstration of compliance (or non-compliance) provided that the methods included or referenced in this procedure are strictly adhered to and a report is prepared according to Section 2.11 of DEQ's Source Sampling Manual, Volume I. Deviations from the procedures described herein will be permitted only if authorization from DEQ is obtained in writing in advance of the tests. EPA Method 5 combined with EPA Method 202 may be substituted for this method.

3.0 Equipment and Supplies

3.1 **Sampling Train (figure 5-1)**: Same as EPA Method 5 Section 6.1. with the following exception: Use of a glass frit filter support is prohibited. The support must be fabricated such that it can be quantitatively rinsed with acetone during sample recovery (refer to Section 5.7.1)

3.2 **Barometer:** Same as EPA Method 5 Section 6.1.2.

3.3 **Gas Density Determination Equipment:** Same as EPA Method 5 Section 6.1.3.

3.4 **Sample Recovery:** Same as EPA Method 5 Section 6.2.

3.5 **Sample Analysis:** Same as EPA Method 5 Section 6.3 with the following addition:

3.5.1 Glass separatory funnel (500-1000 ml) with Teflon[1] stopcock and plug.

4.0 Reagents and Standards

4.1 **Sample Collection**: Same as EPA Method 5 Section 7.1 with the following condition:

4.1.1 Distilled water with a residue content of ≤ 0.001% (0.0l mg/ml) must be used in the impingers. The distilled water reagent blank weight correction will not exceed 0.001%, or 0.01 mg/ml.

4.1.2 Stopcock grease (Section 7.1.5 of EPA Method 5) can bias test results and its use should be avoided whenever possible.

4.2 **Sample Recovery**: Same as EPA Method 5 Section 7.2.

4.3 **Analysis:** Same as EPA Method 5 Section 7.3 with following addition:

4.3.1 Methylene Chloride reagent grade, with a residue content of ≤0.001% (0.013 mg/ml). The methylene chloride reagent blank weight correction will not exceed 0.001%, or 0.013 mg/ml. Hexane may be substituted for methylene chloride. The same purity is required.

4.3.2 Distilled water with a residue content of ≤ 0.001% (0.0l mg/ml). The distilled water reagent blank weight correction will not exceed 0.001%, or 0.01 mg/ml.

5.0 Sample Collection, Preservation, Storage, and Transport

5.1 **Pretest Preparation:** Same as EPA Method 5 Section 8.1.

5.2 **Preliminary Determinations**: Same as EPA Method 5 Section 8.2.

5.3 **Preparation of Sampling Train:** Same as EPA Method 5 Section 8.3.

5.4 **Leak-Check Procedures:** Same as EPA Method 5 Section 8.4.

5.5 **Sampling Train Operation:** Same as EPA Method 5 Section 8.5.

5.6 **Calculation of % Isokinetics:** Same as EPA Method 5 Section 8.6.

5.7 **Sample Recovery:** Same as EPA Method 5 Section 8.7 (with the following additions:

5.7.1 In addition to the nozzle, probe, and filter-holder rinses, the filter frit support is to be rinsed with acetone and stored in Container No. 2.

5.7.2 Container No. 4. The contents of impingers 1 through 3 along with a distilled water rinse of impingers and all interconnects between the heated filter holder to the silica gel impinger must be transferred to Container No. 4. To adequately recover the sample from the impingers and interconnects, each component is to be rinsed in triplicate and the total rinse volume should equal or exceed 75 mls of reagent (distilled water).

5.7.3 Container 5. Rinse all sample exposed surfaces between the filter frit support and the inlet to the silica gel impinger with acetone and store in container No. 5. To adequately recover the sample from this portion of the sampling train, each component is to be rinsed in triplicate and the total rinse volume should equal or exceed 100 mls of reagent (acetone).

5.8 **Sample Transport:** Same as EPA Method 5 Section 8.8.

6.0 Quality Control

6.1 **Miscellaneous Quality Control Procedures:** Same as EPA Method 5 Section 9.1 with the following additions:

6.1.1 Analytical balance calibration and auditing procedures as per Section 7.8 of this method.

6.2 **Volume Metering System Checks:** Same as EPA Method 5 Section 9.2.

7.0 Calibration and Standardization

7.1 **Documentation:** The calibration data and/or calibration curves shall be included in the source test report.

7.2 **Nozzles**: Same as EPA Method 5 Section 10.1.

7.3 **Pitot Tube**: Same as EPA Method 5 Section 10.2 with the following addition:

7.3.1 If calibrated against a standard pitot, Type S pitot tubes shall be recalibrated at least once every six months.

7.3.2 If default Cp value used based on measured pitot features, measurements must be conducted pre and post test.

7.4 **Metering System:** Same as EPA Method 5 Section 10.3.

7.5 **Probe Heater Calibration:** Same as EPA Method 5 Section 10.4.

7.6 **Temperature Sensors:** Same as EPA Method 5 Section 10.5 with the following additions:

7.6.1 Thermometers that measure the filter-oven, impinger exit, and dry-gas meter temperatures are to be calibrated at 32° F and 212°F against an ASTM mercury thermometer or NIST traceable thermometer. At a minimum, the filter-oven, impinger exit, and dry-gas meter thermometers are to be calibrated before initial use and at least once every six months thereafter.

7.6.2 Alternatively, in-stack temperature thermometers are to be calibrated at 32° F and 212°F against an ASTM mercury thermometer or NIST traceable thermometer. At a minimum, the in-stack temperature thermometers are to be calibrated before initial use and at least once every six months thereafter.

7.7 **Barometer:** Same as EPA Method 5 Section 10.6.

7.8 **Analytical Balance:** The following calibration and standardization procedures must be performed on the analytical balance:

7.8.1 The balance must be audited utilizing 0.500 g, 1.0000 g, 10.0000 g, 50.0000 g, and 100.0000 g Class-S standard weights. Alternatively, five (5) Class-S standard weights may be substituted that accurately represent the anticipated measurement range. The balance results must agree within ±1 mg of the Class-S weights. At a minimum, the balance calibration must be performed subsequent to disturbing the analytical balance and annually thereafter.

7.8.2 Prior to weighing filters before and after sampling, adjust the analytical balance to zero and check the accuracy with a 0.5 g Class-S weight. A Class-S standard weight within 1 g of the filter weight may be used as an alternate. The balance results must agree within ±0.5 mg and the relative humidity in the weighing environment must be ≤50%.

7.8.3 Prior to weighing beakers before and after sampling, adjust the analytical balance to zero and check the accuracy with a 100 g Class-S standard weight. A Class-S standard weight within 1 g of the beaker weight may be used as an alternate. The balance results must agree within ±0.5 mg and the relative humidity in the weighing environment must be ≤50%.

8.0 Analytical Procedures

8.1 **Documentation:** Analytical documentation shall be consistent with the data entry forms presented in Figures 5-2a through 5-2c.

8.2 **Analysis:** Same as EPA Method 5 Section 11.2 with following additions:

8.2.1 **Container No. 1:** The sample (filter) must be desiccated and weighed to a constant final weight, even if it is oven dried.

8.2.2 **Container No. 4:** Transfer the contents of Container No. 4 to a separator funnel (Teflon[1] stoppered). Rinse the container with distilled water and add to the separatory funnel. Add 50 ml of methylene chloride or hexane. Stopper the separatory funnel and vigorously shake for 1 minute. Take care to momentarily release the funnel pressure several times during the shaking process. Allow the sample to separate into two distinct layers and transfer the methylene chloride (lower layer) into a tared beaker or evaporating dish made of glass, Teflon[1], or other inert material. Repeat the extraction process twice more.

NOTE: Always leave a small amount of methylene chloride in the separatory funnel to ensure that water does not get into the extracted sample. If water is present in the extracted sample, it will be difficult to completely evaporate the sample to dryness for gravimetric analysis.

8.2.2.*i* Transfer the remaining water in the separator funnel to a tared beaker or evaporating dish and evaporate at 105ºC. Desiccate for 24 hours and weigh to a constant weight.

8.2.2.*ii* Evaporate the combined impinger water extracts from Section 8.2.2 at laboratory temperature (≤ 70ºF) and pressure, desiccate for 24 hours and weigh to a constant weight.

8.2.3 **Container No. 5:** Transfer the contents of container No. 5 to a tared beaker or evaporating dish, evaporate at laboratory temperature and pressure, desiccate for 24 hours, and weigh to a constant weight.

---

[1] Mention of trade names or specific products does not constitute endorsement by DEQ.

8.2.4 **Solvent Blanks:** Evaporate a portion of the solvents in a manner similar to the sample evaporation to determine the solvent blanks.

9.0 Calculations

9.1 **Nomenclature:** Same as EPA Method 5 Section 12.1 with following additions:

C_m = Methylene chloride (or hexane) blank residue concentration, mg/g.

C_w = Distilled water blank residue concentration, mg/g.

m_m = Mass of residue of methylene chloride (or hexane) after evaporation, mg.

m_w = Mass of residue of distilled water after evaporation, mg.

V_{mb} = Volume of methylene chloride (or hexane)blank, ml.

V_{mc} = Volume of methylene chloride (or hexane) used for extracting the impinger water, ml.

V_{wb} = Volume of distilled water blank, ml.

V_{ws} = Volume of distilled water for charging the impingers and for recovery, ml.

W_m = Weight of residue in methylene chloride (or hexane), mg.

W_w = Weight of residue of distilled water, mg.

ρ_m = Density of methylene chloride (or hexane), g/ml (see label on bottle).

ρ_w = Density of distilled water, g/ml (1.0 g/ml).

9.2 **Dry Gas Volume**: Same as EPA Method 5 Section 12.3.

9.3 **Volume of Water Vapor Condensed:** Same as EPA Method 5 Section 12.4.

9.4 **Moisture Content:** Same as EPA Method 5 Section 12.5.

9.5 **Acetone Blank Concentration:** Same as EPA Method 5 Section 12.6.

9.6 **Acetone Blank Deduction:** Same as EPA Method 5 Section 12.7 with the following addition: The acetone reagent blank weight correction will not exceed 0.001%, or 0.01 mg/ml. An acetone blank deduction value (Wa) of 0.0 mg shall be used when the acetone blank concentration (Ca) is less than or equal to zero.

9.7 **Water Blank Concentration:**

$$C_w = \frac{m_w}{V_{wb} \times \rho_w} \qquad \textit{(Eq. 5.9-1)}$$

9.8 Water Blank Deduction:

$$W_w = C_w \times V_{ws} \times \rho_w \qquad (Eq.\ 5.9\text{-}2)$$

NOTE: The distilled water reagent blank weight correction will not exceed 0.001%, or 0.01 mg/ml. A water blank deduction value (W_w) of 0.0 mg shall be used when the water blank concentration (C_w) is less than or equal to zero.

9.9 Methylene Chloride (or Hexane) Blank Concentration:

$$C_m = \frac{m_m}{V_{mb} \times \rho_m} \qquad (Eq.\ 5.9\text{-}3)$$

9.10 Methylene Chloride (or Hexane) Blank Deduction:

$$W_m = C_m \times V_{mc} \times \rho_m \qquad (Eq.\ 5.9\text{-}4)$$

NOTE: The methylene chloride reagent blank weight correction will not exceed 0.001%, or 0.01 mg/ml. A methylene chloride (or hexane) blank deduction value (W_m) of 0.0 mg shall be used when the methylene chloride blank concentration (C_m) is less than or equal to zero.

9.11 Total Particulate Weight:

Determine the total particulate matter catch from the sum of the weights obtained from Containers 1, 2, 4, 5 (including the organic solvent extract of the water from Container No. 4), less the acetone, methylene chloride (or hexane), and distilled water blanks (see Figures 5-2a, 5-2b, and 5-2c).

9.12 **Particulate Concentration:** Same as EPA Method 5 Section 12.9.

9.13 **Isokinetic Variation:** Same as EPA Method 5 Section 12.11.

9.14 **Stack Gas Velocity and Volumetric Flow Rate:** Same as EPA Method 5 Section 12.12.

10.0 Alternative Procedures, Bibliography, Sampling Train Schematic, Example Data Sheets, Etc.:

Same as EPA Method 5 Sections 16, 17 and Figures 5-1 through 5-12 excluding Figure 5-6 (use ODEQ Method 5 Figures 5-2a through 5-2b in place of EPA Method 5 Figure 5-6).

Figure 5-1: Particulate Sampling Train

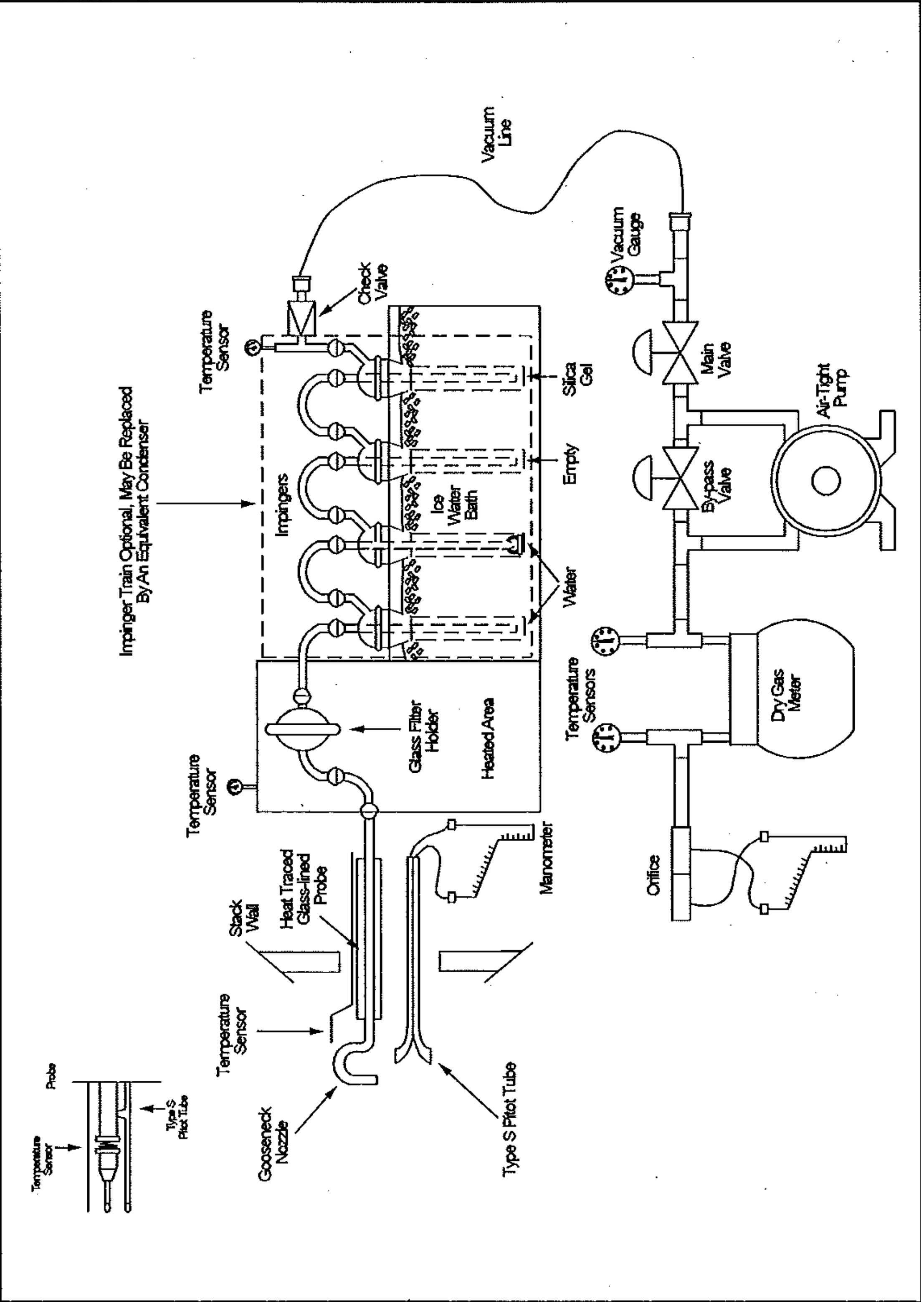

Figure 5-2a
METHOD 5 DATA ANALYSIS FORM

Plant________________________________ **Run Number**________________________

Sample Location_______________________ **Test Date**___________________________

Sample Recovered by____

Reagent	Date/Time	Weight (g)	Audit* (g)	Lab Temp. °F	Lab RH %	Analyst
FRONT HALF:						
Filter Filter ID:_________ Tare Wt.:_________ Date/time into desiccator:_________						
Acetone Beaker ID:_________ Tare Wt.:_________ Solv. Vol.:_________ Solv. ID:_________ Date/time into desiccator:_________						
BACK HALF:						
Acetone Beaker ID:_________ Tare Wt.:_________ Solv. Vol.:_________ Solv. ID:_________ Date/time into desiccator:_________						
Water Beaker ID:_________ Tare Wt.:_________ Water Vol.:________ Water ID:_________ Date/time into desiccator:_________						
MeCl or Hexane Beaker ID:_________ Tare Wt.:_________ Solv. Vol.:_________ Solv. ID:_________ Date/time into desiccator:_________						

*filter 0.5000 g ± 0.5 mg tolerance – NIST traceable Class S weight
beaker 100.0000 g ± 0.5 mg tolerance – NIST traceable Class S weight

Figure 5-2b
METHOD 5 BLANK ANALYSIS DATA FORM

Sample Prepared ___________________________________ **Date**_______________

Reagent	Date/Time	Weight (g)	Audit* (g)	Lab Temp. ºF	Lab RH %	Analyst
Filter Filter ID:__________ Tare Wt.:__________ Date/time into desiccator:_________						
Acetone Beaker ID:_________ Tare Wt.:__________ Solv. Vol.:_________ Solv. ID:__________ Date/time into desiccator:_________						
Water Beaker ID:_________ Tare Wt.:__________ Water Vol.:________ Water ID:_________ Date/time into desiccator:_________						
MeCl or Hexane Beaker ID:_________ Tare Wt.:__________ Solv. Vol.:_________ Solv. Wt:__________ Date/time into desiccator:_________						

*filter 0.5000 g ± 0.5 mg tolerance – NIST traceable Class S weight
beaker 100.0000 g ± 0.5 mg tolerance – NIST traceable Class S weight

Figure 5-2c
METHOD 5 TARE WEIGHT RECORD

Indicate: filters or evaporation containers

Media ID	Date_________ Time________ Temp_____ ºF RH_______ % Audit____ gm By__________	Date_________ Time________ Temp_____ ºF RH_______ % Audit____ gm By__________	Date_________ Time________ Temp_____ ºF RH_______ % Audit____ gm By__________	Date_________ Time________ Temp_____ ºF RH_______ % Audit____ gm By__________	Date_________ Time________ Temp_____ ºF RH_______ % Audit_____gm By__________
	Weight (g)	Weight (g)	Weight (g)	Weight (g)	Weight (g)

SUB-APPENDIX C-7

OREGON DEQ
SOURCE SAMPLING
METHOD 7

Oregon Method 7

State of Oregon
Department of Environmental Quality
Source Sampling Method 7

Sampling Condensable Particulate Emissions from Stationary Sources

1.0 Principle and Applicability

1.1 **Principle:** Particulate matter including condensable gases is withdrawn isokinetically from a flowing gas stream. The particulate matter is determined gravimetrically after extraction with an organic solvent and evaporation.

1.2 **Applicability:** This method is applicable to stationary sources whose primary emissions are condensable gases. It should be considered a modification of Source Sampling Method 5, and applied only when directed to do so by DEQ.

2.0 **Acceptability.** Results of this method will be accepted as demonstration of compliance (or non-compliance) provided that the methods included or referenced in this procedure are strictly adhered to and a report is prepared according to Section 2.11 of DEQ's Source Sampling Manual, Volume I. Deviations from the procedures described herein will be permitted only if permission from DEQ is obtained in writing in advance of the tests.

3.0 **Equipment and Supplies:** Same as Oregon Source Sampling Method 5 Sections 3.1 through 3.5 with the following addendum:

3.1 **Sampling train (Figure 7-1)**: Same as Oregon Source Sampling Method 5 Section 3.1 with the following exceptions:

3.1.1 The heated filter and/or cyclone are optional, but should be used if a significant quantity of filterable particulate matter is present.

3.1.2 An unheated glass fiber filter is placed at the inlet to the silica gel impinger (generally Impinger 4).

4.0 **Reagents and Standards:** Same as Oregon Source Sampling Method 5 Section 4.1 through 4.3.

5.0 **Sample Collection, Preservation, Storage, and Transport:** Same as Oregon Source Sampling Method 5 Sections 5.1 through 5.8 with the following addenda:

5.1 **Preparation of Sampling Train:** Same as Oregon Source Sampling Method 5 Section 5.3 with the following addition:

5.1.1 Insert numbered and pre-weighed filters into each of the front (heated if used) and back (non-heated) filter holders.

5.2 **Sample Recovery:** Same as Oregon Source Sampling Method 5 Section 5.7 with the following addition:

5.2.1 Container 6: Transfer the back filter to container No. 6.

6.0 **Quality Control:** Same as Oregon Source Sampling Method 5 Sections 6.1 and 6.2.

7.0 **Calibration and Standardization:** Same as Oregon Source Sampling Method 5 Sections 7.1 through 7.8.

8.0 **Analytical Procedure**s: Same as Oregon Source Sampling Method 5 Sections 8.1 through 8.2 with the following addendums:

8.1 Documentation: Analytical documentation shall be consistent with the data entry forms presented in Figure 7-2 of Oregon Source Sampling Method 7, and Figures 5-2b through 5-2c of Oregon Source Sampling Method 5

8.2 Analysis: Same as Oregon Source Sampling Method 5 Section 8.2 with the following addition:

8.2.1 **Container No. 6:** Desiccate the back filter in Container No. 6 for 24 hours at 70°F or less. Weigh the filter to a constant weight.

Note: In some cases, desiccation may cause slow vaporization of the condensable material. Therefore, if the weights continue to decrease over time and the sample is obviously dry, use the average of the first three weights to determine the particulate matter catch.

9.0 **Calculations:** Same as Oregon Source Sampling Method 5 Sections 9.1 through 9.14 with the following addendum:

9.1 Total Particulate Weight: Determine the total particulate matter catch from the sum of the weights obtained from Containers 1 (if front filter is used), 2, 4, 5, & 6 (including the organic solvent extract of the water from Container No. 4), less the acetone , methylene chloride (or hexane), and distilled water blanks (see Figure 7-2).

10.0 **Alternative Procedures, Bibliography, Sampling Train Schematic, Example Data Sheets, Etc.:** Same as Oregon Source Sampling Method 5 Section 10.0 with the following addenda:

10.1 An unheated glass fiber filter is placed at the inlet to the silica gel impinger (generally Impinger 4).

10.2 Use ODEQ Method 7 Figure 7-2 in place of ODEQ Method 5 Figure 5-2a.

FIGURE 7-1. OREGON METHOD 7 SAMPLING APPARATUS

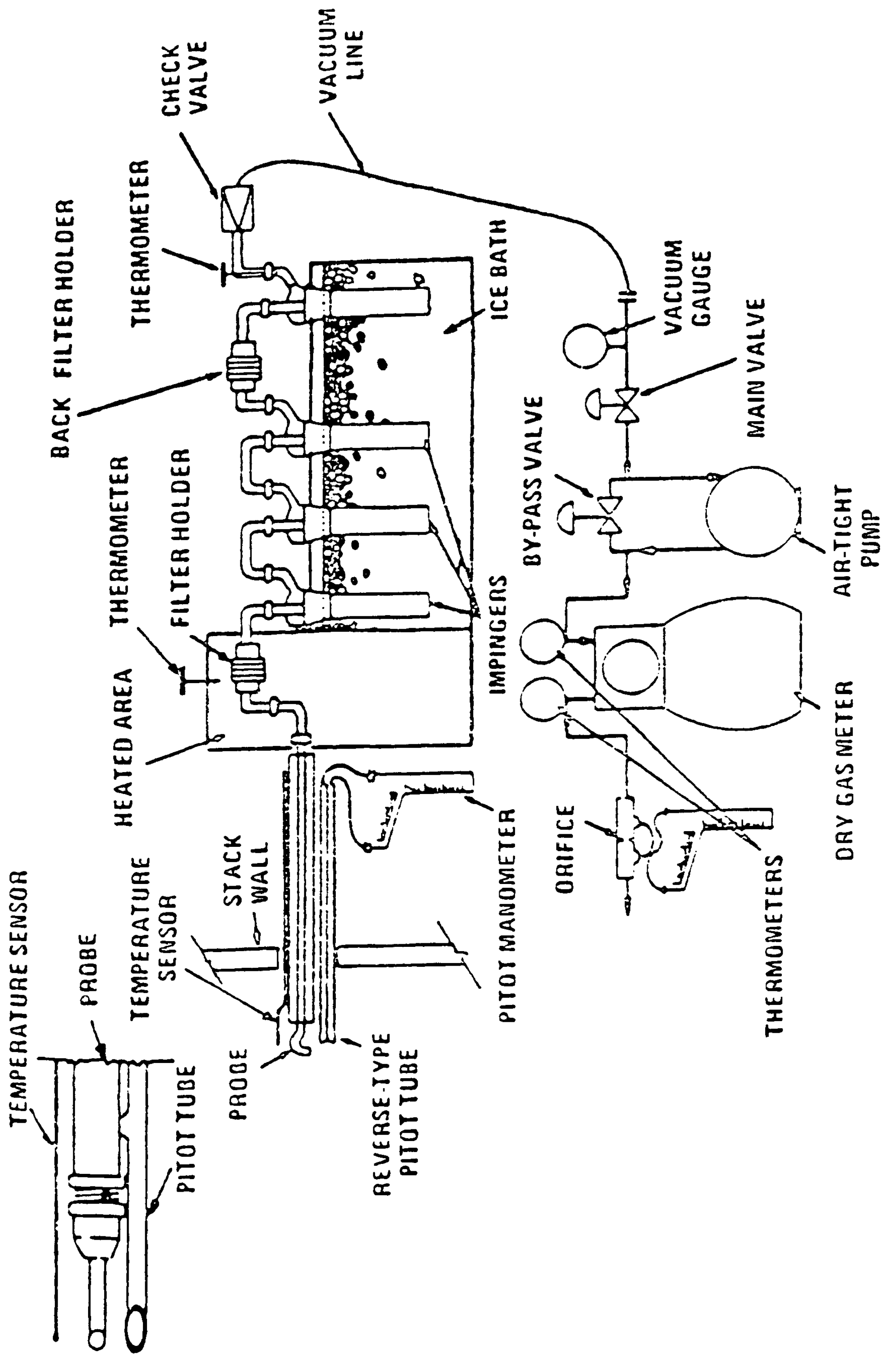

Figure 7-2
OREGON METHOD 7 DATA ANALYSIS FORM

Facility________________________________ **Run Number**____________________
Sample Location_______________________ **Test Date**_______________________
Sample Recovered by____

Reagent	Date/Time	Weight (g)	Audit* (g)	Lab Temp. °F	Lab RH %	Analyst
FRONT HALF:						
Front Filter Filter ID:___________ Tare Wt.:___________ Date/time into desiccator:___________						
Acetone Beaker ID:___________ Tare Wt.:___________ Solv. Vol.:___________ Solv. ID:____________ Date/time into desiccator:___________						
BACK HALF:						
Back Filter Filter ID:___________ Tare Wt.:___________ Date/time into desiccator:___________						
Acetone Beaker ID:___________ Tare Wt.:___________ Solv. Vol.:___________ Solv. ID:____________ Date/time into desiccator:___________						
Water Beaker ID:___________ Tare Wt.:___________ Water Vol.:__________ Water ID:___________ Date/time into desiccator:___________						
MeCl or Hexane Beaker ID:___________ Tare Wt.:___________ Solv. Vol.:___________ Solv. ID:___________ Date/time into desiccator:___________						

*filter 0.5000 g ± 0.5 mg tolerance – NIST traceable Class S weight
beaker 100.0000 g ± 0.5 mg tolerance – NIST traceable Class S weight

SUB-APPENDIX C-8

OREGON DEQ
SOURCE SAMPLING
METHOD 8

Oregon Method 8

State of Oregon
Department of Environmental Quality
Source Sampling Method 8

Sampling Filterable Particulate Emissions from Stationary Sources (High Volume Method)

1. Principle and Applicability

1.1 **Principle:** Particulate matter is withdrawn isokinetically from a flowing gas stream and deposited on a glass fiber filter. The particulate matter is determined gravimetrically after removal of uncombined water.

1.2 **Applicability:** This method is applicable to stationary sources whose exhaust points do not meet minimum EPA Method 1 flow disturbance requirements and whose primary emissions are solid (filterable) particulate. Its primary application is intended to be for wood product handling cyclones and baghouse exhaust systems. Caution must be taken when applying this method to sources with elevated exhaust temperatures and/or moistures as they may diminish the integrity of the sampling filter and damage the sampling apparatus.

2.0 **Acceptability:** Results from this method will be accepted as a demonstration of compliance (or non-compliance) provided that the methods included or referenced in this procedure are strictly adhered to and a report containing at least the minimum amount of information regarding the source is included as described in Section 2.11 of Oregon DEQ's Source Sampling Manual, Volume I. Deviations from the procedures described herein will be permitted only if permission from DEQ is obtained in writing in advance of the tests.

3.0 Sampling Apparatus (Figure 8-1)

3.1 **Nozzle** - smooth metal construction with sharp leading edge. The nozzle shall be connected to the probe by means of a joint designed to minimize particulate matter deposition.

3.2 **Probe** - smooth metal construction. The probe shall be attached to the nozzle and filter holder with air-tight joints designed to minimize particulate matter deposition. The probe should be as short as possible.

3.3 **Filter Holder** - air-tight with support screen for the filter.

3.4 **Metering system** - a calibrated orifice followed by a thermometer or thermocouple and flow control device. The metering system shall be connected to the filter holder by means of an air-tight joint.

3.5 **Pitot Tube** – Standard pitot same as EPA Method 2, Sec. 6.7.1, or S-type same as EPA Method 2, Sec. 6.1, or equivalent.

3.6 **Blower** - high capacity (typically 60 cfm free air). The blower may be connected to the metering system by a flexible hose if desired.

3.7 **Probe-Nozzle Brush** - flexible, nylon bristle brush at least as long as the probe and nozzle.

3.8 **Differential Pressure Gauges** - liquid manometer, Magnehelic[2], or equivalent.

3.9 **Barometer** - mercury, aneroid, or other type capable of measuring atmospheric pressure to within 0.1”Hg. If the barometric pressure is obtained from a nearby weather bureau station, the true station pressure (not corrected for elevation) must be obtained and an adjustment for elevation differences between the station and sampling site must be applied.

3.10 **Temperature Gauges** - Same as EPA Method 2 Section 6.3.

3.11 **Timer** - integrating type, accurate and readable to the nearest 6 seconds (tenth of a minute).

3.12 **Wash Bottles**: Same as EPA Method 5 Section 6.2.2 .

3.13 **Filter Storage Container** - clean manila envelopes and tagboards, or suitable equivalent.

3.14 **Sample Storage Containers** - glass with leak-tight cap that is resistant to attack by the solvent used, and allows complete recovery of particulate matter. Polyethylene bottles are also acceptable.

4.0 Reagents and Standards

4.1 **Filters** - glass fiber filters, free of pinhole leaks or other imperfections and exhibiting at least 99.95% efficiency on 0.3 micron DOP smoke particles. Desiccate individually numbered filters for 24-hours and weigh to the nearest 0.5 mg before use.

4.2 **Rinse Solvent** - acetone, reagent-grade, $\leq$ 0.001% (0.008 mg/ml) residue. For aluminum probes and nozzles, methanol may be substituted for acetone. The same purity is required.

---

[2] Mention of trade names or specific products does not constitute endorsement by DEQ.

5.0 Sample Train Preparation

5.1 All parts of the sampling train shall be cleaned and properly calibrated as directed in Section 10.

5.2 Place a filter in the filter holder with the coarse side facing the flow, being careful not to damage it. Be certain that the filter is positioned so that no air can be drawn around the filter.

5.3 Assemble the sample train with the appropriate nozzle and length of probe. Perform a leak check by plugging the nozzle, turning on the blower, and observing the deflection of the flow orifice pressure gauge. The acceptable leakage rate shall not exceed 5% of the expected sample flow rate.

6.0 Sample Collection, Preservation, Storage, and Transport

6.1 Use a pitot tube to roughly map the velocity distribution across the face of the exhaust opening or duct. Areas of zero or negative flow should also be indicated if present. At each point at which the velocity is measured, measure the flow in the direction giving maximum deflection of the pitot pressure gauge. Record the data on a form similar to Figure 8-6.

6.2 Select six or more points of outgoing (positive) flow from the points measured in Section 6.1 to sample. The points shall be representative of the flow pattern, and shall include the point of maximum velocity. If six points of positive flow cannot be obtained, use the maximum number possible. Do not choose any points closer than 2 inches to the exhaust duct wall.

Alternatively, sample point locations may be determined utilizing criteria specified within EPA Method 1 if the minimum distances from upstream and downstream flow disturbances are met (Figure 1-1 of EPA Method 1).

6.3 Measure the exhaust temperature.

6.4 Determine the nozzle size required for isokinetic sampling. An estimate of the orifice temperature is required. For low temperature exhausts, the orifice temperature is usually very close to the exhaust temperature. For higher temperature exhausts, a trial run may be necessary to determine the expected orifice temperature.

6.5 Calculate the required orifice pressure drop for each chosen sampling point to obtain an isokinetic sample rate. With the probe out of the exhaust stream, turn on the blower and adjust the sample flow rate to that calculated for the first sampling point in Section 6.2. Locate the probe nozzle at the first sampling point, and immediately start the timer. Move the probe around until the velocity pressure matches that for which the sampling flow rate was pre-set. The probe nozzle must be pointing directly into the flow.

6.6 Continually monitor the velocity during the sampling period and move the probe around as required to keep it in an area where the velocity matches the original velocity used to calculate the pre-set sampling rate. Record the sampling time, the orifice temperature, and orifice pressure drop on a data sheet similar to Figure 8-7. Record data every 5 minutes or once per sampling point, whichever is more frequent. Sample for a length of time so that the total sampling time for all points is at least 15 minutes and a minimum of 100 mg of particulate matter is collected.

6.7 Repeat steps 6.5 and 6.6 for each sampling point. The blower need not be turned off between points if readjustments to the new sampling rate can be made rapidly (less than 15 seconds).

6.8 Care should be taken so that the nozzle does not touch the walls of the exhaust stack because particulate matter may be dislodged and enter the sample train. If there is reason to believe this has happened, discontinue the sample, clean the train, and restart the test.

6.9 If excessive loading of the filter should occur such that isokinetic conditions cannot be maintained, replace the filter and continue the test.

6.10 At the conclusion of the sampling period, remove the probe from the exhaust and turn off the blower (do not reverse this order because the filter may be broken and sample lost). Plug the nozzle to prevent sample loss, and transport to the sample recovery area.

6.11 Conduct a post-test leak check (as per Section 5.3).

6.12 Measure the moisture content, molecular weight, and the pressure (absolute) of the exhaust gas. In most cases, the moisture may be measured by the wet bulb/dry bulb technique as described in Oregon Source Sampling Method 4. The molecular weight shall be measured by EPA Method 3 or 3a. If the exhaust gas being sampled is ambient air, the dry molecular weight can be assumed to equal 29 lbs/lb mol (29 g/g mol). If feasible, these supplemental measurements should be conducted during each PM sample run. Otherwise, these supplemental measurements should be conducted immediately prior to and immediately following each PM sample run. The process operating parameters realized during these supplemental measurements must be consistent with the parameters encountered during the PM sampling collection.

7.0 Sample Recovery

7.1 Remove the nozzle plug, turn on the blower, insert the probe brush into the nozzle, and brush the particulate from the nozzle and probe onto the filter. Do not insert the brush so far in that it will come into contact with the filter. Turn off the blower and recover the PM adhered to the brush. This brushing process must be performed after every PM sample run.

7.2 Open the filter holder and carefully remove the filter. Inspect the filter for holes or tears. A leak around the filter is likely if particulate deposits are found at the edge of the filter. If any of these problems are found, the observations should be recorded on the field data sheet and the sample should be voided (repeat the run). Fold the filter once lengthwise with the dirty side in, and place in a folded manila tagboard (or equivalent), folded edge down. Fasten the outside edge of the tagboard (or equivalent) with a paper clip, and place in the manila envelope (or equivalent). Be aware that some filter material will likely remain on the gasket and filter support. If possible, these filter remains should be removed with a spatula and placed within the folded filter.

7.3 Rinse the inside front of the filter holder, probe, and nozzle with a measured amount of acetone or methanol while brushing. Repeat the rinsing/brushing until all particulate and filter remains is removed as evidenced by a lack of visible residue on the inside surfaces after evaporation of the acetone or methanol. Be sure to also recover the PM matter adhered to the recovery brushes. Retain the acetone or methanol rinse and a blank sample of the acetone or methanol in labeled containers for laboratory analysis. This rinsing process must be performed after every PM sample run.

8.0 **Analytical Procedures**

8.1 Desiccate the filter for 24-hours at room temperature (70ºF or less), and weigh to a constant weight to the nearest 0.5mg.

NOTE: Make certain that any particulate that may have dislodged from the filter into the tagboard or envelope (or their equivalent) is returned to the filter before weighing. Alternatively, the filter and corresponding filter receptacle (envelope) may be tared simultaneously and analyzed collectively. In this case, the filter receptacle must be opened prior to being placed in the desiccator to instigate sample drying.

Since the relatively large filter and particulate catch may be hygroscopic, weigh immediately upon removal from the desiccator.

8.2 Filter blanks shall be run in the field before and after the complete source testing activity. A minimum of 2 filter blanks shall be collected for each source test. This is accomplished by inserting a pre-weighed filter into the filter holder, performing a leak check, removing the filter, and treating it as a sample filter in accordance with Section 7.2.

8.3 Quantitatively transfer the solvent rinse and blank solvent to tared beakers or evaporating dishes, evaporate at room temperature (70ºF or less) and pressure, desiccate, and weigh to a constant weight to the nearest 0.5 mg.

8.4 Record the data on forms similar to Figures 8-2, 8-3, 8-4, and 8-5.

9.0 **Exhaust Gas Flow Rate Measurement**

9.1 If the PM sampling location does not satisfy the flow disturbance requirements of EPA Method 1, then an alternate sampling location shall be selected for a velocity traverse. The velocity traverse location shall meet EPA Method 1 requirements and should accurately represent the flow rate to the atmosphere at the particulate sampling point (i.e., no air flows should be added to or removed from the system between the velocity and the particulate sampling points).

9.2 The dry molecular weight of the gas stream shall be determined as per EPA Method 3 or 3a. If the exhaust gas being sampled is ambient air, the dry molecular weight can be assumed to equal 29 lbs/lb mol (29 g/g mol).

9.3 In most cases, the moisture may be measured by the wet bulb/dry bulb technique as described in Oregon Source Sampling Method 4. If Oregon Source Sampling Method 4 is not applicable, then exhaust moisture must be measured as per EPA Method 4.

9.4 The flow rate shall be measured as per EPA Method 2 at the location specified by Section 9.1 of this DEQ method.

9.5 If possible, the flow rate (including velocity, molecular weight, & moisture) should be measured during each PM sample run. Alternatively, these supplemental measurements should be conducted immediately prior to and immediately following each PM sample run. The process operating parameters realized during these supplemental measurements must be consistent with the parameters encountered during the PM sampling collection.

10.0 **Calibration**

10.1 The orifice flow meter shall be calibrated at least once within twelve months of the sampling date using a primary standard or a device which has been calibrated against a primary standard. The calibration data and calibration curves for the orifice and intermediate standard shall be included in the source test report, along with documentation of the primary standard.

10.2 All S-type pitot tubes, differential pressure gauges, and thermometers or thermocouples, shall be calibrated at least once within six months of the sampling date. The calibration data and/or calibration curves shall be included in the source test report.

10.3 The calibration records shall include the date, place, and method of calibration.

10.4 Differential pressure gauges (if not liquid manometers) shall be calibrated against a liquid manometer.

10.5 The following calibration and standardization procedures must be performed on the analytical balance:

10.5.1 The balance must be audited utilizing 0.500 g, 1.0000 g, 10.0000 g, 50.0000 g, and 100.0000 g Class-S standard weights. Alternatively, five (5) Class-S standard weights may be substituted that accurately represent the anticipated measurement range. The balance results must agree within ±1 mg of the Class-S weights. At a minimum, the balance calibration must be performed subsequent to disturbing the analytical balance and annually thereafter.

10.5.2 Prior to weighing filters before and after sampling, adjust the analytical balance to zero and check the accuracy with a 5 g Class-S weight. A Class-S standard weight within 1 g of the filter weight may be used as an alternate. The balance results must agree within ±0.5 mg and the temperature in the weighing environment must be ≤70°F.

10.5.3 Prior to weighing beakers before and after sampling, adjust the analytical balance to zero and check the accuracy with a 100 g Class-S standard weight. A Class-S standard weight within 1 g of the beaker weight may be used as an alternate. The balance results must agree within ±0.5 mg and the temperature in the weighing environment must be ≤ 70°F.

11.0 Calculations

11.1 Total particulate emissions from the system shall be calculated by multiplying the measured particulate concentration by the flow rate through the exhaust system. An index to the parameters utilized in these calculations are as follows:

Bws = Moisture content of sample stream as per EPA 4 or ODEQ 4, vol./vol.

Cg = Calculated PM concentration, gr/dscf.

Cp = Pitot tube coefficient for Method 8 apparatus, typically 0.99

Dn = Sample nozzle diameter, inches.

$\sqrt{dp}$ = Average square root of velocity pressures measured at sample points, (“H_2O)$^{1/2}$.

E= PM emission rate, lb/hr

I = Isokinetic sampling rate percentage, %

Mc = Molecular weight of gas stream used to calibrate orifice, typically 29.0 #/#mol.

m_n = Mass of PM recovered from sampling apparatus, mg

Ms = Molecular weight of sample gas stream on a wet basis, #/# mol.

Pb_s = Barometric pressure during the course of sampling, “Hg.

Ps = Absolute exhaust pressure at sampling location, “Hg.

Qs_{std} = Standard exhaust gas flow rate, dscfm

$SRstd$=Standard sample rate (wet) as indicated by calibration curve, scfm

$SRstd'$ = Corrected standard sample rate (wet) for temp., pressure, & molecular weight, scfm.

$SRstd'_i$ = Corrected standard sample rate (wet) at sample point “i”, scfm.

To_s = Orifice temperature measured at sample point, °R.

Ts=Average exhaust temperature at sampling location, °R

$Vstd'$ = Standard sample volume (dry) of entire test replicate, dscf.

$Ø$ = Sampling time of entire test replicate, min.

$\O_i$ = Sampling time at sample point "i", min.

11.2 Particulate Concentration: The following calculations shall be conducted for each test run:

11.2.1 Total Sample Weight: Calculate the total sample weight from laboratory results by adding the net weight gain of the filter sample(s), adjusted for a blank value, to the net weight of particulate matter collected in the acetone (or methanol) rinse, corrected for an acetone (or methanol) blank. Record the results on a laboratory form similar to Figure 8-5.

11.2.2 Sampling Rate: Sample flow rates for each point shall be determined from the orifice calibration curve. Typically, the orifice calibration curve is a plot of orifice pressure drop versus sample flow rates at standard temperature and pressure. Some calibration curves account for varying orifice temperatures, but rarely do they adjust for orifice pressure and gaseous molecular weight.

Consequently, the calibration curve must be corrected to accurately reflect the relationship between the orifice differential pressure and the standard sampling flow rate. The correction to the standard sampling flow rate for a constant orifice differential is specified by Equation 8.11-1.

$$SRstd' = 4.2 \times SRstd \times \sqrt{\frac{Pb_s}{To_s}} \times \sqrt{\frac{Mc}{Ms}} \qquad \textit{(Eq. 8.11-1)}$$

Note: Equation 8.11-1 only applies to the calibration curve that represents an orifice temperature of 68° F and an orifice pressure of 29.92"Hg. Set Mc equal to Ms (Mc:Ms ratio of 1) if sample gas is mainly comprised of air with Bws less than 0.05 vol./vol.

11.2.3 Total Sample Gas Volume: Calculate the sample gas volume by multiplying each sample point duration in minutes, times the average sample rate (wet standard cubic feet per minute – wscfm) as determined using the orifice calibration curve and the corrected sample rate from Equation 8.11-1. Add the volume of all sample points and adjust for exhaust gas moisture to get the total dry standard sample gas volume for the entire test run as shown by Equation 8.11-2.

$$Vstd' = \left[\sum_{i=1}^{n} SRstd'_i \times \phi_i \right] \times [1 - Bws)] \qquad \textit{(Eq. 8.11-2)}$$

11.2.4 Calculate the particulate concentration in gr/dscf by the following equation:

$$Cg = 0.0154 \times \frac{m_n}{Vstd'} \qquad \text{(Eq. 8.11-3)}$$

11.3 Total Exhaust Gas Flow Rate: Use EPA Method 2 calculations to determine the total exhaust gas flow rate using the data obtained from Section 9 of this DEQ method. For some cyclones, the total flow may be adjusted to account for air purposely vented out the bottom of the cyclone.

11.4 Total Emissions: Calculate the total particulate emission rate (lb/hr) by the following equation:

$$E = 0.00857 \times Cg \times Qs_{std} \qquad \text{(Eq. 8.11-4)}$$

11.5 Percent Isokinetic Sampling Rate: Calculate the isokinetic sampling rate, defined as the ratio of the average velocity of the sample gas entering the sample nozzle to the average sample point velocity. In order to achieve acceptable results, the value of this parameter must be between 80% and 120%. Test results falling outside this range shall be discarded, and the test repeated.

$$I = 0.2017 \times \frac{Vstd'}{\phi \times (1 - Bws) \times Dn^2 \times Cp \times \sqrt{dp}} \times \sqrt{\frac{(Ts + 460) \times Ms}{Ps}} \qquad \text{(Eq. 8.11-5)}$$

12.0 Test Reports

The test report shall include as a minimum the information requested in Section 2.11 of this manual.

Figure 8-1

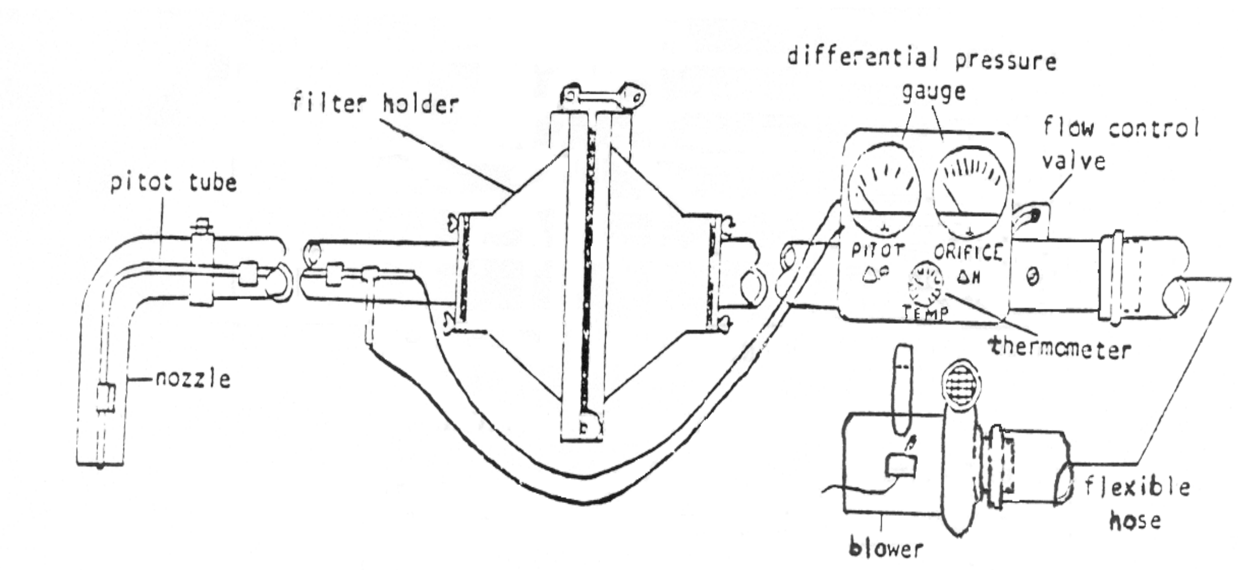
differential pressure
gauge
filter holder
flow control
valve
pitot tube
PITOT
ΔP
ORIFICE
ΔH
TEMP
thermometer
nozzle
flexible
hose
blower

Figure 8-2
METHOD 8 DATA ANALYSIS FORM

Facility________________________________ **Run Number**_______________

Sample Location_______________________ **Test Date**__________________

Sample Recovered by____

Reagent	Date/Time	Weight (g)	Audit* (g)	Lab Temp. °F	Lab RH %	Analyst
<u>Filter</u> Filter ID:___________ Tare Wt.:___________ Date/time into desiccator: ___________						
<u>Acetone</u> Beaker ID:__________ Tare Wt.:___________ Solv. Vol.:__________ Solv. ID:____________ Date/time into desiccator: ____________						

*filter 5.0000 g ± 0.5 mg tolerance – NIST traceable Class S weight
beaker 100.0000 g ± 0.5 mg tolerance – NIST traceable Class S weight

Figure 8-3
METHOD 8 BLANK ANALYSIS DATA FORM

Samples Prepared by________________________ Date________________

Reagent	Date/Time	Weight (g)	Audit* (g)	Lab Temp. ºF	Lab RH %	Analyst
Pre Test Blank Filter Filter ID:____________ Tare Wt.:____________						
Post Test Blank Filter Filter ID:____________ Tare Wt.:____________						
Blank Acetone Beaker ID:___________ Tare Wt.:____________ Solv. Vol.:___________ Solv. ID:_____________						

*filter 5.0000 g ± 0.5 mg tolerance – NIST traceable Class S weight
beaker 100.0000 g ± 0.5 mg tolerance – NIST traceable Class S weight

Figure 8-4
METHOD 8 TARE WEIGHT RECORD

Indicate: filters or evaporation containers (beakers)

Media ID	Date_________ Time________ Temp_____ °F RH_______ % Audit____ gm By__________	Date_________ Time________ Temp_____ °F RH_______ % Audit____ gm By__________	Date_________ Time________ Temp_____ °F RH_______ % Audit____ gm By__________	Date_________ Time________ Temp_____ °F RH_______ % Audit____ gm By__________	Date_________ Time________ Temp_____ °F RH_______ % Audit_____ gm By__________
	Weight (g)	Weight (g)	Weight (g)	Weight (g)	Weight (g)

Figure 8-5

METHOD 8 ANALYSIS SUMMARY

Facility________________________________ Run Number________________
Sample Location________________________ Test Date___________________
Sample Recovered by____

ANALYSIS	RUN _____	RUN _____	RUN _____	RUN _____	RUN _____
SAMPLE FILTER					
Filter ID					
Gross Weight, mg					
Tare Weight, mg					
Net Weight, mg					
PRE TEST BLANK FILTER					
Filter ID					
Gross Weight, mg					
Tare Weight, mg					
Net Weight, mg					
POST TEST BLANK FILTER					
Filter ID					
Gross Weight, mg					
Tare Weight, mg					
Net Weight, mg					
ACETONE RINSE					
Acetone ID					
Acetone Volume, mls					
Gross Weight, mg					
Tare Weight, mg					
Net Weight, mg					
ACETONE BLANK					
Acetone ID					
Acetone Blk Vol., mls					
Gross Weight, mg					
Tare Weight, mg					
Net Weight, mg					
Net Weight, mg/ml					
TOTAL PM RECOVERY*					
PM Recovered, mg					

*Total PM = (Filter) – (Average (pre-test blank & post-test blank)) + (Acetone Rinse) – (Acetone Blank Corrected for Rinse Volume). Note: The blank corrections for the filter and/or rinse samples are ‘0’, if the blank filter or rinse samples yield negative weight gains.

Oregon Source Sampling Method 8
High Volume Sampling Data
Form 1 of 2

Figure 8-6
VELOCITY PRE-SURVEY

Plant Name & Location____
Date____________ **Time**__________________ **By (name)**___________________________
Source Location or ID____

☐Low Pressure System ☐High Pressure System

Type of Exhaust: ☐Straight Vertical ☐China Hat

☐Goose-Neck ☐Other (specify)_________
Temperature: Dry Bulb _______________ºF Wet Bulb ______________ºF

Velocity Survey: Record velocity head at enough points to roughly map the velocity distribution across the exhaust cross-section. Select six points for sample collection and show in diagram.

Point	X inches	Y inches	Δ P “ H_2O	Check if selected ( )
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
Average				

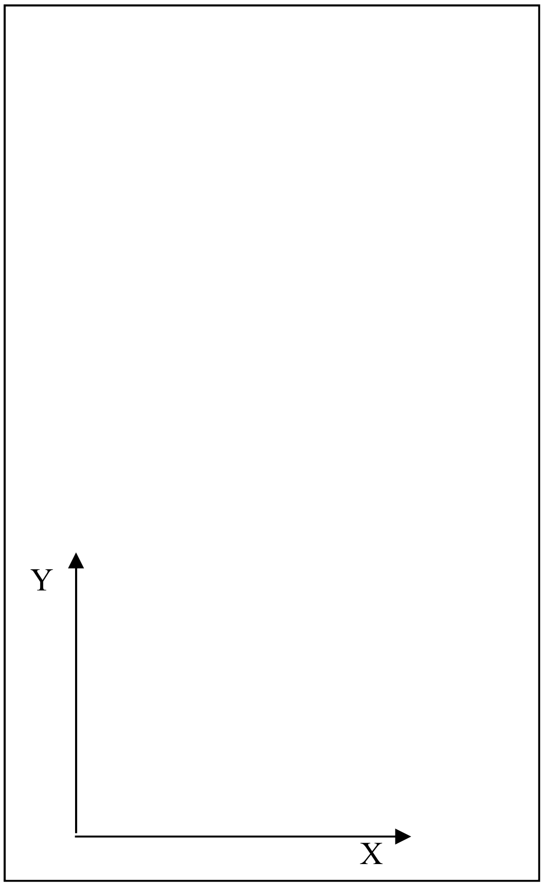

Figure 8-7

Sampling Data and Field Analysis

Plant Name/Location __________________________ Source Identification ________________Run #________

Date_________ Time_________ By (name)______________Process Operation During Test: ______________

Temperature: Dry bulb___________ Wet bulb___________ %Moisture__________ Ambient____________

Gas composition: %O_2 _____________ %CO_2 _____________ Pitot factor (C_p)____________

Static Press (P_g)______"H_2O

Nozzle Dia. _________ Nozzle area (A_n)_____________ Barometric Pressure(P_b) __________________in. H_g

Pt.	Location		Velocity Pressure		Orifice ΔH		Orifice Temperature °F	Sample Time minutes	Sample Rate Indicated by Calibration Curve scfm	Sample Rate Corrected for Sampling Conditions scfm	Sample Volume dscf
	X	Y	ΔP	√ΔP	Pre-set " H_2O	Actual "H_2O					
1											
2											
3											
4											
5											
6											
Avg. or Total			--		--	--			--		

Sample Filter ID:	
Acetone ID:	
Acetone Volume, mls.	
Pre Test Blank Filter ID:	
Post Test Blank Filter , ID:	

APPENDIX D

GENERAL CALIBRATION REQUIREMENTS

FOR
OREGON SOURCE SAMPLING METHODS

Table D-1: CALIBRATION REQUIREMENTS FOR OREGON DEQ SOURCE SAMPLING METHODS

Measurement Equipment	Reference	Calibration Points	Frequency	Acceptance Criteria	Applicable ODEQ Method			
					M4	M5	M7	M8
TEMPERATURE MEASURING DEVICES								
Stack/Exhaust	ASTM mercury thermometer, NIST traceable, or thermocouple/potentiometer	32ºF & 212ºF or Sec. 10.3 of EPA M2	every 6 months or EPA M2	±1.5% absolute	X	X	X	X
Oven/Filter	ASTM mercury thermometer, or NIST traceable	32ºF & 212ºF	every 6 months	±1.5% absolute		X	X	
Impinger Exit	ASTM mercury thermometer, or NIST traceable	32ºF & 212ºF	every 6 months	±1.5% absolute		X	X	
Dry Gas Meter	ASTM mercury thermometer, or NIST traceable	32ºF & 212ºF	every 6 months	±1.5% absolute		X	X	
Orifice Meter	ASTM mercury thermometer, or NIST traceable	32ºF & 212ºF	every 6 months	±1.5% absolute				X
Note: The entire measurement system including readout shall be calibrated. All thermocouples should be checked before each source test. This could be accomplished by noting on the field data sheets that all of the thermocouples and/or thermometers register the same temperature at ambient conditions.								
SAMPLE NOZZLE								
Sample Nozzle (initial & thereafter)	micrometer	3 diameters	12 months & after repair	high minus low ≤0.004”		X	X	X
Sample Nozzle (pre-test)	visual inspection	tapered edge of opening	prior to each field use	no nicks, dents, or corrosion		X	X	X
PITOT TUBES								
S-type pitot tube (preferred procedure)	standard pitot tube (Cp=0.99)	800; 1,500; 3,000; & 4,500 fpm	every 6 months	mean deviation ≤0.01 A & B deviation ≤0.01		X	X	X
S-type pitot tube (D_t, P_A, P_B, x, Z, & W in limits)	specifications illustrated in Method 2, Figures, 2-2, 2-3, 2-4, 2-7, & 2-8	face alignments & dynamic interferences	pre & post each field use	EPA Method 2		X	X	X
Standard pitot tube	specifications of EPA Method 2, Section 6.7 and Figure 2-5	static pressure holes location & size	prior to initial use	≥ 6 D to tip, ≥8 D to bend, 0.1D hole diam.		X	X	X

Note: Where inconsistencies exist, quality assurance requirements specified by method supersede those presented within Tables D-1 & D-2.

Table D-2: CALIBRATION REQUIREMENTS FOR OREGON DEQ SOURCE SAMPLING METHODS

Measurement Equipment	Reference	Calibration Points	Frequency	Acceptance Criteria	Applicable ODEQ Method			
					M4	M5	M7	M8
SAMPLE VOLUME METERING EQUIPMENT								
Dry Gas Meter (pre test)	standard meter	3 orifice pressures (1.0”, 2.0”, & 3.0”H_2O)	every 6 months	Y ± 0.02 from average ΔH@ ±0.2 from average		X	X	
Dry Gas Meter (post test)	standard meter	3 replicates at avg. ΔH and max. vacuum during test	following each source test	Y_{post} ±5% of Y_{pre}		X	X	
Standard Gas Meter (dry gas meter)	spyrometer or wet test meter	5 orifice pressures over range	annual	$Y_{max} – Y_{min} \le 0.030$ $0.95 \le Y \le 1.05$		X	X	
Standard Gas Meter (wet test meter)	spyrometer	3 flow rates (0.25, 0.5, & 0.75 cfm)	annual	deviation ≤ 1%		X	X	
High-Volume Orifice (pre test)	standard orifice or meter (or approved equivalent)	7 settings over full range of orifice	every 12 months	demonstrate linearity on a logarithmic plot				X
Critical Orifices (as a calibration standard)	standard meter	duplicate runs for each orifice	every 6 months	K’ ± 0.5% from average		X	X	
MISCELLANEOUS EQUIPMENT								
Magnehelic[3]	liquid manometer	3 points over range	after each field use	±5%		X	X	X
Barometer (aneroid type)	mercury barometer	one point	annual	± 0.1”Hg	X	X	X	X

Note: Where inconsistencies exist, quality assurance requirements specified by method supersede those presented within Table D-1 & D-2.

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[3] Mention of trade names or specific products does not constitute endorsement by DEQ.

Air Quality Program

Source Sampling Manual

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State of Oregon
Department of Environmental Quality

Air Quality Division

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DEQ METHOD 30

Test Procedures for Determining the Efficiency of
Gasoline Vapor Recovery Systems at Service Stations

STATE OF OREGON
DEPARTMENT OF ENVIRONMETNAL QUALITY

DEQ Air Quality Program
Portland, Oregon
December 1, 1980

Revisions:
May 15, 1981
January 23, 1992

Method 30

Test Procedures for Determining the Efficiency of Gasoline vapor recovery systems at Service Stations and Similar Facilities with Small Storage Tanks

1.0 Introduction

The following test procedures are for determining the efficiency of vapor recovery systems for controlling gasoline vapors emitted during the filling of small storage tanks.

The test procedure for determining the efficiency of systems for controlling gasoline vapors displaced during filling of storage tanks requires determination of the weight of gasoline vapors vented through the storage tank vent and the volume of gasoline dispersed. The percentage effectiveness of control is then calculated from these values.

During the performance test, maintenance, adjustment, replacement of components or other such alteration of the control system is not allowed unless such action is specifically called for in the system's maintenance manual. Any such allowable alteration shall be recorded and included in the test report. During the testing, the control system will be sealed in such a manner that unauthorized maintenance may be detected. Maintenance is to be performed only after notification of the person in charge of the testing, except in case of emergency. Unauthorized maintenance may be reason for immediate failure of the test.

For systems which are identical in design and include the same components as systems tested and found to comply with the test procedures, but differ, primarily in size, the owner or vendor may demonstrate compliance capability and obtain approval by submitting engineering and/or test data demonstrating the relationship between capacity and throughput of each component whose performance is a function of throughput. Examples of such components include: blowers, catalyst, carbon or other absorbent, compressors, heat exchangers, combustors, piping, etc.

For the purpose of determining compliance with applicable Administrative Rules, equipment on systems with 90 percent or greater control efficiency shall be considered to be vapor tight.

2.0 Acceptance of Test Results

Results of this method will be accepted as a demonstration of compliance status of the equipment tested, provided that the methods included or referenced in this procedure are strictly adhered to. A statement containing at least the minimum amount of information regarding the test procedures applied should be included with the results.

Deviations from the procedure described herein will be permitted only if permission from DEQ is obtained in writing in advance of the test.

3.0 Small Storage Tank Filling (Phase I Systems):

3.1 Principle and Applicability:

3.1.1 Principle: During a fuel delivery, the volume of gasoline delivered from the tank to the storage tank is recorded and the concentration of gasoline vapor returning to the tank truck is measured. The weight of gasoline vapor discharged from the vent of the storage tank and, if applicable, from the vent of the vacuum assisted secondary processing unit during the same period is determined. The efficiency of control is calculated from these determinations.

3.1.2. Applicability: The method is applicable to all control systems which have a vapor line connecting the storage tank to the tank truck.

The storage tank is filled by submerged fill.

3.2. Test Equipment

3.2.1. For each vent, including restricted vents and vents of any processing units, a positive displacement meter, with a capacity of 3,000 standard cubic feet per hour (SCFH), a pressure drop of no more than 0.05 inches of water at an air flow of 30 SCFH, and equipped with an automatic data gathering system that can differentiate direction of flow and record volume vented in such a manner that this date can be correlated with simultaneously recorded hydrocarbon concentration data. A manifold for meter outlet with taps for a hydrocarbon (HC) analyzer, a thermocouple, and a pressure sensor is to be used with the positive displacement meter.

3.2.2. Coupling for the vent vapor line to connect the gas meter. Coupling to be sized so as to create no significant additional pressure drop in the system.

3.2.3. Coupling for the vent of the vacuum assisted secondary processing unit to connect the gas meter. Coupling to be sized as to create no significant additional pressure drop on the system.

3.2.4. Coupling for tank truck vapor line with thermocouple, manometer and HC analyzer taps. Coupling to be the same diameter as the vapor return line.

3.2.5. Coupling for tank truck fuel drop line with thermocouple tap. Coupling to be the same diameter as the fuel line.

3.2.6. Two (2) hydrocarbon analyzers (Flame Ionization Detector, FID, or DEQ approved equivalent) with recorders and with a capacity of measuring total gasoline vapor concentration of 100 percent as propane. Both analyzers to be of same make and model.

3.2.7. Three (3) flexible thermocouples or thermistors (0-150°F) with a recorder system.

3.2.8. Explosimeter

3.2.9. Barometer

3.2.10. Three (3) manometers or other pressure sensing devices capable of measuring zero to ten inches of water.

3.2.11. Thermometer

3.3 Testing Procedure:

3.3.1. The test during filling operating will be conducted under, as closely as feasible, normal conditions for the station. Normal conditions will include delivery time and station operating conditions.

3.3.2. Connect manifold to outlet of positive displacement meter and restriction to system vent of underground tank using the coupler, or if the vent has a restriction, remove the restriction and connect the coupler, manifold and outlet. If appropriate, connect another manifold and meter to the vent of the vacuum assisted secondary processing unit. If the system uses an incinerator to control emissions, use test procedures set forth in Section 4.0.

3.3.3. Connect the HC analyzer with recorder, thermocouple and manometer to the vent manifold. Calibrate the equipment in accordance with Section 6.0.

3.3.4. Connect the couplers to the tank truck fuel and vapor return lines.

3.3.5. Connect an HC analyzer with a recorder, a manometer and a thermocoupler to the taps on the coupler on the vapor return line.

3.3.6. Connect tank fuel and vapor return lines to appropriate underground tank lines in accordance with written procedure for the system.

3.3.7. Check the tank truck and all vapor line connections for a tight seal before and during the test with the explosimeter.

3.3.8. Record the initial reading of gas meter(s).

3.3.9. Start filling of the storage tank in accordance with manufacturers' established normal procedure.

3.3.10. Hydrocarbon concentrations, temperature and pressure measurements should be recorded using stripchart recorders within the first 15 seconds of the unloading period. The gas meter reading is to be taken at 120 second intervals.

3.3.11. Record at the start and the end of the test, barometric pressure and ambient temperature.

3.3.12. At the end of the drop, disconnect the tank truck from the storage tank in accordance with manufacturers' instructions (normal procedures). Leave the underground vent instrumentation in place.

3.3.13. Continue recording hydrocarbon concentrations, temperature, pressure and gas meter readings at the storage tank vent and/or the exhaust of any processing unit at 20 minute intervals. Do this for one hour for balance systems and until the system returns to normal conditions as specified by the manufacturer for secondary systems.

3.3.14. Disconnect instrumentation from the vent(s).

3.3.15. Record volume of gasoline that is delivered.

3.3.16. Record final reading of gas meter.

3.4. Calculations:

3.4.1. Volume of gas discharged through "i_{th}" vent (V_{vi}). This includes underground tank vent and any other control system vent.

$$V_{vsi} = \frac{V_{vi} \times 528 \times P_b}{T_{vi} \times 29.92} \quad (ft^3)$$

Where:

V_{vsi} = Volume of gas discharged through "i_{th}" vent, corrected to 68°F and 29.92 in. Hg; (Ft^3).

P_b = Barometric Pressure, (in. Hg).

V_{vi}= Volume of gas recorded by meter on "i_{th}" vent, corrected for amount of vapor removed for the hydrocarbon analysis, (ft^3).

T_{vi} = Average temperature in "i_{th}" vent line, ($^{\circ}R$).

"i_{th}" = The vent under consideration.

3.4.2. Volume of gas returned to the tank truck, (V_t) corrected to 68°F and 29.92 in. Hg.

$$V_t = \frac{0.1337 \times G_t \times [528(P_b + \Delta H)]}{T_t \times 29.92} \quad (ft^3)$$

Where:

G_t = Volume of gasoline delivered, (gal)

$\underline{\Delta}H$ = Final gauge pressure of truck tank, (in Hg)

T_t = Average temperature of gas returned to tank truck, (°R)

P_b = Barometric pressure, (in. Hg)

T_t = Average temperature of gas returned to tank truck, (°R)

P_b = Barometric pressure, (in. Hg)

0.1337 = Conversion factor gallons to ft^3

3.4.3. Control Efficiency (E%):

$$E\% = \frac{V_t \times C_t \times 100}{(V_t \times C_t) + \sum(C_{vi} \times V_{vsi})}$$

Where:

E% = the efficiency of control in percent.

V_t = From 3.4.2 above

Ct = The average fractional volume concentration of gasoline vapor in the return line to the truck as determined by the hydrocarbon analyzer, (decimal fraction).

Cvi = The average fractional volume concentration of gasoline vapor in the "ith" vent as determined by the hydrocarbon analyzer, (decimal fraction).

V_{vsi} = From 3.4.1. above.

4.0 Test Procedure for Determining the Control Efficiency of Gasoline Vapor Incinerators

4.1. Principle and Applicability:

4.1.1. Principle: Hydrocarbon and carbon dioxide concentrations in the exhaust gases, and gas volume and HC concentrations in the inlet vapor, and ambient carbon dioxide concentrations are measured. These values are used to calculate the incinerator HC control efficiency and mass emission rate based on a carbon balance.

4.1.2. Applicability: This method is applicable as a performance test method for gasoline vapor control incinerators.

4.2. Test Scope and Conditions:

4.2.1. Station Status: The procedure is designed to measure incinerator control efficiency under conditions that may be considered normal for the station under test. All dispensing pumps interconnected with or sharing the control system under test shall remain open as is normal. Vehicles shall be fueled as is normal for the test period.

4.2.2. Fuel Reid Vapor Pressure (RVP): The RVP of the fuel dispensed during the test shall be within the range normal for the geographic location and time of the year.

4.3. Test Equipment:

4.3.1. HC Analyzers: HC analyzers using flame ionization detectors calibrated with known concentrations of propane in air are used to measure HC concentrations at both the incinerator inlet and exhaust. A suitable continuous recorder is required to record real-time output from the HC analyzers.

4.3.2 Sample System: The sample probe is to be of a material unaffected by combustion gases (S.S. 307, 316, 3365, etc.). The sample pump should be oil-less and leak-tight. Sample lines are to be inert, teflon is recommended. A thermocouple (0-2000^{o}F) shall be used to monitor temperature of exhaust gases at the inlet to sampling system.

4.3.3 Carbon Dioxide Analyzer: A non-dispersive infrared analyzer calibrated with known quantities of CO_2 concentrations in the exhaust gas.

4.3.4 Other equipment is specified in Section 3.2.

4.4 Test Procedure:

4.4.1 The sampling point should be located in the exhaust stack down-stream of the burner far enough to permit complete mixing of the combustion gases. For most sources, this point is at least eight stack diameters downstream of any interference and two diameters upstream of the stack exit. There are many cases where these conditions cannot be met. The sample point should be no less than one stack diameter from the stack exit and one stack diameter above the high point of the flame and be a point of maximum velocity head as determined by the number of equal areas of a cross-section of the stack. The inlet sampling location is in the system inlet line routing vapors to the burner. A HC sample tap, a pressure sensor tap, and a thermocouple connection to monitor gas temperature must be installed on the inlet side of the volume meter.

4.4.2 Span and calibrate all monitors. Connect sampling probes, pumps and recorders to the monitors and mount sampling probes in the stack and at the inlet.

4.4.3 Mark strip charts at the start of the test period and proceed with HC, CO_2, and volume measurements for at least three burning cycles of the system. The total sampling time should be at least three hours. Sampling for HCs and CO_2 must occur simultaneously. At the end of each cycle, disconnect CO_2 instrument and obtain an ambient air sample. This step requires that the CO_2 instrument be calibrated for the lower concentrations expected at ambient levels.

4.4.4 The quantity of gasoline dispensed during each test shall be recorded.

4.5 Calculations:

CO_{2e} = Carbon dioxide concentration in the exhaust gas (ppmv).

CO_{2a} = Average carbon dioxide concentration in the ambient air (ppmv).

HC_i = Hydrocarbon concentration in the inlet gas to the burner (ppmv as propane).

HC_e = Hydrocarbon concentration in the exhaust (ppmv as propane).

L_d = Gasoline liquid volume dispensed during test period (gallons).

P_i = Static pressure at inlet meter (in Hg).

T_i = Temperature of gas at inlet meter (^oR).

V_i = Inlet gas volume ($ft.^3$).

F = Dilution Factor.

51.8×10^{-6} = Multiplication factor to convert parts per million by volume as propane to grams per cubic foot at 68°F. (52.7×10^{-6} at 68°F)

4.5.1 Calculate the standard total gas volume (V_s) at the burner inlet for each test. (Standard temperature 68°F, standard pressure 29.92 in Hg)

$$V_s = V_i \ X \ \frac{(P_i + P_b)}{(T_i)} \ x \ \frac{528}{29.92} \ (SCF) \qquad (1)$$

4.5.2 Calculate an average vapor volume to liquid volume (v/1) at the inlet for each test.

$$(v/1)_i = \frac{V_s}{L_d} \text{ , (SCF/gal)} \qquad (2)$$

4.5.3 Calculate the mass emission rate $(m/l)_i$ at the inlet for each test.

$$(m/l)_i = 51.8 \times 10^{-6} \ x \ HC_i \ x \ (v/l)_i, \text{ (g/gal)} \qquad (3)$$

4.5.4 A carbon dilution factor (F) can be calculated for the incinerator using the inlet and outlet HC concentrations and the ambient CO_2 concentration. The important criterion for this is that all the significant carbon sources be measured. The values used in the calculation should represent average values obtained from strip chart readings using integration techniques. Some systems have more than one burning mode of operation. For these, it is desirable to have high and low emission levels calculated. This requires that corresponding dilution factors, (v/l) values and $(m/l)_i$ values be calculated for each period in question.

$$F = \frac{HC_i}{HC_e + \frac{(CO_{2e} - CO_{2a})}{3}} \qquad (4)$$

4.5.5 The mass emission rate at the exhaust, $(m/l)_e$, is calculated using the inlet $(m/l)_i$ from equation (3) and the carbon dilution factor from equation (4). The exhaust HC concentration will vary with time and operation of the system. It is likely that, in addition to an overall average mass emission rate using an average HCi, several peak values of $(m/l)_e$ will be required as discussed above. If some correlations between HC_i and HC_e occur over the burning cycle of the system, this calculation should be used to show the change in mass emission rate.

$$(m/l)_e = F \times \frac{HC_e}{HC_i} \times (m/l)_i \text{ g/gal} \qquad (5)$$

4.5.6 Mass control efficiency (E%) can be calculated for an average value over each interval. It represents the reduction of hydrocarbon mass achieved by the incinerator system and this efficiency can vary depending on the loading cycle or the inlet loading.

$$E\% = 100\,[1 - (F \times HC_e)/(HC_i)] \qquad (6)$$

5.0 Acceptance of Systems:

When a system is accepted, it will have certain physical features, such as piping sizes and configurations, which may have to be modified to accommodate the requirements of each installation. Because the pressure drops and other characteristics of the system are influenced by these features and these in turn influence effectiveness, it may be necessary to condition acceptance upon certain criteria which account for physical parameters such as pressure drops and flow rates. When systems are tested for acceptance, these parameters must be ascertained. Some of the conditions that may be imposed upon an acceptance are:

5.1 Allowable pressure drop in the lines leading from the dispensing nozzle to the underground tank.

5.2 The method of calculating the pressure drop.

5.3 The model of dispensing nozzle which may be used.

5.4 The manner in which vapor return lines may be manifolded.

5.5 The type of restriction to be placed on the vent of the underground tank.

5.6 The number of dispensing nozzles which may be serviced by a secondary system.

5.7 Allowable delivery rates.

5.8 Use of the system on full-service stations only.

6.0 Calibration of Equipment:

6.1 Standard methods of equipment shall be used to calibrate the flow meters. The calibration curves to be traceable to National Institute of Standards & Technology (NIST) standards.

6.2 Calibrate temperature recording instruments immediately prior to test period and immediately following test period using ice water (32°F) and a known temperature source about 100°F.

6.3 Calibrate pressure sensing and recording instructions (transducers) prior to the Phase I test with a static pressure calibrator for a range of -3 to +3 inches water or appropriate range of operation. Zero the transducers after each individual test.

6.4 Flame ionization detectors or equivalent total hydrocarbon analyzers are acceptable for measurement of exhaust hydrocarbon concentrations. Calibrations should be performed following the manufacturer's instructions for warm-up time and adjustments. Calibration gases should be propane in hydrocarbon-free air prepared with measured quantities of 100 percent propane. A calibration curve shall be produced using a minimum of five (5) prepared calibration gases in the range of concentrations expected during testing. The calibration of the instrument need not be performed on site, but shall be performed prior to and immediately following the test program. During the test program, the HC analyzer shall be spanned on site with zero gas (3 ppmv C) and with 30 percent and 70 percent concentrations of propane in hydrocarbon-free air at a level near the highest concentration expected. The spanning procedure shall be performed at least twice each test day.

The HC calibration cylinders must be checked against a reference cylinder maintained in the laboratory before each field test. This information must be entered into a log identifying each cylinder by serial number. The reference cylinder must be checked against a primary standard every six months and the results recorded. The reference cylinder is to be discarded when the assayed value changes more than one percent. and when the cylinder pressure drops to 10 percent of the original pressure.

6.5 Non-dispersive infrared analyzers are acceptable for measurement of exhaust CO_2 concentrations. Calibrations should be performed following the manufacturer's instructions. Calibration gases should be known concentrations of CO_2 in the air. A calibration shall be prepared using a minimum of five prepared calibration gases in the range of concentration expected. The calibration of the instrument need not be performed on site but shall be performed immediately prior to and immediately following the test program. During the testing, the analyzer shall be spanned with a known concentration of CO_2 in the air at a level near the highest concentration expected. The spanning procedure shall occur at least twice per test day.

6.6 The barometer shall be calibrated against an NIST traceable standard at least once every 6 months.

6.7 A record of all calibrations must be maintained and submitted with the test report.

7.0 Alternate Equipment

Alternate equipment and techniques may be used if prior written approval is obtained from DEQ.

8.0 Recordkeeping:

A record of the results for tests which are performed for compliance determination shall be maintained at the facility site according to OAR 340-232-0080 and 340-232-0100.

FIGURE A – DISPLACEMENT SYSTEM

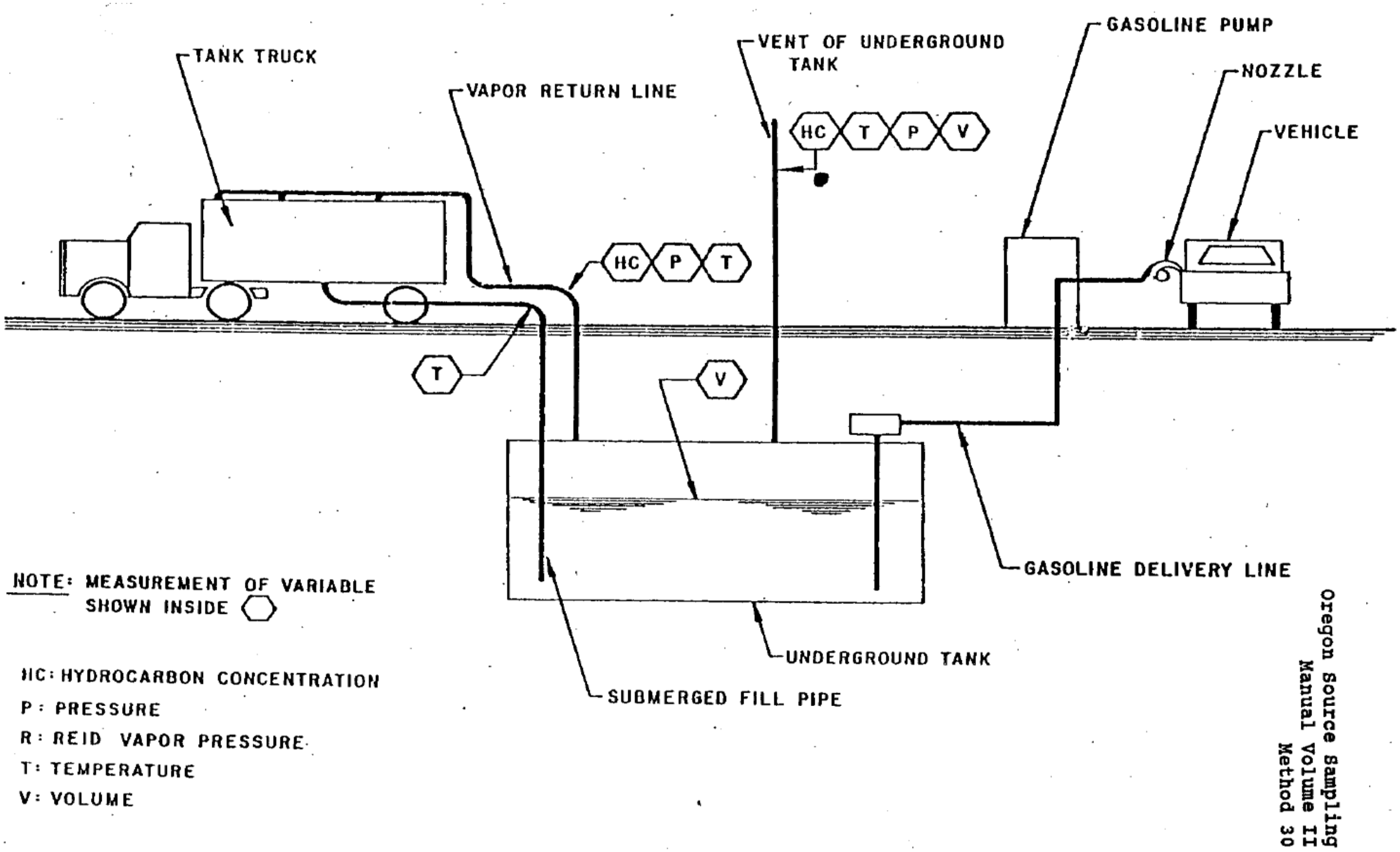
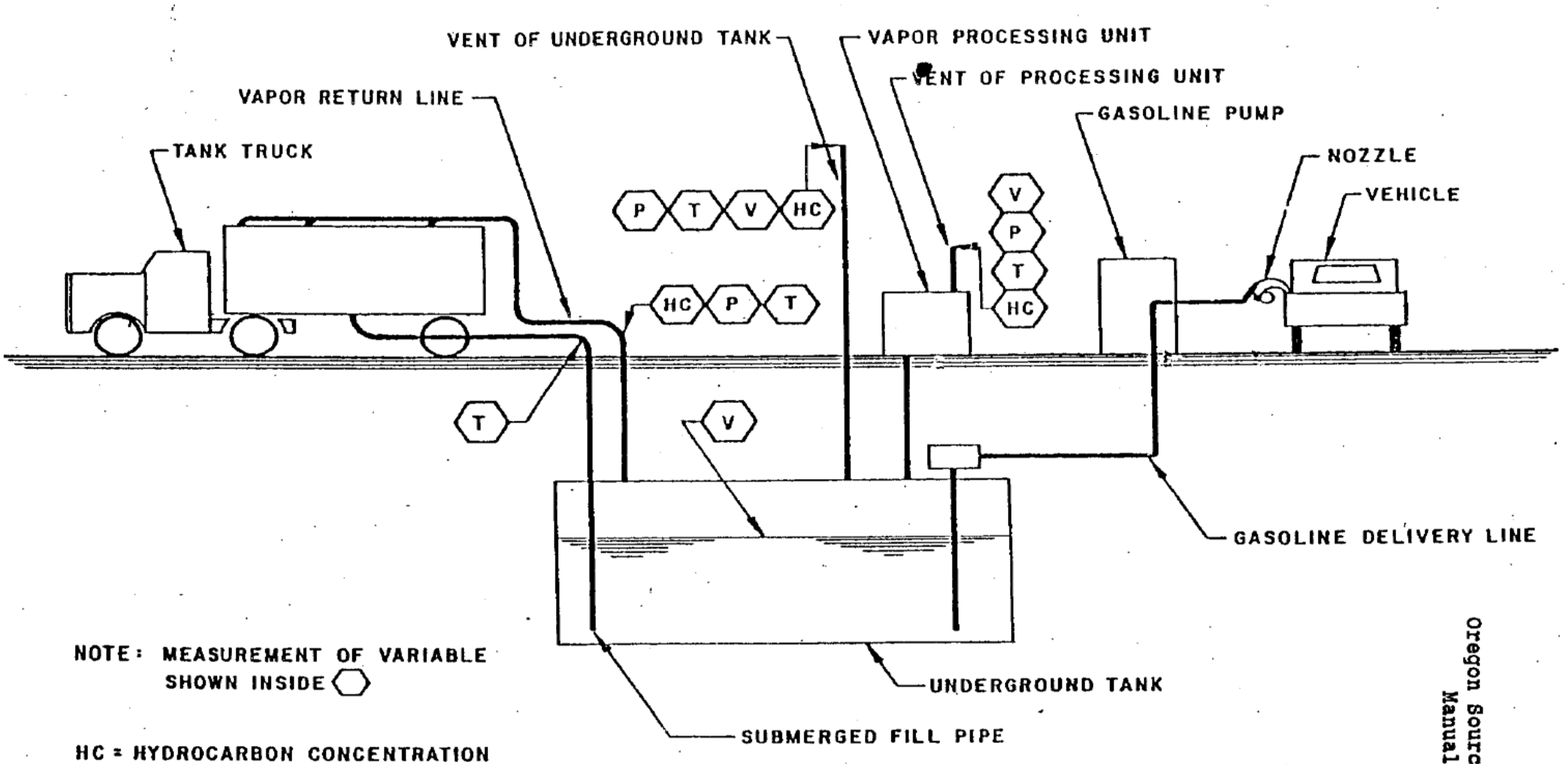


FIGURE A DISPLACEMENT SYSTEM

FIGURE B – VACUUM ASSISTED SECONDARY



HC = HYDROCARBON CONCENTRATION
P = PRESSURE
R = REID VAPOR PRESSURE
T = TEMPERATURE
V = VOLUME

FIGURE B VACUUM ASSISTED SECONDARY

Oregon Source Sampling
Manual Volume II
Method 30

DEQ METHOD 31

Test Procedures for Determining the Efficiency of Vapor Control Systems at Gasoline Bulk Plants

STATE OF OREGON
DEPARTMENT OF ENVIRONMENTAL QUALITY

DEQ Air Quality Program
Portland, Oregon
December 1, 1980

Revisions:
May 15, 1981
January 23, 1992

Method 31

Test Procedures for Determining the Efficiency of Vapor Control Systems at Gasoline Bulk Plants

1.0 Introduction:

1.1 Principle:

Hydrocarbon mass emissions are determined directly using flowmeters and hydrocarbon analyzers.

The mass of hydrocarbon vapor to be controlled or recovered is determined from the volume of gasoline dispensed (either to the bulk storage tank or delivery tank) by pressure, temperature, and concentration measurements of the vapor.

The efficiency of the gasoline vapor control system is determined from the mass of the hydrocarbons emitted and the mass of hydrocarbons controlled.

For purposes of determining compliance with applicable Administrative Rules, equipment on systems with 90 percent or greater control efficiency shall be considered to be vapor tight.

1.2 Applicability:

These procedures are applicable for testing gasoline vapor recovery systems installed at bulk plants for controlling gasoline vapors emitted during the load of bulk storage tanks and for loading of delivery tanks from bulk tanks. Filling of storage tanks will be by submerged fill.

2.0 Acceptance Of Test Results:

2.1 Results of this method will be accepted as a demonstration of compliance of the equipment tested, provided that the methods included or referenced in this procedure are strictly adhered to. A statement containing at least the minimum amount of information regarding the test procedures applied should be included with the results.

Deviations from the procedure described herein will be permitted only if permission from DEQ is obtained in writing in advance of the test.

3.0 Definitions:

3.1 Bulk Gasoline Plant:

"Bulk Gasoline Plant" means a gasoline storage and distribution facility which receives gasoline from bulk terminals by railroad car or trailer transport, stores it in tanks, and subsequently dispenses it via account trucks to local farms, businesses, and gasoline dispensing facilities.

3.2 Delivery Vessel:

"Delivery Vessel" means any tank truck or trailer used for the transport of gasoline from sources of supply to stationary storage tanks.

3.3 Vapor Balance System:

"Vapor Balance System" means a combination of pipes and/or hoses which create a closed system between the vapor spaces of an unloading tank and a receiving tank such that vapors displaced from the receiving tank are transferred to the tank being unloaded.

3.4 Secondary Processing Unit:

"Secondary Processing Unit" means a gasoline vapor control system which utilizes some process as a means of elimination or recovering gasoline vapors which otherwise would be vented to the atmosphere during the transfer of gasoline to or from a bulk plant.

4.0 Test Of Vapor Recovery System For Delivery Of Gasoline To The Bulk Plants:

4.1 Application:

The following test procedures are for determining the efficiency of vapor recovery systems controlling gasoline vapors emitted during the loading of bulk plant storage tanks.

4.2 Principle and Test Conditions:

4.2.1 Principle: During a fuel delivery to the bulk plant, direct measurements of hydrocarbon concentrations and volume of hydrocarbon vapors vented (including emissions from any vapor processing unit) are made. All possible points of emission are checked for vapor leads. The volume of gasoline delivery from the delivery tank to the bulk plant is recorded and the concentration of the hydrocarbon vapors returned to the delivery tank is measured. The efficiency of control is calculated from these determinations.

4.2.2 Test Conditions: The number of transport deliveries to be tested shall be established by DEQ based on an engineering evaluation of the system. As close as possible, the system shall be tested under normal operating conditions. (Dispensing rates shall be at the maximum rate possible consistent with safe and normal operating practices. The processing unit, if any, shall be operated in accordance with the manufacturer's established parameters. Simultaneous use of more than one dispenser during loading of bulk storage tanks shall occur to the extent that such would normally occur.)

4.3 Equipment Required for Bulk Plant Testing:

4.3.1 Two (2) positive displacement dry gas meters each with a capacity of 3,000 standard cubic feet per hour (SCFH) a readability of one cubic foot and a maximum pressure drop of not more than 0.50 inches of water at a flowrate of 30 SCFH.

4.3.2 Two (2) hydrocarbon (HC) analyzers with recorders and with the capability of measuring total gasoline vapor concentration of 100 percent as propane. Both analyzers to be of same make and model, either Flame Ionization Detector or a DEQ approved equivalent.

4.3.3 Three (3) flexible thermocouples or thermistors (0-150^{o}F) with a temperature recorder system having a readability of 1^{o}.

4.3.4 Barometer (Aneroid or Mercury), ± 0.1 in. Hg. readability.

4.3.5 Two (2) manometers or other pressure sensing devices capable of measuring zero to ten inches of water with a readability of 0.1 inches of water.

4.3.6 Coupling for the vent vapor line to accommodate the gas meter, with thermocouple and pressure taps. Coupling to be sized for a minimum pressure drop.

4.3.7 Coupling for the vent of the secondary processing unit, if used, to accommodate the flow measuring device with the thermocouple, pressure and hydrocarbon analyzer taps. Coupling to be sized for a minimum pressure drop.

4.3.8 Coupling for delivery tank vapor return line with thermocouple, pressure and hydrocarbon analyzer taps. Coupling to be the same diameter as the vapor return line.

4.3.9 Two (2) adjustable pressure/vacuum (PV) relief valves capable of replacing the PV relief valve on the storage tank vent.

4.3.10 Coupling for attaching the PV value to the dry gas meter. (Appendix Figure A)

4.3.11 Explosimeter.

4.4 Bulk Plant Storage Tank Loading Test Procedure (Figure A):

4.4.1 Connect appropriate coupler to vent of bulk plant, or if the vent has a PV valve, remove the PV valve and then connect the coupler to the vent. If a Secondary Processing Unit is used, also connect a coupler to the vent of the secondary processing unit.

4.4.2 Connect the appropriate gas meter, HC analyzer with recorder, thermocouple and manometer to the vent coupler and connect the PV valve to the gas meter.

4.4.3 Connect appropriate coupler to the delivery tank vapor return lines.

4.4.4 Connect the HC analyzer with a recorder, a manometer and a thermocouple to the taps on the vapor return line.

4.4.5 Connect delivery tank fuel and vapor return lines to appropriate bulk tank lines in accordance with the owner's or operator's established procedures for the system.

4.4.6 Check the delivery tank and all connections for a tight seal with explosimeter before and during the test.

4.4.7 Record the initial reading of the gas meter(s).

4.4.8 Start loading of the bulk tank in accordance with owner's or operator's established normal procedure.

4.4.9 Hydrocarbon concentrations, temperature and pressure measurements should be recorded starting after the first 15 seconds of the loading periods followed by 60 second intervals. The gas meter readings must be taken at least every 120 seconds.

4.4.10 Record barometric pressure and ambient temperature during the test.

4.4.11 At the end of the bulk tank delivery, disconnect the delivery tank from the bulk tank in accordance with owner's or operator's instructions (normal procedure). Leave the bulk tank vent instrumentation in place.

4.4.12 Continue recording hydrocarbon concentrations, temperature, pressure, and gas meter readings at the bulk tank vent at 20 minute intervals for one hour after the last bulk transfer is made.

4.4.13 Disconnect instrumentation from the vent.

4.4.14 Record volume of gasoline that is delivered.

4.4.15 Record final reading of gas meter(s).

4.5 Calculations:

4.5.1 Volume of gas discharged through "i th" vent. This includes bulk tank vent and any control system vent.

$$V_{vsi} = \frac{V_{vi} \times 528 \times P_b}{T_{vi} \times 29.92}$$

Where:

V_{vsi} = Volume of gas discharged through "i th" vent corrected to 68°F and 29.92 in. Hg, \ (ft^3).

P_b = Barometric pressure, (in. Hg).

V_{vi} = Volume of gas recorded by meter on "ith" vent corrected for amount of vapor removed for the hydrocarbon analysis, (ft^3).

T_{vi} = Average temperature in "i th" vent line, (°R).

4.5.2 Volume of gasoline vapor returned to the tank truck.

$$V_t = \underline{0.1337G_t \times 528(P_b + P)}$$

$$T_t \times 29.92$$

Where:

P_b = Barometric pressure, (in. Hg).

V_t = Volume of gasoline vapor, corrected to 68°F and 29.92 in. Hg., (ft^3)

G_t = Volume of gasoline delivered, (gal.).

P = Final Gauge pressure of tank truck, (in. Hg).

T_t = Average temperature of vapor returned to tank truck (°R).

0.1337 = Conversion factor, (gallons to ft^3). 1 US gal. = 0.1337 ft^3.

4.5.3 Efficiency of Vapor Control System

$$E = \frac{V_t \times C_t - (C_{vi} \times V_{vsi})\ 100}{(V_t \times C_t)}$$

Where:

E = the efficiency of control in percent.

C_t = The average fractional volumetric concentration of gasoline vapors in the return line to the truck as determined by the hydrocarbon analyzer, (decimal fraction).

C_{vi} = The average fractional volumetric concentration of gasoline vapors in the "i_{th}" vent as determined by the hydrocarbon analyzer, (decimal fraction).

5.0 Testing Of Vapor Recovery System For Filling of A Delivery Tank At A Bulk Plant:

5.1 Application:

The following test procedures shall be used for determining the efficiency of vapor recovery systems controlling gasoline vapors emitted during the filling of delivery tanks at a bulk plant.

5.2 Principle and Test Conditions:

5.2.1 Principle: During loading of a delivery tank at the bulk plant, direct measurements of hydrocarbon concentrations and volume of hydrocarbons vented (including emissions from any vapor processing unit) are made. All possible points of emission are checked for vapor leaks. The volume of gasoline dispensed to the delivery tank is recorded and the concentration of the hydrocarbon vapors returned to the bulk storage tank is measured. The efficiency of control is calculated from these determinations.

5.2.2 **Test Conditions:** The number of delivery tank loadings to be testing shall be established by DEQ based on an engineering evaluation. The system shall be tested under normal operating conditions as close as possible. (Dispensing rates shall be at the maximum rate possible consistent with safe and normal operating practices, and simultaneous use of more than one dispenser during loading of delivery tanks shall occur to the extent that such use would represent normal operation of the system).

5.3 Equipment Required for Delivery Tank Testing at the Bulk Plant:

5.3.1 Same as that required in Section 4.3.

5.4 Delivery Tank Loading Test Procedures:

5.4.1 Connect coupler to vent of bulk tank, or if the vent has a PV valve, remove the PV valve and then connect the coupler to the vent. If a secondary processing unit is used, also connect a coupler to the vent of the secondary processing unit.

5.4.2 Connect the appropriate gas meter, HC analyzer with recorder, thermocouple and manometer to the vent coupler and connect the PV valve to the gas meter.

5.4.3 Connect a coupler to the bulk storage tank vapor return lines.

5.4.4 Connect a HC analyzer with a recorder, a manometer and a thermocouple to the taps on the coupler on the vapor return line.

5.4.5 Connect bulk storage tank fill and vapor return lines to the delivery tank in accordance with owner's or operator's established procedures for the system.

5.4.6 Check the delivery tank and all connections for a tight seal with the explosimeter before and during the test.

5.4.7 Record the initial reading of the gas meter(s).

5.4.8 Start fueling of the delivery tank in accordance with manufacturer's established normal procedure.

5.4.9 Hydrocarbon concentrations, temperature and pressure measurements are to be recorded starting after the first 15 seconds of the unloading period followed by 60 second intervals. The gas meter readings may be taken at 120 second intervals.

5.4.10 Record the barometric pressure and ambient temperature before and after the test.

5.4.11 At the end of the delivery tank loading disconnect the delivery tank from the bulk tank in accordance with owner's or operator's instructions (normal procedure). Leave the bulk tank vent instrumentation in place.

5.4.12 Continue recording hydrocarbon concentrations, temperatures, pressure and gas meter readings at the bulk tank vent at 20 minute intervals for one hour, or until the system returns to normal conditions as specified by the manufacturer.

5.4.13 Disconnect instrumentation from the vent.

5.4.14 Record volume of gasoline that is delivered.

5.4.15 Record final reading of gas meter.

5.4.16 Repeat procedure as necessary for additional delivery tank loading.

5.5 Calculations:

5.5.1 Volume of gas discharged through "i th" vent. This includes bulk tank vent and any control system vent.

$$V_{vsi} = \frac{V_{vi} \times 528 \times P_b}{T_{vi} \times 29.92}$$

Where:

V_{vsi} = Volume of gas discharged through "i_{th}" vent corrected to 68° F and 29.92 in. Hg, (ft^3).

P_b = Barometric pressure, (in. Hg).

V_{vi} = Volume of gas recorded by meter on "i_{th}" vent (ft^3, corrected for amount of vapor removed for the hydrocarbon analysis).

T_{vi} = Average temperature in "i_{th}" vent line, (°R).

"i_{th}"= The vent under consideration.

5.5.2 Volume of gas returned to the bulk storage tank.

$$V_t = \frac{0.1337 G_t \times 528 (P_b + P)}{T_t \times 29.92}$$

Where:

P_b = Barometric pressure, (in. Hg).

V_t = Volume of gas returned to the bulk storage tank corrected to 68°F and 29.92 in. Hg, (ft^3).

G_t = Volume of gasoline delivered, (gallons).

P = Final gauge pressure of bulk storage tank, (in. Hg).

T_t = Average temperature of vapor returned to bulk storage tank, (°R).

0.1337 = Conversion factor, (gallons to Ft^3). 1 US gal. = 0.1337 ft^3.

5.5.3 Efficiency of Vapor Control System

$$E_j = \frac{V_t \times C_t - \Sigma(C_{vi} \times V_{vsi}) \times 100}{(V_t \times C_t)}$$

Where:

E_j = The efficiency of control per individual fueling in percent.

C_t = The average fractional volume concentration of gasoline vapors in the return line to the bulk storage tank as determined by the hydrocarbon analyzer, (decimal fraction).

C_{vi} = The average fractional volume concentration of gasoline vapors in the "i_{th}" vent as determined by the hydrocarbon analyzer, (decimal fraction).

$_j$ = The individual loading considered.

$$E_{ave} = \frac{\sum_{j=1}^{n} E_j}{n}$$

Where:

E_{ave} = The average efficiency of control in percent.

E_j = From 5.5.3 above.

n = Number of Loadings Tested.

6.0 Calibrations

6.1 Flow meters

Standard methods and equipment shall be used to calibrate the flow meters within thirty (30) days prior to any test or test series. The calibration curves are to be traceable to NIST.

6.2 Temperature measuring instruments

Calibrate immediately prior to any test period and immediately following test period using ice water (32^oF.) and a known temperature source of about 100^oF.

6.3 Pressure measuring instruments

Calibrate pressure transducers within thirty (30) days prior to the test period and immediately after the test period with a static pressure calibrator of known accuracy.

6.4 Total hydrocarbon analyzer

Follow the manufacturer's instruction concerning warm-up time and adjustments. On each test day prior to testing and at the end of the day's testing, zero the analyzer with a zero gas (3 ppm C) and span with 30 percent and 70 percent concentrations of propane.

6.5 A record of all calibrations made is to be maintained.

7.0 Recordkeeping

A copy of the results of these tests which are performed for compliance determination shall be maintained at the facility site according to OAR 340-232-0080 and 340-232-0100.

FIGURE A - BULK TANK TEST APPARATUS

Oregon Source Sampling
Manual Volume II
Method 31

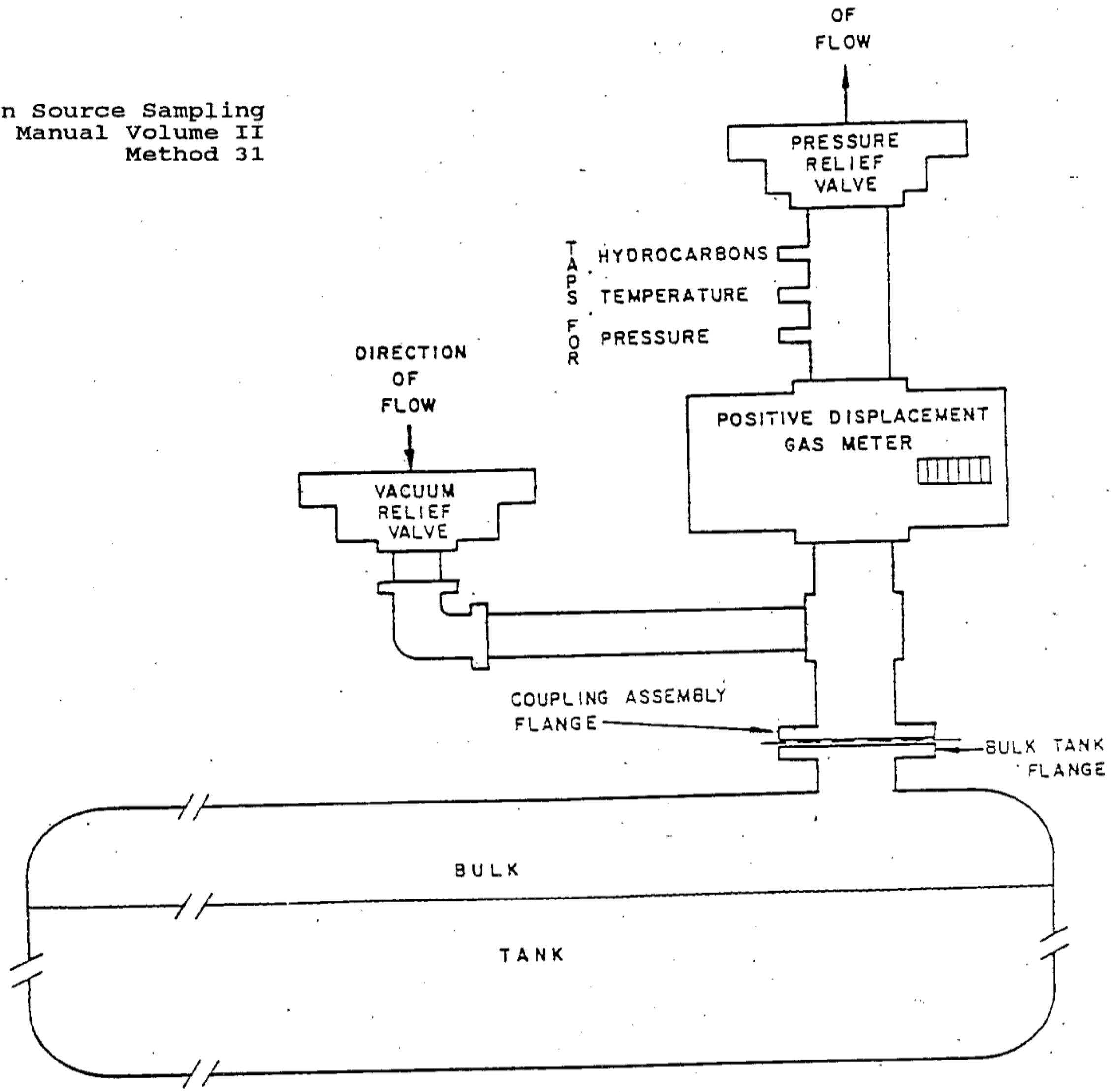
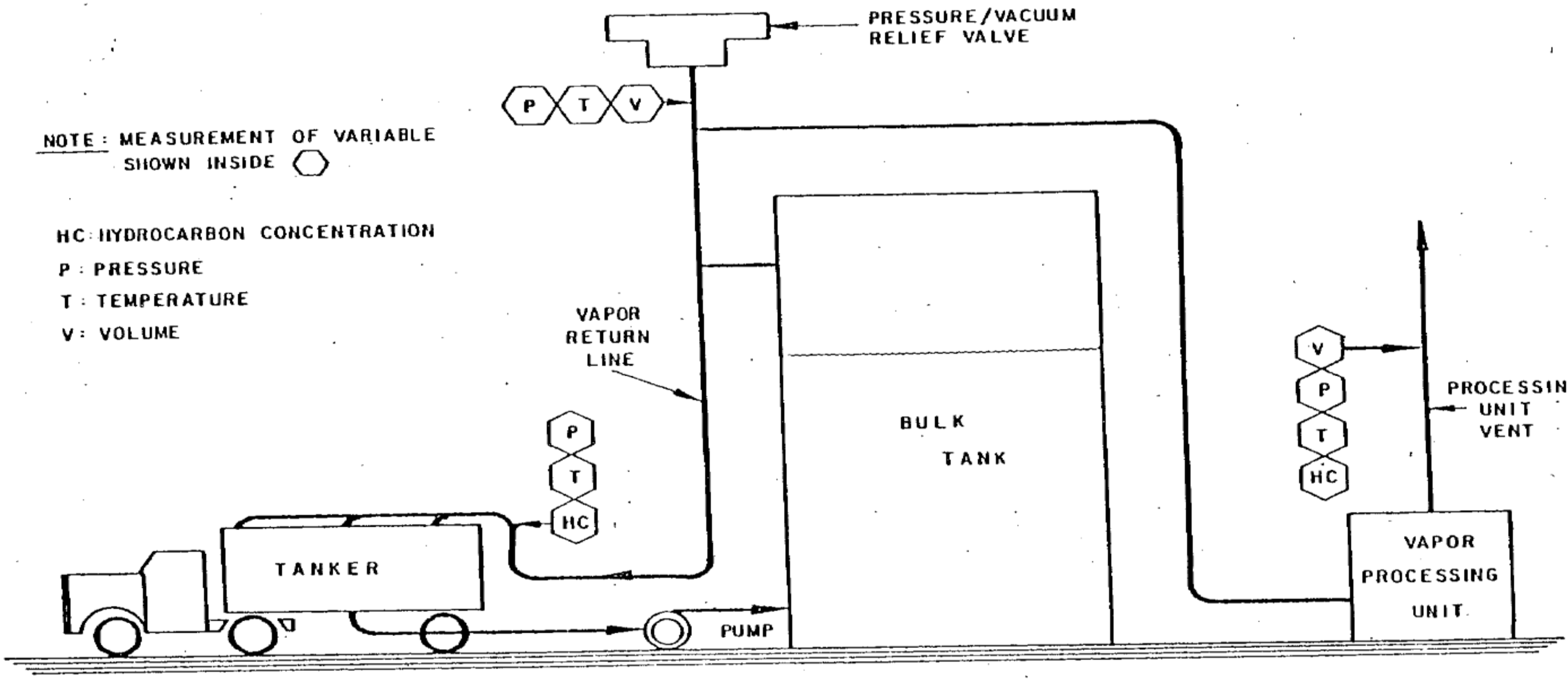


FIGURE A
BULK TANK
TEST APPARATUS

METHOD 31

FIGURE B - GASOLINE TRANSFER FROM DELIVERY TANK TO BULK PLANT



METHOD 31

FIGURE · B
GASOLINE TRANSFER
FROM DELIVERY TANK TO BULK PLANT

Manual Volume 11
Method 31

FIGURE C - GASOLINE TRANSFER FROM BULK PLANT TO DELIVERY TANK

Oregon Source Sampling
Manual Volume II
Method 30

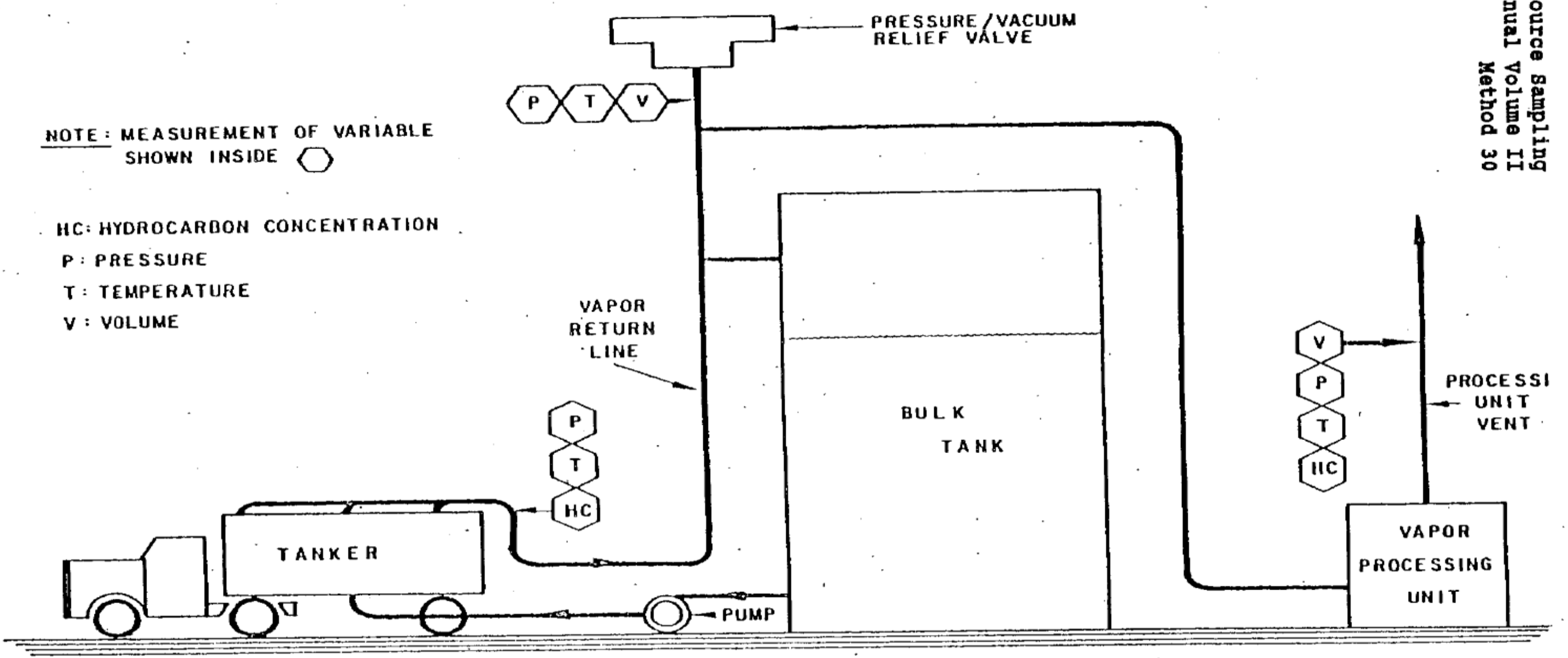


FIGURE-C
GASOLINE TRANSFER
FROM BULK PLANT TO DELIVERY TANK

METHOD 31

FIGURE D – DATA SHEET

Gasoline Vapor Control Equipment Test Method # ____________

Date of Test ______________________
Ambient Temperature ______________ °F
Barometric Pressure ______________ In.Hg

Plant ______________________
Address ______________________
____
Operator ______________________

Gasoline Handling Process:

Start Time: Finish Time: Test Time: Test Run # Gals Del.

Test Equipment Location:

#	Time	Meter Reading	Press	Temp	HC	#	Time	Meter Reading	Press	Temp	HC	

FIGURE E – CALCULATION SHEET

Vapor Control Equipment Efficiency Determination

Test Method: ________

Date: ________________

Test Run # __________

Plant ______________________________

Address ____________________________

____

Test Equipment Location: ____

____

Calculations: (Refer to Paragraphs 4.5 or 5.5 in test Procedure.)

Volume of gas discharged through "i th" vent.

$$V_{si} = \frac{V_{vi} \times 520 \times P_b}{T_{vi} \times 29.92}$$

Volume of gasoline vapor returned to bulk tank or tank truck

$$V_t = \frac{0.1337\ G_t \times 520\ (P_b + \Delta P)}{T_t \times 29.92}$$

Efficiency of Vapor Control System

$$E \text{ or } E_j = \frac{\left[V_t \times C_t - \sum (C_{vi} \times V_{vs})\right]}{V_t \times C_t} \times 100$$

E = Bulk Plant Loading Test

E_j = Delivery Tank Loading Test

Average Efficiency of All Loadings Tested

$$E_{ave} \quad \frac{\sum_{j=1}^{n} E_j}{n}$$

METHOD 31

DEQ METHOD 32

Test Procedures for Vapor Control
Effectiveness of Gasoline Delivery Tanks

STATE OF OREGON
DEPARTMENT OF ENVIRONMENTAL QUALITY

DEQ Air Quality Program
Portland, Oregon
December 1, 1980

Revisions:
May 15, 1981
January 23, 1992

Method 32

Test Procedures for Vapor Control Effectiveness of Gasoline Delivery Tanks

1.0 Introduction:

1.1 Principles:

Pressure and vacuum are applied to the compartments of gasoline truck tanks and the change in pressure/vacuum is recorded after a specified period of time.

1.2 Applicability:

This method is applicable to determining the leak tightness of gasoline truck tanks in use and equipped with vapor collected equipment.

2.0 Acceptance Of Test Results

2.1 Results from this method will be accepted as a demonstration of compliance provided that the methods included or referenced in this procedure are strictly adhered to. A report containing at least the minimum amount of information regarding the test should be included with the results. Deviations from the procedures described herein will be permitted only if permission from DEQ is obtained in writing in advance of the test.

3.0 Definitions

3.1 Delivery Tank:

Any container, including associated pipes and fittings, that is used for the transport of gasoline.

3.2 Compartment

A liquid-tight division in a delivery tank.

3.3 Delivery Tank Vapor Collection System

The entire delivery tank, including domes, dome vents, cargo tank, piping, hose connections, hoses and delivery elbow, and vapor recovery lines.

4.0 Apparatus

4.1 Pressure Source (See Figure B)

Pump or compressed gas cylinder of air or inert gas sufficient to pressurize the delivery tank to 6250 Pascals (25 inches H_2O) above atmospheric pressure.

4.2 Regulator

Low pressure regulator for controlling pressurization tank.

4.3 Vacuum Source

Vacuum pump of sufficient capacity to evacuate a tank to 2500 Pascals (10 inches H_2O) below atmospheric pressure. (The intake manifold of an "idling" gasoline engine is a very good vacuum source).

4.4 Manometer

Liquid manometer, or equivalent, capable of measuring up to 6250 Pascals (25 inches H_2O) gauge pressure with ± 25 Pascals (± 0.1 inches H_2O) readability. Manometer must be positioned vertically.

4.5 Test Cap for Vapor Recovery Hose Fittings

This cap should have a tap for the manometer connection with a fitting with shut-off valve and pressure/vacuum relief valves for connection to the pressure/vacuum supply hose.

4.6 Cap for Liquid Delivery Hose Fitting

4.7 Pressure/Vacuum Supply Hose

4.8 Pressure/Vacuum Relief Valves

The test apparatus shall be equipped with an in-line pressure/vacuum relief valve set to activate at 7000 Pascals (28 inches H_2O) above atmospheric pressure or 3000 Pascals (12 inches H_2O) below atmospheric pressure, with a capacity equal to the pressurizing or evacuating pumps.

5.0 Pretest Condition

5.1 Purging of Vapor

The delivery tank shall be purged of gasoline vapors and tested empty. The tank may be purged by any safe method such as flushing with diesel fuel, heating fuel or jet fuel. (Hauling a load of above fuel before test may be performed.)

5.2 Location

The delivery tank shall be tested where it will be protected from direct sunlight or any other heat source which may affect the pressure/vacuum test results.

6.0 Visual Inspection

6.1 Inspection Procedure

The entire delivery tank including domes, dome vents, cargo tank, piping, hose connections, hoses and delivery elbow shall be inspected for any evidence of wear, damage or misadjustment that could be a potential lead source. Any part found to be defective shall be adjusted, repaired or replaced, as necessary, before the test.

7.0 Pressure Test Procedure

7.1 Pressure Test

7.1.1 The dome covers are to be opened and closed.

7.1.2 Connect static electrical ground connections to delivery tank. Attach the delivery and vapor hoses, remove the delivery elbows and plug the liquid delivery hose fitting with cap.

7.1.3 Attach the test cap vapor recovery hose of the delivery tank.

7.1.4 Connect the pressure/vacuum supply hose to the pressure/vacuum relief valve and the shut-off valve. Attach the pressure source to the supply hose. Attach a manometer to the pressure tap.

7.1.5 Connect compartments of the tank internally to each other, if possible.

7.1.6 Applying air pressure slowly, pressurize the tank, or alternatively the first compartment, to 4500 Pascals (18 inches of water).

7.1.7 Close the shut-off valve, allow the pressure in the delivery tank to stabilize. Adjust the pressure, if necessary, to maintain 4500 Pascals (18 inches of H_2O). Record the initial time and pressure.

7.1.8 At the end of five minutes, record the final time and pressure and then slowly vent tank to atmospheric pressure.

7.1.9 Repeat for each compartment if they were not interconnected.

7.1.10 If the reading is less than 3750 Pascals (15 inches of water), the tank or compartment fails the test. Delivery tanks which do not pass the pressure test are to be repaired and retested.

8.0 Vacuum Test Procedure

8.1 Connect vacuum source to pressure and vacuum supply hose.

8.2 Slowly evacuate the tank, or alternatively the first compartment to 1500 Pascals (6 inches of H_2O) vacuum.

8.3 Close the shut-off valve, allow the pressure in the delivery tank to stabilize. Adjust the vacuum, if necessary, to maintain 1500 Pascals (6 inches of water). Record initial time and pressure.

8.4 At the end of five minutes, record the final time and pressure and then slowly vent back to atmospheric pressure.

8.5 Repeat for each compartment if they were not interconnected.

8.6 If the reading is less than 750 Pascals (3 inches of water) vacuum, the tank or compartment fails the test. Delivery tanks which do not pass the vacuum test are to be repaired and retested.

9.0 Alternative Test Methods

9.1 Techniques, other than those specified above, may be used for purging, pressurizing, or evacuating the delivery tanks, if prior approval is obtained from DEQ. Such approval will be based upon demonstrated equivalency with the methods above.

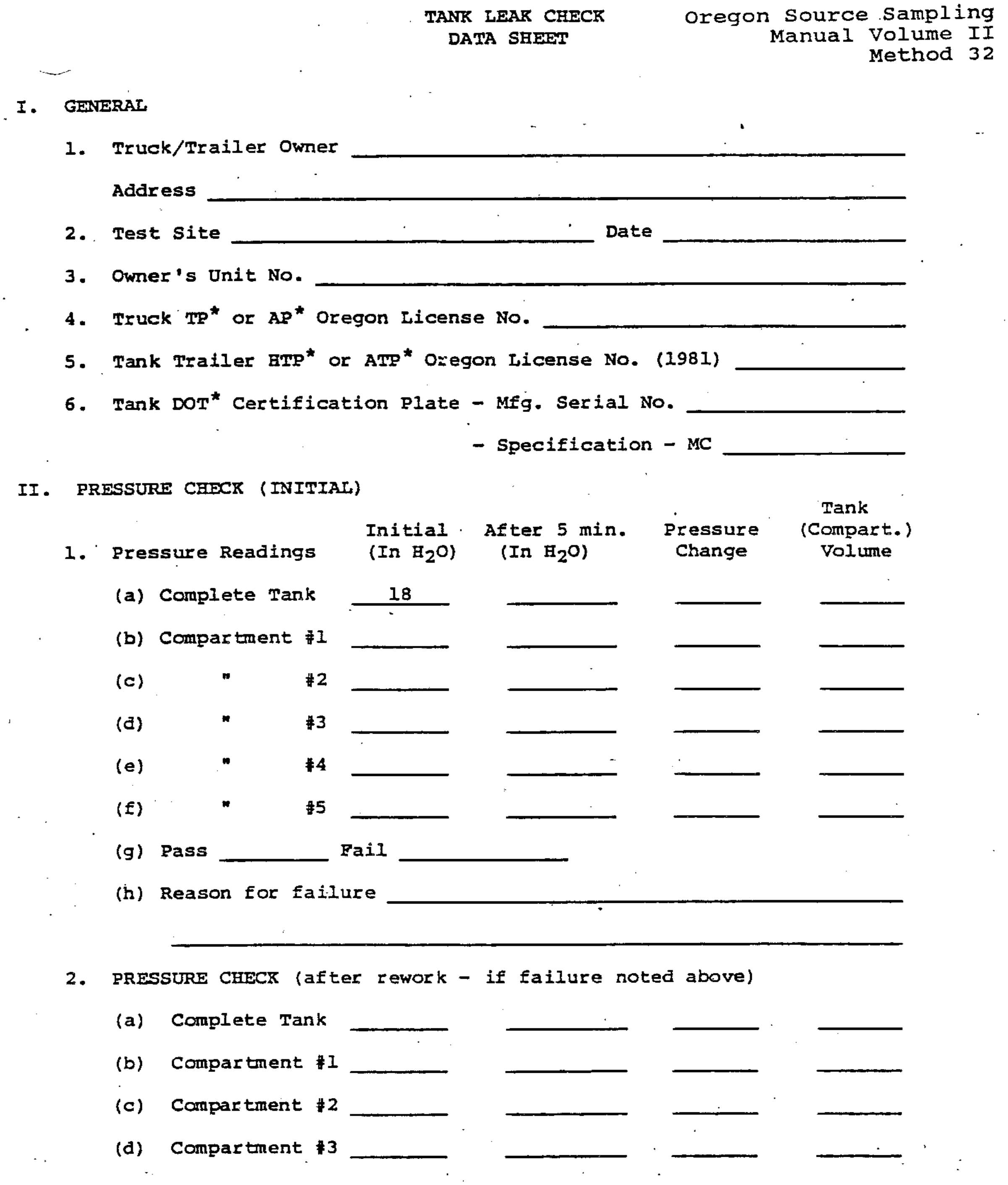
10.0 Test Reports

The contents of the following report form example shall be considered the minimum acceptable contents for reporting the results of the tests.

11.0 Recordkeeping

A copy of the results of these tests which are performed for compliance determination shall be maintained at the facility site and by the delivery tank owner according to OAR 340-232-0080 and 340-232-0100.

FIGURE A - DATA SHEET



TANK LEAK CHECK
DATA SHEET

Oregon Source Sampling
Manual Volume II
Method 32

I. GENERAL

1. Truck/Trailer Owner ____________________
   Address ____________________
2. Test Site ____________________ Date ____________
3. Owner's Unit No. ____________________
4. Truck TP* or AP* Oregon License No. ____________________
5. Tank Trailer HTP* or ATP* Oregon License No. (1981) ____________
6. Tank DOT* Certification Plate – Mfg. Serial No. ____________
   – Specification – MC ____________

II. PRESSURE CHECK (INITIAL)

1. Pressure Readings	Initial (In H_2O)	After 5 min. (In H_2O)	Pressure Change	Tank (Compart.) Volume
(a) Complete Tank	18			
(b) Compartment #1				
(c) " #2				
(d) " #3				
(e) " #4				
(f) " #5				

(g) Pass __________ Fail ______________

(h) Reason for failure ____________________________

____

2. PRESSURE CHECK (after rework – if failure noted above)

(a) Complete Tank				
(b) Compartment #1				
(c) Compartment #2				
(d) Compartment #3				

FIGURE A - DATA SHEET (Con’t)

	Initial (In H_2O)	After 5 min. (In H_2O)	Pressure Change	Tank (Compart.) Volume
(e) Compartment #4				
(f) Compartment #5				

(g) Pass ________ Fail ______________

(h) Reason for failure ____

____

3. VACUUM CHECK

	Initial (In H_2O)	After 5 min. (In H_2O)	Pressure Change	Tank (Compart.) Volume
(a) Complete Tank				
(b) Compartment #1				
(c) Compartment #2				
(d) Compartment #3				
(e) Compartment #4				
(f) Compartment #5				

(g) Pass ________ Fail ______________

(h) Reason for Failure ____

____

Signature of Person Conducting Test ________________________

Date ________________________

*TP - Truck Plate (use Item 4 if truck and tank are on the same chassis)
AP - Apportionment Plate (use Item 4 if truck and tank are on the same chassis)
HTP - Heavy Trailer Plate (use Item 5 for a tank trailer)
ATP - Apportionment Trailer Plate (use Item 5 for a tank trailer)
DOT - Department of Transportation

FIGURE B – GASOLINE TANKS

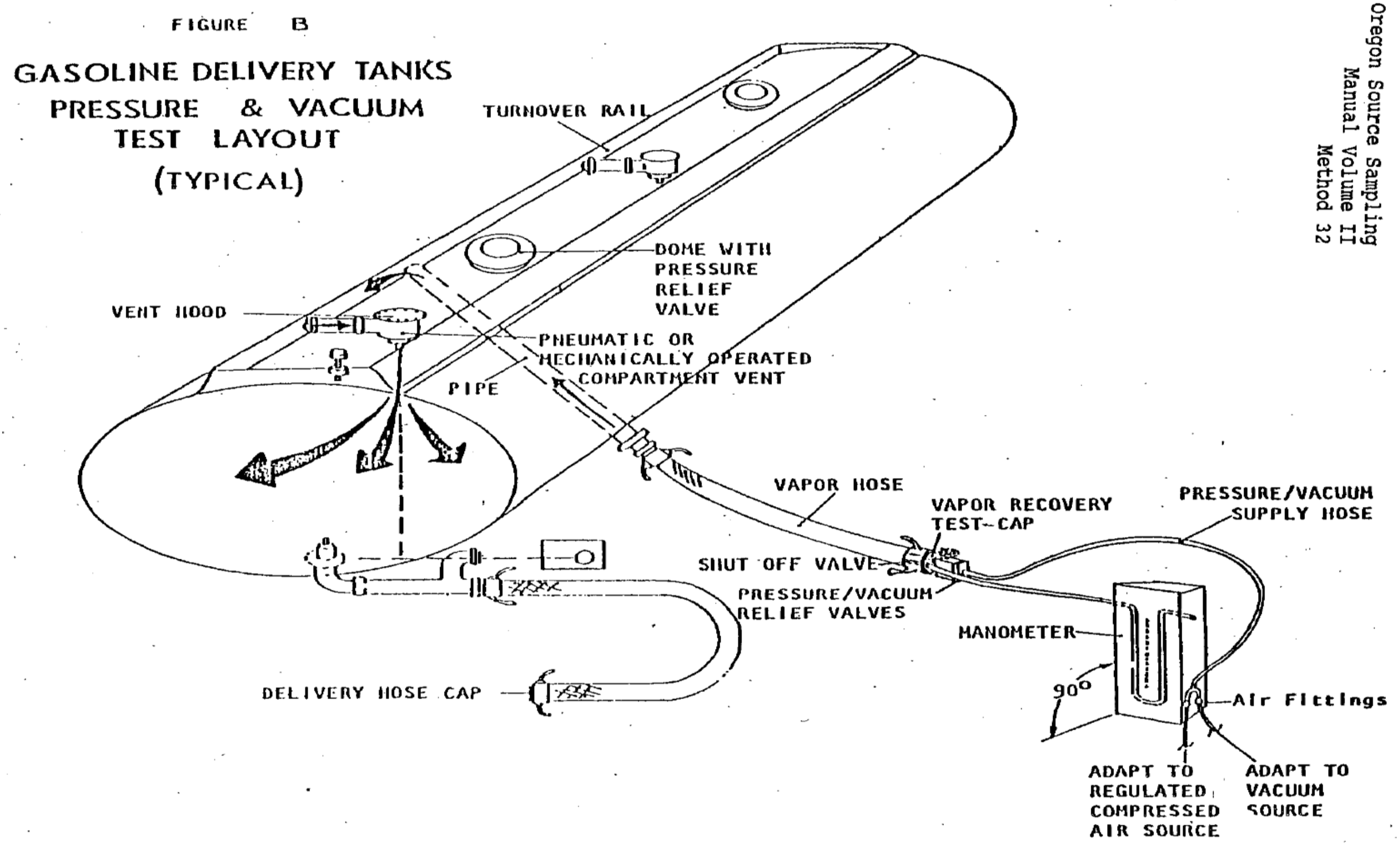


FIGURE B

GASOLINE DELIVERY TANKS
PRESSURE & VACUUM
TEST LAYOUT
(TYPICAL)

DEQ METHOD 33

Test Procedures for Gasoline Vapor Control Systems at Bulk Gasoline Terminals

STATE OF OREGON
DEPARTMENT OF ENVIRONMENTAL QUALITY

DEQ Air Quality Program
Portland, Oregon
December 1, 1980

Revisions:
January 23, 1992

METHOD 33

1.0 Introduction

1.1 Principle:

Hydrocarbon mass emissions are determined directly, using flowmeters and hydrocarbon analyzers.

The mass of hydrocarbon vapor to be controlled or recovered is determined from the volume of gasoline dispensed (either to the bulk terminal facilities or to delivery tanks), and by temperature, pressure and concentration measurements of the released vapor.

The efficiency of the gasoline vapor control systems is determined from the mass of the hydrocarbons emitted and the mass of the hydrocarbons controlled.

1.2 Applicability:

These test procedures are applicable for gasoline vapor recovery systems installed at bulk gasoline terminals for controlling gasoline vapors emitted during the loading of delivery tanks or from the loading of fixed roof gasoline storage tanks as a result of fixed roof tank breathing. These procedures are also applicable for marketing operations at refineries.

2.0 Acceptance Of Test Results

2.1 Results of these tests will be accepted as a demonstration of compliance determination of the equipment tested provided that the methods included or referred to in this procedure are strictly adhered to. A statement containing at least the minimum amount of information regarding the test procedures applied should be included with the report of the test results.

Deviations from the procedure described herein will be permitted only if permission from DEQ is obtained in writing in advance of the test.

3.0 Definitions

3.1 Bulk Gasoline Terminal

"Bulk gasoline terminal" means a gasoline storage facility which receives gasoline from refineries primarily by pipeline, rail, ship, or barge, and delivers gasoline to bulk gasoline plants or to commercial or retail accounts primarily by tank truck.

3.2 Delivery Vessel

"Delivery vessel" means any tank truck or trailer unit for the transport of gasoline from sources of supply to stationary storage tanks.

3.3 Vapor Balance System

"Vapor balance system" means a combination of pipes or hoses which create a closed system between the vapor spaces of an unloading tank and receiving tank such that vapors displaced from the receiving tank are transferred to the tank being unloaded.

4.0 Test Procedures For Determining the Efficiency of Gasoline Vapor Control Systems at Terminals

4.1 Application

The following test procedures are for determining the efficiency of vapor recovery systems controlling gasoline vapors emitted during the storage of gasoline and the filling of delivery tanks at terminals.

4.2 Principle

During the normal operations at a terminal (loadings of delivery tanks and loadings of the storage tanks), all possible points of emission are checked for vapor leaks. The volume of gasoline delivered from the terminal storage tanks to the delivery tanks is recorded, the volume of gasoline delivered to any fixed roof storage tank(s) is recorded (as required), and the mass of the hydrocarbon vapors emitted from the processing unit measured. The mass emission of hydrocarbons is calculated from these determinations.

4.3 Test Conditions

The processing unit may be tested for a series of 24 consecutive one hour periods and pressures in the vapor holder and any fixed roof gasoline storage tanks may be monitored for 30 consecutive days. DEQ shall determine whether testing for longer or shorter periods may be necessary for properly evaluating any system's compliance with performance3 standards. During the test of the processing unit, the pressure during the filling of a number of delivery tanks will be monitored. As much as possible, the system shall be tested under normal operating conditions. Dispensing rate shall be at the maximum rate possible consistent with safe and normal operating practices. Simultaneous use of more than one dispenser during transfer operations shall occur to the extent that such would normally occur and the processing unit shall be operated in accordance with the manufacturer's established parameters as well as in accordance with the owner's or operator's established operating procedures.

4.4 Calibrations

4.4.1 Flowmeters

Standard methods and equipment shall be used to calibrate the flowmeters every month or every five tests, whichever comes first. The calibration curves are to be traceable to NIST standards.

4.4.2 Temperature measuring instruments

Calibrate prior4 to test period and immediately following test period using ice water (32°F) and a known temperature source of about 100°F.

4.4.3 Pressure measuring instruments

Calibrate pressure transducers every month and immediately after each test with a static pressure calibrator of known accuracy.

4.4.4 Total hydrocarbon analyzer

Follow the manufacturer's instructions concerning warm-up time and adjustments. On each test day prior to testing and at the end of the day's testing, zero the analyzer with a zero gas (<3ppm C) and span with 5, 10, 30, and 70 percent concentrations of propane.

4.4.5 A record of all calibration is to be maintained by the source testing person for at least 1 year.

5.0 Testing Vapor Control Systems (Other Than Incineration Units) When Loading Delivery Tanks

5.1 Equipment Required

5.1.1 Flowmeter with a capacity sufficient to determine the volume of exhaust from the vent of processing unit.

5.1.2 Coupler for attaching the flowmeter to vent of processing unit with thermocouple and HC analyzer taps.

5.1.3 Coupler for delivery tank vapor return line with pressure tap.

5.1.4 One hydrocarbon analyzer (either FID or DEQ approved equivalent) with recorder and with a capability of measuring total gasoline vapor concentration of 30 percent as propane.

5.1.5 One (1) flexible thermocouple or thermistor (0-150°F) with recorder system having a readability of 1°F.

5.1.6 Two (2) pressure sensing devices (transducers or equivalent) capable of measuring zero to ten inches of water with recorder systems having a readability of 0.01 in. H_2O.

5.1.7 Coupler with pressure tap for use between pressure-vacuum (PV) relief valve and fixed roof storage tank vent.

5.1.8 Coupler with pressure tap for use between PV valve and vent on vapor holder tank.

5.1.9 One manometer capable of measuring zero to ten inches of water with a readability of 0.1 in. H_2O.

5.1.10 Explosimeter.

5.1.11 Barometer (Aneroid or Mercury), ± 0.1 in. Hg. readability.

5.2 Test Procedure

5.2.1 Connect appropriate coupler to vent of processing unit and connect flowmeter.

5.2.2 Connect hydrocarbon analyzer, with recorder, to appropriate tap on coupler on processing unit vent.

5.2.3 Connect thermocouple with recorder to appropriate tap on coupler on processing unit vent.

5.2.4 Connect coupler between PV valve and vent of vapor holder tank and connect pressure sensing device, with recorder, to coupler.

5.2.5 Connect coupler between PV valve and fixed roof bulk storage tank and connect pressure sensing device, with recorder, to coupler.

5.2.6 Connect the appropriate coupler to vapor return line from delivery tank. Connect the manometer to the coupling in vapor return line from delivery tank. Check the delivery tank and all connections for a tight seal, before and during fueling, with the explosimeter. Record the pressure in the vapor return line from the delivery tank at 5 minute intervals during the filling of the delivery tank. Repeat for the required number of delivery tanks.

5.2.7 Record the pressure on the bulk storage at the start and finish of the test period.

5.2.8 Record the pressure on the vapor-holder tank at the start and the finish of the test period.

5.2.9 Record the hydrocarbon concentrations, temperature and exhaust gas flowrate from the processor vent at the start and the finish of the test period.

5.2.10 At the end of the specified times, disconnect all instrumentation and couplings from the vapor recovery systems.

5.2.11 Record the volume of gasoline that is delivered over the time of the test period.

5.3 Calculations

5.3.1 Review pressures recorded during the filling of delivery tanks to determine if any equaled or exceeded one (1) pound per square inch.

5.3.2 Volume of gas discharged through the processing unit vent.

$$V = \frac{V_p \times 528 \times P_b}{T_p \times 29.92}$$

Where:

V = Volume of gas discharged through processor vent, corrected to 68°F and 29.92 in. Hg, (ft^3).

P_b = Barometric pressure, (in. Hg).

V_p = Volume of gas determined by flowmeter on the processing vent, corrected for amount of vapor removed for the hydrocarbon analysis, (ft^3).

T_p = Average temperature in the processing vent line, (°R.)

5.3.3 Weight of hydrocarbons discharged through the processing vent per 1,000 gallons of gasoline loaded into the delivery tanks.

$$W = \frac{C \times V \times M \times 1000}{379 \times G}$$

Where:

W = Weight of hydrocarbons discharged through the processor vent per 1000 gallons of gasoline loaded into delivery tanks, (lbs).

C = Average fractional concentration of hydrocarbons at vent, (decimal fraction)

V = From 5.3.2 above.

M = Molecular weight of hydrocarbon compound used to calibrate hydrocarbon analyzer, (lbs/lb Mole).

G = Total quantity of gasoline loaded into delivery tanks (gals).

Review the pressure recording from the transducers on the storage tanks and vapor holder and determine the number of times and total time (hours), if any, that the pressure exceeded the setting of the PV valve on either the vapor holder or on the fixed roof storage tank.

6.0 Testing Vapor Control Systems (Other Than Incineration Units) When Loading Fixed Roof Storage Tanks

6.1 Equipment Required

Same equipment as in Section 5.1.

6.2 Test Procedures

6.2.1 Connect appropriate coupler to vent of processing unit and connect flowmeter.

6.2.2 Connect hydrocarbon analyzer, with recorder, to appropriate tap on coupler on processing unit vent.

6.2.3 Connect thermocouple with recorder to appropriate tap on coupler on processing unit vent.

6.2.4 Connect coupler between PV valve and vent of vapor holding tank and connect pressure sensing device, with recorder, to coupler.

6.2.5 Connect coupler between PV valve and fixed roof storage tank and connect pressure sensing device, with recorder, to coupler.

6.2.6 Record the pressure on the bulk storage tank and connect pressure sensing device, with recorder, to coupler.

6.2.7 Record the pressure on the vapor-holding tank at the start and finish of the test period.

6.2.8 Record the hydrocarbon concentration, temperature and exhaust gas flowrate from the processor vent at the start and finish of the test.

6.2.9 At the end of the specified times, disconnect all instr4umentation and couplings from the vapor recovery systems.

6.2.10 Record the volume of gasoline that is delivered during the specified testing times.

6.2.11 Pressure monitoring of delivery tanks is to be performed, as appropriate, in accordance with Section 5.2.6.

6.3 Calculations

6.3.1 Volume of gas discharged through the processing unit vent.

$$V = \frac{V_p \times 528 \times P_b}{T_p \times 29.92}$$

Where:

V = Volume of gas discharged through processor vent, corrected to 68°F and 29.92 in. Hg, (ft^3).

P_b = Barometric pressure, (in. Hg).

V_p = Volume of gas determined by flow meter on the processing vent, corrected for amount of vapor removed by hydrocarbon analysis, (ft^3).

T_p = Average temperature in the processing vent line, (°R).

6.3.2 Weight of hydrocarbons discharged through the processing vent per 1000 gallons loaded into the delivery tanks.

$$W = \frac{C \times V \times M \times 1000}{379 \times G}$$

Where:

W = Weight of hydrocarbons discharged through the processor vent per 1000 gallons of gasoline loaded into delivery tanks, (lbs).

C = Average fractional concentration of hydrocarbons at vent, (decimal fraction).

V = From 6.3.1 above.

M = Molecular weight of hydrocarbon compound used to calibrate hydrocarbon analyzer, (lbs/lb Mole); (44 for propane).

G = Total quantity of gasoline loaded into fixed roof storage tank(s), (gals).

Review the pressure recording from the transducers on the storage tanks and vapor holder and determine the number of times and total time (hours), if any, that the pressure exceeded the setting of the PV valve on either the vapor holder or on the fixed roof storage tank.

7.0 Testing Exhaust Emissions From Incineration-Type Processing Unit

7.1 Equipment Required

7.1.1 One (1) positive displacement flowmeter (capacity of 11,000 SCFH) with a coupler with pressure and temperature taps.

7.1.2 One (1) hydrocarbon analyzer (FID or DEQ approved equivalent) capable of measuring hydrocarbons in the range 0 to 10 percent as propane.

7.1.3 One (1) oxygen analyzer (paramagnetic or DEQ approved equivalent) capable of measuring oxygen in the range 0 to 25 percent by volume.

7.1.4 Apparatus for performing the State of Oregon, DEQ source sampling Method #2 (Determination of Stack Velocity and Volumetric Flow Rate).

7.1.5 One (1) sample conditioner capable of adjusting the temperature of the exhaust gas sample to a range acceptable to the hydrocarbon and oxygen analyzers.

7.1.6 One (1) 1/4" ID stainless steel sampling probe (SS316 or equivalent), of appropriate length.

7.1.7 One (1) dry gas meter sufficiently accurate to measure the sample volume within one percent.

7.1.8 One (1) needle valve, or equivalent, to adjust flow rate.

7.1.9 One (1) rotameter, or equivalent, to measure a 0 to 10 SCFH flow range, with a readability of 0.1^{o}.

7.1.10 One (1) pump of a leak-free, vacuum type.

7.1.11 One (1) thermocouple with recorder, 0 - 150^{o}F with a readability of 1^{o}.

7.1.12 One (1) pressure sensor with recorder for a range of -2 to +2 psig.

7.1.13 Calibration of test equipment according to recommended procedure, Section 4.4, page 3.

7.2 Test Procedure

7.2.1 Insert the flowmeter (0-11,000 SCFH) into the pipe supplying the incinerator, connect thermocouple and pressure sensor and record initial volume.

7.2.2 Using the appar4atus and procedure for Method 2, 7.1.4, perform a velocity traverse of the incinerator exhaust vapor.

7.2.3 Insert the sample probe to the location of the average exhaust velocity, leaving the Method 2 apparatus in place. Connect the sample conditioner, hydrocarbon analyzer, oxygen analyzer, sample pump, rotameter, needle valve and dry gas meter to the sample probe.

7.2.4 Start analyzer recorders.

7.2.5 Adjust the sample flow rate proportional to the stack gas velocity and sample until the dry gas meter registers one (1) ft.^{3}. Mark on analyzer recorder strip charts beginning and ending of sample period.

7.2.6 At the end of the test period, record the total volume of vapors going to the incinerator and average temperature and pressure.

7.2.7 Record the average hydrocarbon and oxygen concentration in the incinerator exhaust. Repeat as required.

7.2.8 Record the volume of gasoline delivered during the test period.

7.2.9 Pressure monitoring of delivery tanks and fixed roof storage tanks is to be performed, as appropriate, in accordance with Section 5.2.6 and 6.2.6.

7.3 Calculations

7.3.1

$$V_p = \frac{V \times 528 \times PA}{T \times 29.92}$$

Where:

V_p = Volume of vapor going to the incinerator (ft.^{3})

V = Volume of gas recorded by meter (ft.^{3}).

PA = Absolute pressure in the pipe going to the incinerator, (in. Hg).

T = Average absolute temperature of the vapor, (°R).

7.3.2

$$EA = \frac{O_{2\%}}{.264N_2\% - O_2\%}$$

Where:

EA = Excess air in the incinerator exhaust gas.

$O_2\%$= Percent by volume oxygen in the incinerator exhaust.

$N_2\%$= Percent by volume nitrogen in the incinerator exhaust.

7.3.3

$$W = \frac{V_p \text{ x } C \text{ x } M \text{ x } (EA) \text{ x } 1000}{379 \text{ x } G}$$

Where:

W = Weight of hydrocarbons discharged through the incinerator vent per 1000 gallons of gasoline into delivery tanks, or, as appropriate, fixed roof tanks, (lbs).

V_p = From 7.3.1 above.

M = Molecular weight of hydrocarbon compound used to calibrate hydrocarbon analyzer, (lbs/lb Mole).

EA = From 7.3.2 above.

G = Total quantity of gasoline loaded into delivery tanks, or, as appropriate, fixed roof storage tanks, (gals).

C = Average fractional concentration of hydrocarbons at vent, (decimal fraction).

8.0 Alternative Test Methods

Techniques, other than those specified above, may be used for testing vapor recovery systems at terminals if prior written approval is obtained from DEQ Such approval will be based upon demonstrated equivalency with the methods in Section 5 through Section 8.

9.0 Recordkeeping

A record of the results for tests which are performed for compliance determination shall be maintained at the facility site according to OAR 340-232-0080 and 340-232-0100.

Appendix I, Submerged Fill Inspection Guideline,
May 1, 1981

Department of Environmental Quality
Air Program
VOC Compliance Determination Guideline
Submerged Fill

Gasoline Dispensing Facilities

OAR 340-244-0240(3) requires submerged filling of gasoline storage tanks at gasoline dispensing facilities (service stations, motor pools, etc.).

“Submerged Fill” is defined in OAR 340-244-0030(29) as “the filling of a gasoline storage tank through a submerged fill pipe whose discharge is no more than the applicable distance specified in OAR 340-244-0240(3) from the bottom of the tank. Bottom filling of gasoline storage tanks is included in this definition.”

The applicable distance in OAR 340-244-0240(3) is no more than 12 inches from the bottom of the storage tank for submerged fill pipes installed on or before November 9, 2006 or no more than 6 inches from the bottom of the storage tank for submerged fill pipes installed after November 9, 2006. Submerged fill pipes not meeting these specifications are allowed if can be demonstrated that the liquid level in the tank is always above the entire opening of the fill pipe. Documentation providing such demonstration must be made available for inspection by DEQ during the course of a site visit.

Bulk Gasoline Plants

OAR 340-232-0080(1)(a) requires submerged filling at bulk gasoline plants in the Portland-Vancouver Air Quality Maintenance Area, Medford-Ashland Air Quality Maintenance Area, and Salem-Keizer Area Transportation Study (SKATS) Area.

“Submerged Fill" is defined in OAR 340-232-0030(70) as "any fill pipe or hose, the discharge opening of which is entirely submerged when the liquid is 6 inches above the bottom of the tank; or when applied to a tank which is loaded from the side, shall mean any fill pipe, the discharge of which is entirely submerged when the liquid level is 28 inches, or twice the diameter of the fill pipe, whichever is greater, above the bottom of the tank."

40 CFR 63.11086(a) requires submerged filling at bulk gasoline plants statewide.

Submerged Fill" is defined in 40 CFR 63.11100 as "the filling of a gasoline cargo tank or a stationary storage tank through a submerged fill pipe whose discharge is no more than the applicable distance specified in 40 CFR 63.11086(a) from the bottom of the tank. Bottom filling of gasoline cargo tanks or storage tanks is included in this definition.

The applicable distance in 40 CFR 63.11086(a) is no more than 12 inches from the bottom of the storage tank for submerged fill pipes installed on or before November 9, 2006 or no more than 6 inches from the bottom of the storage tank for submerged fill pipes installed after November 9, 2006. Submerged fill pipes not meeting these specifications are allowed if can be demonstrated that the liquid level in the tank is always above the entire opening of the fill pipe. Documentation providing such demonstration must be made available for inspection by DEQ during the course of a site visit.

Gasoline Delivery Vessels

OAR 340-232-0085(1)(a) requires submerged filling of delivery vessels receiving gasoline from a bulk gasoline terminal or a bulk gasoline plant, with a daily throughput of 4,000 or more gallons based on a 30-day rolling average, located in the Portland-Vancouver AQMA.

"Submerged Fill" is defined in OAR 340-232-0030(70) as "any fill pipe or hose, the discharge opening of which is entirely submerged when the liquid is 6 inches above the bottom of the tank; or when applied to a tank which is loaded from the side, shall mean any fill pipe, the discharge of which is entirely submerged when the liquid level is 28 inches, or twice the diameter of the fill pipe, whichever is greater, above the bottom of the tank."

Technique to determine compliance

(1) For underground tanks, open the fill pipe and determine that a submerged fill pipe extends down into the tank.

(2) Take a 20 foot measure tape or equivalent stick with an L extension on the bottom (11) and lower it down the fill tube, forcing the tape catch to scrape against the tube side, or catch on the bottom of the fill pipe.

(3) Note when scraping ceases; the bottom of the fill tube has been reached. Read the tape or mark the stick.

(4) Extend the tape on down to the bottom of the tank. Read the tape, or marking stick.

(5) If the difference in tape readings is at or less than the applicable distance the source is in compliance with the submerged fill pipe rule.

(6) Bulk plants or above-ground-tanks which are bottom filled can be considered in compliance, so long as the top of the fill line is less than twice the diameter of fill pipe or less than 18 inches above the tank bottom.

(7) Cylindrical tanks with horizontal fill pipes that do not meet requirements of (6) but have an elbow extending down toward the bottom of the tank must meet the requirements of (6).

(8) Horizontal tanks with side fill which do not meet the requirements of (6) but which have an elbow extending toward the bottom shall meet the requirements of (5).

(9) <u>Remember</u> gasoline is explosive, dangerous, toxic and non-spark measuring devices shall be used. Close all openings which were opened to conduct the test. A clean rag should be available for wiping during the test process to prevent gasoline burns to hands, etc.

(10) Good judgment relative to safety and courtesy is a must at all times.

Air Quality Program

Continuous Monitoring Manual

State of Oregon
Department of Environmental Quality

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Table of Contents

Executive Summary

DEQ’s Continuous Monitoring Manual provides specifications and procedures for conducting continuous monitoring at facilities regulated by DEQ’s stationary source air quality permit program. The manual includes requirements for preparing monitoring plans that include standard operating and quality assurance procedures to ensure that continuous monitor systems will provide accurate and reliable data. The manual is applicable to continuous emission monitoring systems (CEMS), continuous parameter monitoring systems (CPMS), and continuous opacity monitoring systems (COMS). In addition to DEQ specific requirements, the manual incorporates by reference federal monitoring requirements contained in 40 CFR Parts 60, 63, and 75. The Continuous Monitoring Manual was first written in 1992 and revised in 2015. The Continuous Monitoring Manual is included in Oregon’s State Implementation Plan.

1.0 Introduction

This manual provides guidance and direction to owners and operators that are responsible for continuously monitoring air emissions, operating parameters, or opacity from their facilities. For purposes of this manual, continuous monitoring systems (CMS) are divided into three (3) main subgroups:

- Continuous Emission Monitoring Systems (CEMS),
- Continuous Parameter Monitoring Systems (CPMS), and
- Continuous Opacity Monitoring Systems (COMS).

CMS that are required by permit condition, but not subject to federal regulations are subject to the requirements of this manual. This manual also applies to CMS that are required by the following federal standards. The monitoring requirements specified in the federal standards are incorporated by reference as publsihed in the July 2012 Code of Federal Regulations (CFR. If there is an inconsistency between the requirements of this manual and the federal requirements, the federal requirement will take precedence:

- New Source Performance Standards (NSPS), 40 CFR Part 60;
- National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Part 63; and
- Acid Rain Program, 40 CFR Part 75.

When required to perform continuous monitoring by DEQ, CMS operators are required to perform the monitoring in accordance with this manual, at a minimum, to ensure reported data are complete and of high quality. Operators may choose more rigorous specifications or more sophisticated procedures appropriate for their purposes.

2.0 Monitoring Objectives

2.1 Program Objectives

The objectives of a monitoring program will vary depending on the regulation or permit, but may include one or more of the following. The CMS must be designed to meet the appropriate objectives.

- Measure air contaminant concentrations and operating parameters as required by permit or regulation;
- Ensure high quality data is collected to determine continuous compliance with permit or regulation;
- Prevent possible adverse environmental effects;
- Determine emissions improvements and trends in conjunction with process changes; or
- Provide accurate and reliable data as part of an integrated emissions inventory program.

2.2 Data Quality Objectives

Each monitoring program must meet specific data quality objectives. These are data completeness, representativeness, accuracy, precision, and comparability. A brief description of each objective is provided below.

- Completeness is the measure of the number of valid data points collected over the possible number of data points in a period of time.
- Representativeness refers to measurements which accurately depict the condition of interest. One aspect of representativeness involves the method chosen to perform the monitoring; it must be accurate in both a qualitative and quantitative sense.
- Accuracy describes how close the measurement is to the "true value" of the quantity being measured.
- Precision is a measure of variability, or scatter, of the system's response to repeated challenges by the same standard. Precision is a measure of repeatability, how closely multiple measurements agree.
- Comparability is a measure of how data sets are similar or different. It determines how data sets can be used collectively.

3.0 Continuous Monitoring Plans

The source operator must prepare and maintain written standard operating procedures (SOP) and a quality assurance plan (QAP) for each continuous monitoring system used at a source. The SOP and QAP must be submitted to DEQ prior to operation of a CMS. These documents must be reviewed periodically by the CMS operator and revised as necessary based on experience with the CMS. The SOP and QAP msut contain detailed, complete, step-by-step written procedures. Both documents msut be made available to DEQ personnel for inspection upon request.

3. 1 Standard operating procedures

Standard operating procedures (SOP) must be written for each CMS. The contents of the SOP must include, as a minimum, the following information:

a. Source owner or operator name and address.
b. Identification, description, and location of monitors in the CMS.
c. Description and location of the sample interface (i.e. sample probe).
d. Manufacturer and model number of each monitor in the CMS.
e. Equipment involved in sample transport, sample conditioning, analysis, and data recording.
f. Procedures for routine operation checks, including daily zero and span calibration drift (CD) check.
g. Procedures for routine preventive maintenance. Initially, these procedures can be taken from the manufacturer's installation and operation manuals. However, as the CMS operators gain more experience with the CMS, it may

be necessary or desirable to modify these procedures to increase or decrease frequency of maintenance and add or delete some procedures.

h. Routine maintenance spare parts inventory.
i. Procedures for calculating and converting CMS data into the reporting units of the standard.
j. Documentation of the activities described in 3.1 a – i.

3.2 Quality Assurance Plan

Prior to initiating a continuous monitoring program, a written quality assurance plan (QAP) must be prepared. The QAP must include quality control and quality assurance procedures for ensuring that the CMS will provide accurate and reliable data. For these purposes, the terms "Quality Control" (QC) and "Quality Assurance" (QA) are defined as follows:

- <u>"Quality Control"</u> refers to an activity carried out during routine internal operations to ensure that the data produced are within known limits of accuracy and precision. Examples of QC activities include periodic calibrations, routine zero and span checks, routine leak checks, routine check of optical alignment, etc. QC represents the core activity in a Quality Assurance program.
- <u>"Quality Assurance"</u> refers to all of the planned and systematic activities carried out externally and independent of routine operation to document data quality. QA activities include written documentation of operation, calibration, and QC procedures; independent system and performance audits; data validation; evaluation of QC data; etc. QA requires documentation of all aspects of the CMS effort, from the responsibilities of each person involved to how the data are reported.

The contents of the QAP are dependent on the applicable regulation or permit condition. Some systems may be subject to multiple regulations, and therefore multiple plan requirements. The plan should be reviewed annually and updated when there are changes to equipment and procedures. Plan updates should be submitted to DEQ for review. In general, a satisfactory QAP plan includes the following:

a. Data quality objectives.
b. Chain of responsibility for CMS operation, corrective action, and training program.
c. Procedure for measuring the CMS accuracy and precision including the following:
    - CMS calibrations
    - Zero and span drift checks
    - Performance audits
    - System audits
d. Quality control activities
e. Quality control documentation
f. Procedures for data recording, calculations, and reporting
g. Criteria for taking corrective actions

h. Procedures for corrective action

Monitoring plan requirements for various regulations are summarized in the following table.

REGULATIONS	AQ/QC PROGRAM PLAN REQUIREMENTS
NSPS	40 CFR Part 60, section 60.13 and appendix F, section 3
NESHAP	40 CFR Part 63, Subpart A, Section 63.8
Acid Rain Program	40 CFR Part 75, Appendix B, Section 1.

* This table may not include all references to applicable monitoring plan requirements.

4.0 Continuous Emission Monitoring Systems

4.1 CEMS Equipment and Installation Specifications

Equipment specifications, installation, and measurement location are defined according to the applicable performance specification. Refer to the following reference table for equipment specifications, installation, and measurement location requirements.

REGULATIONS	EQUIPMENT SPECIFICATIONS, INSTALLATION & MEASUREMENT LOCATION REQUIREMENTS
NSPS	40 CFR Part 60, section 60.13 and appendix B
NESHAP	40 CFR Part 63, section 63.8
Acid Rain Program	40 CFR Part 75, Subpart A – H and appendices A-J
Oregon DEQ Requirements	Appendix A of this manual

*This table may not include all references to applicable equipment and installation requirements.

4.2 Performance Assessments for CEMS

Performance assessments are utilized to determine quality of monitored data. In general, most regulations divide the assessments into four (4) separate activities:

- Initial performance specifications
- Daily performance assessments
- Quarterly performance assessments, and
- Annual performance assessments.

The requirement of each assessment depends on the applicable performance specifications and the QA/QC requirements. Performance assessments requirements are detailed below.

REGULATIONS	PERFORMANCE ASSESSMENTS
NSPS	40 CFR Part 60, Appendices B & F
NESHAP	40 CFR Part 63, section 63.8
Acid Rain Program	40 CFR Part 75, Subparts A – H and appendices A and B
Oregon DEQ Requirements	Appendix A of this manual

*This table may not include all references to applicable performance assessment requirements.

5.0 Continuous Parameter Monitoring Systems

A continuous parameter monitoring system (CPMS) continuously monitors source or pollution control device operating parameters. These may include, but are not limited to:

- Fuel consumption rates;
- Production rates;
- Oxygen concentration;
- Moisture content;
- Process temperatures;
- Pollution control device parameters (e.g., pressure drop, voltages, water flow and pressure, etc.)

There are three basic types of CPMS:

- CPMS used for the purpose of determining pollutant emissions rates (PEMS);
- CPMS used for the purpose of monitoring pollution control device operations; and,
- CPMS used for the purpose of monitoring source operations.

It is not the intention of this manual to cover each and every possible CPMS. Requirements for CPMS that are used for determining pollutant emissions rates are generally found within applicable federal regulation. CPMS requirements are detailed below.

REGULATIONS	CPMS REQUIREMENTS
NSPS	40 CFR Part 60, applicable subparts and appendices B and F
NESHAP	40 CFR Part 63, Applicable subparts
Acid Rain Program	40 CFR Part 75, Subpart E and appendices D and E
Oregon DEQ Requirements	Appendix B of this manual

*This table may not include all references to applicable CPMS performance requirements.

6.0 Continuous Opacity Monitoring Systems (COMS)

This section addresses specific requirements for the operation of continuous opacity monitoring systems (COMS). These requirements do *not* supersede any requirements specified by rule, regulation, or by permit condition**.**

Existing COMS installed prior to 6/1/91 must be maintained and operated in accordance with permit requirements; and, unless otherwise specified, are not subject to the requirements of this manual. If the COMS system is not subject to federal regulation and is installed, replaced, relocated or substantially refurbished after 6/1/91, then the COMS must satisfy 40 CFR Part 60, Spec. 1 requirements in effect at the time of the change.

All continuous opacity monitoring systems (COMS) must complete a minimum of one cycle of sampling and analyzing for each successive 10-second period (15 seconds for non-NSPS sources if approved by the DEQ).

Federal requirements for COMS can be found within the applicable federal regulations cited below.

REGULATIONS	COMS REQUIREMENTS
NSPS	40 CFR Part 60, sectin 60.13 and appendix B, specification 1
NESHAP	40 CFR Part 63, secton 63.8
Acid Rain Program -Optional Emissions Protocols	40 CFR Part 75, Subpart B

*This table may not include all references to applicable COMS performance requirements.

7.0 Recordkeeping and Reporting

This section addresses specific requirements for recordkeeping and reporting requirements for CMS. If inconsistencies exist, these requirements do not supersede any requirements specified by regulation or permit condition.

The source owner or operator must maintain records of all CMS activities in a file and/or log book. This record must be used by the CMS operator to ensure that the CMS is operating correctly. The record must also be made available to DEQ personnel upon request.

Recordkeeping and reporting requirements for various regulations are cited below.

REGULATIONS	**RECORDKEEPING & REPORTING REQUIREMENTS**
NSPS	40 CFR Part 60, applicable subparts and appendix F
NESHAP	40 CFR Part 63, applicable subparts
Acid Rain Program	40 CFR Part 75, subparts E, F and G and appendices B, D, and E
Oregon DEQ Requirements	Appendix C of this manual

*This table may not include all references to applicable recordkeeping and reporting requirements.

Appendix A

DEQ Continuous Emission Monitoring Requirements

General continuous emissions monitoring requirements are outlined below. These requirements do not supersede any requirements specified by regulation or permit condition. Refer to Section 4.0 of this monitoring manual.

A.1 CEMS Not Required by Federal Program and Installed after 6/1/91

1. The CEMS must continuously monitor and record the concentration of gaseous pollutant emissions on a wet or dry basis discharged into the atmosphere. The CEMS must consist of subsystems for sample extraction, conditioning, detection, analysis, and data recording/processing.
2. All CEMS must meet the requirements of 40 CFR 60 Appendix B (performance specifications) and Appendix F (QA/QC procedures).
3. All continuous emissions monitoring systems (CEMS) must complete a minimum of one cycle of sampling and analyzing for each successive 15-minute period unless the DEQ has specified a different frequency (i.e. Medford AQMA requires one minute cycle).

A.2 CEMS Not Required by Federal Program and Installed Prior to 6/1/91:

1. The CEMS must continuously monitor and record the concentration of gaseous pollutant emissions discharged to the atmosphere from any stationary source using CEMS approved by DEQ.
2. The span of the CEMS must be set:

   a. At 200% of the permit requirement concentration or the emission standard, whichever is lower. The span may be set at alternative values with DEQ approval.
   b. The CEMS must be capable of recording down-scale drift below zero.

3. The CEMS must be pollutant specific and free from interferences. (e.g.: For TRS CEMS, the measured TRS must exclude SO_2)
4. The CEMS analyzer must be maintained in an environment conducive to analyzer stability.
5. Extractive CEMS operating procedures must include automatic back-flushing of sample line and probe to purge condensed moisture and particulate material.
6. If the emissions must be corrected for diluent oxygen, periodically test and record the concentration of oxygen in the exhaust gases using an oxygen CEMS, Orsat Analyzer, or equivalent.

   a. An Oxygen CEMS, if used, must be calibrated according to written procedures, approved by the Department, at least twice each year using two calibration gases having oxygen concentrations of approximately 5 and 15 percent by volume, accurate to within 0.5% oxygen.

   b. Oxygen must be measured at least semi-annually, after any major maintenance/-repair on duct work, and frequently enough to be representative of average oxygen concentration.

7. The zero and span drift of CEMS must be measured and recorded daily when the CEMS is in operation. Span gases used for this procedure need not be NIST traceable. However, the concentration of the gases should be verified by an analyzer calibrated with certifiable calibration gases. It may be necessary to periodically certify the concentration of the zero and span drift check gases.
8. A cylinder gas audit (CGA) of the CEMS must be performed weekly with successive CGAs performed no closer than six days apart. The CGA must include a "zero" gas and a minimum of one upscale gas concentration at approximately 60 percent of analyzer full-scale. The CGA results must satisfy the audit specifications outlined within 40 CFR 60, Appendix F.

   a. If 4 consecutive weekly CGAs result in the CEMS being within the allowable specifications, the frequency of the CGAs may be reduced to once each month with successive CGAs performed no closer than 21 days apart.
   b. If three consecutive monthly CGAs result in the CEMS being within specifications, the frequency of the CGAs may be reduced to once each quarter with successive CGAs performed no closer than two months apart.
   c. If two consecutive quarterly CGAs result in the CEMS being within specifications, the CGA frequency may be reduced to once every six months with successive CGAs no closer than five months apart.
   d. The minimum CGA frequency must be once every six months with successive CGAs no closer than five months apart.
   e. The CGA frequency must revert back to a weekly frequency if a CGA results in the CEMS failing to meet the performance specifications of 40 CFR Part 60, Appendix F.

      i. The concentration of the cylinder audit gases must be traceable to National Institute of Standards and Technology (NIST) standard reference materials (SRM) or EPA certified reference materials (CRM) and reanalyzed every 6-months using EPA Reference Methods (40 CFR 60, Appendix A). Gases may be analyzed at less frequent intervals if the manufacturer guarantees their certified concentration for longer time periods.
      ii. Cylinder gases must be introduced to include as much of the monitoring system as feasible, in no case may gas conditioning subsystems (i.e. SO_2 scrubbers for TRS CEMS) be excluded or by-passed.

9. A Relative Accuracy Audit (RAA) must be performed at least once each year. The RAA may satisfy one of the CGA requirements. RAA must satisfy the audit specifications outlined within 40 CFR 60, Appendix F.
10. If the CEMS system is not subject to federal regulation and is installed, replaced, relocated or substantially refurbished after 6/1/91, then the CEMS is not applicable to the requirements of this section and must comply with section A.1 of this appendix.
11. As an alternative to complying with conditions 1 through 9 of this section, the owner/operator may choose to comply with the requirements of section A.1 of this appendix.
12. Data must be recorded in units of the standard.

APPENDIX B

DEQ CONTINUOUS PARAMETER MONITORING REQUIREMENTS

General continuous parameter monitoring requirements are outlined below. These requirements do not supersede any requirements specified by rule, regulation, or by permit condition. Refer to Section 5.0 of this manual.

B.1 CPMS General Requirements:

1. CPMS must be installed in a location that is representative of the monitored process and free from interferences.
2. CPMS must be installed and maintained in an environment conducive to CPMS stability and data reliability.
3. CPMS must be calibrated and certified by the manufacturer prior to installation. (Applies to CPMS installed after 6/1/91).
4. All CPMS must complete a minimum of one cycle of sampling and analyzing for each successive 15-minute period unless the DEQ has specified a different frequency (i.e. Medford AQMA requires one minute cycle).

B.2 Pollutant Emissions Related CPMS

1. CPMS for the purpose of determining emission rates (i.e. stack gas flow monitoring devices) require the highest level of QA/QC. If CPMS system is installed to satisfy 40CFR Parts 60 and 75, then requirements specified by those regulations must be followed.
   a. CPMS installed after 6/1/91 must meet 40 CFR Part 60 Appendix B performance specification 6. The reference methods for determining relative accuracy (RA) are EPA or DEQ methods 1 through 4.
   b. Performance audits must be conducted quarterly in conjunction with the CEMS audits. It may not be possible to conduct audits on some CPMS. Exemption from this requirement must be approved by DEQ.

2. Stack Gas Flow Monitoring

   CPMS data are necessary for converting emission concentrations to units of the standard. This is accomplished by continuously monitoring stack gas flow rates to calculate the emissions as a rate (pounds per hour) in addition to the CEMS output (percent or parts per million).

   There are several acceptable alternatives for measuring flow rates (ultrasonic sensors, pitot tubes, process rates - steam, air flows, etc.). The CPMS must include the capability to measure and/or assume the following variables for determining the stack gas flow rate.

   - Stack gas temperature,
   - Stack gas pressure (absolute),
   - Stack gas moisture content,
   - Stack gas molecular weight,
   - Stack gas velocity, and
   - Cross-sectional area of the stack at the point of velocity measurements.

Flow rate metering systems generally measure and record the velocity, or velocity pressure (fifth bullet item 5 above). Other parameters are either directly or indirectly measured. In some circumstances parameters can be accurately assumed based on historical data collected from the source.

B.3 Pollution Control Device Related CPMS

1. Pollution control device related CPMS include but are not limited to:
   - Operating pressure and/or temperature,
   - Water flow rate, temperature, and/or pressure
   - Electrical current and voltage, and
   - Cycle time.

2. Calibration checks must be performed in accordance with the manufacturer's procedures at least once per month. Depending on the CPMS, an exemption from this requirement may be obtained from the DEQ upon written request. For example, water flow devices are typically calibrated only once, prior to installation.

B.4 Source Operation Related CPMS

Source related CPMS include but are not limited to:

- Steam flow & pressure meters,
- Fuel flow meters,
- Operating temperatures & pressures,
- Excess air levels,
- Hour meters and cycle time.

At a minimum, source related CPMS must meet the general CPMS requirements listed above. Depending on the CPMS, an exemption from this requirement may be obtained from the DEQ upon written request. Temperature CPMS must be calibrated during each planned maintenance outage or annually, whichever is more frequent.

APPENDIX C

DEQ RECORDKEEPING AND REPORTING REQUIREMENTS

General DEQ CMS recordkeeping and reporting requirements are outlined below. These requirements do not supersede any requirements specified by regulation or permit condition. Refer to Section 7.0 of this monitoring manual.

C.1 Recordkeeping

The source owner or operator must maintain records of all CMS activities in a file and/or log book. This record must be used by the CMS operator to ensure that the CMS is operating correctly. The record must also be made available to DEQ personnel upon request. The record must include as a minimum the following information:

1. Records of routine observation checks.
2. Records of routine maintenance and adjustments.
3. Records of parts that are replaced.
4. Spare parts inventory for the CMS.
5. Records of CMS calibrations.
6. Records of CMS daily calibration drift.
7. Records of CMS audits.
8. Records of corrective action taken to bring an “out-of- control” (40CFR60 App F) CMS into control.
9. Records of date and time when CMS is inoperative or “out-of-control” (40CFR60 App F).

C.2 Reporting Requirements

The source owner or operator may be required, by permit condition, to submit monitoring reports to the DEQ. These reports must include as a minimum the following information:

1. Reporting period (determined by permit condition).
2. CMS type, manufacturer, serial number, and location.
3. Monitoring data must be reduced and reported as follows (unless otherwise specified by permit or rule):
    a. For opacity monitoring systems (COMS):
        i. 6-minute (clock) averages
        ii. Hourly (clock) averages
        iii. Monthly average of the hourly averages.
    b. For emissions monitoring systems (CEMS):
        i. Hourly (clock) averages.
        ii. Monthly average of the hourly averages.
4. Data completeness information. The following completeness requirements are essential for a CMS data average to be accepted (unless otherwise specified by permit or rule):
    - For a 6-minute or 1-hour reporting period, a minimum of 75% of the data must be included in the average.
    - For a 24-hour or monthly reporting period, a minimum of 90% of the data must be included in the average.

    Insufficient data completeness, excluding CMS downtime due to daily zero and span checks and performance audits, will void that data period. All data collected must be reported. Non-valid data must be highlighted. Data recorded during periods of CMS breakdowns, repairs, audits, calibration checks, and zero and span adjustments must not be included in the data averages.

5. Specific identification and supporting documentation, as required by rule or by permit condition, for each period of excess emissions that occurs.
6. The date and time identifying each period during which the CMS was inoperative (out-of-control as per 40CFR60 App F) except for zero and span checks and the nature of the CMS repairs or adjustments.
7. Reporting requirements for CMS performance assessments conducted during the reporting period are outlined below. Assessment requirements are dependent on applicable performance specifications and QA/QC requirements. Additional reporting requirements may be stipulated by permit or DEQ communication.
    - Results of initial performance assessment, submit to DEQ.
    - Results of daily performance assessments, submit to DEQ upon request.
    - Quarterly performance assessments, submit to DEQ upon request.
    - Semiannual performance assessments, submit to DEQ upon request.
    - Annual performance assessments, submit to DEQ.
    - Performance assessments not specifically listed above, submit to DEQ upon request.