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CHAPTER 340
DEPARTMENT OF ENVIRONMENTAL QUALITY

FILING CAPTION: Air Quality Permitting Updates 2022

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RULES:
340-200-0020, 340-200-0025, 340-200-0035, 340-200-0040, 340-204-0300, 340-204-0310, 340-206-0010, 340-208-0110, 340-208-0510, 340-208-0610, 340-209-0080, 340-210-0100, 340-210-0205, 340-210-0215, 340-210-0225, 340-210-0230, 340-210-0240, 340-210-0250, 340-214-0110, 340-214-0114, 340-214-0130, 340-214-0330, 340-216-0020, 340-216-0025, 340-216-0040, 340-216-0054, 340-216-0056, 340-216-0060, 340-216-0064, 340-216-0066, 340-216-0068, 340-216-0082, 340-216-0084, 340-216-8010, 340-216-8020, 340-218-0020, 340-218-0040, 340-218-0050, 340-218-0080, 340-218-0150, 340-218-0170, 340-218-0180, 340-218-0240, 340-220-0180, 340-222-0020, 340-222-0035, 340-222-0040, 340-222-0041, 340-222-0042, 340-222-0046, 340-222-0060, 340-224-0030, 340-224-0100, 340-224-0520, 340-224-0530, 340-225-0030, 340-225-0050, 340-225-0070, 340-226-0100, 340-226-0130, 340-226-0140, 340-226-0210, 340-228-0210, 340-232-0030, 340-232-0040, 340-232-0090, 340-232-0160, 340-232-0170, 340-234-0010, 340-234-0210, 340-236-8010, 340-238-0030, 340-238-0040, 340-238-0070, 340-238-0080, 340-244-0040, 340-245-0060

AMEND: 340-200-0020

RULE TITLE: General Air Quality Definitions

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Updating General Air Quality Definitions.

RULE TEXT:
As used in OAR chapter 340, divisions 200 through 268, unless specifically defined otherwise:
(1) "Act" or "FCAA" means the Federal Clean Air Act, 42 U.S.C.A. § 7401 to 7671q.
(2) "Activity" means any process, operation, action, or reaction (e.g., chemical) at a source that emits a regulated pollutant.
(3) "Actual emissions" means the mass emissions of a regulated pollutant from an emissions source during a specified time period as set forth in OAR chapter 340, divisions 214, 220 and 222.
(4) "Adjacent", as used in the definitions of major source and source and in OAR 340-216-0070, means interdependent facilities that are nearby to each other.
(5) "Affected source" means a source that includes one or more affected units that are subject to emission reduction requirements or limitations under Title IV of the FCAA.

(6) "Affected states" means all states:

(a) Whose air quality may be affected by a proposed permit, permit modification, or permit renewal and that are contiguous to Oregon; or

(b) That are within 50 miles of the permitted source.

(7) "Aggregate insignificant emissions" means the annual actual emissions of any regulated pollutant from one or more designated activities at a source that are less than or equal to the lowest applicable level specified in this section. The total emissions from each designated activity and the aggregate emissions from all designated activities must be less than or equal to the lowest applicable level specified:

(a) One ton for total reduced sulfur, hydrogen sulfide, sulfuric acid mist, any Class I or II substance subject to a standard promulgated under or established by Title VI of the FCAA, and each criteria pollutant, except lead;

(b) 120 pounds for lead;

(c) 600 pounds for fluorides;

(d) 500 pounds for PM10 in a PM10 nonattainment area;

(e) 500 pounds for direct PM2.5 in a PM2.5 nonattainment area;

(f) The lesser of the amount established in 40 C.F.R. 68.130 or 1,000 pounds;

(g) An aggregate of 5,000 pounds for all hazardous air pollutants;

(h) 2,756 tons CO2e for greenhouse gases.

(8) "Air contaminant" means a dust, fume, gas, mist, odor, smoke, vapor, pollen, soot, carbon, acid, particulate matter, regulated pollutant, or any combination thereof, exclusive of uncombined water.

(9) "Air Contaminant Discharge Permit" or "ACDP" means written authorization issued, renewed, amended, or revised by DEQ, under OAR chapter 340, division 216.

(10) “Air pollution control device” or “control device” means equipment, other than inherent process equipment that is used to destroy or remove a regulated pollutant prior to discharge to the atmosphere.

(a) The types of equipment that may commonly be used as control devices include, but are not limited to, fabric filters; mechanical collectors; electrostatic precipitators; inertial separators; afterburners; thermal or catalytic incinerators; adsorption devices (e.g., carbon beds, condensers); scrubbers (e.g., wet collection and gas absorption devices); selective catalytic or non-catalytic reduction systems; flue gas recirculation systems; spray dryers; spray towers; mist eliminators at acid plants and sulfur recovery plants; injection systems (e.g., water, steam, ammonia, sorbent or limestone injection); and combustion devices independent of the particular process being conducted at an emissions unit (e.g., the destruction of emissions achieved by venting process emission streams to flares, boilers or process heaters).

(b)(A) For purposes of OAR 340-212-0200 through 340-212-0280, a control device does not include passive control measures that act to prevent regulated pollutants from forming, such as the use of seals, lids, or roofs to prevent the release of regulated pollutants, use of low-polluting fuel or feedstocks, or the use of combustion or other process design features or characteristics.

(B) If an applicable requirement establishes that particular equipment which otherwise meets this definition of a control device does not constitute a control device as applied to a particular regulated pollutant-specific emissions unit, then that definition will be binding for purposes of OAR 340-212-0200 through 340-212-0280.

(11) "Alternative method" means any method of sampling and analyzing for an air pollutant which is not a reference or equivalent method but which has been demonstrated to DEQ's satisfaction to, in specific cases, produce results adequate for determination of compliance. The alternative method must comply with the intent of the rules, is at least equivalent in objectivity and reliability to the uniform recognized procedures, and is demonstrated to be reproducible, selective, sensitive, accurate, and applicable to the program. An alternative method used to meet an applicable federal requirement for which a reference method is specified must be approved by EPA unless EPA has delegated authority for the approval to DEQ.

(12) "Ambient air" means that portion of the atmosphere, external to buildings, to which the general public has access.

(13) "Applicable requirement" means all of the following as they apply to emissions units in an Oregon Title V Operating Permit program source or ACDP program source, including requirements that have been promulgated or approved by

the EPA through rule making at the time of issuance but have future-effective compliance dates:
(a) Any standard or other requirement provided for in the applicable implementation plan approved or promulgated by the EPA through rulemaking under Title I of the FCAA that implements the relevant requirements of the FCAA, including any revisions to that plan promulgated in 40 C.F.R. part 52;
(b) Any standard or other requirement adopted under OAR 340-200-0040 of the State of Oregon Clean Air Act Implementation Plan that is more stringent than the federal standard or requirement which has not yet been approved by the EPA, and other state-only enforceable air pollution control requirements;
(c) Any term or condition in an ACDP, OAR chapter 340, division 216, including any term or condition of any preconstruction permits issued under OAR chapter 340, division 224, New Source Review, until or unless DEQ revokes or modifies the term or condition by a permit modification;
(d) Any term or condition in a Notice of Construction and Approval of Plans, OAR 340-210-0205 through 340-210-0240, until or unless DEQ revokes or modifies the term or condition by a Notice of Construction and Approval of Plans or a permit modification;
(e) Any term or condition in a Notice of Approval, OAR 340-218-0190, issued before July 1, 2001, until or unless DEQ revokes or modifies the term or condition by a Notice of Approval or a permit modification;
(f) Any term or condition of a PSD permit issued by the EPA until or unless the EPA revokes or modifies the term or condition by a permit modification;
(g) Any standard or other requirement under section 111 of the FCAA, including section 111(d);
(h) Any standard or other requirement under section 112 of the FCAA, including any requirement concerning accident prevention under section 112(r)(7) of the FCAA;
(i) Any standard or other requirement of the acid rain program under Title IV of the FCAA or the regulations promulgated thereunder;
(j) Any requirements established under section 504(b) or section 114(a)(3) of the FCAA;
(k) Any standard or other requirement under section 126(a)(1) and(c) of the FCAA;
(l) Any standard or other requirement governing solid waste incineration, under section 129 of the FCAA;
(m) Any standard or other requirement for consumer and commercial products, under section 183(e) of the FCAA;
(n) Any standard or other requirement for tank vessels, under section 183(f) of the FCAA;
(o) Any standard or other requirement of the program to control air pollution from outer continental shelf sources, under section 328 of the FCAA;
(p) Any standard or other requirement of the regulations promulgated to protect stratospheric ozone under Title VI of the FCAA, unless the Administrator has determined that such requirements need not be contained in an Oregon Title V Operating Permit; and
(q) Any national ambient air quality standard or increment or visibility requirement under part C of Title I of the FCAA, but only as it would apply to temporary sources permitted under section 504(e) of the FCAA.
(14) “Attainment area” or “unclassified area” means an area that has not otherwise been designated by EPA as nonattainment with ambient air quality standards for a particular regulated pollutant. Attainment areas or unclassified areas may also be referred to as sustainment or maintenance areas as designated in OAR chapter 340, division 204. Any particular location may be part of an attainment area or unclassified area for one regulated pollutant while also being in a different type of designated area for another regulated pollutant.
(15) “Attainment pollutant” means a pollutant for which an area is designated an attainment or unclassified area.
(16) "Baseline emission rate" means the actual emission rate during a baseline period as determined under OAR chapter 340, division 222.
(17) "Baseline period" means the period used to determine the baseline emission rate for each regulated pollutant under OAR chapter 340, division 222.
(18) "Best Available Control Technology" or "BACT" means an emission limitation, including, but not limited to, a visible emission standard, based on the maximum degree of reduction of each air contaminant subject to regulation under the FCAA which would be emitted from any proposed major source or major modification which, on a case-by-case basis,

taking into account energy, environmental, and economic impacts and other costs, is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such air contaminant. In no event may the application of BACT result in emissions of any air contaminant that would exceed the emissions allowed by any applicable new source performance standard or any standard for hazardous air pollutant. If an emission limitation is not feasible, a design, equipment, work practice, or operational standard, or combination thereof, may be required. Such standard must, to the degree possible, set forth the emission reduction achievable and provide for compliance by prescribing appropriate permit conditions.

(19) "Biomass" means non-fossilized and biodegradable organic material originating from plants, animals, and microorganisms, including products, byproducts, residues and waste from agriculture, forestry, and related industries as well as the non-fossilized and biodegradable organic fractions of industrial and municipal wastes, including gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic matter.

(20) "Capacity" means the maximum regulated pollutant emissions from a stationary source under its physical and operational design.

(21) “Capture efficiency” means the amount of regulated pollutant collected and routed to an air pollution control device divided by the amount of total emissions generated by the process being controlled.

(22) "Capture system" means the equipment, including but not limited to hoods, ducts, fans, and booths, used to contain, capture and transport a regulated pollutant to a control device.

(23) "Carbon dioxide equivalent" or "CO2e" means an amount of a greenhouse gas or gases expressed as the equivalent amount of carbon dioxide, and is computed by multiplying the mass of each of the greenhouse gases by the global warming potential published for each gas at 40 C.F.R. part 98, subpart A, Table A–1-Global Warming Potentials, and adding the resulting value for each greenhouse gas to compute the total equivalent amount of carbon dioxide.

(24) "Categorically insignificant activity" means any of the following listed regulated pollutant emitting activities principally supporting the source or the major industrial group. Categorically insignificant activities must comply with all applicable requirements.

(a) Constituents of a chemical mixture present at less than 1 percent by weight of any chemical or compound regulated under divisions 200 through 268 excluding divisions 248 and 262 of this chapter, or less than 0.1 percent by weight of any carcinogen listed in the U.S. Department of Health and Human Service's Annual Report on Carcinogens when usage of the chemical mixture is less than 100,000 pounds/year;

(b) Evaporative and tailpipe emissions from on-site motor vehicle operation;

(c) Distillate oil, kerosene, gasoline, natural gas or propane burning equipment, provided the aggregate expected actual emissions of the equipment identified as categorically insignificant do not exceed the de minimis level for any regulated pollutant, based on the expected maximum annual operation of the equipment. If a source’s expected emissions from all such equipment exceed the de minimis levels, then the source may identify a subgroup of such equipment as categorically insignificant with the remainder not categorically insignificant. The following equipment may never be included as categorically insignificant:

(A) Any individual distillate oil, kerosene or gasoline burning equipment with a rating greater than 0.4 million Btu/hour;

(B) Any individual natural gas or propane burning equipment with a rating greater than 2.0 million Btu/hour.

(d) Distillate oil, kerosene, gasoline, natural gas or propane burning equipment brought on site for six months or less for maintenance, construction or similar purposes, such as but not limited to generators, pumps, hot water pressure washers and space heaters, provided that any such equipment that performs the same function as the permanent equipment, must be operated within the source's existing PSEL;

(e) Office activities;

(f) Food service activities;

(g) Janitorial activities;

(h) Personal care activities;

(i) Groundskeeping activities including, but not limited to building painting and road and parking lot maintenance;

(j) On-site laundry activities;
(k) On-site recreation facilities;
(l) Instrument calibration;
(m) Maintenance and repair shop;
(n) Automotive repair shops or storage garages;
(o) Air cooling or ventilating equipment not designed to remove air contaminants generated by or released from associated equipment;
(p) Refrigeration systems with less than 50 pounds of charge of ozone depleting substances regulated under Title VI, including pressure tanks used in refrigeration systems but excluding any combustion equipment associated with such systems;
(q) Bench scale laboratory equipment and laboratory equipment used exclusively for chemical and physical analysis, including associated vacuum producing devices but excluding research and development facilities;
(r) Temporary construction activities;
(s) Warehouse activities;
(t) Accidental fires;
(u) Air vents from air compressors;
(v) Air purification systems;
(w) Continuous emissions monitoring vent lines;
(x) Demineralized water tanks;
(y) Pre-treatment of municipal water, including use of deionized water purification systems;
(z) Electrical charging stations;
(aa) Fire brigade training;
(bb) Instrument air dryers and distribution;
(cc) Process raw water filtration systems;
(dd) Pharmaceutical packaging;
(ee) Fire suppression;
(ff) Blueprint making;
(gg) Routine maintenance, repair, and replacement such as anticipated activities most often associated with and performed during regularly scheduled equipment outages to maintain a plant and its equipment in good operating condition, including but not limited to steam cleaning, abrasive use, and woodworking;
(hh) Electric motors;
(ii) Storage tanks, reservoirs, transfer and lubricating equipment used for ASTM grade distillate or residual fuels, lubricants, and hydraulic fluids;
(jj) On-site storage tanks not subject to any New Source Performance Standards (NSPS), including underground storage tanks (UST), storing gasoline or diesel used exclusively for fueling of the facility's fleet of vehicles;
(kk) Natural gas, propane, and liquefied petroleum gas (LPG) storage tanks and transfer equipment;
(ll) Pressurized tanks containing gaseous compounds;
(mm) Vacuum sheet stacker vents;
(nn) Emissions from wastewater discharges to publicly owned treatment works (POTW) provided the source is authorized to discharge to the POTW, not including on-site wastewater treatment and/or holding facilities;
(oo) Log ponds;
(pp) Stormwater settling basins;
(qq) Fire suppression and training;
(rr) Paved roads and paved parking lots within an urban growth boundary;
(ss) Hazardous air pollutant emissions in fugitive dust from paved and unpaved roads except for those sources that have processes or activities that contribute to the deposition and entrainment of hazardous air pollutants from surface soils;
(tt) Health, safety, and emergency response activities;

(uu) Emergency generators and pumps used only during loss of primary equipment or utility service due to circumstances beyond the reasonable control of the owner or operator, or to address a power emergency, provided that the aggregate horsepower rating of all stationary emergency generator and pump engines is not more than 3,000 horsepower. If the aggregate horsepower rating of all stationary emergency generator and pump engines is more than 3,000 horsepower, then no emergency generators and pumps at the source may be considered categorically insignificant;

(vv) Non-contact steam vents and leaks and safety and relief valves for boiler steam distribution systems;

(ww) Non-contact steam condensate flash tanks;

(xx) Non-contact steam vents on condensate receivers, deaerators and similar equipment;

(yy) Boiler blowdown tanks;

(zz) Industrial cooling towers that do not use chromium-based water treatment chemicals;

(aaa) Ash piles maintained in a wetted condition and associated handling systems and activities;

(bbb) Uncontrolled oil/water separators in effluent treatment systems, excluding systems with a throughput of more than 400,000 gallons per year of effluent located at the following sources:

(A) Petroleum refineries;

(B) Sources that perform petroleum refining and re-refining of lubricating oils and greases including asphalt production by distillation and the reprocessing of oils and/or solvents for fuels; or

(C) Bulk gasoline plants, bulk gasoline terminals, and pipeline facilities;

(ccc) Combustion source flame safety purging on startup;

(ddd) Broke beaters, pulp and repulping tanks, stock chests and pulp handling equipment, excluding thickening equipment and repulpers;

(eee) Stock cleaning and pressurized pulp washing, excluding open stock washing systems; and

(fff) White water storage tanks.

(25) "Certifying individual" means the responsible person or official authorized by the owner or operator of a source who certifies the accuracy of the emission statement.

(26) "Class I area" or “PSD Class I area” means any Federal, State or Indian reservation land which is classified or reclassified as a Class I area under OAR 340-204-0050 and 340-204-0060.

(27) “Class II area” or “PSD Class II area’ means any land which is classified or reclassified as a Class II area under OAR 340-204-0050 and 340-204-0060.

(28) “Class III area” or “PSD Class III area’ means any land which is reclassified as a Class III area under OAR 340-204-0060.

(29) "Commence" or "commencement" means that the owner or operator has obtained all necessary preconstruction approvals required by the FCAA and either has:

(a) Begun, or caused to begin, a continuous program of actual on-site construction of the source to be completed in a reasonable time; or

(b) Entered into binding agreements or contractual obligations, which cannot be canceled or modified without substantial loss to the owner or operator, to undertake a program of construction of the source to be completed in a reasonable time.

(30) "Commission" or "EQC" means Environmental Quality Commission.

(31) "Constant process rate" means the average variation in process rate for the calendar year is not greater than plus or minus ten percent of the average process rate.

(32) "Construction":

(a) Except as provided in subsection (b) means any physical change including, but not limited to, fabrication, erection, installation, demolition, replacement, or modification of a source or part of a source;

(b) As used in OAR chapter 340, division 224 means any physical change including, but not limited to, fabrication, erection, installation, demolition, or modification of an emissions unit, or change in the method of operation of a source which would result in a change in actual emissions.

(33) "Continuous compliance determination method" means a method, specified by the applicable standard or an applicable permit condition, which:

(a) Is used to determine compliance with an emission limitation or standard on a continuous basis, consistent with the averaging period established for the emission limitation or standard; and

(b) Provides data either in units of the standard or correlated directly with the compliance limit.

(34) "Continuous monitoring systems" means sampling and analysis, in a timed sequence, using techniques which will adequately reflect actual emissions or concentrations on a continuing basis as specified in the DEQ Continuous Monitoring Manual, found in OAR 340-200-0035, and includes continuous emission monitoring systems, continuous opacity monitoring system (COMS) and continuous parameter monitoring systems.

(35) “Control efficiency” means the product of the capture and removal efficiencies.

(36) "Criteria pollutant" means any of the following regulated pollutants: nitrogen oxides, volatile organic compounds, particulate matter, PM10, PM2.5, sulfur dioxide, carbon monoxide, and lead.

(37) "Data" means the results of any type of monitoring or method, including the results of instrumental or non-instrumental monitoring, emission calculations, manual sampling procedures, recordkeeping procedures, or any other form of information collection procedure used in connection with any type of monitoring or method.

(38) “Day” means a 24-hour period beginning at 12:00 a.m. midnight or a 24-hour period as specified in a permit.

(39) "De minimis emission level" means the level for the regulated pollutants listed below:

(a) Greenhouse Gases (CO2e) = 2,756 tons per year.

(b) CO = 1 ton per year.

(c) NOx = 1 ton per year.

(d) SO2 = 1 ton per year.

(e) VOC = 1 ton per year.

(f) PM = 1 ton per year.

(g) PM10 (except Medford AQMA) = 1 ton per year.

(h) PM10 (Medford AQMA) = 0.5 ton per year and 5.0 pounds/day.

(i) Direct PM2.5 = 1 ton per year.

(j) Lead = 0.1 ton per year.

(k) Fluorides = 0.3 ton per year.

(l) Sulfuric Acid Mist = 0.7 ton per year.

(m) Hydrogen Sulfide = 1 ton per year.

(n) Total Reduced Sulfur (including hydrogen sulfide) = 1 ton per year.

(o) Reduced Sulfur = 1 ton per year.

(p) Municipal waste combustor organics (dioxin and furans) = 0.0000005 ton per year.

(q) Municipal waste combustor metals = 1 ton per year.

(r) Municipal waste combustor acid gases = 1 ton per year.

(s) Municipal solid waste landfill gases (measured as nonmethane organic compounds) = 1 ton per year

(t) Single HAP = 1 ton per year

(u) Combined HAP (aggregate) = 1 ton per year

(40) "Department" or “DEQ”:

(a) Means Department of Environmental Quality; except

(b) As used in OAR chapter 340, divisions 218 and 220 means Department of Environmental Quality, or in the case of Lane County, LRAPA.

(41) “DEQ method [#]” means the sampling method and protocols for measuring a regulated pollutant as described in the DEQ Source Sampling Manual, found in OAR 340-200-0035.

(42) “Designated area” means an area that has been designated as an attainment, unclassified, sustainment, nonattainment, reattainment, or maintenance area under OAR chapter 340, division 204 or applicable provisions of the FCAA.

(43) “Destruction efficiency” means removal efficiency.

(44) "Device" means any machine, equipment, raw material, product, or byproduct at a source that produces or emits a regulated pollutant.

(45) "Direct PM2.5" has the meaning provided in the definition of PM2.5.

(46) "Director" means the Director of DEQ or the Director's designee.

(47) "Draft permit" means the version of an Oregon Title V Operating Permit for which DEQ or LRAPA offers public participation under OAR 340-218-0210 or the EPA and affected State review under 340-218-0230.

(48) "Dry standard cubic foot" means the amount of gas that would occupy a volume of one cubic foot, if the gas were free of uncombined water at standard conditions.

(49) "Effective date of the program" means the date that the EPA approves the Oregon Title V Operating Permit program submitted by DEQ on a full or interim basis. In case of a partial approval, the "effective date of the program" for each portion of the program is the date of the EPA approval of that portion.

(50) "Emergency" means any situation arising from sudden and reasonably unforeseeable events beyond the control of the owner or operator, including acts of God, which situation requires immediate corrective action to restore normal operation, and that causes the source to exceed a technology-based emission limitation under the permit, due to unavoidable increases in emissions attributable to the emergency. An emergency does not include noncompliance to the extent caused by improperly designed equipment, lack of preventative maintenance, careless or improper operation, or operator error.

(51) "Emission" means a release into the atmosphere of any regulated pollutant or any air contaminant.

(52) "Emission estimate adjustment factor" or "EEAF" means an adjustment applied to an emission factor to account for the relative inaccuracy of the emission factor.

(53) "Emission factor" means an estimate of the rate at which a regulated pollutant is released into the atmosphere, as the result of some activity, divided by the rate of that activity (e.g., production or process rate).

(54) "Emission(s) limitation," “emission(s) limit,” "emission(s) standard or “emission(s) limitation or standard” means:

(a) Except as provided in subsection (b), a requirement established by a state, local government, or EPA rule; a permit condition or order, which limits the quantity, rate, or concentration of emissions of regulated pollutants on a continuous basis, including any requirements which limit the level of opacity, prescribe equipment, set fuel specifications, or prescribe operation or maintenance procedures for a source to assure continuous emission reduction.

(b) As used in OAR 340-212-0200 through 340-212-0280, any applicable requirement that constitutes an emission(s) limit, emission(s) limitation, emission(s) standard, standard of performance or means of emission(s) limitation as defined under the FCAA. An emission limitation or standard may be expressed in terms of the pollutant, expressed either as a specific quantity, rate or concentration of emissions, e.g., pounds of SO2 per hour, pounds of SO2 per million British thermal units of fuel input, kilograms of VOC per liter of applied coating solids, or parts per million by volume of SO2, or as the relationship of uncontrolled to controlled emissions, e.g., percentage capture and destruction efficiency of VOC or percentage reduction of SO2. An emission limitation or standard may also be expressed either as a work practice, process or control device parameter, or other form of specific design, equipment, operational, or operation and maintenance requirement. For purposes of 340-212-0200 through 340-212-0280, an emission limitation or standard does not include general operation requirements that an owner or operator may be required to meet, such as requirements to obtain a permit, operate and maintain sources using good air pollution control practices, develop and maintain a malfunction abatement plan, keep records, submit reports, or conduct monitoring.

(55) "Emission reduction credit banking" means to presently reserve, subject to requirements of OAR chapter 340, division 268, Emission Reduction Credits, emission reductions for use by the reserver or assignee for future compliance with air pollution reduction requirements.

(56) "Emission reporting form" means a paper or electronic form developed by DEQ that must be completed by the permittee to report calculated emissions, actual emissions, or permitted emissions for interim emission fee assessment purposes.

(57) "Emissions unit" means any part or activity of a source that emits or has the potential to emit any regulated

pollutant.

(a) A part of a source is any machine, equipment, raw material, product, or byproduct that produces or emits regulated pollutants. An activity is any process, operation, action, or reaction, e.g., chemical, at a stationary source that emits regulated pollutants. Except as described in subsection (d), parts and activities may be grouped for purposes of defining an emissions unit if the following conditions are met:

(A) The group used to define the emissions unit may not include discrete parts or activities to which a distinct emissions standard applies or for which different compliance demonstration requirements apply; and

(B) The emissions from the emissions unit are quantifiable.

(b) Emissions units may be defined on a regulated pollutant by regulated pollutant basis where applicable.

(c) The term emissions unit is not meant to alter or affect the definition of the term "unit" under Title IV of the FCAA.

(d) Parts and activities cannot be grouped for determining emissions increases from an emissions unit under OAR chapter 340, divisions 210 and 224, or for determining the applicability of any New Source Performance Standard.

(58) "EPA" or "Administrator" means the Administrator of the United States Environmental Protection Agency or the Administrator's designee.

(59) "EPA Method 9" means the method for Visual Determination of the Opacity of Emissions From Stationary Sources described in 40 C.F.R. part 60, Appendix A–4.

(60) "Equivalent method" means any method of sampling and analyzing for a regulated pollutant that has been demonstrated to DEQ's satisfaction to have a consistent and quantitatively known relationship to the reference method, under specified conditions. An equivalent method used to meet an applicable federal requirement for which a reference method is specified must be approved by EPA unless EPA has delegated authority for the approval to DEQ.

(61) "Event" means excess emissions that arise from the same condition and occur during a single calendar day or continue into subsequent calendar days.

(62) "Exceedance" means a condition that is detected by monitoring that provides data in terms of an emission limitation or standard and that indicates that emissions, or opacity, are greater than the applicable emission limitation or standard, or less than the applicable standard in the case of a percent reduction requirement, consistent with any averaging period specified for averaging the results of the monitoring.

(63) "Excess emissions" means emissions in excess of an emission limit, or a risk limit under OAR chapter 340, division 245, contained in an applicable requirement, a permit or permit attachment limit; or emissions in violation of any applicable air quality rule.

(64) "Excursion" means a departure from an indicator range established for monitoring under OAR 340-212-0200 through 340-212-0280 and 340-218-0050(3)(a), consistent with any averaging period specified for averaging the results of the monitoring.

(65) "Federal Land Manager" means with respect to any lands in the United States, the Secretary of the federal department with authority over such lands.

(66) "Federal Major Source" means any source listed in subsections (a) or (d) below:

(a) A source with potential to emit:

(A) 100 tons per year or more of any individual regulated pollutant, excluding greenhouse gases and hazardous air pollutants listed in OAR chapter 340, division 244 if in a source category listed in subsection (c), or

(B) 250 tons per year or more of any individual regulated pollutant, excluding greenhouse gases and hazardous air pollutants listed in OAR chapter 340, division 244, if not in a source category listed in subsection (c).

(b) Calculations for determining a source's potential to emit for purposes of subsections (a) and (d) must include the following:

(A) Fugitive emissions and insignificant activity emissions; and

(B) Increases or decreases due to a new or modified source.

(c) Source categories:

(A) Fossil fuel-fired steam electric plants of more than 250 million BTU/hour heat input;

(B) Coal cleaning plants with thermal dryer(C) Kraft pulp mills;

(D) Portland cement plants;
(E) Primary zinc smelters;
(F) Iron and steel mill plants;
(G) Primary aluminum ore reduction plants;
(H) Primary copper smelters;
(I) Municipal incinerators capable of charging more than 50 tons of refuse per day;
(J) Hydrofluoric acid plants;
(K) Sulfuric acid plants;
(L) Nitric acid plants;
(M) Petroleum refineries;
(N) Lime plants;
(O) Phosphate rock processing plants;
(P) Coke oven batteries;
(Q) Sulfur recovery plants;
(R) Carbon black plants, furnace process;
(S) Primary lead smelters;
(T) Fuel conversion plants;
(U) Sintering plants;
(V) Secondary metal production plants;
(W) Chemical process plants, excluding ethanol production facilities that produce ethanol by natural fermentation included in NAICS codes 325193 or 312140;
(X) Fossil fuel fired boilers, or combinations thereof, totaling more than 250 million BTU per hour heat input;
(Y) Petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels;
(Z) Taconite ore processing plants;
(AA) Glass fiber processing plants;
(BB) Charcoal production plants.
(d) A major stationary source as defined in part D of Title I of the FCAA, including:
(A) For ozone nonattainment areas, sources with the potential to emit 100 tons per year or more of VOCs or oxides of nitrogen in areas classified as "marginal" or "moderate," 50 tons per year or more in areas classified as "serious," 25 tons per year or more in areas classified as "severe," and 10 tons per year or more in areas classified as "extreme"; except that the references in this paragraph to 100, 50, 25, and 10 tons per year of nitrogen oxides do not apply with respect to any source for which the Administrator has made a finding, under section 182(f)(1) or (2) of the FCAA, that requirements under section 182(f) of the FCAA do not apply;
(B) For ozone transport regions established under section 184 of the FCAA, sources with the potential to emit 50 tons per year or more of VOCs;
(C) For carbon monoxide nonattainment areas that are classified as "serious" and in which stationary sources contribute significantly to carbon monoxide levels as determined under rules issued by the Administrator, sources with the potential to emit 50 tons per year or more of carbon monoxide.
(D) For PM10 nonattainment areas classified as "serious," sources with the potential to emit 70 tons per year or more of PM10.
(67) "Final permit" means the version of an Oregon Title V Operating Permit issued by DEQ or LRAPA that has completed all review procedures required by OAR 340-218-0120 through 340-218-0240.
(68) "Form" means a paper or electronic form developed by DEQ.
(69) “Fuel burning equipment” means equipment, other than internal combustion engines, the principal purpose of which is to produce heat or power by indirect heat transfer.
(70) "Fugitive emissions":
(a) Except as used in subsection (b), means emissions of any air contaminant which escape to the atmosphere from any

point or area that is not identifiable as a stack, vent, duct, or equivalent opening.

(b) As used to define a major Oregon Title V Operating Permit program source, means those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.

(71) "General permit":

(a) Except as provided in subsection (b), means an Oregon Air Contaminant Discharge Permit established under OAR 340-216-0060;

(b) As used in OAR chapter 340, division 218 means an Oregon Title V Operating Permit established under OAR 340-218-0090.

(72)(a) "Greenhouse gases" or "GHGs" means the aggregate group of carbon dioxide (CO2), methane (CH4), nitrous oxide (N20), sulfur hexafluoride (SF6), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and other fluorinated greenhouse gases or fluorinated GHG as defined in 40 C.F.R. part 98.

(b) The definition of greenhouse gases in subsection (a) of this section does not include, for purposes of division 216, 218, and 224, carbon dioxide emissions from the combustion or decomposition of biomass except to the extent required by federal law.

(73) "Growth allowance" means an allocation of some part of an airshed's capacity to accommodate future proposed sources and modifications of sources.

(74) "Hardboard" means a flat panel made from wood that has been reduced to basic wood fibers and bonded by adhesive properties under pressure.

(75) “Hazardous Air Pollutant” or “HAP” means an air contaminant listed by the EPA under section 112(b) of the FCAA or determined by the EQC to cause, or reasonably be anticipated to cause, adverse effects to human health or the environment.

(76) "Immediately" means as soon as possible but in no case more than one hour after a source knew or should have known of an excess emission period.

(77) "Indian governing body" means the governing body of any tribe, band, or group of Indians subject to the jurisdiction of the United States and recognized by the United States as possessing power of self-government.

(78) "Indian reservation" means any federally recognized reservation established by Treaty, Agreement, Executive Order, or Act of Congress.

(79) "Inherent process equipment" means equipment that is necessary for the proper or safe functioning of the process, or material recovery equipment that the owner or operator documents is installed and operated primarily for purposes other than compliance with air pollution regulations. Equipment that must be operated at an efficiency higher than that achieved during normal process operations in order to comply with the applicable emission limitation or standard is not inherent process equipment. For the purposes of OAR 340-212-0200 through 340-212-0280, inherent process equipment is not considered a control device.

(80) "Insignificant activity" means an activity or emission that DEQ has designated as categorically insignificant, or that meets the criteria of aggregate insignificant emissions.

(81) "Insignificant change" means an off-permit change defined under OAR 340-218-0140(2)(a) to either a significant or an insignificant activity which:

(a) Does not result in a re-designation from an insignificant to a significant activity;

(b) Does not invoke an applicable requirement not included in the permit; and

(c) Does not result in emission of regulated pollutants not regulated by the source's permit.

(82) “Internal combustion engine” means stationary gas turbines and reciprocating internal combustion engines.

(83) "Late payment" means a fee payment which is received after the due date.

(84) "Liquefied petroleum gas" has the meaning given by the American Society for Testing and Materials in ASTM D1835-82, "Standard Specification for Liquid Petroleum Gases."

(85) "Lowest Achievable Emission Rate" or "LAER" means that rate of emissions which reflects: the most stringent emission limitation which is contained in the implementation plan of any state for such class or category of source, unless the owner or operator of the proposed source demonstrates that such limitations are not achievable; or the most

stringent emission limitation which is achieved in practice by such class or category of source, whichever is more stringent. The application of this term cannot permit a proposed new or modified source to emit any air contaminant in excess of the amount allowable under applicable New Source Performance Standards (NSPS) or standards for hazardous air pollutants.

(86) "Maintenance area" means any area that was formerly nonattainment for a criteria pollutant but has since met the ambient air quality standard, and EPA has approved a maintenance plan to comply with the standards under 40 C.F.R. 51.110. Maintenance areas are designated by the EQC according to division 204.

(87) "Maintenance pollutant" means a regulated pollutant for which a maintenance area was formerly designated a nonattainment area.

(88) "Major Modification" means any physical change or change in the method of operation of a source that results in satisfying the requirements of OAR 340-224-0025.

(89) “Major New Source Review” or “Major NSR” means the new source review process and requirements under OAR 340-224-0010 through 340-224-0070 and 340-224-0500 through 340-224-0540 based on the location and regulated pollutants emitted.

(90) "Major source":

(a) Except as provided in subsection (b) of this section, means a source that emits, or has the potential to emit, any regulated air pollutant at a Significant Emission Rate. The fugitive emissions and insignificant activity emissions of a stationary source are considered in determining whether it is a major source. Potential to emit calculations must include emission increases due to a new or modified source and may include emission decreases.

(b) As used in OAR chapter 340, division 210, Stationary Source Notification Requirements; Compliance Assurance Monitoring, OAR 340-212-0200 through 340-212-0280; OAR 340-216-0066, Standard ACDPs; OAR chapter 340, division 218, Oregon Title V Operating Permits; OAR chapter 340, division 220, Oregon Title V Operating Permit Fees; 340-216-0066, Standard ACDPs, and OAR chapter 340, division 236, Emission Standards for Specific Industries; means any stationary source or any group of stationary sources that are located on one or more contiguous or adjacent properties and are under common control of the same person or persons under common control belonging to a single major industrial grouping or supporting the major industrial group and that is described in paragraphs (A), (B), or (C). For the purposes of this subsection, a stationary source or group of stationary sources is considered part of a single industrial grouping if all of the regulated pollutant emitting activities at such source or group of sources on contiguous or adjacent properties belong to the same major group (i.e., all have the same two-digit code) as described in the Standard Industrial Classification Manual (U.S. Office of Management and Budget, 1987) or support the major industrial group.

(A) A major source of hazardous air pollutants, which means:

(i) For hazardous air pollutants other than radionuclides, any stationary source or group of stationary sources located within a contiguous area and under common control that emits or has the potential to emit, in the aggregate, 10 tons per year or more of any hazardous air pollutants that has been listed under OAR 340-244-0040; 25 tons per year or more of any combination of such hazardous air pollutants, or such lesser quantity as the Administrator may establish by rule. Emissions from any oil or gas exploration or production well, along with its associated equipment, and emissions from any pipeline compressor or pump station will not be aggregated with emissions from other similar units, whether or not such units are in a contiguous area or under common control, to determine whether such units or stations are major sources; or

(ii) For radionuclides, "major source" will have the meaning specified by the Administrator by rule.

(B) A major stationary source of regulated pollutants, as defined in section 302 of the FCAA, that directly emits or has the potential to emit 100 tons per year or more of any regulated pollutant, except greenhouse gases, including any major source of fugitive emissions of any such regulated pollutant. The fugitive emissions of a stationary source are not considered in determining whether it is a major stationary source for the purposes of section 302(j) of the FCAA, unless the source belongs to one of the following categories of stationary sources:

(i) Coal cleaning plants (with thermal dryers);

(ii) Kraft pulp mills;
(iii) Portland cement plants;
(iv) Primary zinc smelters;
(v) Iron and steel mills;
(vi) Primary aluminum ore reduction plants;
(vii) Primary copper smelters;
(viii) Municipal incinerators capable of charging more than 50 tons of refuse per day;
(ix) Hydrofluoric, sulfuric, or nitric acid plants;
(x) Petroleum refineries;
(xi) Lime plants;
(xii) Phosphate rock processing plants;
(xiii) Coke oven batteries;
(xiv) Sulfur recovery plants;
(xv) Carbon black plants (furnace process);
(xvi) Primary lead smelters;
(xvii) Fuel conversion plants;
(xviii) Sintering plants;
(xix) Secondary metal production plants;
(xx) Chemical process plants, excluding ethanol production facilities that produce ethanol by natural fermentation included in NAICS codes 325193 or 312140;
(xxi) Fossil-fuel boilers, or combination thereof, totaling more than 250 million British thermal units per hour heat input;
(xxii) Petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels;
(xxiii) Taconite ore processing plants;
(xxiv) Glass fiber processing plants;
(xxv) Charcoal production plants;
(xxvi) Fossil-fuel-fired steam electric plants of more than 250 million British thermal units per hour heat input; or
(xxvii) Any other stationary source category, that as of August 7, 1980 is being regulated under section 111 or 112 of the FCAA.

(C) From July 1, 2011 through November 6, 2014, a major stationary source of regulated pollutants, as defined by Section 302 of the FCAA, that directly emits or has the potential to emit 100 tons per year or more of greenhouse gases and directly emits or has the potential to emit 100,000 tons per year or more CO2e, including fugitive emissions.

(91) "Material balance" means a procedure for determining emissions based on the difference in the amount of material added to a process and the amount consumed and/or recovered from a process.

(92) "Modification," except as used in the terms "major modification" “permit modification” and “Title I modification,” means any physical change to, or change in the method of operation of, a source or part of a source that results in an increase in the source or part of the source's potential to emit any regulated pollutant on an hourly basis. Modifications do not include the following:

(a) Increases in hours of operation or production rates that do not involve a physical change or change in the method of operation;

(b) Changes in the method of operation due to using an alternative fuel or raw material that the source or part of a source was physically capable of accommodating during the baseline period; and

(c) Routine maintenance, repair and like-for-like replacement of components unless they increase the expected life of the source or part of a source by using component upgrades that would not otherwise be necessary for the source or part of a source to function.

(93) "Monitoring" means any form of collecting data on a routine basis to determine or otherwise assess compliance with emission limitations or standards. Monitoring may include record keeping if the records are used to determine or assess compliance with an emission limitation or standard such as records of raw material content and usage, or records

documenting compliance with work practice requirements. Monitoring may include conducting compliance method tests, such as the procedures in appendix A to 40 C.F.R. part 60, on a routine periodic basis. Requirements to conduct such tests on a one-time basis, or at such times as a regulatory authority may require on a non-regular basis, are not considered monitoring requirements for purposes of this definition. Monitoring may include one or more than one of the following data collection techniques as appropriate for a particular circumstance:

(a) Continuous emission or opacity monitoring systems.

(b) Continuous process, capture system, control device or other relevant parameter monitoring systems or procedures, including a predictive emission monitoring system.

(c) Emission estimation and calculation procedures (e.g., mass balance or stoichiometric calculations).

(d) Maintaining and analyzing records of fuel or raw materials usage.

(e) Recording results of a program or protocol to conduct specific operation and maintenance procedures.

(f) Verifying emissions, process parameters, capture system parameters, or control device parameters using portable or in situ measurement devices.

(g) Visible emission observations and recording.

(h) Any other form of measuring, recording, or verifying on a routine basis emissions, process parameters, capture system parameters, control device parameters or other factors relevant to assessing compliance with emission limitations or standards.

(94) "Natural gas" means a naturally occurring mixture of hydrocarbon and nonhydrocarbon gases found in geologic formations beneath the earth's surface, of which the principal component is methane.

(95) "Netting basis" means an emission rate determined as specified in OAR 340-222-0046.

(96) "Nitrogen oxides" or "NOx" means all oxides of nitrogen except nitrous oxide.

(97) "Nonattainment area" means a geographical area of the state, as designated by the EQC or the EPA, that exceeds any state or federal primary or secondary ambient air quality standard. Nonattainment areas are designated by the EQC according to division 204.

(98) "Nonattainment pollutant" means a regulated pollutant for which an area is designated a nonattainment area. Nonattainment areas are designated by the EQC according to division 204.

(99) "Normal source operation" means operation that does not include such conditions as forced fuel substitution, equipment malfunction, or highly abnormal market conditions.

(100) "Odor" means that property of an air contaminant that affects the sense of smell.

(101) "Offset" means an equivalent or greater emission reduction that is required before allowing an emission increase from a source that is subject to Major NSR or State NSR.

(102) "Opacity" means the degree to which emissions, excluding uncombined water, reduce the transmission of light and obscure the view of an object in the background as measured by EPA Method 9 or other method, as specified in each applicable rule.

(103) "Oregon Title V Operating Permit" or “Title V permit” means written authorization issued, renewed, amended, or revised under OAR chapter 340, division 218.

(104) "Oregon Title V Operating Permit program" or “Title V program” means the Oregon program described in OAR chapter 340, division 218 and approved by the Administrator under 40 C.F.R. part 70.

(105) "Oregon Title V Operating Permit program source" or “Title V source” means any source subject to the permitting requirements, OAR chapter 340, division 218.

(106) "Ozone precursor" means nitrogen oxides and volatile organic compounds.

(107) "Ozone season" means the contiguous 3 month period during which ozone exceedances typically occur, i.e., June, July, and August.

(108) "Particleboard" means matformed flat panels consisting of wood particles bonded together with synthetic resin or other suitable binder.

(109) "Particulate matter":

(a) Except as provided in subsection (b) of this section, means all finely divided solid and liquid material, other than uncombined water, that is emitted to the ambient air as measured by the test method specified in each applicable rule, or where not specified by rule, in the permit.

(b) As used in OAR chapter 340, division 208, Visible Emissions and Nuisance Requirements, means all finely divided solid material, including dust, and all finely divided liquid material, other than uncombined water, that is emitted to the ambient air.

(110) "Permit" means an Air Contaminant Discharge Permit or an Oregon Title V Operating Permit, permit attachment and any amendments or modifications thereof.

(111) "Permit modification" means a permit revision that meets the applicable requirements of OAR chapter 340, division 216, OAR chapter 340, division 224, or OAR 340-218-0160 through 340-218-0180.

(112) "Permit revision" means any permit modification or administrative permit amendment.

(113) "Permitted emissions" as used in OAR chapter 340, division 220 means each regulated pollutant portion of the PSEL, as identified in an ACDP, Oregon Title V Operating Permit, review report, or by DEQ under OAR 340-220-0090.

(114) "Permittee" means the owner or operator of a source, authorized to emit regulated pollutants under an ACDP or Oregon Title V Operating Permit.

(115) "Person" means individuals, corporations, associations, firms, partnerships, joint stock companies, public and municipal corporations, political subdivisions, the State of Oregon and any agencies thereof, and the federal government and any agencies thereof.

(116) "Plant Site Emission Limit" or "PSEL" means the total mass emissions per unit time of an individual regulated pollutant specified in a permit for a source. The PSEL for a major source may consist of more than one permitted emission for purposes of Oregon Title V Operating Permit Fees in OAR chapter 340, division 220.

(117) “Plywood" means a flat panel built generally of an odd number of thin sheets of veneers of wood in which the grain direction of each ply or layer is at right angles to the one adjacent to it.

(118) "PM10":

(a) When used in the context of emissions, means finely divided solid or liquid material, including condensable particulate, other than uncombined water, with an aerodynamic diameter less than or equal to a nominal 10 micrometers, emitted to the ambient air as measured by the test method specified in each applicable rule or, where not specified by rule, in each individual permit;

(b) When used in the context of ambient concentration, means airborne finely divided solid or liquid material with an aerodynamic diameter less than or equal to a nominal 10 micrometers as measured under 40 C.F.R. part 50, Appendix J or an equivalent method designated under 40 C.F.R. part 53.

(119) "PM2.5":

(a) When used in the context of direct PM2.5 emissions, means finely divided solid or liquid material, including condensable particulate, other than uncombined water, with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers, emitted to the ambient air as measured by the test method specified in each applicable rule or, where not specified by rule, in each individual permit.

(b) When used in the context of PM2.5 precursor emissions, means sulfur dioxide (SO2) and nitrogen oxides (NOx) emitted to the ambient air as measured by the test method specified in each applicable rule or, where not specified by rule, in each individual permit.

(c) When used in the context of ambient concentration, means airborne finely divided solid or liquid material with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers as measured under 40 C.F.R. part 50, Appendix L, or an equivalent method designated under 40 C.F.R. part 53.

(120) "PM2.5 fraction" means the fraction of PM2.5 in relation to PM10 for each emissions unit that is included in the netting basis and PSEL.

(121) "Pollutant-specific emissions unit" means an emissions unit considered separately with respect to each regulated pollutant.

(122) “Portable” means designed and capable of being carried or moved from one location to another. Indicia of portability include, but are not limited to, wheels, skids, carrying handles, dolly, trailer, or platform.

(123) "Potential to emit" or "PTE" means the lesser of:

(a) The regulated pollutant emissions capacity of a stationary source; or

(b) The maximum allowable regulated pollutant emissions taking into consideration any physical or operational limitation, including use of control devices and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, if the limitation is enforceable by the U.S. EPA Administrator.

(c) This definition does not alter or affect the use of this term for any other purposes under the FCAA or the term "capacity factor" as used in Title IV of the FCAA and the regulations promulgated thereunder. Secondary emissions are not considered in determining the potential to emit.

(124) "ppm" means parts per million by volume unless otherwise specified in the applicable rule or an individual permit. It is a dimensionless unit of measurement for gases that expresses the ratio of the volume of one component gas to the volume of the entire sample mixture of gases.

(125) "Predictive emission monitoring system" or "PEMS" means a system that uses process and other parameters as inputs to a computer program or other data reduction system to produce values in terms of the applicable emission limitation or standard.

(126) "Press/cooling vent" means any opening through which particulate and gaseous emissions from plywood, particleboard, or hardboard manufacturing are exhausted, either by natural draft or powered fan, from the building housing the process. Such openings are generally located immediately above the board press, board unloader, or board cooling area.

(127) "Process upset" means a failure or malfunction of a production process or system to operate in a normal and usual manner.

(128) "Proposed permit" means the version of an Oregon Title V Operating Permit that DEQ or LRAPA proposes to issue and forwards to the Administrator for review in compliance with OAR 340-218-0230.

(129) “Reattainment area” means an area that is designated as nonattainment and has three consecutive years of monitoring data that shows the area is meeting the ambient air quality standard for the regulated pollutant for which the area was designated a nonattainment area, but a formal redesignation by EPA has not yet been approved. Reattainment areas are designated by the EQC according to division 204.

(130) “Reattainment pollutant” means a regulated pollutant for which an area is designated a reattainment area.

(131) "Reference method" means any method of sampling and analyzing for a regulated pollutant as specified in 40 C.F.R. part 52, 60, 61 or 63.

(132) "Regional agency" means Lane Regional Air Protection Agency.

(133) "Regulated air pollutant" or "Regulated pollutant":

(a) Except as provided in subsections (b), (c) and (d), means:

(A) Nitrogen oxides or any VOCs;

(B) Any pollutant for which an ambient air quality standard has been promulgated, including any precursors to such pollutants;

(C) Any pollutant that is subject to any standard promulgated under section 111 of the FCAA;

(D) Any Class I or II substance subject to a standard promulgated under or established by Title VI of the FCAA;

(E) Any pollutant listed under OAR 340-244-0040 or 40 C.F.R. 68.130;

(F) Greenhouse gases; and

(G) Toxic Air Contaminants.

(b) As used in OAR chapter 340, division 220, Oregon Title V Operating Permit Fees, regulated pollutant means particulate matter, volatile organic compounds, oxides of nitrogen and sulfur dioxide.

(c) As used in OAR chapter 340, division 222, Plant Site Emission Limits and division 224, New Source Review, regulated pollutant does not include any pollutant listed in OAR chapter 340, divisions 246 or 247.

(d) As used in OAR chapter 340, division 202, Ambient Air Quality Standards And PSD Increments through division 208, Visible Emissions and Nuisance Requirements; division 215, Greenhouse Reporting Requirements; division 222, Stationary Source Plant Site Emission Limits through division 244, Oregon Federal Hazardous Air Pollutant Program;

and division 248, Asbestos Requirements through division 268, Emission Reduction Credits; regulated pollutant means only the air contaminants listed under paragraphs (a)(A) through (F).

(134) “Removal efficiency” means the performance of an air pollution control device in terms of the ratio of the amount of the regulated pollutant removed from the airstream to the total amount of regulated pollutant that enters the air pollution control device.

(135) "Renewal" means the process by which a permit is reissued at the end of its term.

(136) "Responsible official" means one of the following:

(a) For a corporation: a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit and either:

(A) The facilities employ more than 250 persons or have gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars); or

(B) The delegation of authority to such representative is approved in advance by DEQ or LRAPA.

(b) For a partnership or sole proprietorship: a general partner or the proprietor, respectively;

(c) For a municipality, State, Federal, or other public agency: either a principal executive officer or ranking elected official. For the purposes of this division, a principal executive officer of a Federal agency includes the chief executive officer having responsibility for the overall operations of a principal geographic unit of EPA (e.g., a Regional Administrator of the EPA); or

(d) For affected sources:

(A) The designated representative in so far as actions, standards, requirements, or prohibitions under Title IV of the FCAA or the regulations promulgated there under are concerned; and

(B) The designated representative for any other purposes under the Oregon Title V Operating Permit program.

(137) "Secondary emissions" means emissions that are a result of the construction and/or operation of a source or modification, but that do not come from the source itself. Secondary emissions must be specific, well defined, quantifiable, and impact the same general area as the source associated with the secondary emissions. Secondary emissions may include, but are not limited to:

(a) Emissions from ships and trains coming to or from a facility;

(b) Emissions from off-site support facilities that would be constructed or would otherwise increase emissions as a result of the construction or modification of a source.

(138) "Section 111" means section 111 of the FCAA, 42 U.S.C. § 7411, which includes Standards of Performance for New Stationary Sources (NSPS).

(139) "Section 111(d)" means subsection 111(d) of the FCAA, 42 U.S.C. § 7411(d), which requires states to submit to the EPA plans that establish standards of performance for existing sources and provides for implementing and enforcing such standards.

(140) "Section 112" means section 112 of the FCAA, 42 U.S.C. § 7412, which contains regulations for Hazardous Air Pollutants.

(141) "Section 112(b)" means subsection 112(b) of the FCAA, 42 U.S.C. § 7412(b), which includes the list of hazardous air pollutants to be regulated.

(142) "Section 112(d)" means subsection 112(d) of the FCAA, 42 U.S.C. § 7412(d), which directs the EPA to establish emission standards for sources of hazardous air pollutants. This section also defines the criteria to be used by the EPA when establishing the emission standards.

(143) "Section 112(e)" means subsection 112(e) of the FCAA, 42 U.S.C. § 7412(e), which directs the EPA to establish and promulgate emissions standards for categories and subcategories of sources that emit hazardous air pollutants.

(144) "Section 112(r)(7)" means subsection 112(r)(7) of the FCAA, 42 U.S.C. § 7412(r)(7), which requires the EPA to promulgate regulations for the prevention of accidental releases and requires owners or operators to prepare risk management plans.

(145) "Section 114(a)(3)" means subsection 114(a)(3) of the FCAA, 42 U.S.C. § 7414(a)(3), which requires enhanced monitoring and submission of compliance certifications for major sources.

(146) "Section 129" means section 129 of the FCAA, 42 U.S.C. § 7429, which requires the EPA to establish emission standards and other requirements for solid waste incineration units.

(147) "Section 129(e)" means subsection 129(e) of the FCAA, 42 U.S.C. § 7429(e), which requires solid waste incineration units to obtain Oregon Title V Operating Permits.

(148) "Section 182(f)" means subsection 182(f) of the FCAA, 42 U.S.C. § 7511a(f), which requires states to include plan provisions in the SIP for NOx in ozone nonattainment areas.

(149) "Section 182(f)(1)" means subsection 182(f)(1) of the FCAA, 42 U.S.C. § 7511a(f)(1), which requires states to apply those plan provisions developed for major VOC sources and major NOx sources in ozone nonattainment areas.

(150) "Section 183(e)" means subsection 183(e) of the FCAA, 42 U.S.C. § 7511b(e), which requires the EPA to study and develop regulations for the control of certain VOC sources under federal ozone measures.

(151) "Section 183(f)" means subsection 183(f) of the FCAA, 42 U.S.C. § 7511b(f), which requires the EPA to develop regulations pertaining to tank vessels under federal ozone measures.

(152) "Section 184" means section 184 of the FCAA, 42 U.S.C. § 7511c, which contains regulations for the control of interstate ozone air pollution.

(153) "Section 302" means section 302 of the FCAA, 42 U.S.C. § 7602, which contains definitions for general and administrative purposes in the FCAA.

(154) "Section 302(j)" means subsection 302(j) of the FCAA, 42 U.S.C. § 7602(j), which contains definitions of "major stationary source" and "major emitting facility."

(155) "Section 328" means section 328 of the FCAA, 42 U.S.C. § 7627, which contains regulations for air pollution from outer continental shelf activities.

(156) "Section 408(a)" means subsection 408(a) of the FCAA, 42 U.S.C. § 7651g(a), which contains regulations for the Title IV permit program.

(157) "Section 502(b)(10) change" means a change which contravenes an express permit term but is not a change that:

(a) Would violate applicable requirements;

(b) Would contravene federally enforceable permit terms and conditions that are monitoring, recordkeeping, reporting, or compliance certification requirements; or

(c) Is a FCAA Title I modification.

(158) "Section 504(b)" means subsection 504(b) of the FCAA, 42 U.S.C. § 7661c(b), which states that the EPA can prescribe by rule procedures and methods for determining compliance and for monitoring.

(159) "Section 504(e)" means subsection 504(e) of the FCAA, 42 U.S.C. § 761c(e), which contains regulations for permit requirements for temporary sources.

(160) "Significant emission rate" or "SER," except as provided in subsections (v) and (w), means an emission rate equal to the rates specified for the regulated pollutants below:

(a) Greenhouse gases (CO2e) = 75,000 tons per year

(b) Carbon monoxide = 100 tons per year except in a serious nonattainment area = 50 tons per year, provided DEQ has determined that stationary sources contribute significantly to carbon monoxide levels in that area.

(c) Nitrogen oxides (NOX) = 40 tons per year.

(d) Particulate matter = 25 tons per year.

(e) PM10 = 15 tons per year.

(f) Direct PM2.5 = 10 tons per year.

(g) PM2.5 precursors (SO2 or NOx) = 40 tons per year.

(h) Sulfur dioxide (SO2) = 40 tons per year.

(i) Ozone precursors (VOC or NOx) = 40 tons per year except:

(I) In a serious or severe ozone nonattainment area = 25 tons per year.

(II) In an extreme ozone nonattainment area = any emissions increase.

(j) Lead = 0.6 tons per year.

(k) Inorganic fluoride compounds (as measured by EPA method 13A or 13B), excluding hydrogen fluoride = 3 tons per year.

(l) Sulfuric acid mist = 7 tons per year.

(m) Hydrogen sulfide = 10 tons per year.

(n) Total reduced sulfur (including hydrogen sulfide) = 10 tons per year.

(o) Reduced sulfur compounds (including hydrogen sulfide) = 10 tons per year.

(p) Municipal waste combustor organics (measured as total tetra- through octa- chlorinated dibenzo-p-dioxins and dibenzofurans) = 0.0000035 tons per year.

(q) Municipal waste combustor metals (measured as particulate matter) = 15 tons per year.

(r) Municipal waste combustor acid gases (measured as sulfur dioxide and hydrogen chloride) = 40 tons per year.

(s) Municipal solid waste landfill emissions (measured as nonmethane organic compounds) = 50 tons per year.

(t) Ozone depleting substances in aggregate = 100 tons per year.

(u) For the Medford-Ashland Air Quality Maintenance Area, the SER for PM10 is defined as 5.0 tons per year on an annual basis and 50.0 pounds per day on a daily basis.

(v) For regulated pollutants not listed in subsections (a) through (u), the SER is zero.

(w) Any new source or modification with an emissions increase less than the rates specified above and that is located within 10 kilometers of a Class I area, and would have an impact on such area equal to or greater than 1 ug/m3 (24 hour average) is emitting at a SER. This subsection does not apply to greenhouse gas emissions.

(161) "Significant impact" means an additional ambient air quality concentration equal to or greater than the significant impact level. For sources of VOC or NOx, a source has a significant impact if it is located within the ozone impact distance defined in OAR 340 division 224.

(162) “Significant impact level” or “SIL” means the ambient air quality concentrations listed below. The threshold concentrations listed below are used for comparison against the ambient air quality standards and PSD increments established under OAR chapter 340, division 202, but do not apply for protecting air quality related values, including visibility.

(a) For Class I areas:

(A) PM2.5:

(i) Annual = 0.06 g/m3.

(ii) 24-hour = 0.07 g/m3.

(B) PM10:

(i) 24-hour = 0.30 g/m3.

(C) Sulfur dioxide:

(i) Annual = 0.10 g/m3.

(ii) 24-hour = 0.20 g/m3.

(iii) 3-hour = 1.0 g/m3.

(D) Nitrogen dioxide: annual = 0.10 g/m3.

(b) For Class II areas:

(A) PM2.5:

(i) Annual = 0.3 g/m3.

(ii) 24-hour = 1.2 g/m3.

(B) PM10:

(i) 24-hour = 1.0 g/m3.

(C) Sulfur dioxide:

(i) Annual = 1.0 g/m3.

(ii) 24-hour = 5.0 g/m3.

(iii) 3-hour =25.0 g/m3.

(iv) 1-hour = 8.0 g/m3.

(D) Nitrogen dioxide:

(i) Annual =1.0 g/m3.

(ii) 1-hour = 8.0 g/m3.

(E) Carbon monoxide:

(i) 8-hour = 0.5 mg/m3.

(ii) 1-hour = 2.0 mg/m3.

(c) For Class III areas:

(A) PM2.5:

(i) Annual = 0.3 g/m3.

(ii) 24-hour = 1.2 g/m3.

(B) PM10:

(i) 24-hour = 1.0 g/m3.

(C) Sulfur dioxide:

(i) Annual = 1.0 g/m3.

(ii) 24-hour = 5.0 g/m3.

(iii) 3-hour = 25.0 g/m3.

(D) Nitrogen dioxide: annual = 1.0 g/m3

(E) Carbon monoxide:

(i) 8-hour = 0.5 mg/m3.

(ii) 1-hour = 2.0 mg/m3.

(163) "Significant impairment" occurs when DEQ determines that visibility impairment interferes with the management, protection, preservation, or enjoyment of the visual experience within a Class I area. DEQ will make this determination on a case-by-case basis after considering the recommendations of the Federal Land Manager and the geographic extent, intensity, duration, frequency, and time of visibility impairment. These factors will be considered along with visitor use of the Class I areas, and the frequency and occurrence of natural conditions that reduce visibility.

(164) "Small scale local energy project" means:

(a) A system, mechanism or series of mechanisms located primarily in Oregon that directly or indirectly uses or enables the use of, by the owner or operator, renewable resources including, but not limited to, solar, wind, geothermal, biomass, waste heat or water resources to produce energy, including heat, electricity and substitute fuels, to meet a local community or regional energy need in this state;

(b) A system, mechanism or series of mechanisms located primarily in Oregon or providing substantial benefits to Oregon that directly or indirectly conserves energy or enables the conservation of energy by the owner or operator, including energy used in transportation;

(c) A recycling project;

(d) An alternative fuel project;

(e) An improvement that increases the production or efficiency, or extends the operating life, of a system, mechanism, series of mechanisms or project otherwise described in this section of this rule, including but not limited to restarting a dormant project;

(f) A system, mechanism or series of mechanisms installed in a facility or portions of a facility that directly or indirectly reduces the amount of energy needed for the construction and operation of the facility and that meets the sustainable building practices standard established by the State Department of Energy by rule; or

(g) A project described in subsections (a) to (f), whether or not the existing project was originally financed under ORS 470, together with any refinancing necessary to remove prior liens or encumbrances against the existing project.

(h) A project described in subsections (a) to (g) that conserves energy or produces energy by generation or by processing or collection of a renewable resource.

(165) "Source" means any building, structure, facility, installation or combination thereof that emits or is capable of

emitting air contaminants to the atmosphere, is located on one or more contiguous or adjacent properties and is owned or operated by the same person or by persons under common control. The term includes all air contaminant emitting activities that belong to a single major industrial group, i.e., that have the same two-digit code, as described in the Standard Industrial Classification Manual, U.S. Office of Management and Budget, 1987, or that support the major industrial group.

(166) "Source category":

(a) Except as provided in subsection (b), means all the regulated pollutant emitting activities that belong to the same industrial grouping, i.e., that have the same two-digit code, as described in the Standard Industrial Classification Manual, U.S. Office of Management and Budget, 1987.

(b) As used in OAR chapter 340, division 220, Oregon Title V Operating Permit Fees, means a group of major sources that DEQ determines are using similar raw materials and have equivalent process controls and air pollution control device.

(167) "Source test" means the average of at least three test runs conducted under the DEQ Source Sampling Manual found in 340-200-0035.

(168) "Standard conditions" means a temperature of 68° Fahrenheit (20° Celsius) and a pressure of 14.7 pounds per square inch absolute (1.03 Kilograms per square centimeter).

(169) "Startup" and "shutdown" means that time during which a source or control device is brought into normal operation or normal operation is terminated, respectively.

(170) "State Implementation Plan" or "SIP" means the State of Oregon Clean Air Act Implementation Plan as adopted by the EQC under OAR 340-200-0040 and approved by EPA.

(171) “State New Source Review” or “State NSR” means the new source review process and requirements under OAR 340-224-0010 through 340-224-0038, 340-224-0245 through 340-224-0270 and 340-224-0500 through 340-224-0540 based on the location and regulated pollutants emitted.

(172) "Stationary source" means any building, structure, facility, or installation at a source that emits or may emit any regulated pollutant. Stationary source includes portable sources that are required to have permits under OAR chapter 340, division 216.

(173) "Substantial underpayment" means the lesser of 10 percent of the total interim emission fee for the major source or five hundred dollars.

(174) “Sustainment area” means a geographical area of the state for which DEQ has ambient air quality monitoring data that shows an attainment or unclassified area could become a nonattainment area but a formal redesignation by EPA has not yet been approved. The presumptive geographic boundary of a sustainment area is the applicable urban growth boundary in effect on the date this rule was last approved by the EQC, unless superseded by rule. Sustainment areas are designated by the EQC according to division 204.

(175) “Sustainment pollutant” means a regulated pollutant for which an area is designated a sustainment area.

(176) "Synthetic minor source" means a source that would be classified as a major source under OAR 340-200-0020, but for limits on its potential to emit regulated pollutants contained in an ACDP or Oregon Title V permit issued by DEQ.

(177) "Title I modification" means one of the following modifications under Title I of the FCAA:

(a) A major modification subject to OAR 340-224-0050, Requirements for Sources in Nonattainment Areas or OAR 340-224-0055, Requirements for Sources in Reattainment Areas;

(b) A major modification subject to OAR 340-224-0060, Requirements for Sources in Maintenance Areas;

(c) A major modification subject to OAR 340-224-0070, Prevention of Significant Deterioration Requirements for Sources in Attainment or Unclassified Areas or 340-224-0045 Requirements for Sources in Sustainment Areas;

(d) A modification that is subject to a New Source Performance Standard under Section 111 of the FCAA; or,

(e) A modification under Section 112 of the FCAA.

(178) "Total reduced sulfur" or "TRS" means the sum of the sulfur compounds hydrogen sulfide, methyl mercaptan, dimethyl sulfide, dimethyl disulfide, and any other organic sulfides present expressed as hydrogen sulfide (H_2S).

(179) “Toxic air contaminant” means an air pollutant that has been determined by the EQC to cause, or reasonably be anticipated to cause, adverse effects to human health and is listed in OAR 340-247-8010 Table 1.

(180) “Type A State NSR” means State NSR as specified in OAR 340-224-0010(2)(a).

(181) “Type B State NSR” means State NSR that is not Type A State NSR.

(182) "Typically Achievable Control Technology" or "TACT" means the emission limit established on a case-by-case basis for a criteria pollutant from a particular emissions unit under OAR 340-226-0130.

(183) "Unassigned emissions" means the amount of emissions that are in excess of the PSEL but less than the netting basis.

(184) "Unavoidable" or "could not be avoided" means events that are not caused entirely or in part by design, operation, maintenance, or any other preventable condition in either process or control device.

(185) “Unclassified area” or “attainment area” means an area that has not otherwise been designated by EPA as nonattainment with ambient air quality standards for a particular regulated pollutant. Attainment areas or unclassified areas may also be referred to as sustainment or maintenance areas as designated in OAR chapter 340, division 204. Any particular location may be part of an attainment area or unclassified area for one regulated pollutant while also being in a different type of designated area for another regulated pollutant.

(186) "Upset" or "Breakdown" means any failure or malfunction of any air pollution control device or operating equipment that may cause excess emissions.

(187) "Veneer" means a single flat panel of wood not exceeding 1/4 inch in thickness formed by slicing or peeling from a log.

(188) "Veneer dryer" means equipment in which veneer is dried.

(189) "Visibility impairment" means any humanly perceptible change in visual range, contrast or coloration from that which existed under natural conditions. Natural conditions include fog, clouds, windblown dust, rain, sand, naturally ignited wildfires, and natural aerosols.

(190) "Volatile organic compounds" or "VOC" means any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, that participates in atmospheric photochemical reactions.

(a) VOC includes any such organic compound other than the following, which have been determined to have negligible photochemical reactivity:

(A) Methane;

(B) Ethane;

(C) Methylene chloride (dichloromethane);

(D) 1,1,1-trichloroethane (methyl chloroform);

(E) 1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113);

(F) Trichlorofluoromethane (CFC-11);

(G) Dichlorodifluoromethane (CFC-12);

(H) Chlorodifluoromethane (HCFC-22);

(I) Trifluoromethane (HFC-23);

(J) 1,2-dichloro 1,1,2,2-tetrafluoroethane (CFC-114);

(K) Chloropentafluoroethane (CFC-115);

(L) 1,1,1-trifluoro 2,2-dichloroethane (HCFC-123);

(M) 1,1,1,2-tetrafluoroethane (HFC-134a);

(N) 1,1-dichloro 1-fluoroethane (HCFC-141b);

(O) 1-chloro 1,1-difluoroethane (HCFC-142b);

(P) 2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124);

(Q) Pentafluoroethane (HFC-125);

(R) 1,1,2,2-tetrafluoroethane (HFC-134);

(S) 1,1,1-trifluoroethane (HFC-143a);

(T) 1,1-difluoroethane (HFC-152a);
(U) Parachlorobenzotrifluoride (PCBTF);
(V) Cyclic, branched, or linear completely methylated siloxanes;
(W) Acetone;
(X) Perchloroethylene (tetrachloroethylene);
(Y) 3,3-dichloro-1,1,1,2,2-pentafluoropropane (HCFC-225ca);
(Z) 1,3-dichloro-1,1,2,2,3-pentafluoropropane (HCFC-225cb);
(AA) 1,1,1,2,3,4,4,5,5,5-decafluoropentane (HFC 43-10mee);
(BB) Difluoromethane (HFC-32);
(CC) Ethylfluoride (HFC-161);
(DD) 1,1,1,3,3,3-hexafluoropropane (HFC-236fa);
(EE) 1,1,2,2,3-pentafluoropropane (HFC-245ca);
(FF) 1,1,2,3,3-pentafluoropropane (HFC-245ea);
(GG) 1,1,1,2,3-pentafluoropropane (HFC-245eb);
(HH) 1,1,1,3,3-pentafluoropropane (HFC-245fa);
(II) 1,1,1,2,3,3-hexafluoropropane (HFC-236ea);
(JJ) 1,1,1,3,3-pentafluorobutane (HFC-365mfc);
(KK) chlorofluoromethane (HCFC-31);
(LL) 1 chloro-1-fluoroethane (HCFC-151a);
(MM) 1,2-dichloro-1,1,2-trifluoroethane (HCFC-123a);
(NN) 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-butane (C4 F9 OCH3 or HFE-7100);
(OO) 2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-heptafluoropropane ((CF3)2 CFCF2 OCH3);
(PP) 1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane (C4 F9 OC2 H5 or HFE-7200);
(QQ) 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane ((CF3)2 CFCF2 OC2 H5);
(RR) Methyl acetate;
(SS) 1,1,1,2,2,3,3-heptafluoro-3-methoxy-propane (n-C3F7OCH3, HFE-7000);
(TT) 3-ethoxy- 1,1,1,2,3,4,4,5,5,6,6,6-dodecafluoro-2-(trifluoromethyl) hexane (HFE-7500);
(UU) 1,1,1,2,3,3,3-heptafluoropropane (HFC 227ea);
(VV) Methyl formate (HCOOCH3);
(WW) 1,1,1,2,2,3,4,5,5,5-decafluoro-3-methoxy-4-trifluoromethyl-pentane (HFE-7300);
(XX) Propylene carbonate;
(YY) Dimethyl carbonate;
(ZZ) Trans -1,3,3,3-tetrafluoropropene (also known as HFO-1234ze);
(AAA) HCF2 OCF2 H (HFE-134);
(BBB) HCF2 OCF2 OCF2 H (HFE-236cal2);
(CCC) HCF2 OCF2 CF2 OCF2 H (HFE-338pcc13);
(DDD) HCF2 OCF2 OCF2 CF2 OCF2 H (H-Galden 1040x or H-Galden ZT 130 (or 150 or 180));
(EEE) Trans 1-chloro-3,3,3-trifluoroprop-1-ene (also known as SolsticeTM 1233zd(E));
(FFF) 2,3,3,3-tetrafluoropropene (also known as HFO–1234yf);
(GGG) 2-amino-2-methyl-1-propanol;
(HHH) perfluorocarbon compounds which fall into these classes:
(i) Cyclic, branched, or linear, completely fluorinated alkanes;
(ii) Cyclic, branched, or linear, completely fluorinated ethers with no unsaturations;
(iii) Cyclic, branched, or linear, completely fluorinated tertiary amines with no unsaturations; and
(iv) Sulfur containing perfluorocarbons with no unsaturations and with sulfur bonds only to carbon and fluorine;
(III) cis-1,1,1,4,4,4-hexafluorobut-2-ene (also known as HFO-1336mzz-Z); and
(JJJ) t-butyl acetate.

(b) For purposes of determining compliance with emissions limits, VOC will be measured by an applicable test method in the DEQ Source Sampling Manual referenced in OAR 340-200-0035. Where such a method also measures compounds with negligible photochemical reactivity, these negligibly-reactive compounds may be excluded as VOC if the amount of such compounds is accurately quantified, and DEQ approves the exclusion.

(c) When considering a requested exclusion of negligibly-reactive compounds under subsection (b), DEQ may require an owner or operator to provide monitoring or testing methods and results that demonstrate, to DEQ's satisfaction, the amount of negligibly-reactive compounds in the source's emissions.

(191) "Wood fired veneer dryer" means a veneer dryer, that is directly heated by the products of combustion of wood fuel in addition to or exclusive of steam or natural gas or propane combustion.

(192) “Wood fuel-fired device” means a device or appliance designed for wood fuel combustion, including cordwood stoves, woodstoves and fireplace stove inserts, fireplaces, wood fuel-fired cook stoves, pellet stoves and combination fuel furnaces and boilers that burn wood fuels.

(193) "Year" means any consecutive 12 month period of time.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040 with the exception of all references to toxic air contaminants and OAR chapter 340, division 245.]

[NOTE: Referenced publications not linked to below are available from the agency.]

[NOTE: View a PDF of referenced tables and EPA Methods by clicking on "Tables" link below.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.035, 468A.040, 468A.050, 468A.055, 468A.070, 468A.075, 468A.085, 468A.105, 468A.135, 468A.140, 468A.155, 468A.280, 468A.310, 468A.315, 468A.360, 468A.363, 468A.380, 468A.385, 468A.420, 468A.495, 468A.500, 468A.505, 468A.515, 468A.575, 468A.595, 468A.600, 468A.610, 468A.612, 468A.620, 468A.635, 468A.707, 468A.740, 468A.745, 468A.750, 468A.775, 468A.780, 468A.797, 468A.799, 468A.803, 468A.820, & Or. Laws 2009, chapter 754

State of Oregon Department of Environmental Quality

OAR 340-200-0020 Attachments

State of Oregon
Department of Environmental Quality

OAR 340-200-0020

Table 1 Significant Air Quality Impact

Pollutant	Averaging Time	Air Quality Area Designation		
		Class I	Class II	Class III
SO_2 (μg/m^3)*	Annual	0.10	1.0	1.0
	24-hour	0.20	5.0	5.0
	3-hour	1.0	25.0	25.0
	1-hour	---	8.0	---
PM10 (μg/m3)	Annual	0.20	0.2	0.2
	24-hour	0.30	1.0	1.0
PM2.5 (μg/m3)	Annual	0.06	0.3	0.3
	24-hour	0.07	1.2	1.2
NO2 (μg/m3)	Annual	0.10	1.0	1.0
	1-hour	---	8.0	---
CO (mg/m3)**	8 hour	---	0.5	0.5
	1-hour	---	2.0	2.0

* micrograms/cubic meter
**milligrams/cubic meter

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Table 2 Significant Emission Rates

Pollutant	Emission Rate
Greenhouse Gases (CO2e)	75,000 tons/year
Carbon Monoxide	100 tons/year
Nitrogen Oxides (NOX)	40 tons/year
Particulate Matter	25 tons/year
PM10	15 tons/year
Direct PM2.5	10 tons/year
PM2.5 precursors (SO2 or NOx)	40 tons/year
Sulfur Dioxide (SO2)	40 tons/year
Volatile Organic Compounds (VOC)	40 tons/year
Ozone precursors (VOC or NOx)	40 tons/year
Lead	0.6 ton/year
Fluorides	3 tons/year
Sulfuric Acid Mist	7 tons/year
Hydrogen Sulfide	10 tons/year
Total Reduced Sulfur (including hydrogen sulfide)	10 tons/year
Reduced sulfur compounds (including hydrogen sulfide)	10 tons/year
Municipal waste combustor organics (measured as total tetra- through octa- chlorinated dibenzo-p- dioxins and dibenzofurans)	0.0000035 ton/year
Municipal waste combustor metals (measured as particulate matter)	15 tons/year
Municipal waste combustor acid gases (measured as sulfur dioxide and hydrogen chloride)	40 tons/year
Municipal solid waste landfill emissions (measured as nonmethane organic compounds)	50 tons/year

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Table 3 Significant Emission Rates for the Medford-Ashland Air Quality Maintenance Area

Air Contaminant	Emission Rate	
	Annual	Day
PM10	5 tons	50 lbs.

State of Oregon
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Environmental
Quality

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Table 4 De Minimis Emission Levels

Pollutant	De Minimis (tons/year, except as noted)
Greenhouse Gases (CO2e)	2,756
CO	1
NOx	1
SO2	1
VOC	1
PM	1
PM10 (except Medford AQMA)	1
PM10/PM2.5 (Medford AQMA)	0.5 [5.0 lbs/day]
Direct PM2.5	1
Lead	0.1
Fluorides	0.3
Sulfuric Acid Mist	0.7
Hydrogen Sulfide	1
Total Reduced Sulfur (including hydrogen sulfide)	1
Reduced Sulfur	1
Municipal waste combustor organics (Dioxin and furans)	0.0000005
Municipal waste combustor metals	1
Municipal waste combustor acid gases	1
Municipal solid waste landfill gases	1
Single HAP	1
Combined HAP (aggregate)	1

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Table 5 Generic PSELS

Pollutant	Generic PSEL (tons/year, except as noted)
Greenhouse Gases (CO2e)	74,000
CO	99
NOx	39
SO2	39
VOC	39
PM	24
PM10 (except Medford AQMA)	14
PM10/PM2.5 (Medford AQMA)	4.5 [49 lbs/day]
Direct PM2.5	9
Lead	0.5
Fluorides	2
Sulfuric Acid Mist	6
Hydrogen Sulfide	9
Total Reduced Sulfur (including hydrogen sulfide)	9
Reduced Sulfur	9
Municipal waste combustor organics (Dioxin and furans)	0.0000030
Municipal waste combustor metals	14
Municipal waste combustor acid gases	39
Municipal solid waste landfill gases	49
Single HAP	9
Combined HAPs (aggregate)	24

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METHOD 9 - VISUAL DETERMINATION OF THE OPACITY OF EMISSIONS FROM STATIONARY SOURCES

Many stationary sources discharge visible emissions into the atmosphere; these emissions are usually in the shape of a plume. This method involves the determination of plume opacity by qualified observers. The method includes procedures for the training and certification of observers, and procedures to be used in the field for determination of plume opacity. The appearance of a plume as viewed by an observer depends upon a number of variables, some of which may be controllable and some of which may not be controllable in the field. Variables which can be controlled to an extent to which they no longer exert a significant influence upon plume appearance include: Angle of the observer with respect to the plume; angle of the observer with respect to the sun; point of observation of attached and detached steam plume; and angle of the observer with respect to a plume emitted from a rectangular stack with a large length to width ratio. The method includes specific criteria applicable to these variables.

Other variables which may not be controllable in the field are luminescence and color contrast between the plume and the background against which the plume is viewed. These variables exert an influence upon the appearance of a plume as viewed by an observer, and can affect the ability of the observer to accurately assign opacity values to the observed plume. Studies of the theory of plume opacity and field studies have demonstrated that a plume is most visible and presents the greatest apparent opacity when viewed against a contrasting background. It follows from this, and is confirmed by field trials, that the opacity of a plume, viewed under conditions where a contrasting background is present can be assigned with the greatest degree of accuracy. However, the potential for a positive error is also the greatest when a plume is viewed under such contrasting conditions. Under conditions presenting a less contrasting background, the apparent opacity of a plume is less and approaches zero as the color and luminescence contrast decrease toward zero. As a result, significant negative bias and negative errors can be made when a plume is viewed under less contrasting conditions. A negative bias decreases rather than increases the possibility that a plant operator will be cited for a violation of opacity standards due to observer error.

Studies have been undertaken to determine the magnitude of positive errors which can be made by qualified observers while reading plumes under contrasting conditions and using the procedures set forth in this method. The results of these studies (field trials) which involve a total of 769 sets of 25 readings each are as follows:

(1) For black plumes (133 sets at a smoke generator), 100 percent of the sets were read with a positive error[1] of less than 7.5 percent opacity; 99 percent were read with a positive error of less than 5 percent opacity.

(2) For white plumes (170 sets at a smoke generator, 168 sets at a coal-fired power plant, 298 sets at a sulfuric acid plant), 99 percent of the sets were read with a positive error of less than 7.5 percent opacity; 95 percent were read with a positive error of less than 5 percent opacity. The positive observational error associated with an average of twenty-five readings is therefore established. The accuracy of the method must be taken into account when determining possible violations of applicable opacity standards.

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[1] For a set, positive error-average opacity determined by observer' s 25 observations-average opacity determined from transmissometer's 25 recordings.

1. Principle and Applicability

1.1 Principle. The opacity of emissions from stationary sources is determined visually by a qualified observer.

1.2 Applicability. This method is applicable for the determination of the opacity of emissions from stationary sources pursuant to §60.11(b) and for qualifying observers for visually determining opacity of emissions.

2. Procedures

The observer qualified in accordance with section 3 of this method shall use the following procedures for visually determining the opacity of emissions:

2.1 Position. The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. Consistent with maintaining the above requirement, the observer shall, as much as possible, make his observations from a position such that his line of vision is approximately perpendicular to the plume direction, and when observing opacity of emissions from rectangular outlets (e.g., roof monitors, open baghouses, noncircular stacks), approximately perpendicular to the longer axis of the outlet. The observer's line of sight should not include more than one plume at a time when multiple stacks are involved, and in any case the observer should make his observations with his line of sight perpendicular to the longer axis of such a set of multiple stacks (e.g., stub stacks on baghouses).

2.2 Field Records. The observer shall record the name of the plant, emission location, type facility, observer's name and affiliation, a sketch of the observer's position relative to the source, and the date on a field data sheet (Figure 9–1). The time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky condition (presence and color of clouds), and plume background are recorded on a field data sheet at the time opacity readings are initiated and completed.

2.3 Observations. Opacity observations shall be made at the point of greatest opacity in that portion of the plume where condensed water vapor is not present. The observer shall not look continuously at the plume, but instead shall observe the plume momentarily at 15-second intervals.

2.3.1 Attached Steam Plumes. When condensed water vapor is present within the plume as it emerges from the emission outlet, opacity observations shall be made beyond the point in the plume at which condensed water vapor is no longer visible. The observer shall record the approximate distance from the emission outlet to the point in the plume at which the observations are made.

2.3.2 Detached Steam Plume. When water vapor in the plume condenses and becomes visible at a distinct distance from the emission outlet, the opacity of emissions should be evaluated at the emission outlet prior to the condensation of water vapor and the formation of the steam plume.

2.4 Recording Observations. Opacity observations shall be recorded to the nearest 5 percent at 15-second intervals on an observational record sheet. (See Figure 9–2 for an example.) A minimum of 24 observations shall be recorded. Each momentary observation recorded shall be deemed to represent the average opacity of emissions for a 15-second period.

2.5 Data Reduction. Opacity shall be determined as an average of 24 consecutive observations recorded at 15-second intervals. Divide the observations recorded on the record sheet into sets of 24 consecutive observations. A set is composed of any 24 consecutive observations. Sets need not be consecutive in time and in no case shall two sets overlap. For each set of 24 observations, calculate the average by summing the opacity of the 24 observations and dividing this sum by 24. If an applicable standard specifies an averaging time requiring more than 24 observations, calculate the average for all observations made during the specified time period. Record the average opacity on a record sheet. (See Figure 9–1 for an example.)

3. Qualifications and Testing

3.1 Certification Requirements. To receive certification as a qualified observer, a candidate must be tested and demonstrate the ability to assign opacity readings in 5 percent increments to 25 different black plumes and 25 different white plumes, with an error not to exceed 15 percent opacity on any one reading and an average error not to exceed 7.5 percent opacity in each category. Candidates shall be tested according to the procedures described in section 3.2. Smoke generators used pursuant to section 3.2 shall be equipped with a smoke meter which meets the requirements of section 3.3.

The certification shall be valid for a period of 6 months, at which time the qualification procedure must be repeated by any observer in order to retain certification.

3.2 Certification Procedure. The certification test consists of showing the candidate a complete run of 50 plumes—25 black plumes and 25 white plumes—generated by a smoke generator. Plumes within each set of 25 black and 25 white runs shall be presented in random order. The candidate assigns an opacity value to each plume and records his observation on a suitable form. At the completion of each run of 50 readings, the score of the candidate is determined. If a candidate fails to qualify, the complete run of 50 readings must be repeated in any retest. The smoke test may be administered as part of a smoke school or training program, and may be preceded by training or familiarization runs of the smoke generator during which candidates are shown black and white plumes of known opacity.

3.3 Smoke Generator Specifications. Any smoke generator used for the purposes of section 3.2 shall be equipped with a smoke meter installed to measure opacity across the diameter of the smoke generator stack. The smoke meter output shall display instack opacity based upon a pathlength equal to the stack exit diameter, on a full 0 to 100 percent chart recorder scale. The smoke meter optical design and performance shall meet the specifications shown in Table 9–1.

The smoke meter shall be calibrated as prescribed in section 3.3.1 prior to the conduct of each smoke reading test. At the completion of each test, the zero and span drift shall be checked and if the drift exceeds ±1 percent opacity, the condition shall be corrected prior to conducting any subsequent test runs. The smoke meter shall be demonstrated, at the time of installation, to meet the specifications listed in Table 9–1. This demonstration shall be repeated following any subsequent repair or replacement of the photocell or associated electronic circuitry including the chart recorder or output meter, or every 6 months, whichever occurs first.

Table 9–1—Smoke Meter Design and Performance Specifications

Parameter	Specification
a. Light source	Incandescent lamp operated at nominal rated voltage.
b. Spectral response of photocell	Photopic (daylight spectral response of the human eye—Citation 3).
c. Angle of view	15° maximum total angle.

d. Angle of projection	15° maximum total angle.
e. Calibration error	±3% opacity, maximum.
f. Zero and span drift	±1% opacity, 30 minutes.
g. Response time	5 seconds.

3.3.1 Calibration. The smoke meter is calibrated after allowing a minimum of 30 minutes warmup by alternately producing simulated opacity of 0 percent and 100 percent. When stable response at 0 percent or 100 percent is noted, the smoke meter is adjusted to produce an output of 0 percent or 100 percent, as appropriate. This calibration shall be repeated until stable 0 percent and 100 percent readings are produced without adjustment. Simulated 0 percent and 100 percent opacity values may be produced by alternately switching the power to the light source on and off while the smoke generator is not producing smoke.

3.3.2 Smoke Meter Evaluation. The smoke meter design and performance are to be evaluated as follows:

3.3.2.1 Light Source. Verify from manufacturer's data and from voltage measurements made at the lamp, as installed, that the lamp is operated within ±5 percent of the nominal rated voltage.

3.3.2.2 Spectral Response of Photocell. Verify from manufacturer's data that the photocell has a photopic response; i.e., the spectral sensitivity of the cell shall closely approximate the standard spectral-luminosity curve for photopic vision which is referenced in (b) of Table 9–1.

FIGURE 9-1
RECORD OF VISUAL DETERMINATION OF OPACITY

PAGE____of____

COMPANY____________

LOCATION____________

TEST NUMBER____________

DATE____________

TYPE FACILITY____________

CONTROL DEVICE____________

HOURS OF OBSERVATION____________

OBSERVER____________

OBSERVER CERTIFICATION DATE____________

OBSERVER AFFILIATION____________

POINT OF EMISSIONS____________

HEIGHT OF DISCHARGE POINT____________

	Initial			Final
CLOCK TIME				
OBSERVER LOCATION Distance to Discharge				
Direction from Discharge				
Height of Observation Point				
BACKGROUND DESCRIPTION				
WEATHER CONDITIONS Wind Direction				
Wind Speed				
Ambient Temperature				
SKY CONDITIONS (clear, overcast, % clouds, etc.)				
PLUME DESCRIPTION Color				
Distance Visible				
OTHER INFORMATION				

SUMMARY OF AVERAGE OPACITY

Set Number	Time	Opacity	
	Start--End	Sum	Average

Readings ranged from ____ to ____ % opacity

The source was/was not in compliance with ____ at the time evaluation was made.

Figure 9–2—Observation Record

Company	Observer
Location	Type facility
Test Number	Point of emissions
Date	

		Seconds				**Steam plume (check if applicable)**		
Hr.	**Min.**	**0**	**15**	**30**	**45**	**Attached**	**Detached**	**Comments**
	0							
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
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	22							
	23							
	24							
	25							
	26							
	27							
	28							

Company	Observer
Location	Type facility
Test Number	Point of emissions
Date	

Hr.	Min.	Seconds				Steam plume (check if applicable)		Comments
		0	15	30	45	Attached	Detached	
	29							
	30							
	31							
	32							
	33							
	34							
	35							
	36							
	37							
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3.3.2.3 Angle of View. Check construction geometry to ensure that the total angle of view of the smoke plume, as seen by the photocell, does not exceed 15°. The total angle of view may be calculated from: $\Theta = 2 \tan^{-1} d/2L$, where Θ = total angle of view; d = the sum of the photocell diameter+ the diameter of the limiting aperture; and L = the distance from the photocell to the limiting aperture. The limiting aperture is the point in the path between the photocell and the smoke plume where the angle of view is most restricted. In smoke generator smoke meters this is normally an orifice plate.

3.3.2.4 Angle of Projection. Check construction geometry to ensure that the total angle of projection of the lamp on the smoke plume does not exceed 15°. The total angle of projection may be calculated from: $\Theta = 2 \tan^{-1} d/2L$, where Θ = total angle of projection; d=the sum of the length of the lamp filament + the diameter of the limiting aperture; and L = the distance from the lamp to the limiting aperture.

3.3.2.5 Calibration Error. Using neutral-density filters of known opacity, check the error between the actual response and the theoretical linear response of the smoke meter. This check is accomplished by first calibrating the smoke meter according to 3.3.1 and then inserting a series of three neutral-density filters of nominal opacity of 20, 50, and 75 percent in the smoke meter pathlength. Filters calibrated within ±2 percent shall be used. Care should be taken when inserting the filters to prevent stray light from affecting the meter. Make a total of five nonconsecutive readings for each filter. The maximum error on any one reading shall be 3 percent opacity.

3.3.2.6 Zero and Span Drift. Determine the zero and span drift by calibrating and operating the smoke generator in a normal manner over a 1-hour period. The drift is measured by checking the zero and span at the end of this period.

3.3.2.7 Response Time. Determine the response time by producing the series of five simulated 0 percent and 100 percent opacity values and observing the time required to reach stable response. Opacity values of 0 percent and 100 percent may be simulated by alternately switching the power to the light source off and on while the smoke generator is not operating.

4. Bibliography

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2. Weisburd, Melvin I., Field Operations and Enforcement Manual for Air, U.S. Environmental Protection Agency, Research Triangle Park, NC. APTD–1100, August 1972, pp. 4.1–4.36.

3. Condon, E.U., and Odishaw, H., Handbook of Physics, McGraw-Hill Co., New York, NY, 1958, Table 3.1, p. 6–52.

AMEND: 340-200-0025

RULE TITLE: Abbreviations and Acronyms

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "(68) “MSERT” means minor source emission reduction technology "and "(104) “SER” means significant emission rate."

RULE TEXT:

(1) “AAQS” means ambient air quality standard.
(2) "ACDP" means Air Contaminant Discharge Permit.
(3) "ACT" means Federal Clean Air Act.
(4) "AE" means Actual Emissions.
(5) "AICPA" means Association of Independent Certified Public Accountants.
(6) "AQCR" means Air Quality Control Region.
(7) “AQRV” means Air Quality Related Value
(8) "AQMA" means Air Quality Maintenance Area.
(9) "ASME" means American Society of Mechanical Engineers.
(10) "ASTM" means American Society for Testing & Materials.
(11) "ATETP" means Automotive Technician Emission Training Program.
(12) "AWD" means all wheel drive.
(13) "BACT" means Best Available Control Technology.
(14) “BART” means Best Available Retrofit Technology.
(15) "BLS" means black liquor solids.
(16) "CAA" means Clean Air Act
(17) "CAR" means control area responsible party.
(18) "CBD" means central business district.
(19) "CCTMP" means Central City Transportation Management Plan.
(20) "CEM" means continuous emissions monitoring.
(21) "CEMS" means continuous emission monitoring system.
(22) "CERCLA" means Comprehensive Environmental Response Compensation and Liability Act.
(23) "CFRMS" means continuous flow rate monitoring system.
(24) "CFR" or “C.F.R.” means Code of Federal Regulations.
(25) "CMS" means continuous monitoring system.
(26) "CO" means carbon monoxide.
(27) “CO2e” means carbon dioxide equivalent.
(28) "COMS" means continuous opacity monitoring system.
(29) "CPMS" means continuous parameter monitoring system.
(30) "DEQ" means Department of Environmental Quality.
(31) "DOD" means Department of Defense.
(32) "EA" means environmental assessment.
(33) "ECO" means employee commute options.
(34) "EEAF" means emissions estimate adjustment factor.
(35) "EF" means emission factor.
(36) "EGR" means exhaust gas re-circulation.
(37) "EIS" means Environmental Impact Statement.
(38) "EPA" means Environmental Protection Agency.
(39) "EQC" means Environmental Quality Commission.
(40) "ESP" means electrostatic precipitator.

(41) "FCAA" means Federal Clean Air Act.

(42) "FHWA" means Federal Highway Administration.

(43) "FONSI" means finding of no significant impact.

(44) "FTA" means Federal Transit Administration.

(45) "GFA" means gross floor area.

(46) “GHG” means greenhouse gases.

(47) "GLA" means gross leasable area.

(48) "GPM" means grams per mile.

(49) "gr/dscf" means grains per dry standard cubic foot.

(50) "GTBA" means grade tertiary butyl alcohol.

(51) "GVWR" means gross vehicle weight rating.

(52) "HAP" means hazardous air pollutant.

(53) "HEPA" means high efficiency particulate air.

(54) "HMIWI" means hospital medical infectious waste incinerator.

(55) "I/M" means inspection and maintenance program.

(56) "IG" means inspection grade.

(57) "IRS" means Internal Revenue Service.

(58) "ISECP" means indirect source emission control program.

(59) "ISTEA" means Intermodal Surface Transportation Efficiency Act.

(60) "LAER" means Lowest Achievable Emission Rate.

(61) "LDT2" means light duty truck 2.

(62) "LIDAR" means laser radar; light detection and ranging.

(63) "LPG" means liquefied petroleum gas.

(64) "LRAPA" means Lane Regional Air Protection Agency.

(65) "LUCS" means Land Use Compatibility Statement.

(66) "MACT" means Maximum Achievable Control Technology.

(67) "MPO" means Metropolitan Planning Organization.

(68) "MTBE" means methyl tertiary butyl ether.

(69) "MWC" means municipal waste combustor.

(70) "NAAQS" means National Ambient Air Quality Standards.

(71) “NAICS” means North American Industrial Classification System.

(72) "NEPA" means National Environmental Policy Act.

(73) "NESHAP" means National Emissions Standard for Hazardous Air Pollutants.

(74) "NIOSH" means National Institute of Occupational Safety & Health.

(75) "NOx" means nitrogen oxides.

(76) "NSPS" means New Source Performance Standards.

(77) "NSR" means New Source Review.

(78) "NSSC" means neutral sulfite semi-chemical.

(79) "O3" means ozone.

(80) "OAR" means Oregon Administrative Rules.

(81) "ODOT" means Oregon Department of Transportation.

(82) "ORS" means Oregon Revised Statutes.

(83) "OSAC" means orifice spark advance control.

(84) "OSHA" means Occupational Safety & Health Administration.

(85) "PCDCE" means pollution control device collection efficiency.

(86) "PEMS" means predictive emission monitoring system.

(87) "PM" means particulate matter.

(88) "PM10" means particulate matter less than 10 microns.
(89) “PM2.5” means particulate matter less than 2.5 microns.
(90) "POTW" means Publicly Owned Treatment Works.
(91) "POV" means privately owned vehicle.
(92) “ppm” means parts per million.
(93) "PSD" means Prevention of Significant Deterioration.
(94) "PSEL" means Plant Site Emission Limit.
(95) "QIP" means quality improvement plan.
(96) "RACT" means Reasonably Available Control Technology.
(97) “ROI” means range of influence.
(98) "RVCOG" means Rogue Valley Council of Governments.
(99) "RWOC" means running weighted oxygen content.
(100) "scf" means standard cubic feet.
(101) "SCS" means speed control switch.
(102) "SD" means standard deviation.
(103) “SER” means significant emission rate.
(104) “SERP” means source emission reduction plan.
(105) “SIC” means Standard Industrial Classification from the Standard Industrial Classification Manual (U.S. Office of Management and Budget, 1987).
(106) "SIP" means State Implementation Plan.
(107) "SKATS" means Salem-Keizer Area Transportation Study.
(108) “SLAMS” means State or Local Air Monitoring Stations.
(109) "SO2" means sulfur dioxide.
(110) "SOCMI" means synthetic organic chemical manufacturing industry.
(111) "SOS" means Secretary of State.
(112) “SPMs” means Special Purpose Monitors.
(113) "TAC" means thermostatic air cleaner.
(114) "TACT" means Typically Achievable Control Technology.
(115) "TCM" means transportation control measures.
(116) "TCS" means throttle control solenoid.
(117) "TIP" means Transportation Improvement Program.
(118) “tpy” means tons per year.
(119) "TRS" means total reduced sulfur.
(120) "TSP" means total suspended particulate matter.
(121) "UGA" means urban growth area.
(122) "UGB" means urban growth boundary.
(123) “USC” means United States Code.
(124) "US DOT" means United States Department of Transportation.
(125) "UST" means underground storage tanks.
(126) "UTM" means universal transverse mercator.
(127) "VIN" means vehicle identification number.
(128) "VMT" means vehicle miles traveled.
(129) "VOC" means volatile organic compounds.
[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-200-0035

RULE TITLE: Reference Materials

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Changing (3) to refer to the April 2015 edition of the DEQ continuous Monitoring Manual.

RULE TEXT:

As used in divisions 200 through 268, the following materials refer to the versions listed below.

(1) "C.F.R." or “CFR” means Code of Federal Regulations and, unless otherwise expressly identified, refers to the July 1, 2022 edition.

(2) The DEQ Source Sampling Manual refers to the November 2018 edition.

(3) The DEQ Continuous Monitoring Manual refers to the April 2015 edition.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040 with the exception of all references to toxic air contaminants and OAR chapter 340, division 245.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A

STATUTES/OTHER IMPLEMENTED: ORS 468A

State of Oregon Department of Environmental Quality

OAR 340-200-0035
DEQ Source Sampling Manual
DEQ Continuous Monitoring Manual

Air Quality Program

Source Sampling Manual

Volume 1

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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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Table of Contents

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	<u>Discuss the following for each pollutant measured:</u> - Specie (CO, PM, Formaldehyde, Opacity, etc.) - Reporting unit for each specie (ppmdv, lbs/hr, lbs/ton, etc.)
9	Test Methods	<u>Include the following for each test method:</u> - 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°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.

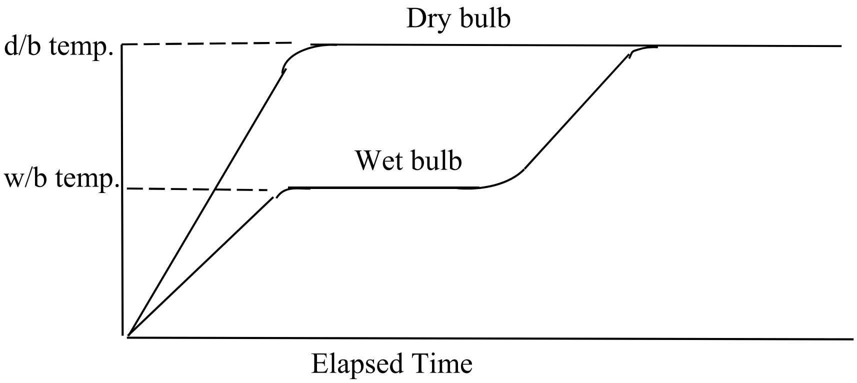

Figure 4-1

4.4 Moisture Equation:

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

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.

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[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:

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

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:

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

9.10 Methylene Chloride (or Hexane) Blank Deduction:

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

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

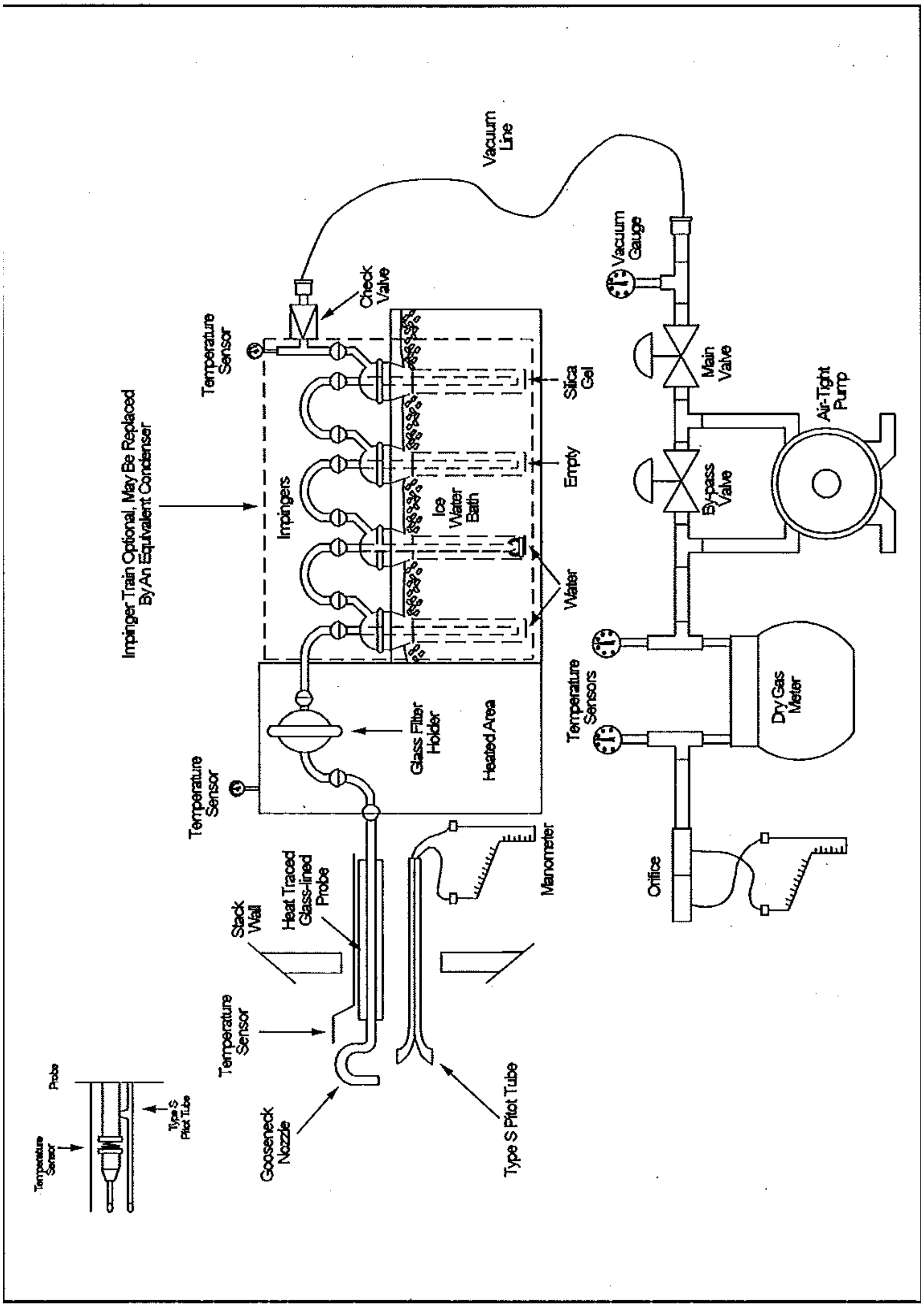

Figure 5-2a
METHOD 5 DATA ANALYSIS FORM

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
<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:_________						
<u>Water</u> Beaker ID:_________ Tare Wt.:__________ Water Vol.:________ Water ID:_________ Date/time into desiccator:_________						
<u>MeCl or Hexane</u> 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

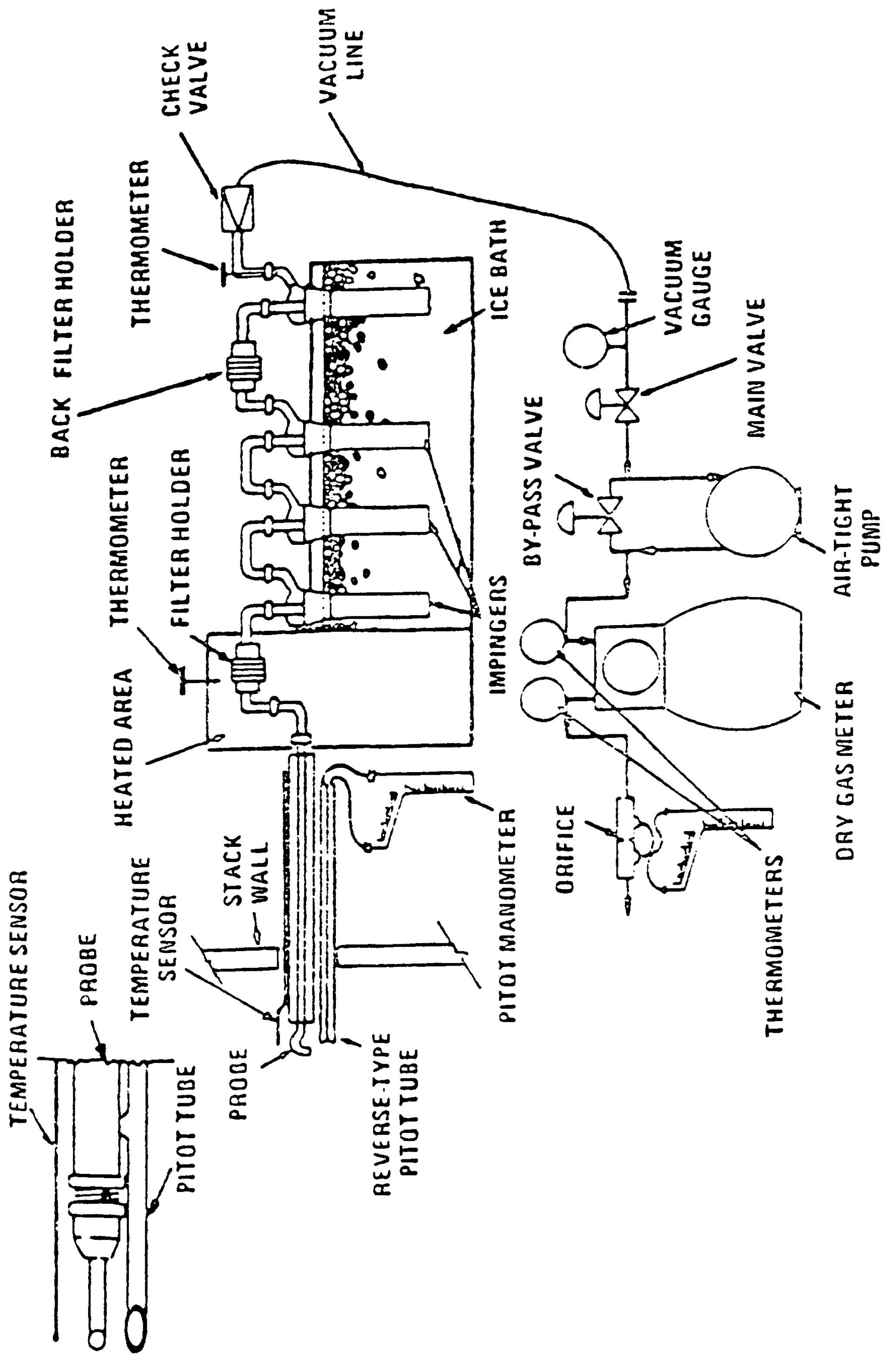

Figure 7-2
OREGON METHOD 7 DATA ANALYSIS FORM

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.

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[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.

$Ø_i$ = 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.

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

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

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

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:

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

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.

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

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

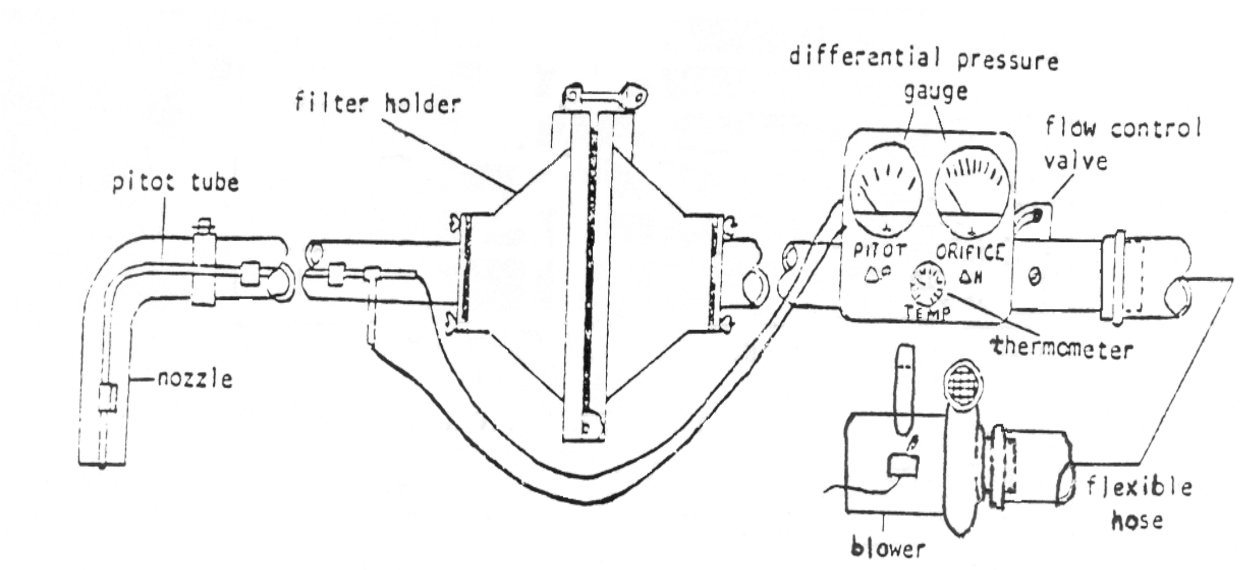
differential pressure gauge
filter holder
flow control valve
pitot tube
PITOT
ΔP
ORIFICE
ΔH
TEMP
thermometer
nozzle
flexible hose
blower

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. 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: ____________						

*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_____ 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)

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	ΔP " H_2O	Check if selected ( )
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
Average				

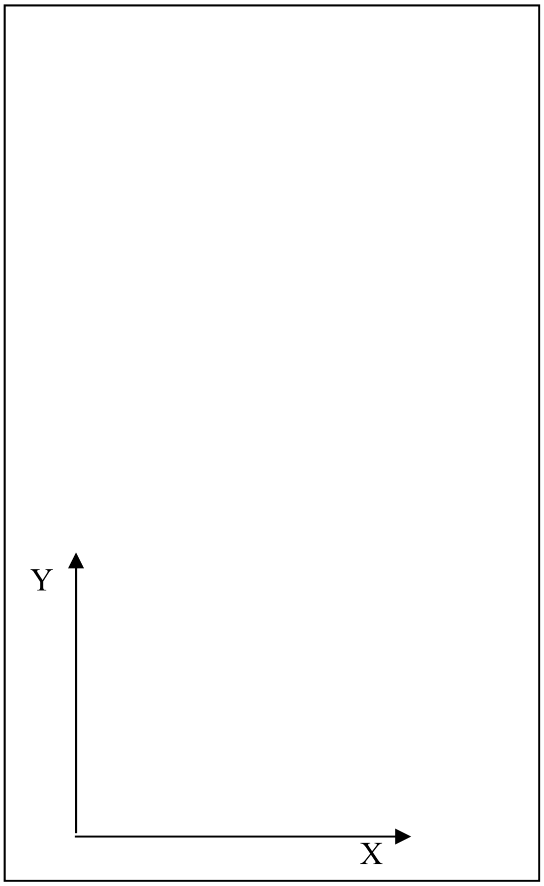

Figure 8-7

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	32°F & 212°F 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	32°F & 212°F	every 6 months	±1.5% absolute		X	X	
Impinger Exit	ASTM mercury thermometer, or NIST traceable	32°F & 212°F	every 6 months	±1.5% absolute		X	X	
Dry Gas Meter	ASTM mercury thermometer, or NIST traceable	32°F & 212°F	every 6 months	±1.5% absolute		X	X	
Orifice Meter	ASTM mercury thermometer, or NIST traceable	32°F & 212°F	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	$Y_{max} - Y_{min} \leq 0.030$ $0.95 \leq Y \leq 1.05$		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

Volume II

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January, 1992
April, 2015

State of Oregon
Department of
Environmental
Quality

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

This report prepared by:

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Table of Contents

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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.

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

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, (°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.

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

Where:

G_t = Volume of gasoline delivered, (gal)

ΔH = 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

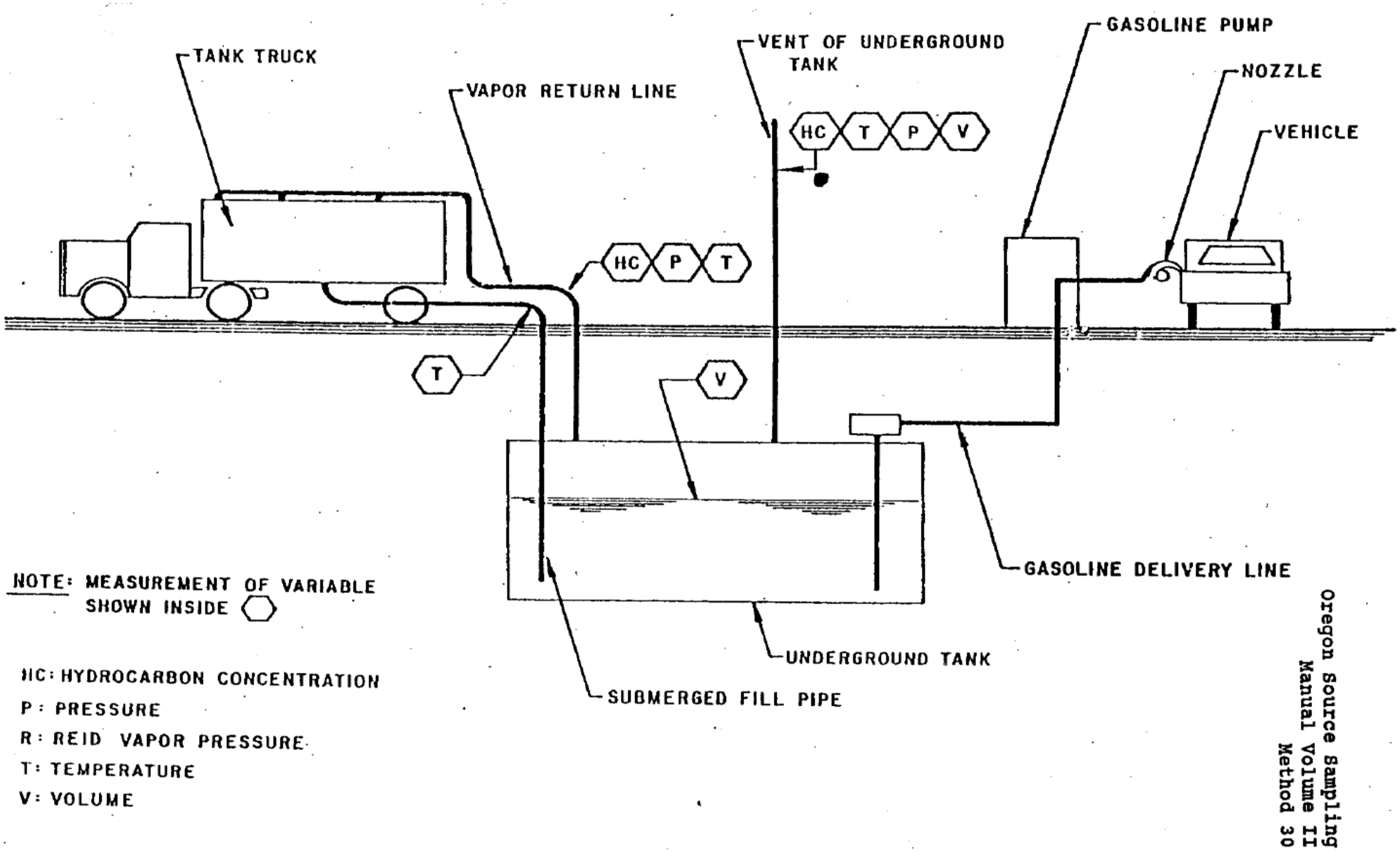
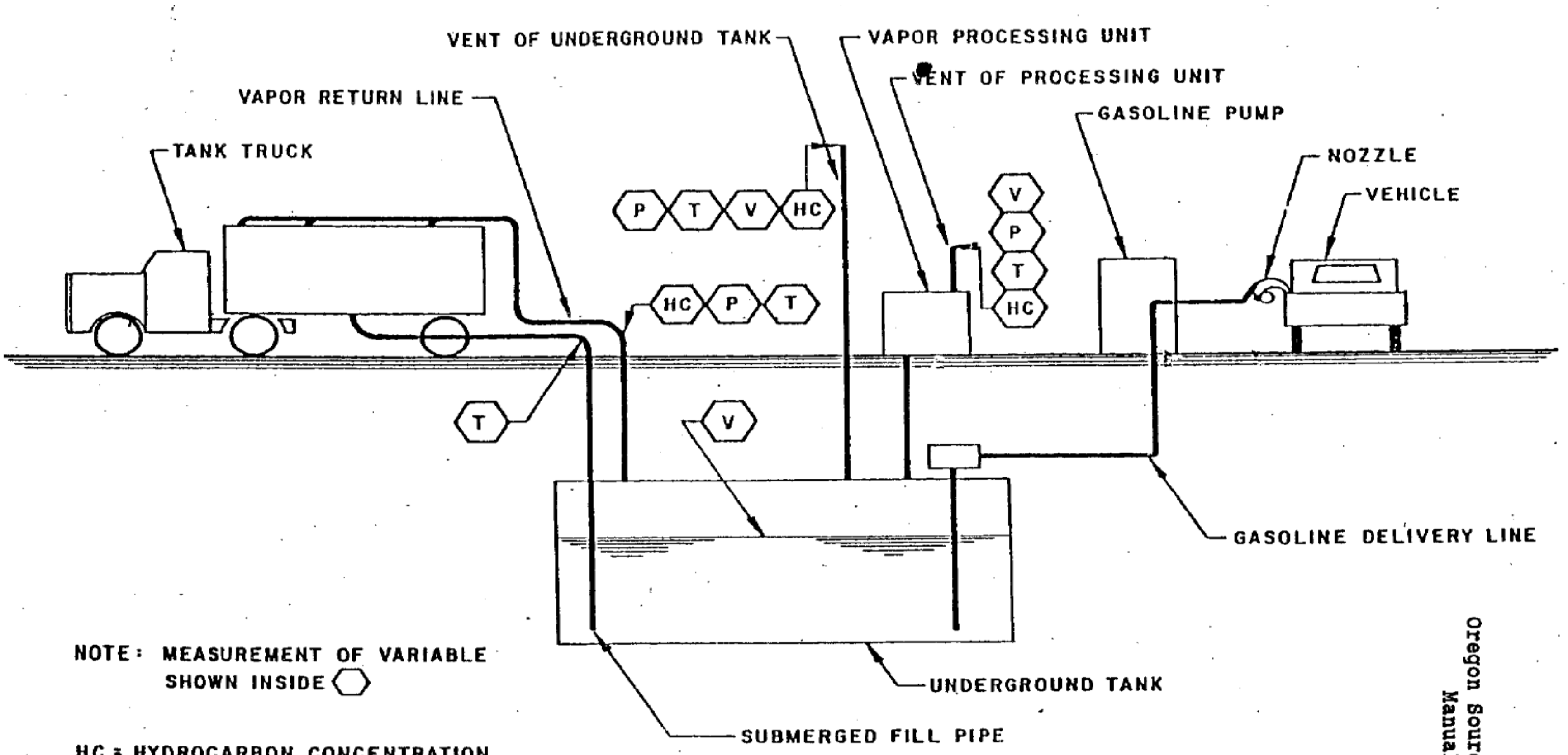


FIGURE A DISPLACEMENT SYSTEM

FIGURE B – VACUUM ASSISTED SECONDARY



NOTE: MEASUREMENT OF VARIABLE SHOWN INSIDE ⬡

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°F) with a temperature recorder system having a readability of 1°.

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.

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

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.

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

T_t x 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

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

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

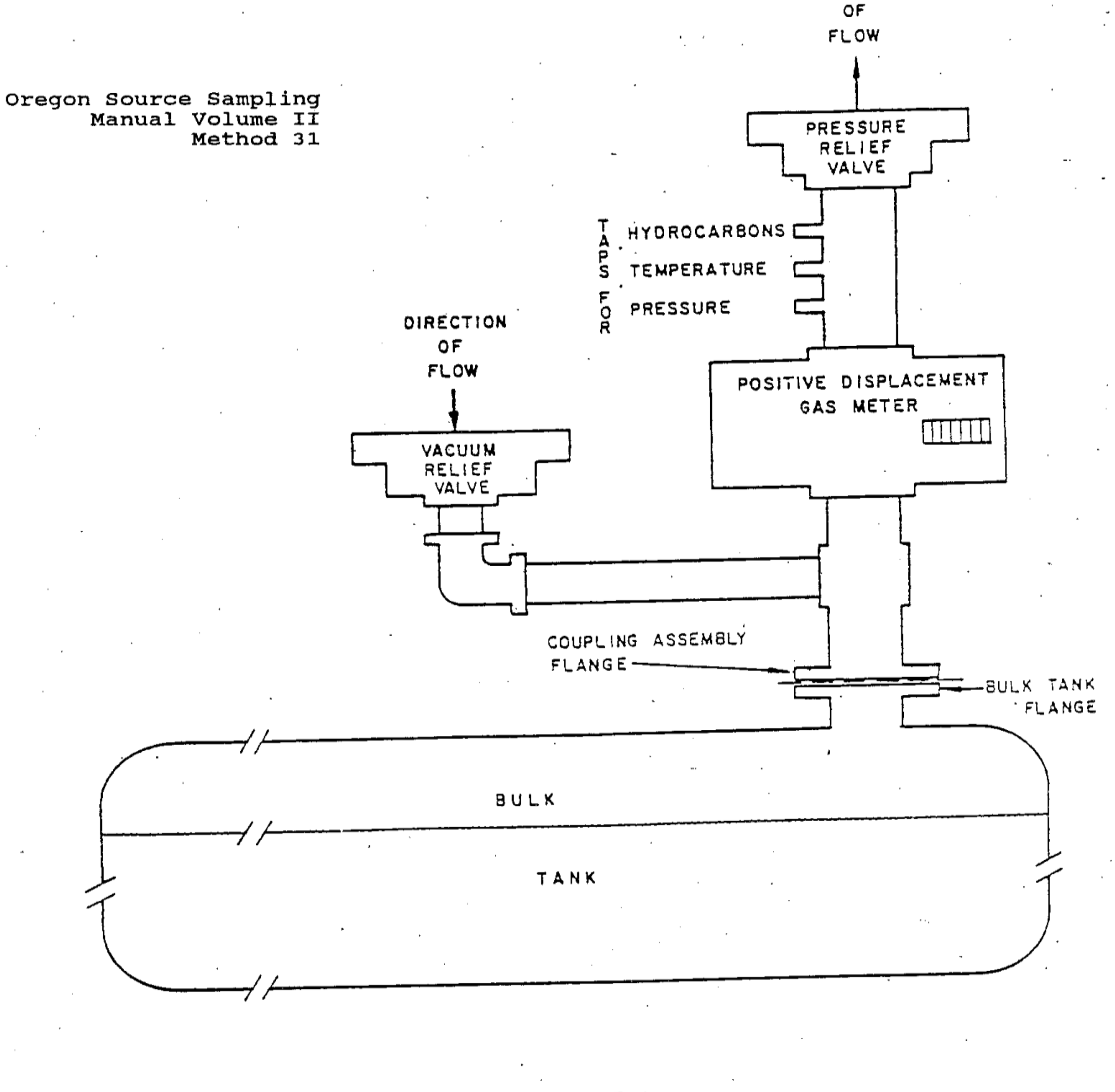
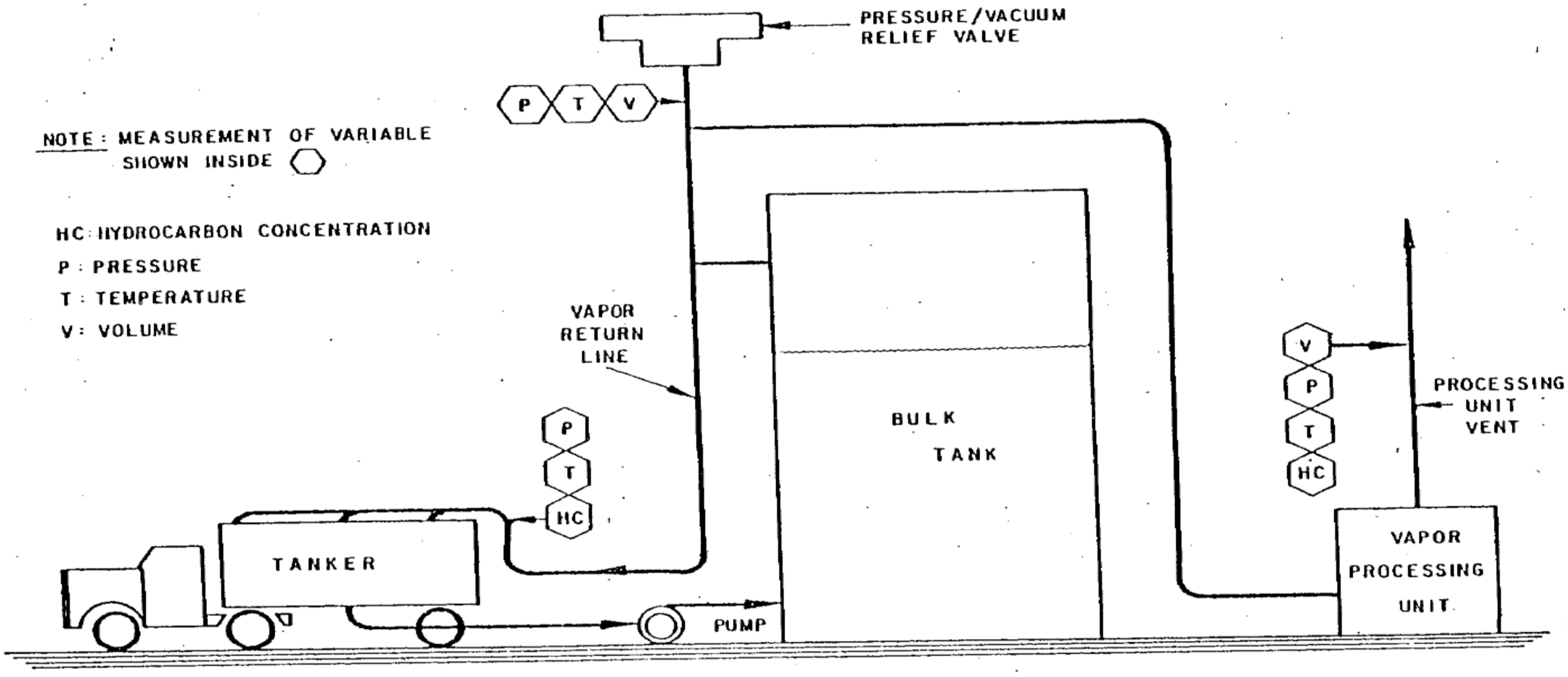


FIGURE A
BULK TANK
TEST APPARATUS

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

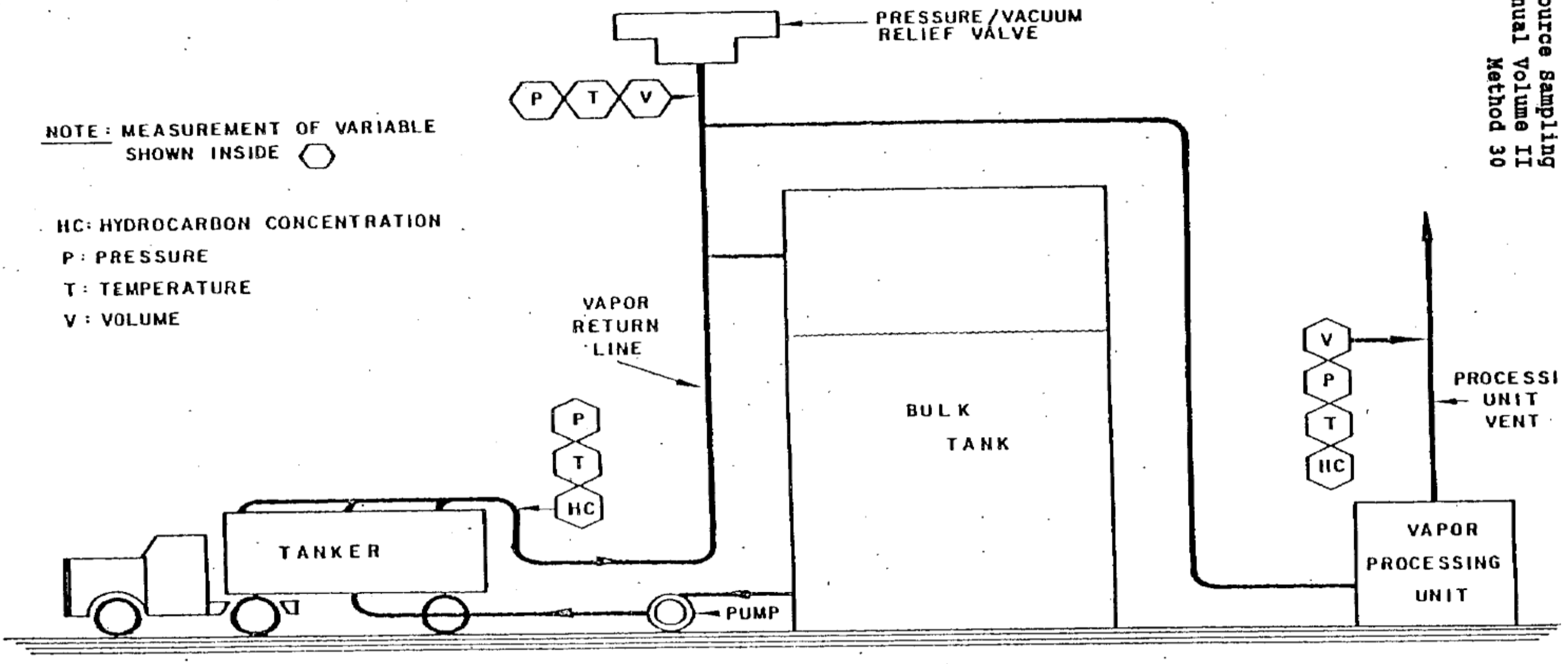
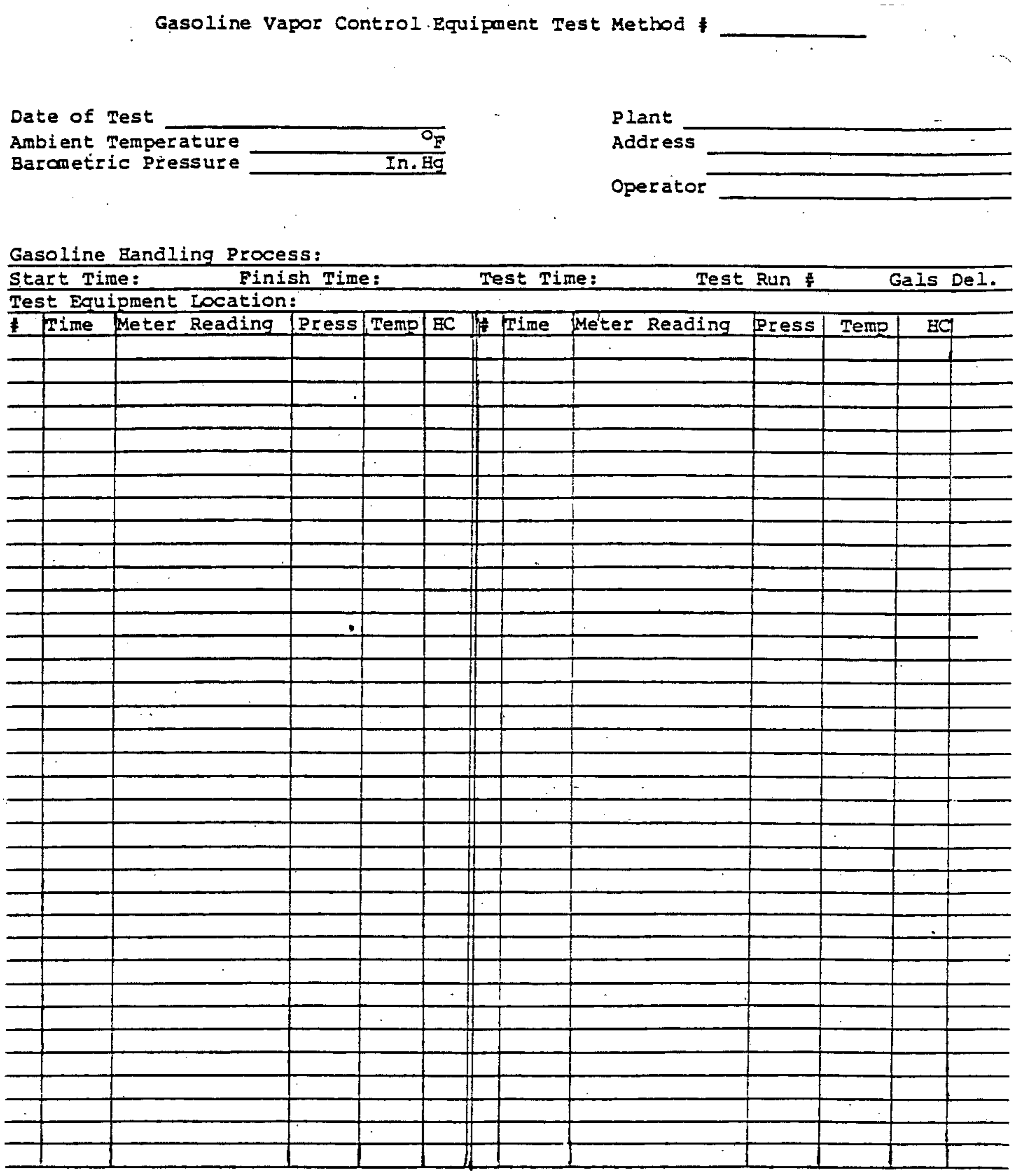


FIGURE - C
GASOLINE TRANSFER
FROM BULK PLANT TO DELIVERY TANK

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

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

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 $\pm$ 25 Pascals ($\pm$ 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.

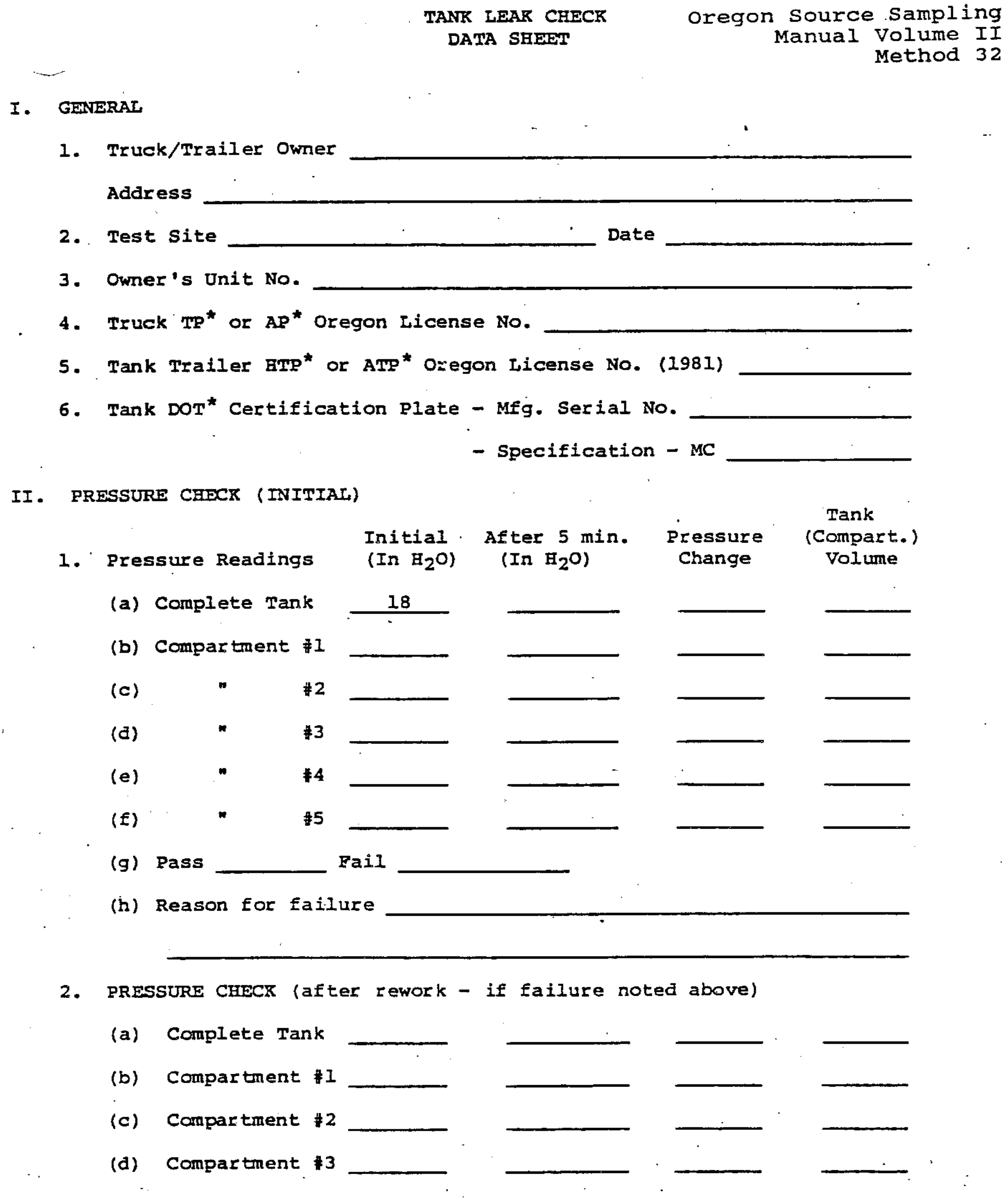
10.0 Test Reports

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

(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

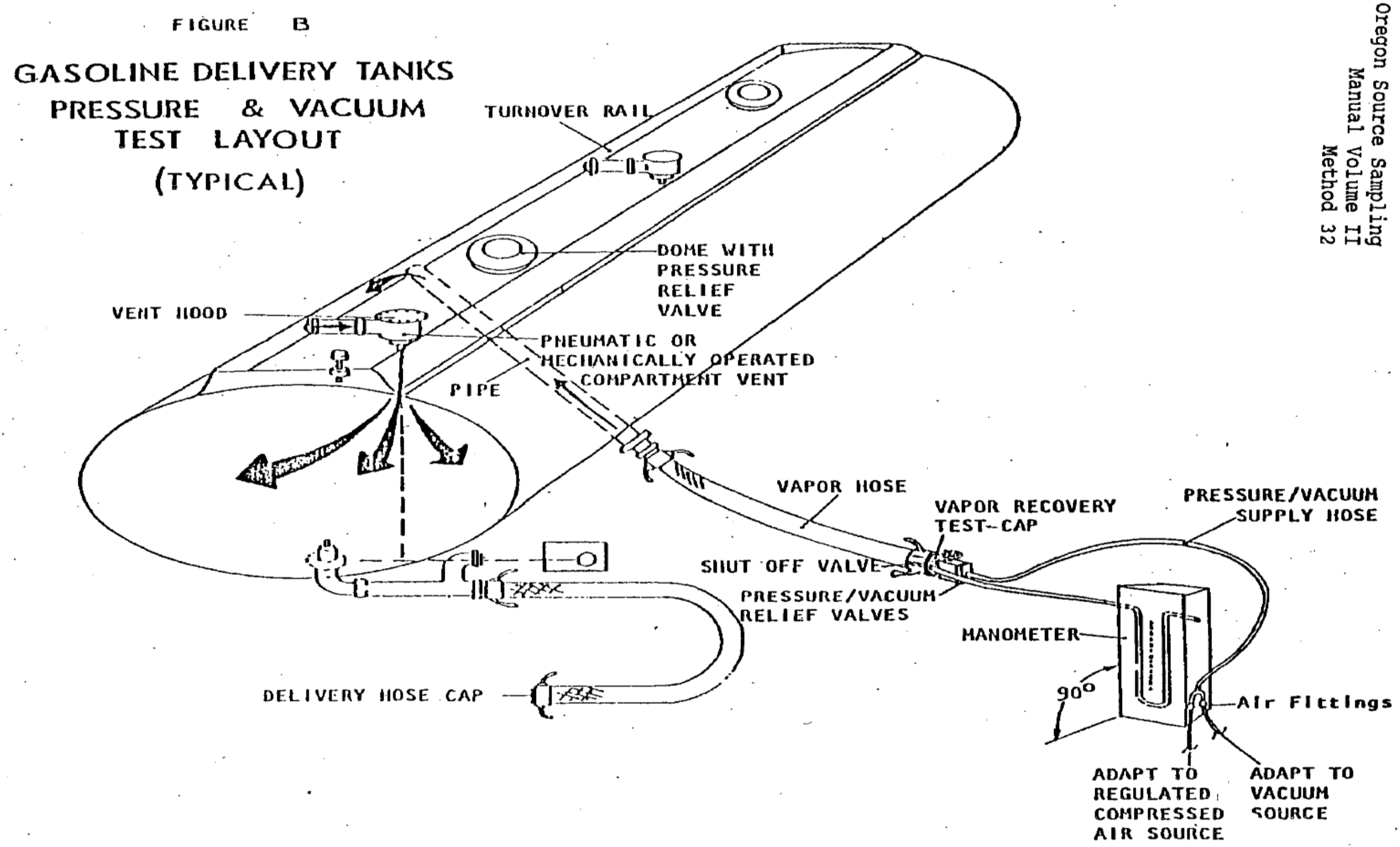


FIGURE B

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) Remember 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.

Continuous Monitoring Manual

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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:

- "Quality Control" 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.
- "Quality Assurance" 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.

AMEND: 340-200-0040

RULE TITLE: State of Oregon Clean Air Act Implementation Plan

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Updating date to reflect the last date the DEQ State Implementation Plan was amended.

RULE TEXT:

(1) This implementation plan, consisting of Volumes 2 and 3 of the State of Oregon Air Quality Control Program, contains control strategies, rules and standards prepared by DEQ and is adopted as the State Implementation Plan (SIP) of the State of Oregon under the FCAA, 42 U.S.C.A 7401 to 7671q.

(2) Except as provided in section (3), revisions to the SIP will be made under the EQC's rulemaking procedures in OAR chapter 340, division 11 of this chapter and any other requirements contained in the SIP and will be submitted to the EPA for approval. The SIP was last modified by the EQC on November 18, 2022.

(3) Notwithstanding any other requirement contained in the SIP, DEQ may:

(a) Submit to the EPA any permit condition implementing a rule that is part of the federally-approved SIP as a source-specific SIP revision after DEQ has complied with the public hearings provisions of 40 C.F.R. 51.102; and

(b) Approve the standards submitted by LRAPA if LRAPA adopts verbatim, other than non-substantive differences, any standard that the EQC has adopted, and submit the standards to EPA for approval as a SIP revision.

(4) Revisions to the State of Oregon Clean Air Act Implementation Plan become federally enforceable upon approval by the EPA. If any provision of the federally approved State Implementation Plan conflicts with any provision adopted by the EQC, DEQ must enforce the more stringent provision.

STATUTORY/OTHER AUTHORITY: ORS 468A, ORS 468.020

STATUTES/OTHER IMPLEMENTED: ORS 468A.035, 468A.135

AMEND: 340-204-0300

RULE TITLE: Designation of Sustainment Areas

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Amending rule note to removed "except sections (2), (3) and (4)"

RULE TEXT:

(1) The EQC may designate sustainment areas provided that DEQ submits a request for designation that includes the following information:

(a) Monitoring data showing that an area is exceeding or has the potential to exceed an ambient air quality standard;

(b) A description of the affected area based on the monitoring data;

(c) A discussion and identification of the priority sources contributing to the exceedance or potential exceedance of the ambient air quality standard; and

(d) A discussion of the reasons for the proposed designation.

(2) Designation of sustainment areas:

(a) The Lakeview UGB as defined in OAR 340-204-0010 is designated as a sustainment area for PM2.5.

(b) Reserved

(3) An area designated as a sustainment area under section (2) will automatically be reclassified immediately upon the EPA officially designating the area as a nonattainment area.

(4) The EQC may rescind the designation based on a request by DEQ. DEQ will consider the following information for rescinding the designation:

(a) Whether at least three consecutive years of monitoring data shows the area is meeting the ambient air quality standard; and

(b) A request by a local government.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.035

AMEND: 340-204-0310

RULE TITLE: Designation of Reattainment Areas

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Removing ", except sections (2) and (3), " from rule note.

RULE TEXT:

(1) The EQC may designate reattainment areas provided that DEQ submits a request for designation that includes the following information:

(a) At least three consecutive years of monitoring data showing that an area that is currently designated by EPA as nonattainment is attaining an ambient air quality standard; and

(b) A discussion of the reasons for the proposed designation.

(2) Reserved for list of reattainment areas.

(3) An area designated as a reattainment area under section (2) will automatically be reclassified immediately upon:

(a) The EQC designating the area as a maintenance area and EPA officially designating the area as an attainment area; or

(b) The EQC rescinding the designation based on a request by DEQ. DEQ will consider the following information for rescinding the designation:

(A) Monitoring data that shows the area is not meeting the ambient air quality standard; and

(B) A request by a local government.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.035

AMEND: 340-206-0010

RULE TITLE: Introduction

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "an AQMA as defined in OAR 340-204-0010, or " to opening paragraph.

RULE TEXT:

OAR 340-206-0030, 340-206-0050 and 340-206-0060 are effective within priority I and II air quality control regions (AQCR) as defined in 40 CFR part 51, subpart H (1995), when the AQCR contains an AQMA as defined in OAR 340-204-0010, or a nonattainment area listed in 40 CFR part 81. All other rules in this division are equally applicable to all areas of the state. Notwithstanding any other regulation or standard, this division is designed to prevent the excessive accumulation of air contaminants during periods of atmospheric stagnation or at any other time, which if allowed to continue to accumulate unchecked could result in concentrations of these contaminants reaching levels which could cause significant harm to the health of persons. This division establishes criteria for identifying and declaring air pollution episodes at levels below the level of significant harm and are adopted pursuant to the requirements of the FCAA as amended and 40 CFR part 51.151. Levels of significant harm for various regulated pollutants listed in 40 CFR part 51.151 are:

(1) For sulfur dioxide (SO2) — 1.0 ppm, 24-hour average.
(2) For particulate matter:
(a) PM10 — 600 micrograms per cubic meter, 24-hour average.
(b) PM2.5 — 350.5 micrograms per cubic meter, 24-hour average.
(3) For carbon monoxide (CO):
(a) 50 ppm, 8-hour average.
(b) 75 ppm, 4-hour average.
(c) 125 ppm, 1-hour average.
(4) For ozone (O3) — 0.6 ppm, 2-hour average.
(5) For nitrogen dioxide (NO2):
(a) 2.0 ppm, 1-hour average.
(b) 0.5 ppm, 24-hour average.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.035

AMEND: 340-208-0110

RULE TITLE: Visible Air Contaminant Limitations

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Making emission unit applicability clearer.

RULE TEXT:

(1) The emissions standards in this rule do not apply to:

(a) Fugitive emissions from a source or part of a source; or

(b) Recovery furnaces regulated under OAR chapter 340, division 234.

(2) The visible emissions standards in this rule are based on the average of 24 consecutive observations recorded at 15-second intervals, or more frequently as allowed under subsection (b), which comprise a six-minute block. Six-minute blocks need not be consecutive in time and in no case may two blocks overlap. For each set of 24 observations, the six-minute block average is calculated by summing the opacity of the 24 observations and dividing the sum by 24. Six-minute block averages are measured by:

(a) EPA Method 9;

(b) A continuous opacity monitoring system (COMS) installed and operated in accordance with the DEQ Continuous Monitoring Manual or 40 C.F.R. part 60 [NOTE: DEQ manual is published with OAR 340-200-0035]; or

(c) An alternative monitoring method approved by DEQ that is equivalent to EPA Method 9.

(3)(a) For all emissions units, no person may emit or allow to be emitted any visible emissions that equal or exceed an average of 20 percent opacity, except as allowed under subsection (b) or (c).

(b) For wood-fired boilers installed, constructed or last modified on or after June 1, 1970 but before April 16, 2015, visible emissions may equal or exceed an average of 20 percent opacity for up to two independent six-minute blocks in any hour, as long as the average opacity during each of these two six-minute blocks is less than 40 percent;

(c) For wood-fired boilers installed, constructed or last modified prior to June 1, 1970:

(A) Visible emissions may equal or exceed an average of 20 percent opacity but may not equal or exceed 40 percent opacity, as the average of all six-minute blocks during grate cleaning operations provided the grate cleaning is performed in accordance with a grate cleaning plan approved by DEQ; or

(B) DEQ may approve, at the owner's or operator's request, a boiler specific limit greater than an average of 20 percent opacity, but not to equal or exceed an average of 40 percent opacity, based on the opacity measured during a source test that demonstrates compliance with OAR 340-228-0210(2)(d) and:

(i) Opacity must be measured for at least 60 minutes during each compliance source test run using any method included in section (2);

(ii) The boiler specific limit will be the average of at least 30 six-minute block averages obtained during the compliance source test;

(iii) The boiler-specific limit will include a higher limit for one six-minute period during any hour based on the maximum six-minute block average measured during the compliance source test;

(iv) Specific opacity limits will be included in the permit for each affected source as a minor permit modification (simple fee) for sources with an Oregon Title V Operating Permit or a Basic Technical Modification for sources with an Air Contaminant Discharge Permit; and

(v) If an alternative limit is established in accordance with this paragraph, the exception provided in paragraph (A) does not apply.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

[NOTE: View a PDF of referenced EPA Method by clicking on "Tables" link below.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.035

State of Oregon Department of Environmental Quality

OAR 340-208-0110

EPA Method 9

APPENDIX A–4 TO PART 60—TEST METHODS 6 THROUGH 10B

Method 6—Determination of sulfur dioxide emissions from stationary sources
Method 6A—Determination of sulfur dioxide, moisture, and carbon dioxide emissions from fossil fuel combustion sources
Method 6B—Determination of sulfur dioxide and carbon dioxide daily average emissions from fossil fuel combustion sources
Method 6C—Determination of Sulfur Dioxide Emissions From Stationary Sources (Instrumental Analyzer Procedure)
Method 7—Determination of nitrogen oxide emissions from stationary sources
Method 7A—Determination of nitrogen oxide emissions from stationary sources—Ion chromatographic method
Method 7B—Determination of nitrogen oxide emissions from stationary sources (Ultraviolet spectrophotometry)
Method 7C—Determination of nitrogen oxide emissions from stationary sources—Alkaline-permanganate/colorimetric method
Method 7D—Determination of nitrogen oxide emissions from stationary sources—Alkaline-permanganate/ion chromatographic method
Method 7E—Determination of Nitrogen Oxides Emissions From Stationary Sources (Instrumental Analyzer Procedure)
Method 8—Determination of sulfuric acid mist and sulfur dioxide emissions from stationary sources
Method 9—Visual determination of the opacity of emissions from stationary sources
Alternate method 1—Determination of the opacity of emissions from stationary sources remotely by lidar
Method 10—Determination of carbon monoxide emissions from stationary sources
Method 10A—Determination of carbon monoxide emissions in certifying continuous emission monitoring systems at petroleum refineries
Method 10B—Determination of carbon monoxide emissions from stationary sources

The test methods in this appendix are referred to in §60.8 (Performance Tests) and §60.11 (Compliance With Standards and Maintenance Requirements) of 40 CFR part 60, subpart A (General Provisions). Specific uses of these test methods are described in the standards of performance contained in the subparts, beginning with Subpart D.

Within each standard of performance, a section title ‘‘Test Methods and Procedures’’ is provided to: (1) Identify the test methods to be used as reference methods to the facility subject to the respective standard and (2) identify any special instructions or conditions to be followed when applying a method to the respective facility. Such instructions (for example, establish sampling rates, volumes, or temperatures) are to be used either in addition to, or as a substitute for procedures in a test method. Similarly, for sources subject to emission monitoring requirements, specific instructions pertaining to any use of a test method as a reference method are provided in the subpart or in Appendix B.

Inclusion of methods in this appendix is not intended as an endorsement or denial of their applicability to sources that are not subject to standards of performance. The methods are potentially applicable to other sources; however, applicability should be confirmed by careful and appropriate evaluation of the conditions prevalent at such sources.

The approach followed in the formulation of the test methods involves specifications for equipment, procedures, and performance. In concept, a performance specification approach would be preferable in all methods because this allows the greatest flexibility to the user. In practice, however, this approach is impractical in most cases because performance specifications cannot be established. Most of the methods described herein, therefore, involve specific equipment specifications and procedures, and only a few methods in this appendix rely on performance criteria.

Minor changes in the test methods should not necessarily affect the validity of the results and it is recognized that alternative and equivalent methods exist. section 60.8 provides authority for the Administrator to specify or approve (1) equivalent methods, (2) alternative methods, and (3) minor changes in the methodology of the test methods. It should be clearly understood that unless otherwise identified all such methods and changes must have prior approval of the Administrator. An owner employing such methods or deviations from the test methods without obtaining prior approval does so at the risk of subsequent disapproval and retesting with approved methods.

Within the test methods, certain specific equipment or procedures are recognized as being acceptable or potentially acceptable and are specifically identified in the methods. The items identified as acceptable options may be used without approval but must be identified in the test report. The potentially approvable options are cited as ‘‘subject to the approval of the Administrator’’ or as ‘‘or equivalent.’’ Such potentially approvable techniques or alternatives may be used at the discretion of the owner without prior approval. However, detailed descriptions for applying these potentially approvable techniques or alternatives are not provided in the test methods. Also, the potentially approvable options are not necessarily acceptable in all applications. Therefore, an owner electing to use such potentially approvable techniques or alternatives is responsible for: (1) assuring that the techniques or alternatives are in fact applicable and are properly executed; (2) including a written description of the alternative method in the test report (the written method must be clear and must be capable of being performed without additional instruction, and the degree of detail should be similar to the detail contained in the test methods); and (3) providing any rationale or supporting data necessary to show the validity of the alternative in the particular application. Failure to meet these requirements can result in the Administrator's disapproval of the alternative.

Method 6—Determination of Sulfur Dioxide Emissions From Stationary Sources

NOTE: This method does not include all of the specifications (*e.g.*, equipment and supplies) and procedures (*e.g.*, sampling and analytical) essential to its performance. Some material is incorporated by reference from other methods in this part. Therefore, to obtain reliable results, persons using this method should have a thorough knowledge of at least the following additional test methods: Method 1, Method 2, Method 3, Method 5, and Method 8.

1.0 Scope and Application

1.1 Analytes.

Analyte	CAS No.	Sensitivity
SO_2	7449–09–5	3.4 mg SO_2/m^3 $(2.12 \times 10)_{-7}$ lb/ft^3

1.2 Applicability. This method applies to the measurement of sulfur dioxide (SO_2) emissions from stationary sources.

1.3 Data Quality Objectives. Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods.

2.0 Summary of Method

2.1 A gas sample is extracted from the sampling point in the stack. The SO_2 and the sulfur trioxide, including those fractions in any sulfur acid mist, are separated. The SO_2 fraction is measured by the barium-thorin titration method.

3.0 Definitions [Reserved]

4.0 Interferences

4.1 Free Ammonia. Free ammonia interferes with this method by reacting with SO_2 to form particulate sulfite and by reacting with the indicator. If free ammonia is present (this can be determined by knowledge of the process and/or noticing white particulate matter in the probe and isopropanol bubbler), alternative methods, subject to the approval of the Administrator are required. One approved alternative is listed in Reference 13 of section 17.0.

4.2 Water-Soluble Cations and Fluorides. The cations and fluorides are removed by a glass wool filter and an isopropanol bubbler; therefore, they do not affect the SO_2 analysis. When samples are collected from a gas stream with high concentrations of metallic fumes (*i.e.*, very fine cation aerosols) a high-efficiency glass fiber filter must be used in place of the glass wool plug (*i.e.*, the one in the probe) to remove the cation interferent.

5.0 Safety

5.1 Disclaimer. This method may involve hazardous materials, operations, and equipment. This test method may not address all of the safety problems associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and determine the applicability of regulatory limitations before performing this test method.

5.2 Corrosive reagents. The following reagents are hazardous. Personal protective equipment and safe procedures are useful in preventing chemical splashes. If contact occurs, immediately flush with copious amounts of water for at least 15 minutes. Remove clothing under shower and decontaminate. Treat residual chemical burns as thermal burns.

5.2.1 Hydrogen Peroxide (H_2O_2). Irritating to eyes, skin, nose, and lungs. 30% H_2O_2 is a strong oxidizing agent. Avoid contact with skin, eyes, and combustible material. Wear gloves when handling.

5.2.2 Sodium Hydroxide (NaOH). Causes severe damage to eyes and skin. Inhalation causes irritation to nose, throat, and lungs. Reacts exothermically with limited amounts of water.

5.2.3 Sulfuric Acid (H_2SO_4). Rapidly destructive to body tissue. Will cause third degree burns. Eye damage may result in blindness. Inhalation may be fatal from spasm of the larynx, usually within 30 minutes. May cause lung tissue damage with edema. 1 mg/m^3 for 8 hours will cause lung damage or, in higher concentrations, death. Provide ventilation to limit inhalation. Reacts violently with metals and organics.

6.0 Equipment and Supplies

6.1 Sample Collection. The following items are required for sample collection:

6.1.1 Sampling Train. A schematic of the sampling train is shown in Figure 6–1. The sampling equipment described in Method 8 may be substituted in place of the midget impinger equipment of Method 6. However, the Method 8 train must be modified to include a heated filter between the probe and isopropanol impinger, and the operation of the sampling train and sample analysis must be at the flow rates and solution volumes defined in Method 8. Alternatively, SO_2 may be determined simultaneously with particulate matter and moisture determinations by either (1) replacing the water in a Method 5 impinger system with a 3 percent H_2O_2 solution, or (2) replacing the Method 5 water impinger system with a Method 8 isopropanol-filter-H_2O_2 system. The analysis for SO_2 must be consistent with the procedure of Method 8. The Method 6 sampling train consists of the following components:

6.1.1.1 Probe. Borosilicate glass or stainless steel (other materials of construction may be used, subject to the approval of the Administrator), approximately 6 mm (0.25 in.) inside diameter, with a heating system to prevent water condensation and a filter (either in-stack or heated out-of-stack) to remove particulate matter, including sulfuric acid mist. A plug of glass wool is a satisfactory filter.

6.1.1.2 Bubbler and Impingers. One midget bubbler with medium-coarse glass frit and borosilicate or quartz glass wool packed in top (see Figure 6–1) to prevent sulfuric acid mist carryover, and three 30-ml midget impingers. The midget bubbler and midget impingers must be connected in series with leak-free glass connectors. Silicone grease may be used, if necessary, to prevent leakage. A midget impinger may be used in place of the midget bubbler.

NOTE: Other collection absorbers and flow rates may be used, subject to the approval of the Administrator, but the collection efficiency must be shown to be at least 99 percent for each test run and must be documented in the report. If the efficiency is found to be acceptable after a series of three tests, further documentation is not required. To conduct the efficiency test, an extra absorber must be added and analyzed separately. This extra absorber must not contain more than 1 percent of the total SO_2.

6.1.1.3 Glass Wool. Borosilicate or quartz.

6.1.1.4 Stopcock Grease. Acetone-insoluble, heat-stable silicone grease may be used, if necessary.

6.1.1.5 Temperature Sensor. Dial thermometer, or equivalent, to measure temperature of gas leaving impinger train to within 1 °C (2 °F).

6.1.1.6 Drying Tube. Tube packed with 6- to 16- mesh indicating-type silica gel, or equivalent, to dry the gas sample and to protect the meter and pump. If silica gel is previously used, dry at 177 °C (350 °F) for 2 hours. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to the approval of the Administrator.

6.1.1.7 Valve. Needle valve, to regulate sample gas flow rate.

6.1.1.8 Pump. Leak-free diaphragm pump, or equivalent, to pull gas through the train. Install a small surge tank between the pump and rate meter to negate the pulsation effect of the diaphragm pump on the rate meter.

6.1.1.9 Rate Meter. Rotameter, or equivalent, capable of measuring flow rate to within 2 percent of the selected flow rate of about 1 liter/min (0.035 cfm).

6.1.1.10 Volume Meter. Dry gas meter (DGM), sufficiently accurate to measure the sample volume to within 2 percent, calibrated at the selected flow rate and conditions actually encountered during sampling, and equipped with a temperature sensor (dial thermometer, or equivalent) capable of measuring temperature accurately to within 3 °C (5.4 °F). A critical orifice may be used in place of the DGM specified in this section provided that it is selected, calibrated, and used as specified in section 16.0.

6.1.2 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). See the note in Method 5, section 6.1.2.

6.1.3 Vacuum Gauge and Rotameter. At least 760-mm Hg (30-in. Hg) gauge and 0- to 40-ml/min rotameter, to be used for leak-check of the sampling train.

6.2 Sample Recovery. The following items are needed for sample recovery:

6.2.1 Wash Bottles. Two polyethylene or glass bottles, 500-ml.

6.2.2 Storage Bottles. Polyethylene bottles, 100-ml, to store impinger samples (one per sample).

6.3 Sample Analysis. The following equipment is needed for sample analysis:

6.3.1 Pipettes. Volumetric type, 5-ml, 20-ml (one needed per sample), and 25-ml sizes.

6.3.2 Volumetric Flasks. 100-ml size (one per sample) and 1000-ml size.

6.3.3 Burettes. 5- and 50-ml sizes.

6.3.4 Erlenmeyer Flasks. 250-ml size (one for each sample, blank, and standard).

6.3.5 Dropping Bottle. 125-ml size, to add indicator.

6.3.6 Graduated Cylinder. 100-ml size.

6.3.7 Spectrophotometer. To measure absorbance at 352 nm.

7.0 Reagents and Standards

NOTE: Unless otherwise indicated, all reagents must conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society. Where such specifications are not available, use the best available grade.

7.1 Sample Collection. The following reagents are required for sample collection:

7.1.1 Water. Deionized distilled to conform to ASTM Specification D 1193–77 or 91 Type 3 (incorporated by reference—see §60.17). The $KMnO_4$ test for oxidizable organic matter may be omitted when high concentrations of organic matter are not expected to be present.

7.1.2 Isopropanol, 80 Percent by Volume. Mix 80 ml of isopropanol with 20 ml of water.

7.1.2.1 Check each lot of isopropanol for peroxide impurities as follows: Shake 10 ml of isopropanol with 10 ml of freshly prepared 10 percent potassium iodide solution. Prepare a blank by similarly treating 10 ml of water. After 1 minute, read the absorbance at 352 nm on a spectrophotometer using a 1-cm path length. If absorbance exceeds 0.1, reject alcohol for use.

7.1.2.2 Peroxides may be removed from isopropanol by redistilling or by passage through a column of activated alumina; however, reagent grade isopropanol with suitably low peroxide levels may be obtained from commercial sources. Rejection of contaminated lots may, therefore, be a more efficient procedure.

7.1.3 Hydrogen Peroxide (H_2O_2), 3 Percent by Volume. Add 10 ml of 30 percent H_2O_2 to 90 ml of water. Prepare fresh daily.

7.1.4 Potassium Iodide Solution, 10 Percent Weight by Volume (w/v). Dissolve 10.0 g of KI in water, and dilute to 100 ml. Prepare when needed.

7.2 Sample Recovery. The following reagents are required for sample recovery:

7.2.1 Water. Same as in section 7.1.1.

7.2.2 Isopropanol, 80 Percent by Volume. Same as in section 7.1.2.

7.3 Sample Analysis. The following reagents and standards are required for sample analysis:

7.3.1 Water. Same as in section 7.1.1.

7.3.2 Isopropanol, 100 Percent.

7.3.3 Thorin Indicator. 1-(o-arsonophenylazo)-2-naphthol-3,6-disulfonic acid, disodium salt, or equivalent. Dissolve 0.20 g in 100 ml of water.

7.3.4 Barium Standard Solution, 0.0100 N. Dissolve 1.95 g of barium perchlorate trihydrate [$Ba(ClO_4)_2$ $3H_2O$] in 200 ml water, and dilute to 1 liter with isopropanol. Alternatively, 1.22 g of barium chloride dihydrate [$BaCl_2$ $2H_2O$] may be used instead of the barium perchlorate trihydrate. Standardize as in section 10.5.

7.3.5 Sulfuric Acid Standard, 0.0100 N. Purchase or standardize to ±0.0002 N against 0.0100 N NaOH which has previously been standardized against potassium acid phthalate (primary standard grade).

8.0 Sample Collection, Preservation, Storage and Transport

8.1 Preparation of Sampling Train. Measure 15 ml of 80 percent isopropanol into the midget bubbler and 15 ml of 3 percent H_2O_2 into each of the first two midget impingers. Leave the final midget impinger dry. Assemble the train as shown in Figure 6–1. Adjust the probe heater to a temperature sufficient to prevent water condensation. Place crushed ice and water around the impingers.

8.2 Sampling Train Leak-Check Procedure. A leak-check prior to the sampling run is recommended, but not required. A leak-check after the sampling run is mandatory. The leak-check procedure is as follows:

8.2.1 Temporarily attach a suitable (*e.g.*, 0- to 40- ml/min) rotameter to the outlet of the DGM, and place a vacuum gauge at or near the probe inlet. Plug the probe inlet, pull a vacuum of at least 250 mm Hg (10 in. Hg), and note the flow rate as indicated by the rotameter. A leakage rate in excess of 2 percent of the average sampling rate is not acceptable.

NOTE: Carefully (*i.e.*, slowly) release the probe inlet plug before turning off the pump.

8.2.2 It is suggested (not mandatory) that the pump be leak-checked separately, either prior to or after the sampling run. To leak-check the pump, proceed as follows: Disconnect the drying tube from the probe-impinger assembly. Place a vacuum gauge at the inlet to either the drying tube or the pump, pull a vacuum of 250 mm Hg (10 in. Hg), plug or pinch off the outlet of the flow meter, and then turn off the pump. The vacuum should remain stable for at least 30 seconds.

If performed prior to the sampling run, the pump leak-check shall precede the leak-check of the sampling train described immediately above; if performed after the sampling run, the pump leak-check shall follow the sampling train leak-check.

8.2.3 Other leak-check procedures may be used, subject to the approval of the Administrator.

8.3 Sample Collection.

8.3.1 Record the initial DGM reading and barometric pressure. To begin sampling, position the tip of the probe at the sampling point, connect the probe to the bubbler, and start the pump. Adjust the sample flow to a constant rate of approximately 1.0 liter/min as indicated by the rate meter. Maintain this constant rate (±10 percent) during the entire sampling run.

8.3.2 Take readings (DGM volume, temperatures at DGM and at impinger outlet, and rate meter flow rate) at least every 5 minutes. Add more ice during the run to keep the temperature of the gases leaving the last impinger at 20 °C (68 °F) or less.

8.3.3 At the conclusion of each run, turn off the pump, remove the probe from the stack, and record the final readings. Conduct a leak-check as described in section 8.2. (This leak-check is mandatory.) If a leak is detected, void the test run or use procedures acceptable to the Administrator to adjust the sample volume for the leakage.

8.3.4 Drain the ice bath, and purge the remaining part of the train by drawing clean ambient air through the system for 15 minutes at the sampling rate. Clean ambient air can be provided by passing air through a charcoal filter or through an extra midget impinger containing 15 ml of 3 percent H_2O_2. Alternatively, ambient air without purification may be used.

8.4 Sample Recovery. Disconnect the impingers after purging. Discard the contents of the midget bubbler. Pour the contents of the midget impingers into a leak-free polyethylene bottle for shipment. Rinse the three midget impingers and the connecting tubes with water, and add the rinse to the same storage container. Mark the fluid level. Seal and identify the sample container.

9.0 Quality Control

Section	Quality control measure	Effect
7.1.2	Isopropanol check	Ensure acceptable level of peroxide impurities in isopropanol.
8.2, 10.1–10.4	Sampling equipment leak-check and calibration.	Ensure accurate measurement of stack gas flow rate, sample volume.
10.5	Barium standard solution standardization	Ensure precision of normality determination
11.2.3	Replicate titrations	Ensure precision of titration determinations.

10.0 Calibration and Standardization

10.1 Volume Metering System.

10.1.1 Initial Calibration.

10.1.1.1 Before its initial use in the field, leak-check the metering system (drying tube, needle valve, pump, rate meter, and DGM) as follows: Place a vacuum gauge at the inlet to the drying tube and pull a vacuum of 250 mm Hg (10 in. Hg). Plug or pinch off the outlet of the flow meter, and then turn off the pump. The vacuum must remain stable for at least 30 seconds. Carefully release the vacuum gauge before releasing the flow meter end.

10.1.1.2 Remove the drying tube, and calibrate the metering system (at the sampling flow rate specified by the method) as follows: Connect an appropriately sized wet-test meter (*e.g.*, 1 liter per revolution) to the inlet of the needle valve. Make three independent calibration runs, using at least five revolutions of the DGM per run. Calculate the calibration factor Y (wet-test meter calibration volume divided by the DGM volume, both volumes adjusted to the same reference temperature and pressure) for each run, and average the results (Y_i). If any Y-value deviates by more than 2 percent from (Y_i), the metering system is unacceptable for use. If the metering system is acceptable, use (Y_i) as the calibration factor for subsequent test runs.

10.1.2 Post-Test Calibration Check. After each field test series, conduct a calibration check using the procedures outlined in section 10.1.1.2, except that three or more revolutions of the DGM may be used, and only two independent runs need be made. If the average of the two post-test calibration factors does not deviate by more than 5 percent from Y_i, then Y_i is accepted as the DGM calibration factor (Y), which is used in Equation 6–1 to calculate collected sample volume (see section 12.2). If the deviation is more than 5 percent, recalibrate the metering system as in section 10.1.1, and determine a post-test calibration factor (Y_f). Compare Y_i and Y_f; the smaller of the two factors is accepted as the DGM calibration factor. If recalibration indicates that the metering system is unacceptable for use, either void the test run or use methods, subject to the approval of the Administrator, to determine an acceptable value for the collected sample volume.

10.1.3 DGM as a Calibration Standard. A DGM may be used as a calibration standard for volume measurements in place of the wet-test meter specified in section 10.1.1.2, provided that it is calibrated initially and recalibrated periodically according to the same procedures outlined in Method 5, section 10.3 with the following exceptions: (a) the DGM is calibrated against a wet-test meter having a capacity of 1 liter/rev (0.035 ft^3/rev) or 3 liters/rev (0.1 ft^3/rev) and having the capability of measuring volume to within 1 percent; (b) the DGM is calibrated at 1 liter/min (0.035 cfm); and (c) the meter box of the Method 6 sampling train is calibrated at the same flow rate.

10.2 Temperature Sensors. Calibrate against mercury-in-glass thermometers. An alternative mercury-free thermometer may be used if the thermometer is, at a minimum, equivalent in terms of performance or suitably effective for the specific temperature measurement application.

10.3 Rate Meter. The rate meter need not be calibrated, but should be cleaned and maintained according to the manufacturer's instructions.

10.4 Barometer. Calibrate against a mercury barometer or NIST-traceable barometer prior to the field test.

10.5 Barium Standard Solution. Standardize the barium perchlorate or chloride solution against 25 ml of standard sulfuric acid to which 100 ml of 100 percent isopropanol has been added. Run duplicate analyses. Calculate the normality using the average of duplicate analyses where the titrations agree within 1 percent or 0.2 ml, whichever is larger.

11.0 Analytical Procedure

11.1 Sample Loss Check. Note level of liquid in container and confirm whether any sample was lost during shipment; note this finding on the analytical data sheet. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results.

11.2 Sample Analysis.

11.2.1 Transfer the contents of the storage container to a 100-ml volumetric flask, dilute to exactly 100 ml with water, and mix the diluted sample.

11.2.2 Pipette a 20-ml aliquot of the diluted sample into a 250-ml Erlenmeyer flask and add 80 ml of 100 percent isopropanol plus two to four drops of thorin indicator. While stirring the solution, titrate to a pink endpoint using 0.0100 N barium standard solution.

11.2.3 Repeat the procedures in section 11.2.2, and average the titration volumes. Run a blank with each series of samples. Replicate titrations must agree within 1 percent or 0.2 ml, whichever is larger.

NOTE: Protect the 0.0100 N barium standard solution from evaporation at all times.

12.0 Data Analysis and Calculations

Carry out calculations, retaining at least one extra significant figure beyond that of the acquired data. Round off figures after final calculation.

12.1 NOMENCLATURE

C_{SO_2} = Concentration of SO_2, dry basis, corrected to standard conditions, mg/dscm (lb/dscf).
N = Normality of barium standard titrant, meq/ml.
P_{bar} = Barometric pressure, mm Hg (in. Hg).
P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
T_m = Average DGM absolute temperature, °K (°R).
T_{std} = Standard absolute temperature, 293 °K (528 °R).
V_a = Volume of sample aliquot titrated, ml.
V_m = Dry gas volume as measured by the DGM, dcm (dcf).
$V_{m(std)}$ = Dry gas volume measured by the DGM, corrected to standard conditions, dscm (dscf).
V_{soln} = Total volume of solution in which the SO_2 sample is contained, 100 ml.
V_t = Volume of barium standard titrant used for the sample (average of replicate titration), ml.
V_{tb} = Volume of barium standard titrant used for the blank, ml.
Y = DGM calibration factor.

12.2 Dry Sample Gas Volume, Corrected to Standard Conditions.

$$V_{m(std)} = \frac{\left(V_m Y\, T_{std}\, P_{bar}\right)}{\left(T_m\, P_{std}\right)} \qquad \text{Eq. 6-1}$$

$$= \frac{K_1 Y\, V_m\, P_{bar}}{T_m}$$

Where:

K_1 = 0.3855 °K/mm Hg for metric units,
K_1 = 17.65 °R/in. Hg for English units.

12.3 SO_2 Concentration.

$$C_{so_2} = \frac{K_2\, N\left(V_t - V_{tb}\right)\left(V_{soln}/V_a\right)}{V_{m(std)}} \qquad \text{Eq. 6-2}$$

Where:

K_2 = 32.03 mg SO_2/meq for metric units,
K_2 = 7.061×10^{-5} lb SO_2/meq for English units.

13.0 Method Performance

13.1 Range. The minimum detectable limit of the method has been determined to be 3.4 mg SO_2/m^3 (2.12×10^{-7} lb/ft^3). Although no upper limit has been established, tests have shown that concentrations as high as 80,000 mg/m^3 (0.005 lb/ft^3) of SO_2 can be collected efficiently at a rate of 1.0 liter/min (0.035 cfm) for 20 minutes in two midget impingers, each containing 15 ml of 3 percent H_2O_2. Based on theoretical calculations, the upper concentration limit in a 20 liter (0.7 ft^3) sample is about 93,300 mg/m^3 (0.00583 lb/ft^3).

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 Alternative Procedures

16.1 Nomenclature. Same as section 12.1, with the following additions:

B_{wa} = Water vapor in ambient air, proportion by volume.
M_a = Molecular weight of the ambient air saturated at impinger temperature, g/g-mole (lb/lb-mole).
M_s = Molecular weight of the sample gas saturated at impinger temperature, g/g-mole (lb/lb-mole).
P_c = Inlet vacuum reading obtained during the calibration run, mm Hg (in. Hg).
P_{sr} = Inlet vacuum reading obtained during the sampling run, mm Hg (in. Hg).

$\bar{Q}_{std}$ = Volumetric flow rate through critical orifice, scm/min (scf/min).

Q_{std} = Average flow rate of pre-test and post-test calibration runs, scm/min (scf/min).

T_{amb} = Ambient absolute temperature of air, °K (°R).

V_{sb} = Volume of gas as measured by the soap bubble meter, m^3 (ft^3).

$V_{sb(std)}$ = Volume of gas as measured by the soap bubble meter, corrected to standard conditions, scm (scf).

θ = Soap bubble travel time, min.

θ_s = Time, min.

16.2 Critical Orifices for Volume and Rate Measurements. A critical orifice may be used in place of the DGM specified in section 6.1.1.10, provided that it is selected, calibrated, and used as follows:

16.2.1 Preparation of Sampling Train. Assemble the sampling train as shown in Figure 6–2. The rate meter and surge tank are optional but are recommended in order to detect changes in the flow rate.

NOTE: The critical orifices can be adapted to a Method 6 type sampling train as follows: Insert sleeve type, serum bottle stoppers into two reducing unions. Insert the needle into the stoppers as shown in Figure 6–3.

16.2.2 Selection of Critical Orifices.

16.2.2.1 The procedure that follows describes the use of hypodermic needles and stainless steel needle tubings, which have been found suitable for use as critical orifices. Other materials and critical orifice designs may be used provided the orifices act as true critical orifices, (*i.e.*, a critical vacuum can be obtained) as described in this section. Select a critical orifice that is sized to operate at the desired flow rate. The needle sizes and tubing lengths shown in Table 6–1 give the following approximate flow rates.

16.2.2.2 Determine the suitability and the appropriate operating vacuum of the critical orifice as follows: If applicable, temporarily attach a rate meter and surge tank to the outlet of the sampling train, if said equipment is not present (see section 16.2.1). Turn on the pump and adjust the valve to give an outlet vacuum reading corresponding to about half of the atmospheric pressure. Observe the rate meter reading. Slowly increase the vacuum until a stable reading is obtained on the rate meter. Record the critical vacuum, which is the outlet vacuum when the rate meter first reaches a stable value. Orifices that do not reach a critical value must not be used.

16.2.3 Field Procedures.

16.2.3.1 Leak-Check Procedure. A leak-check before the sampling run is recommended, but not required. The leak-check procedure is as follows: Temporarily attach a suitable (*e.g.*, 0–40 ml/min) rotameter and surge tank, or a soap bubble meter and surge tank to the outlet of the pump. Plug the probe inlet, pull an outlet vacuum of at least 250 mm Hg (10 in. Hg), and note the flow rate as indicated by the rotameter or bubble meter. A leakage rate in excess of 2 percent of the average sampling rate ($\bar{Q}_{std}$) is not acceptable. Carefully release the probe inlet plug before turning off the pump.

16.2.3.2 Moisture Determination. At the sampling location, prior to testing, determine the percent moisture of the ambient air using the wet and dry bulb temperatures or, if appropriate, a relative humidity meter.

16.2.3.3 Critical Orifice Calibration. At the sampling location, prior to testing, calibrate the entire sampling train (*i.e.*, determine the flow rate of the sampling train when operated at critical conditions). Attach a 500-ml soap bubble meter to the inlet of the probe, and operate the sampling train at an outlet vacuum of 25 to 50 mm Hg (1 to 2 in. Hg) above the critical vacuum. Record the information listed in Figure 6–4. Calculate the standard volume of air measured by the soap bubble meter and the volumetric flow rate using the equations below:

$$V_{sb(std)} = V_{sb}\left(T_{std}/T_{amb}\right)\left(P_{bar}/P_{std}\right) \qquad \text{Eq. 6-4}$$

$$Q_{std} = \frac{V_{sb(std)}}{\theta} \qquad \text{Eq. 6-5}$$

16.2.3.4 Sampling.

16.2.3.4.1 Operate the sampling train for sample collection at the same vacuum used during the calibration run. Start the watch and pump simultaneously. Take readings (temperature, rate meter, inlet vacuum, and outlet vacuum) at least every 5 minutes. At the end of the sampling run, stop the watch and pump simultaneously.

16.2.3.4.2 Conduct a post-test calibration run using the calibration procedure outlined in section 16.2.3.3. If the Q_{std} obtained before and after the test differ by more than 5 percent, void the test run; if not, calculate the volume of the gas measured with the critical orifice using Equation 6–6 as follows:

$$V_{m(std)} = \frac{\overline{Q}_{std}\ \theta_s\ \left(1 - B_{wa}\right)\left(P_{bar} + P_{sr}\right)}{\left(P_{bar} + P_c\right)} \qquad \text{Eq. 6-6}$$

16.2.3.4.3 If the percent difference between the molecular weight of the ambient air at saturated conditions and the sample gas is more that ±3 percent, then the molecular weight of the gas sample must be considered in the calculations using the following equation:

$$_{(std)} = \frac{\overline{Q}_{std}\ \theta_s\ \left(1 - B_{wa}\right)\left(P_{bar} + P_{sr}\right)\left(M_a/M_s\right)^1}{\left(P_{bar} + P_c\right)} \qquad \text{Eq. 6-7}$$

NOTE: A post-test leak-check is not necessary because the post-test calibration run results will indicate whether there is any leakage.

16.2.3.4.4 Drain the ice bath, and purge the sampling train using the procedure described in section 8.3.4.

16.3 Elimination of Ammonia Interference. The following alternative procedures must be used in addition to those specified in the method when sampling at sources having ammonia emissions.

16.3.1 Sampling. The probe shall be maintained at 275 °C (527 °F) and equipped with a high-efficiency in-stack filter (glass fiber) to remove particulate matter. The filter material shall be unreactive to SO_2. Whatman 934AH (formerly Reeve Angel 934AH) filters treated as described in Reference 10 in section 17.0 of Method 5 is an example of a filter that has been shown to work. Where alkaline particulate matter and condensed moisture are present in the gas stream, the filter shall be heated above the moisture dew point but below 225 °C (437 °F).

16.3.2 Sample Recovery. Recover the sample according to section 8.4 except for discarding the contents of the midget bubbler. Add the bubbler contents, including the rinsings of the bubbler with water, to a separate polyethylene bottle from the rest of the sample. Under normal testing conditions where sulfur trioxide will not be present significantly, the tester may opt to delete the midget bubbler from the sampling train. If an approximation of the sulfur trioxide concentration is desired, transfer the contents of the midget bubbler to a separate polyethylene bottle.

16.3.3 Sample Analysis. Follow the procedures in sections 11.1 and 11.2, except add 0.5 ml of 0.1 N HCl to the Erlenmeyer flask and mix before adding the indicator. The following analysis procedure may be used for an approximation of the sulfur trioxide concentration. The accuracy of the calculated concentration will depend upon the ammonia to SO_2 ratio and the level of oxygen present in the gas stream. A fraction of the SO_2 will be counted as sulfur trioxide as the ammonia to SO_2 ratio and the sample oxygen content increases. Generally, when this ratio is 1 or less and the oxygen content is in the range of 5 percent, less than 10 percent of the SO_2 will be counted as sulfur trioxide. Analyze the peroxide and isopropanol sample portions separately. Analyze the peroxide portion as described above. Sulfur trioxide is determined by difference using sequential titration of the isopropanol portion of the sample. Transfer the contents of the isopropanol storage container to a 100-ml volumetric flask, and dilute to exactly 100 ml with water. Pipette a 20-ml aliquot of this solution into a 250-ml Erlenmeyer flask, add 0.5 ml of 0.1 N HCl, 80 ml of 100 percent isopropanol, and two to four drops of thorin indicator. Titrate to a pink endpoint using 0.0100 N barium perchlorate. Repeat and average the titration volumes that agree within 1 percent or 0.2 ml, whichever is larger. Use this volume in Equation 6–2 to determine the sulfur trioxide concentration. From the flask containing the remainder of the isopropanol sample, determine the fraction of SO_2 collected in the bubbler by pipetting 20-ml aliquots into 250-ml Erlenmeyer flasks. Add 5 ml of 3 percent H_2O_2, 100 ml of 100 percent isopropanol, and two to four drips of thorin indicator, and titrate as before. From this titration volume, subtract the titrant volume determined for sulfur trioxide, and add the titrant volume determined for the peroxide portion. This final volume constitutes V_t, the volume of barium perchlorate used for the SO_2 sample.

17.0 References

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18.0 Tables, Diagrams, Flowcharts and Validation Data

TABLE 6–1—APPROXIMATE FLOW RATES FOR VARIOUS NEEDLE SIZES

Needle size (gauge)	Needle length (cm)	Flow rate (ml/min)
21	7.6	1,100
22	2.9	1,000
22	3.8	900
23	3.8	500
23	5.1	450
24	3.2	400

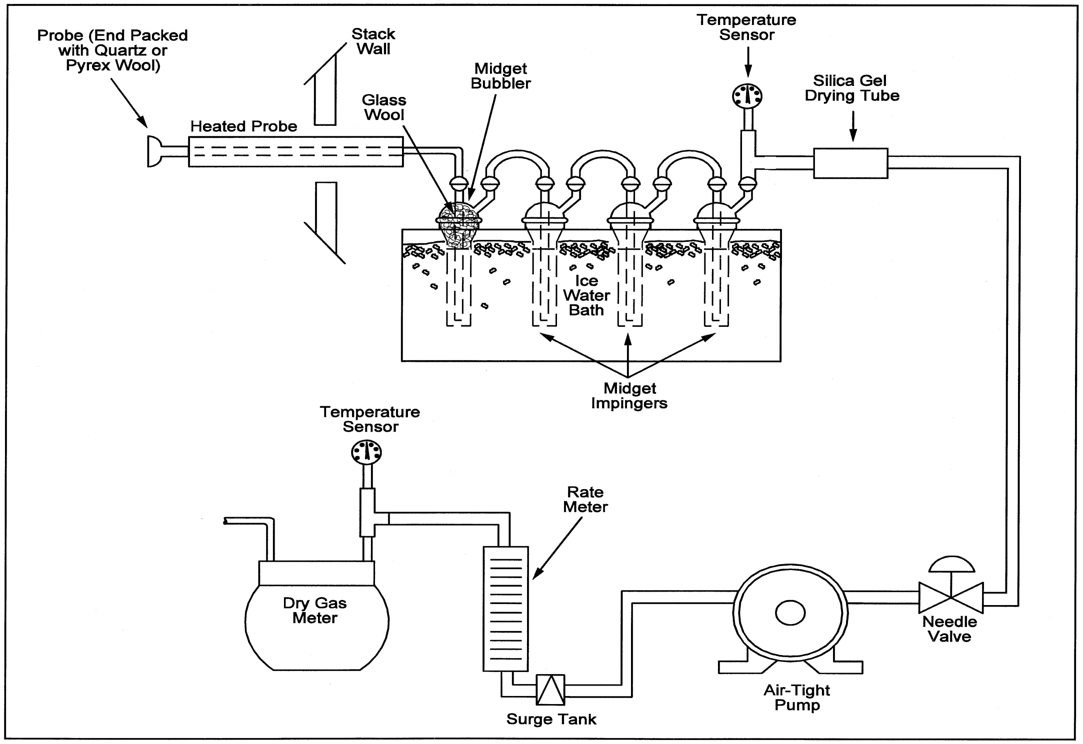

Figure 6-1. Sulfur Dioxide Sampling Train.

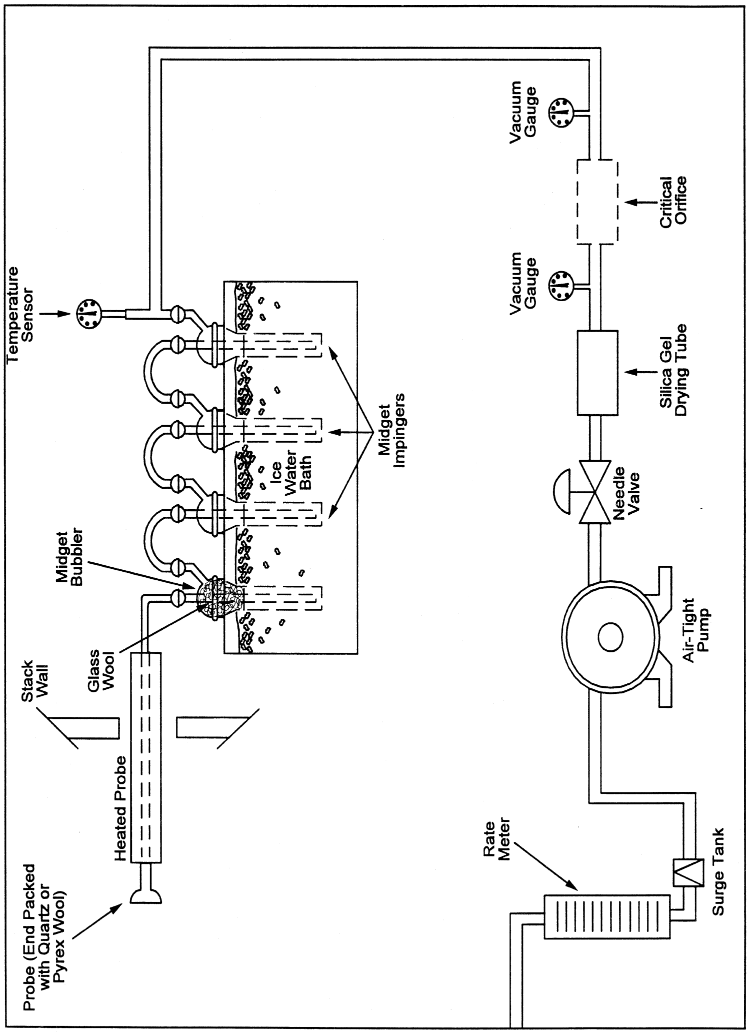

Figure 6-2. Sulfur Dioxide Sampling Train Using a Critical Orifice.

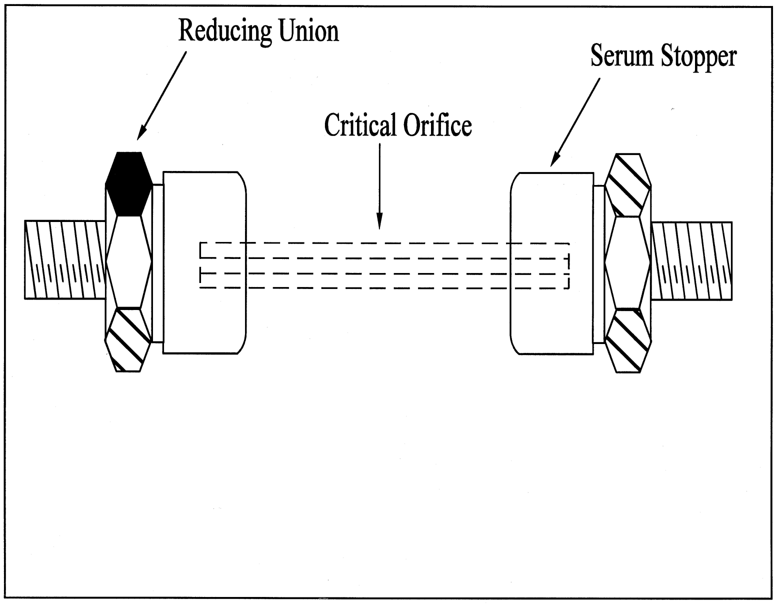

Figure 6-3. Critical Orifice Adaptation for the Method 6 Sampling Train.

Date ______________________ Train ID ____________

Critical orifice size ________ Critical vacuum ______

		Pretest	Post-test
Soap bubble meter volume,	cc	______	______
V_{sb}	m^3 (ft^3)	______	______
Time, θ	sec	______	______
	min	______	______
Barometric pressure, P_{bar}	mm Hg (in. Hg)	______	______
Ambient temperature, t_{amb}	°C (°F)	______	______
Inlet vacuum, P_c	mm Hg (in. Hg)	______	______
Outlet vacuum	mm Hg (in. Hg)	______	______
$V_{sb(std)}$	m^3 (ft^3)	______	______
Flow rate, Q_{std}	$\frac{m^3}{min}\left(\frac{ft^3}{min}\right)$	______	______

Figure 6-4. Critical Orifice Calibration Data Sheet.

METHOD 6A—DETERMINATION OF SULFUR DIOXIDE, MOISTURE, AND CARBON DIOXIDE FROM FOSSIL FUEL COMBUSTION SOURCES

NOTE: This method does not include all of the specifications (*e.g.*, equipment and supplies) and procedures (*e.g.*, sampling and analytical) essential to its performance. Some material is incorporated by reference from other methods in this part. Therefore, to obtain reliable results, persons using this method should have a thorough knowledge of at least the following additional test methods: Method 1, Method 2, Method 3, Method 5, Method 6, and Method 19.

1.0 Scope and Application

1.1 Analytes.

Analyte	CAS No.	Sensitivity
SO_2	7449–09–05	3.4 mg SO_2/m^3 (2.12×10^{-7} lb/ft^3)
CO_2	124–38–9	N/A
H_2O	7732–18–5	N/A

1.2 Applicability. This method is applicable for the determination of sulfur dioxide (SO_2) emissions from fossil fuel combustion sources in terms of concentration (mg/dscm or lb/dscf) and in terms of emission rate (ng/J or lb/10^6 Btu) and for the determination of carbon dioxide (CO_2) concentration (percent). Moisture content (percent), if desired, may also be determined by this method.

1.3 Data Quality Objectives. Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods.

2.0 Summary of Method

2.1 A gas sample is extracted from a sampling point in the stack. The SO_2 and the sulfur trioxide, including those fractions in any sulfur acid mist, are separated. The SO_2 fraction is measured by the barium-thorin titration method. Moisture and CO_2 fractions are collected in the same sampling train, and are determined gravimetrically.

3.0 Definitions [Reserved]

4.0 Interferences

Same as Method 6, section 4.0.

5.0 Safety

5.1 Disclaimer. This method may involve hazardous materials, operations, and equipment. This test method may not address all of the safety problems associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to performing this test method.

5.2 Corrosive reagents. Same as Method 6, section 5.2.

6.0 Equipment and Supplies

6.1 Sample Collection. Same as Method 6, section 6.1, with the exception of the following:

6.1.1 Sampling Train. A schematic of the sampling train used in this method is shown in Figure 6A–1.

6.1.1.1 Impingers and Bubblers. Two 30 = ml midget impingers with a 1 = mm restricted tip and two 30 = ml midget bubblers with unrestricted tips. Other types of impingers and bubblers (*e.g.*, Mae West for SO_2 collection and rigid cylinders containing Drierite for moisture absorbers), may be used with proper attention to reagent volumes and levels, subject to the approval of the Administrator.

6.1.1.2 CO_2 Absorber. A sealable rigid cylinder or bottle with an inside diameter between 30 and 90 mm , a length between 125 and 250 mm, and appropriate connections at both ends. The filter may be a separate heated unit or may be within the heated portion of the probe. If the filter is within the sampling probe, the filter should not be within 15 cm of the probe inlet or any unheated section of the probe, such as the connection to the first bubbler. The probe and filter should be heated to at least 20 °C (68 °F) above the source temperature, but not greater than 120 °C (248 °F). The filter temperature (*i.e.*, the sample gas temperature) should be monitored to assure the desired temperature is maintained. A heated Teflon connector may be used to connect the filter holder or probe to the first impinger.

NOTE: For applications downstream of wet scrubbers, a heated out-of-stack filter (either borosilicate glass wool or glass fiber mat) is necessary.

6.2 Sample Recovery. Same as Method 6, section 6.2.

6.3 Sample Analysis. Same as Method 6, section 6.3, with the addition of a balance to measure within 0.05 g.

7.0 Reagents and Standards

NOTE: Unless otherwise indicated, all reagents must conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society. Where such specifications are not available, use the best available grade.

7.1 Sample Collection. Same as Method 6, section 7.1, with the addition of the following:

7.1.1 Drierite. Anhydrous calcium sulfate ($CaSO_4$) desiccant, 8 mesh, indicating type is recommended.

NOTE: Do not use silica gel or similar desiccant in this application.

7.1.2 CO_2 Absorbing Material. Ascarite II. Sodium hydroxide-coated silica, 8- to 20-mesh.

7.2 Sample Recovery and Analysis. Same as Method 6, sections 7.2 and 7.3, respectively.

8.0 Sample Collection, Preservation, Transport, and Storage

8.1 Preparation of Sampling Train.

8.1.1 Measure 15 ml of 80 percent isopropanol into the first midget bubbler and 15 ml of 3 percent hydrogen peroxide into each of the two midget impingers (the second and third vessels in the train) as described in Method 6, section 8.1. Insert the glass wool into the top of the isopropanol bubbler as shown in Figure 6A–1. Place about 25 g of Drierite into the second midget bubbler (the fourth vessel in the train). Clean the outside of the bubblers and impingers and allow the vessels to reach room temperature. Weigh the four vessels simultaneously to the nearest 0.1 g, and record this initial weight (m_{wi}).

8.1.2 With one end of the CO_2 absorber sealed, place glass wool into the cylinder to a depth of about 1 cm (0.5 in.). Place about 150 g of CO_2 absorbing material in the cylinder on top of the glass wool, and fill the remaining space in the cylinder with glass wool. Assemble the cylinder as shown in figure 6A–2. With the cylinder in a horizontal position, rotate it around the horizontal axis. The CO_2 absorbing material should remain in position during the rotation, and no open spaces or channels should be formed. If necessary, pack more glass wool into the cylinder to make the CO_2 absorbing material stable. Clean the outside of the cylinder of loose dirt and moisture and allow the cylinder to reach room temperature. Weigh the cylinder to the nearest 0.1 g, and record this initial weight (m_{ai}).

8.1.3 Assemble the train as shown in figure 6A–1. Adjust the probe heater to a temperature sufficient to prevent condensation (see note in section 6.1). Place crushed ice and water around the impingers and bubblers. Mount the CO_2 absorber outside the water bath in a vertical flow position with the sample gas inlet at the bottom. Flexible tubing (*e.g.*, Tygon) may be used to connect the last SO_2 absorbing impinger to the moisture absorber and to connect the moisture absorber to the CO_2 absorber. A second, smaller CO_2 absorber containing Ascarite II may be added in-line downstream of the primary CO_2 absorber as a breakthrough indicator. Ascarite II turns white when CO_2 is absorbed.

8.2 Sampling Train Leak-Check Procedure and Sample Collection. Same as Method 6, sections 8.2 and 8.3, respectively.

8.3 Sample Recovery.

8.3.1 Moisture Measurement. Disconnect the isopropanol bubbler, the SO_2 impingers, and the moisture absorber from the sample train. Allow about 10 minutes for them to reach room temperature, clean the outside of loose dirt and moisture, and weigh them simultaneously in the same manner as in section 8.1. Record this final weight (m_{wf}).

8.3.2 Peroxide Solution. Discard the contents of the isopropanol bubbler and pour the contents of the midget impingers into a leak-free polyethylene bottle for shipping. Rinse the two midget impingers and connecting tubes with water, and add the washing to the same storage container.

8.3.3 CO_2 Absorber. Allow the CO_2 absorber to warm to room temperature (about 10 minutes), clean the outside of loose dirt and moisture, and weigh to the nearest 0.1 g in the same manner as in section 8.1. Record this final weight (m_{af}). Discard used Ascarite II material.

9.0 Quality Control

Same as Method 6, section 9.0.

10.0 Calibration and Standardization

Same as Method 6, section 10.0.

11.0 Analytical Procedure

11.1 Sample Analysis. The sample analysis procedure for SO_2 is the same as that specified in Method 6, section 11.0.

12.0 Data Analysis and Calculations

Same as Method 6, section 12.0, with the addition of the following:

12.1 Nomenclature.

C_w = Concentration of moisture, percent.

C_{CO2} = Concentration of CO_2, dry basis, percent.

E_{SO2} = Emission rate of SO_2, ng/J (lb/10^6 Btu).

F_C = Carbon F-factor from Method 19 for the fuel burned, dscm/J (dscf/10^6 Btu).

m_{wi} = Initial weight of impingers, bubblers, and moisture absorber, g.

m_{wf} = Final weight of impingers, bubblers, and moisture absorber, g.

m_{ai} = Initial weight of CO_2 absorber, g.

m_{af} = Final weight of CO_2 absorber, g.

m_{SO2} = Mass of SO_2 collected, mg.

$V_{CO2(std)}$ = Equivalent volume of CO_2 collected at standard conditions, dscm (dscf).

$V_{w(std)}$ = Equivalent volume of moisture collected at standard conditions, scm (scf).

12.2 CO_2 Volume Collected, Corrected to Standard Conditions.

$$V_{CO_2(std)} = K_3 \left(m_{af} - m_{ai}\right) \qquad \text{Eq. 6A-1}$$

Where:

K_3 = Equivalent volume of gaseous CO_2 at standard conditions, 5.467×10^{-4} dscm/g (1.930×10^{-2} dscf/g).

12.3 Moisture Volume Collected, Corrected to Standard Conditions.

$$V_{w(std)} = K_4 \left(m_{wf} - m_{wi}\right) \qquad \text{Eq. 6A-2}$$

Where:

K_4 = Equivalent volume of water vapor at standard conditions, 1.336×10^{-3} scm/g (4.717×10^{-2} scf/g).

12.4 SO_2 Concentration.

$$C_{so_2} = \frac{K_2 N \left(V_t - V_{tb}\right)\left(V_{so\ln}/V_a\right)}{V_{m(std)} + V_{co_2(std)}} \qquad \text{Eq. 6A-3}$$

Where:

K₂ = 32.03 mg SO₂/meq. SO₂ (7.061 × 10⁻⁵ lb SO₂/meq. SO₂)

12.5 CO_2 Concentration.

$$C_{co_2} = \frac{V_{co_2(std)}}{V_{m(std)} + V_{co_2(std)}} \qquad \text{Eq. 6A-4}$$

12.6 Moisture Concentration.

$$C_w = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)} + V_{co_2(std)}} \qquad \text{Eq. 6A-5}$$

13.0 Method Performance

13.1 Range and Precision. The minimum detectable limit and the upper limit for the measurement of SO_2 are the same as for Method 6. For a 20-liter sample, this method has a precision of ±0.5 percent CO_2 for concentrations between 2.5 and 25 percent CO_2 and ±1.0 percent moisture for moisture concentrations greater than 5 percent.

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 Alternative Methods

If the only emission measurement desired is in terms of emission rate of SO_2 (ng/J or lb/10^6 Btu), an abbreviated procedure may be used. The differences between the above procedure and the abbreviated procedure are described below.

16.1 Sampling Train. The sampling train is the same as that shown in Figure 6A–1 and as described in section 6.1, except that the dry gas meter is not needed.

16.2 Preparation of the Sampling Train. Follow the same procedure as in section 8.1, except do not weigh the isopropanol bubbler, the SO_2 absorbing impingers, or the moisture absorber.

16.3 Sampling Train Leak-Check Procedure and Sample Collection. Leak-check and operate the sampling train as described in section 8.2, except that dry gas meter readings, barometric pressure, and dry gas meter temperatures need not be recorded during sampling.

16.4 Sample Recovery. Follow the procedure in section 8.3, except do not weigh the isopropanol bubbler, the SO_2 absorbing impingers, or the moisture absorber.

16.5 Sample Analysis. Analysis of the peroxide solution is the same as that described in section 11.1.

16.6 Calculations.

16.6.1 SO_2 Collected.

$$m_{SO_2} = K_2 N \left(V_t - V_{tb}\right)\left(V_{soln}/V_a\right) \qquad \text{Eq. 6A-6}$$

Where:

K_2 = 32.03 mg SO_2/meq. SO_2

K_2 = 7.061×10^{-5} lb SO_2/meq. SO_2

16.6.2 Sulfur Dioxide Emission Rate.

$$E_{SO_2} = K_5 F_c m_{so_2} / \left(m_{af} - m_{ai}\right) \qquad \text{Eq. 6A-7}$$

Where:

$K_5 = 1.829 \times 10^9$ mg/dscm
$K_2 = 0.1142$ lb/dscf

17.0 References

Same as Method 6, section 17.0, References 1 through 8, with the addition of the following:

1. Stanley, Jon and P.R. Westlin. An Alternate Method for Stack Gas Moisture Determination. Source Evaluation Society Newsletter. *3*(4). November 1978.

2. Whittle, Richard N. and P.R. Westlin. Air Pollution Test Report: Development and Evaluation of an Intermittent Integrated SO_2/CO_2 Emission Sampling Procedure. Environmental Protection Agency, Emission Standard and Engineering Division, Emission Measurement Branch. Research Triangle Park, NC. December 1979. 14 pp.

18.0 Tables, Diagrams, Flowcharts, and Validation Data

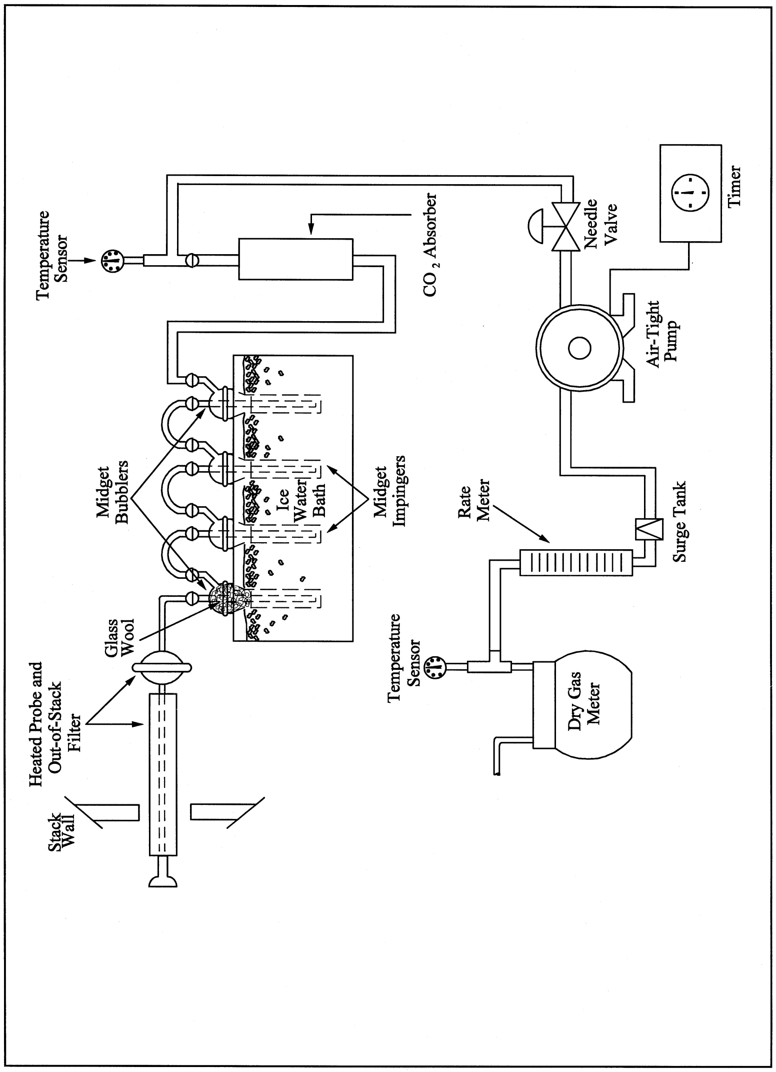

Figure 6A-1. Sampling train.

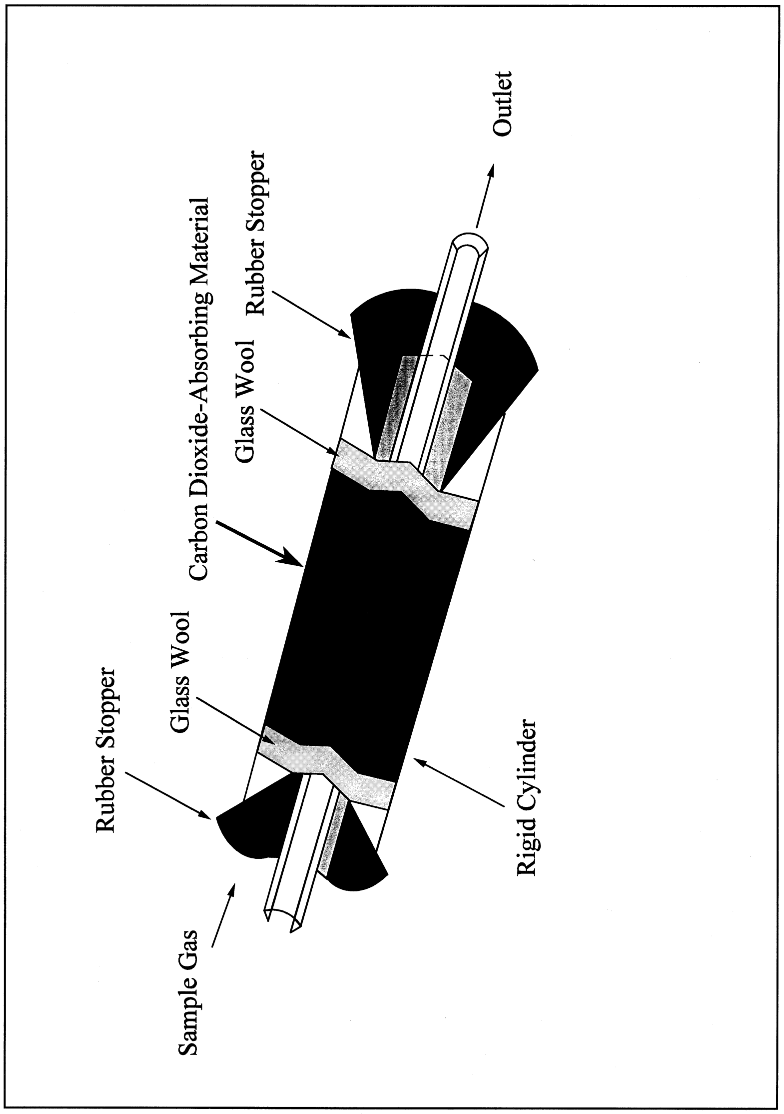

Figure 6A-2. CO_2 Absorber

METHOD 6B—DETERMINATION OF SULFUR DIOXIDE AND CARBON DIOXIDE DAILY AVERAGE EMISSIONS FROM FOSSIL FUEL COMBUSTION SOURCES

NOTE: This method does not include all of the specifications (*e.g.*, equipment and supplies) and procedures (*e.g.*, sampling and analytical) essential to its performance. Some material is incorporated by reference from other methods in this part. Therefore, to obtain reliable results, persons using this method should have a thorough knowledge of at least the following additional test methods: Method 1, Method 2, Method 3, Method 5, Method 6, and Method 6A.

1.0 Scope and Application

1.1 Analytes.

Analyte	CAS No.	Sensitivity
Sulfur dioxide (SO_2)	7449–09–05	3.4 mg SO_2/m^3 (2.12×10^{-7} lb/ft^3)
Carbon dioxide (CO_2)	124–38–9	N/A

1.2 Applicability. This method is applicable for the determination of SO_2 emissions from combustion sources in terms of concentration (ng/dscm or lb/dscf) and emission rate (ng/J or lb/10^6 Btu), and for the determination of CO_2 concentration (percent) on a daily (24 hours) basis.

1.3 Data Quality Objectives. Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods.

2.0 Summary of Method

2.1 A gas sample is extracted from the sampling point in the stack intermittently over a 24-hour or other specified time period. The SO_2 fraction is measured by the barium-thorin titration method. Moisture and CO_2 fractions are collected in the same sampling train, and are determined gravimetrically.

3.0 Definitions [Reserved]

4.0 Interferences

Same as Method 6, section 4.0.

5.0 Safety

5.1 Disclaimer. This method may involve hazardous materials, operations, and equipment. This test method may not address all of the safety problems associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to performing this test method.

5.2 Corrosive Reagents. Same as Method 6, section 5.2.

6.0 Equipment and Supplies

Same as Method 6A, section 6.0, with the following exceptions and additions:

6.1 The isopropanol bubbler is not used. An empty bubbler for the collection of liquid droplets, that does not allow direct contact between the collected liquid and the gas sample, may be included in the sampling train.

6.2 For intermittent operation, include an industrial timer-switch designed to operate in the ''on'' position at least 2 minutes continuously and ''off'' the remaining period over a repeating cycle. The cycle of operation is designated in the applicable regulation. At a minimum, the sampling operation should include at least 12, equal, evenly-spaced periods per 24 hours.

6.3 Stainless steel sampling probes, type 316, are not recommended for use with Method 6B because of potential sample contamination due to corrosion. Glass probes or other types of stainless steel, *e.g.*, Hasteloy or Carpenter 20, are recommended for long-term use.

NOTE: For applications downstream of wet scrubbers, a heated out-of-stack filter (either borosilicate glass wool or glass fiber mat) is necessary. Probe and filter heating systems capable of maintaining a sample gas temperature of between 20 and 120 °C (68 and 248 °F) at the filter are also required in these cases. The electric supply for these heating systems should be continuous and separate from the timed operation of the sample pump.

7.0 Reagents and Standards

Same as Method 6A, section 7.0, with the following exceptions:

7.1 Isopropanol is not used for sampling.

7.2 The hydrogen peroxide absorbing solution shall be diluted to no less than 6 percent by volume, instead of 3 percent as specified in Methods 6 and 6A.

7.3 If the Method 6B sampling train is to be operated in a low sample flow condition (less than 100 ml/min or 0.21 ft^3/hr), molecular sieve material may be substituted for Ascarite II as the CO_2 absorbing material. The recommended molecular sieve material is Union Carbide 1⁄16 inch pellets, 5 A°, or equivalent. Molecular sieve material need not be discarded following the sampling run, provided that it is regenerated as per the manufacturer's instruction. Use of molecular sieve material at flow rates higher than 100 ml/min (0.21 ft^3/hr) may cause erroneous CO_2 results.

8.0 Sample Collection, Preservation, Transport, and Storage

8.1 Preparation of Sampling Train. Same as Method 6A, section 8.1, with the addition of the following:

8.1.1 The sampling train is assembled as shown in Figure 6A–1 of Method 6A, except that the isopropanol bubbler is not included.

8.1.2 Adjust the timer-switch to operate in the ''on'' position from 2 to 4 minutes on a 2-hour repeating cycle or other cycle specified in the applicable regulation. Other timer sequences may be used with the restriction that the total sample volume collected is between 25 and 60 liters (0.9 and 2.1 ft^3) for the amounts of sampling reagents prescribed in this method.

8.1.3 Add cold water to the tank until the impingers and bubblers are covered at least two-thirds of their length. The impingers and bubbler tank must be covered and protected from intense heat and direct sunlight. If freezing conditions exist, the impinger solution and the water bath must be protected.

NOTE: Sampling may be conducted continuously if a low flow-rate sample pump [20 to 40 ml/min (0.04 to 0.08 ft^3/hr) for the reagent volumes described in this method] is used. If sampling is continuous, the timer-switch is not necessary. In addition, if the sample pump is designed for constant rate sampling, the rate meter may be deleted. The total gas volume collected should be between 25 and 60 liters (0.9 and 2.1 ft^3) for the amounts of sampling reagents prescribed in this method.

8.2 Sampling Train Leak-Check Procedure. Same as Method 6, section 8.2.

8.3 Sample Collection.

8.3.1 The probe and filter (either in-stack, out-of-stack, or both) must be heated to a temperature sufficient to prevent water condensation.

8.3.2 Record the initial dry gas meter reading. To begin sampling, position the tip of the probe at the sampling point, connect the probe to the first impinger (or filter), and start the timer and the sample pump. Adjust the sample flow to a constant rate of approximately 1.0 liter/min (0.035 cfm) as indicated by the rotameter. Observe the operation of the timer, and determine that it is operating as intended (*i.e.*, the timer is in the "on" position for the desired period, and the cycle repeats as required).

8.3.3 One time between 9 a.m. and 11 a.m. during the 24-hour sampling period, record the dry gas meter temperature (T_m) and the barometric pressure ($P_{(bar)}$).

8.3.4 At the conclusion of the run, turn off the timer and the sample pump, remove the probe from the stack, and record the final gas meter volume reading. Conduct a leak-check as described in section 8.2. If a leak is found, void the test run or use procedures acceptable to the Administrator to adjust the sample volume for leakage. Repeat the steps in sections 8.3.1 to 8.3.4 for successive runs.

8.4 Sample Recovery. The procedures for sample recovery (moisture measurement, peroxide solution, and CO_2 absorber) are the same as those in Method 6A, section 8.3.

9.0 Quality Control

Same as Method 6, section 9.0., with the exception of the isopropanol-check.

10.0 Calibration and Standardization

Same as Method 6, section 10.0, with the addition of the following:

10.1 Periodic Calibration Check. After 30 days of operation of the test train, conduct a calibration check according to the same procedures as the post-test calibration check (Method 6, section 10.1.2). If the deviation between initial and periodic calibration factors exceeds 5 percent, use the smaller of the two factors in calculations for the preceding 30 days of data, but use the most recent calibration factor for succeeding test runs.

11.0 Analytical Procedures

11.1 Sample Loss Check and Analysis. Same as Method 6, sections 11.1 and 11.2, respectively.

12.0 Data Analysis and Calculations

Same as Method 6A, section 12.0, except that P_{bar} and T_m correspond to the values recorded in section 8.3.3 of this method. The values are as follows:

P_{bar} = Initial barometric pressure for the test period, mm Hg.

T_m = Absolute meter temperature for the test period, °K.

13.0 Method Performance

13.1 Range.

13.1.1 Sulfur Dioxide. Same as Method 6.

13.1.2 Carbon Dioxide. Not determined.

13.2 Repeatability and Reproducibility. EPA-sponsored collaborative studies were undertaken to determine the magnitude of repeatability and reproducibility achievable by qualified testers following the procedures in this method. The results of the studies evolve from 145 field tests including comparisons with Methods 3 and 6. For measurements of emission rates from wet, flue gas desulfurization units in (ng/J), the repeatability (intra-laboratory precision) is 8.0 percent and the reproducibility (inter-laboratory precision) is 11.1 percent.

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 Alternative Methods

Same as Method 6A, section 16.0, except that the timer is needed and is operated as outlined in this method.

17.0 References

Same as Method 6A, section 17.0, with the addition of the following:

1. Butler, Frank E., et. al. The Collaborative Test of Method 6B: Twenty-Four-Hour Analysis of SO_2 and CO_2. JAPCA. Vol. 33, No. 10. October 1983.

18.0 Tables, Diagrams, Flowcharts, and Validation Data [Reserved]

METHOD 6C—DETERMINATION OF SULFUR DIOXIDE EMISSIONS FROM STATIONARY SOURCES (INSTRUMENTAL ANALYZER PROCEDURE)

1.0 Scope and Application

What is Method 6C?

Method 6C is a procedure for measuring sulfur dioxide (SO_2) in stationary source emissions using a continuous instrumental analyzer. Quality assurance and quality control requirements are included to assure that you, the tester, collect data of known quality. You must document your adherence to these specific requirements for equipment, supplies, sample collection and analysis, calculations, and data analysis.

This method does not completely describe all equipment, supplies, and sampling and analytical procedures you will need but refers to other methods for some of the details. Therefore, to obtain reliable results, you should also have a thorough knowledge of these additional test methods which are found in appendix A to this part:

(a) Method 1—Sample and Velocity Traverses for Stationary Sources.

(b) Method 4—Determination of Moisture Content in Stack Gases.

(c) Method 6—Determination of Sulfur Dioxide Emissions from Stationary Sources.

(d) Method 7E—Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure).

1.1 Analytes. What does this method determine? This method measures the concentration of sulfur dioxide.

Analyte	CAS No.	Sensitivity
SO_2	7446–09–5	Typically <2% of Calibration Span.

1.2 Applicability. When is this method required? The use of Method 6C may be required by specific New Source Performance Standards, Clean Air Marketing rules, State Implementation Plans, and permits where SO_2 concentrations in stationary source emissions must be measured, either to determine compliance with an applicable emission standard or to conduct performance testing of a continuous emission monitoring system (CEMS). Other regulations may also require the use of Method 6C.

1.3 Data Quality Objectives. How good must my collected data be? Refer to section 1.3 of Method 7E.

2.0 Summary of Method

In this method, you continuously sample the effluent gas and convey the sample to an analyzer that measures the concentration of SO_2. You must meet the performance requirements of this method to validate your data.

3.0 Definitions

Refer to section 3.0 of Method 7E for the applicable definitions.

4.0 Interferences

Refer to Section 4.0 of Method 7E.

5.0 Safety

Refer to section 5.0 of Method 7E.

6.0 Equipment and Supplies

Figure 7E–1 of Method 7E is a schematic diagram of an acceptable measurement system.

6.1 What do I need for the measurement system? The essential components of the measurement system are the same as those in sections 6.1 and 6.2 of Method 7E, except that the SO_2 analyzer described in section 6.2 of this method must be used instead of the analyzer described in section 6.2 of Method 7E. You must follow the noted specifications in section 6.1 of Method 7E.

6.2 What analyzer must I use? You may use an instrument that uses an ultraviolet, non-dispersive infrared, fluorescence, or other detection principle to continuously measure SO_2 in the gas stream and meets the performance specifications in section 13.0. The low-range and dual-range analyzer provisions in sections 6.2.8.1 and 6.2.8.2 of Method 7E apply.

7.0 Reagents and Standards

7.1 Calibration Gas. What calibration gases do I need? Refer to section 7.1 of Method 7E for the calibration gas requirements. Example calibration gas mixtures are listed below.

(a) SO_2 in nitrogen (N_2).

(b) SO_2 in air.

(c) SO_2 and CO_2 in N_2.

(d) SO_2 andO_2 in N_2.

(e) $SO_2/CO_2/O_2$ gas mixture in N_2.

(f) CO_2/NO_X gas mixture in N_2.

(g) $CO_2/SO_2/NO_X$ gas mixture in N_2.

7.2 Interference Check. What additional reagents do I need for the interference check? The test gases for the interference check are listed in Table 7E–3 of Method 7E. For the alternative interference check, you must use the reagents described in section 7.0 of Method 6.

8.0 Sample Collection, Preservation, Storage, and Transport

8.1 Sampling Site and Sampling Points. You must follow the procedures of section 8.1 of Method 7E.

8.2 Initial Measurement System Performance Tests. You must follow the procedures in section 8.2 of Method 7E. If a dilution-type measurement system is used, the special considerations in section 8.3 of Method 7E also apply.

8.3 Interference Check. You must follow the procedures of section 8.2.7 of Method 7E to conduct an interference check, substituting SO_2 for NO_X as the method pollutant. For dilution-type measurement systems, you must use the alternative interference check procedure in section 16 and a co-located, unmodified Method 6 sampling train.

8.4 Sample Collection. You must follow the procedures of section 8.4 of Method 7E.

8.5 Post-Run System Bias Check and Drift Assessment. You must follow the procedures of section 8.5 of Method 7E.

9.0 Quality Control

Follow quality control procedures in section 9.0 of Method 7E.

10.0 Calibration and Standardization

Follow the procedures for calibration and standardization in section 10.0 of Method 7E.

11.0 Analytical Procedures

Because sample collection and analysis are performed together (see section 8), additional discussion of the analytical procedure is not necessary.

12.0 Calculations and Data Analysis

You must follow the applicable procedures for calculations and data analysis in section 12.0 of Method 7E as applicable, substituting SO_2 for NO_X as appropriate.

13.0 Method Performance

13.1 The specifications for the applicable performance checks are the same as in section 13.0 of Method 7E.

13.2 Alternative Interference Check. The results are acceptable if the difference between the Method 6C result and the modified Method 6 result is less than 7.0 percent of the Method 6 result for each of the three test runs. For the purposes of comparison, the Method 6 and 6C results must be expressed in the same units of measure.

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 Alternative Procedures

16.1 Alternative Interference Check. You may perform an alternative interference check consisting of at least three comparison runs between Method 6C and Method 6. This check validates the Method 6C results at each particular source category (type of facility) where the check is performed. When testing under conditions of low concentrations (<15 ppm), this alternative interference check is not allowed.

NOTE: The procedure described below applies to non-dilution sampling systems only. If this alternative interference check is used for a dilution sampling system, use a standard Method 6 sampling train and extract the sample directly from the exhaust stream at points collocated with the Method 6C sample probe.

a. Build the modified Method 6 sampling train (flow control valve, two midget impingers containing 3 percent hydrogen peroxide, and dry gas meter) shown in Figure 6C–1. Connect the sampling train to the sample bypass discharge vent. Record the dry gas meter reading before you begin sampling. Simultaneously collect modified Method 6 and Method 6C samples. Open the flow control valve in the modified Method 6 train as you begin to sample with Method 6C. Adjust the Method 6 sampling rate to 1 liter per minute (.10 percent). The sampling time per run must be the same as for Method 6 plus twice the average measurement system response time. If your modified Method 6 train does not include a pump, you risk biasing the results high if you over-pressurize the midget impingers and cause a leak. You can reduce this risk by cautiously increasing the flow rate as sampling begins.

b. After completing a run, record the final dry gas meter reading, meter temperature, and barometric pressure. Recover and analyze the contents of the midget impingers using the procedures in Method 6. Determine the average gas concentration reported by Method 6C for the run.

17.0 References

1. ‘‘EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards’’ September 1997 as amended, EPA–600/R–97/121

18.0 Tables, Diagrams, Flowcharts, and Validation Data

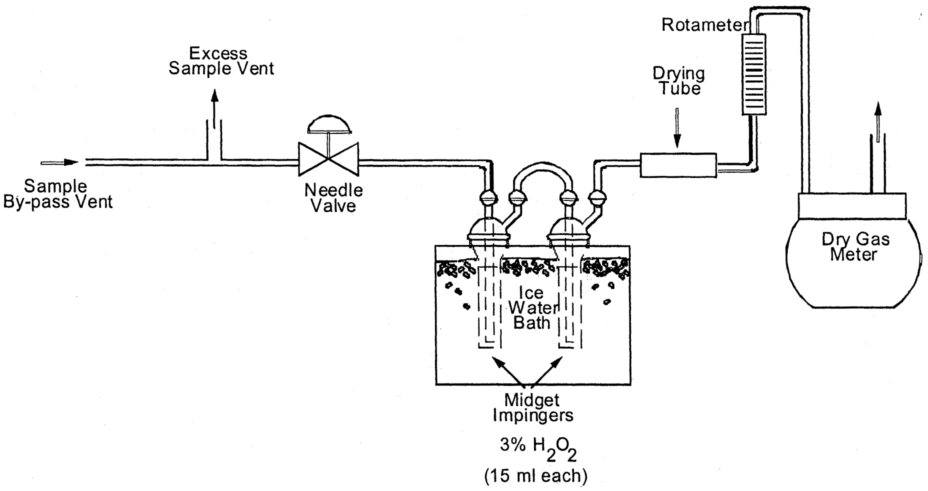

Figure 6C-1. Modified Method 6 Alternative Interference Check Sampling Train

METHOD 7—DETERMINATION OF NITROGEN OXIDE EMISSIONS FROM STATIONARY SOURCES

NOTE: This method does not include all of the specifications (*e.g.*, equipment and supplies) and procedures (*e.g.*, sampling and analytical) essential to its performance. Some material is incorporated by reference from other methods in this part. Therefore, to obtain reliable results, persons using this method should have a thorough knowledge of at least the following additional test methods: Method 1 and Method 5.

1.0 Scope and Application

1.1 Analytes.

Analyte	CAS No.	Sensitivity
Nitrogen oxides (NO_X), as NO_2, including:		
Nitric oxide (NO)	10102–43–9	
Nitrogen dioxide (NO_2)	10102–44–0	2–400 mg/dscm

1.2 Applicability. This method is applicable for the measurement of nitrogen oxides (NO_X) emitted from stationary sources.

1.3 Data Quality Objectives. Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sample methods.

2.0 Summary of Method

A grab sample is collected in an evacuated flask containing a dilute sulfuric acid-hydrogen peroxide absorbing solution, and the nitrogen oxides, except nitrous oxide, are measured colorimetrically using the phenoldisulfonic acid (PDS) procedure.

3.0 Definitions [Reserved]

4.0 Interferences

Biased results have been observed when sampling under conditions of high sulfur dioxide concentrations. At or above 2100 ppm SO_2, use five times the H_2O_2 concentration of the Method 7 absorbing solution. Laboratory tests have shown that high concentrations of SO_2 (about 2100 ppm) cause low results in Method 7 and 7A. Increasing the H_2O_2 concentration to five times the original concentration eliminates this bias. However, when no SO_2 is present, increasing the concentration by five times results in a low bias.

5.0 Safety

5.1 Disclaimer. This method may involve hazardous materials, operations, and equipment. This test method may not address all of the safety problems associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to performing this test method.

5.2 Corrosive Reagents. The following reagents are hazardous. Personal protective equipment and safe procedures are useful in preventing chemical splashes. If contact occurs, immediately flush with copious amounts of water for at least 15 minutes. Remove clothing under shower and decontaminate. Treat residual chemical burns as thermal burns.

5.2.1 Hydrogen Peroxide (H_2O_2). Irritating to eyes, skin, nose, and lungs.

5.2.2 Phenoldisulfonic Acid. Irritating to eyes and skin.

5.2.3 Sodium Hydroxide (NaOH). Causes severe damage to eyes and skin. Inhalation causes irritation to nose, throat, and lungs. Reacts exothermically with limited amounts of water.

5.2.4 Sulfuric Acid (H_2SO_4). Rapidly destructive to body tissue. Will cause third degree burns. Eye damage may result in blindness. Inhalation may be fatal from spasm of the larynx, usually within 30 minutes. May cause lung tissue damage with edema. 1 mg/m^3 for 8 hours will cause lung damage or, in higher concentrations, death. Provide ventilation to limit inhalation. Reacts violently with metals and organics.

5.2.5 Phenol. Poisonous and caustic. Do not handle with bare hands as it is absorbed through the skin.

6.0 Equipment and Supplies

6.1 Sample Collection. A schematic of the sampling train used in performing this method is shown in Figure 7–1. Other grab sampling systems or equipment, capable of measuring sample volume to within 2.0 percent and collecting a sufficient sample volume to allow analytical reproducibility to within 5 percent, will be considered acceptable alternatives, subject to the approval of the Administrator. The following items are required for sample collection:

6.1.1 Probe. Borosilicate glass tubing, sufficiently heated to prevent water condensation and equipped with an in-stack or heated out-of-stack filter to remove particulate matter (a plug of glass wool is satisfactory for this purpose). Stainless steel or Teflon tubing may also be used for the probe. Heating is not necessary if the probe remains dry during the purging period.

6.1.2 Collection Flask. Two-liter borosilicate, round bottom flask, with short neck and 24/40 standard taper opening, protected against implosion or breakage.

6.1.3 Flask Valve. T-bore stopcock connected to a 24/40 standard taper joint.

6.1.4 Temperature Gauge. Dial-type thermometer, or other temperature gauge, capable of measuring 1 °C (2 °F) intervals from −5 to 50 °C (23 to 122 °F).

6.1.5 Vacuum Line. Tubing capable of withstanding a vacuum of 75 mm (3 in.) Hg absolute pressure, with ''T'' connection and T-bore stopcock.

6.1.6 Vacuum Gauge. U-tube manometer, 1 meter (39 in.), with 1 mm (0.04 in.) divisions, or other gauge capable of measuring pressure to within 2.5 mm (0.10 in.) Hg.

6.1.7 Pump. Capable of evacuating the collection flask to a pressure equal to or less than 75 mm (3 in.) Hg absolute.

6.1.8 Squeeze Bulb. One-way.

6.1.9 Volumetric Pipette. 25-ml.

6.1.10 Stopcock and Ground Joint Grease. A high-vacuum, high-temperature chlorofluorocarbon grease is required. Halocarbon 25–5S has been found to be effective.

6.1.11 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm (0.1 in.) Hg. See note in Method 5, section 6.1.2.

6.2 Sample Recovery. The following items are required for sample recovery:

6.2.1 Graduated Cylinder. 50-ml with 1 ml divisions.

6.2.2 Storage Containers. Leak-free polyethylene bottles.

6.2.3 Wash Bottle. Polyethylene or glass.

6.2.4 Glass Stirring Rod.

6.2.5 Test Paper for Indicating pH. To cover the pH range of 7 to 14.

6.3 Analysis. The following items are required for analysis:

6.3.1 Volumetric Pipettes. Two 1-ml, two 2-ml, one 3-ml, one 4-ml, two 10-ml, and one 25-ml for each sample and standard.

6.3.2 Porcelain Evaporating Dishes. 175- to 250-ml capacity with lip for pouring, one for each sample and each standard. The Coors No. 45006 (shallowform, 195-ml) has been found to be satisfactory. Alternatively, polymethyl pentene beakers (Nalge No. 1203, 150-ml), or glass beakers (150-ml) may be used. When glass beakers are used, etching of the beakers may cause solid matter to be present in the analytical step; the solids should be removed by filtration.

6.3.3 Steam Bath. Low-temperature ovens or thermostatically controlled hot plates kept below 70 °C (160 °F) are acceptable alternatives.

6.3.4 Dropping Pipette or Dropper. Three required.

6.3.5 Polyethylene Policeman. One for each sample and each standard.

6.3.6 Graduated Cylinder. 100-ml with 1-ml divisions.

6.3.7 Volumetric Flasks. 50-ml (one for each sample and each standard), 100-ml (one for each sample and each standard, and one for the working standard KNO_3 solution), and 1000-ml (one).

6.3.8 Spectrophotometer. To measure at 410 nm.

6.3.9 Graduated Pipette. 10-ml with 0.1-ml divisions.

6.3.10 Test Paper for Indicating pH. To cover the pH range of 7 to 14.

6.3.11 Analytical Balance. To measure to within 0.1 mg.

7.0 Reagents and Standards

Unless otherwise indicated, it is intended that all reagents conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available; otherwise, use the best available grade.

7.1 Sample Collection. The following reagents are required for sampling:

7.1.1 Water. Deionized distilled to conform to ASTM D 1193–77 or 91 Type 3 (incorporated by reference—see § 60.17). The $KMnO_4$ test for oxidizable organic matter may be omitted when high concentrations of organic matter are not expected to be present.

7.1.2 Absorbing Solution. Cautiously add 2.8 ml concentrated H_2SO_4 to a 1-liter flask partially filled with water. Mix well, and add 6 ml of 3 percent hydrogen peroxide, freshly prepared from 30 percent hydrogen peroxide solution. Dilute to 1 liter of water and mix well. The absorbing solution should be used within 1 week of its preparation. Do not expose to extreme heat or direct sunlight.

7.2 Sample Recovery. The following reagents are required for sample recovery:

7.2.1 Water. Same as in 7.1.1.

7.2.2 Sodium Hydroxide, 1 N. Dissolve 40 g NaOH in water, and dilute to 1 liter.

7.3 Analysis. The following reagents and standards are required for analysis:

7.3.1 Water. Same as in 7.1.1.

7.3.2 Fuming Sulfuric Acid. 15 to 18 percent by weight free sulfur trioxide. HANDLE WITH CAUTION.

7.3.3 Phenol. White solid.

7.3.4 Sulfuric Acid. Concentrated, 95 percent minimum assay.

7.3.5 Potassium Nitrate (KNO_3). Dried at 105 to 110 °C (221 to 230 °F) for a minimum of 2 hours just prior to preparation of standard solution.

7.3.6 Standard KNO_3 Solution. Dissolve exactly 2.198 g of dried KNO_3 in water, and dilute to 1 liter with water in a 1000-ml volumetric flask.

7.3.7 Working Standard KNO_3 Solution. Dilute 10 ml of the standard solution to 100 ml with water. One ml of the working standard solution is equivalent to 100 μg nitrogen dioxide (NO_2).

7.3.8 Phenoldisulfonic Acid Solution. Dissolve 25 g of pure white phenol solid in 150 ml concentrated sulfuric acid on a steam bath. Cool, add 75 ml fuming sulfuric acid (15 to 18 percent by weight free sulfur trioxide—HANDLE WITH CAUTION), and heat at 100 °C (212 °F) for 2 hours. Store in a dark, stoppered bottle.

7.3.9 Concentrated Ammonium Hydroxide.

8.0 Sample Collection, Preservation, Storage and Transport

8.1 Sample Collection.

8.1.1 Flask Volume. The volume of the collection flask and flask valve combination must be known prior to sampling. Assemble the flask and flask valve, and fill with water to the stopcock. Measure the volume of water to ±10 ml. Record this volume on the flask.

8.1.2 Pipette 25 ml of absorbing solution into a sample flask, retaining a sufficient quantity for use in preparing the calibration standards. Insert the flask valve stopper into the flask with the valve in the ‘‘purge’’ position. Assemble the sampling train as shown in Figure 7–1, and place the probe at the sampling point. Make sure that all fittings are tight and leak-free, and that all ground glass joints have been greased properly with a high-vacuum, high temperature chlorofluorocarbon-based stopcock grease. Turn the flask valve and the pump valve to their ‘‘evacuate’’ positions. Evacuate the flask to 75 mm (3 in.) Hg absolute pressure, or less. Evacuation to a pressure approaching the vapor pressure of water at the existing temperature is desirable. Turn the pump valve to its ‘‘vent’’ position, and turn off the pump. Check for leakage by observing the manometer for any pressure fluctuation. (Any variation greater than 10 mm (0.4 in.) Hg over a period of 1 minute is not acceptable, and the flask is not to be used until the leakage problem is corrected. Pressure in the flask is not to exceed 75 mm (3 in.) Hg absolute at the time sampling is commenced.) Record the volume of the flask and valve (V_f), the flask temperature (T_i), and the barometric pressure. Turn the flask valve counterclockwise to its ‘‘purge’’ position, and do the same with the pump valve. Purge the probe and the vacuum tube using the squeeze bulb. If condensation occurs in the probe and the flask valve area, heat the probe, and purge until the condensation disappears. Next, turn the pump valve to its ‘‘vent’’ position. Turn the flask valve clockwise to its ‘‘evacuate’’ position, and record the difference in the mercury levels in the manometer. The absolute internal pressure in the flask (P_i) is equal to the barometric pressure less the manometer reading. Immediately turn the flask valve to the ‘‘sample’’ position, and permit the gas to enter the flask until pressures in the flask and sample line (*i.e.*, duct, stack) are equal. This will usually require about 15 seconds; a longer period indicates a plug in the probe, which must be corrected before sampling is continued. After collecting the sample, turn the flask valve to its ''purge'' position, and disconnect the flask from the sampling train.

8.1.3 Shake the flask for at least 5 minutes.

8.1.4 If the gas being sampled contains insufficient oxygen for the conversion of NO to NO_2 (*e.g.*, an applicable subpart of the standards may require taking a sample of a calibration gas mixture of NO in N_2), then introduce oxygen into the flask to permit this conversion. Oxygen may be introduced into the flask by one of three methods: (1) Before evacuating the sampling flask, flush with pure cylinder oxygen, then evacuate flask to 75 mm (3 in.) Hg absolute pressure or less; or (2) inject oxygen into the flask after sampling; or (3) terminate sampling with a minimum of 50 mm (2 in.) Hg vacuum remaining in the flask, record this final pressure, and then vent the flask to the atmosphere until the flask pressure is almost equal to atmospheric pressure.

8.2 Sample Recovery. Let the flask sit for a minimum of 16 hours, and then shake the contents for 2 minutes.

8.2.1 Connect the flask to a mercury filled U-tube manometer. Open the valve from the flask to the manometer, and record the flask temperature (T_f), the barometric pressure, and the difference between the mercury levels in the manometer. The absolute internal pressure in the flask (P_f) is the barometric pressure less the manometer reading. Transfer the contents of the flask to a leak-free polyethylene bottle. Rinse the flask twice with 5 ml portions of water, and add the rinse water to the bottle. Adjust the pH to between 9 and 12 by adding 1 N NaOH, dropwise (about 25 to 35 drops). Check the pH by dipping a stirring rod into the solution and then touching the rod to the pH test paper. Remove as little material as possible during this step. Mark the height of the liquid level so that the container can be checked for leakage after transport. Label the container to identify clearly its contents. Seal the container for shipping.

9.0 Quality Control

Section	Quality control measure	Effect
10.1	Spectrophotometer calibration	Ensure linearity of spectrophotometer response to standards.

10.0 Calibration and Standardization

10.1 Spectrophotometer.

10.1.1 Optimum Wavelength Determination.

10.1.1.1 Calibrate the wavelength scale of the spectrophotometer every 6 months. The calibration may be accomplished by using an energy source with an intense line emission such as a mercury lamp, or by using a series of glass filters spanning the measuring range of the spectrophotometer. Calibration materials are available commercially and from the National Institute of Standards and Technology. Specific details on the use of such materials should be supplied by the vendor; general information about calibration techniques can be obtained from general reference books on analytical chemistry. The wavelength scale of the spectrophotometer must read correctly within 5 nm at all calibration points; otherwise, repair and recalibrate the spectrophotometer. Once the wavelength scale of the spectrophotometer is in proper calibration, use 410 nm as the optimum wavelength for the measurement of the absorbance of the standards and samples.

10.1.1.2 Alternatively, a scanning procedure may be employed to determine the proper measuring wavelength. If the instrument is a double-beam spectrophotometer, scan the spectrum between 400 and 415 nm using a 200 μg NO_2 standard solution in the sample cell and a blank solution in the reference cell. If a peak does not occur, the spectrophotometer is probably malfunctioning and should be repaired. When a peak is obtained within the 400 to 415 nm range, the wavelength at which this peak occurs shall be the optimum wavelength for the measurement of absorbance of both the standards and the samples. For a single-beam spectrophotometer, follow the scanning procedure described above, except scan separately the blank and standard solutions. The optimum wavelength shall be the wavelength at which the maximum difference in absorbance between the standard and the blank occurs.

10.1.2 Determination of Spectrophotometer Calibration Factor K_c. Add 0 ml, 2.0 ml, 4.0 ml, 6.0 ml, and 8.0 ml of the KNO_3 working standard solution (1 ml = 100 μg NO_2) to a series of five 50-ml volumetric flasks. To each flask, add 25 ml of absorbing solution and 10 ml water. Add 1 N NaOH to each flask until the pH is between 9 and 12 (about 25 to 35 drops). Dilute to the mark with water. Mix thoroughly, and pipette a 25-ml aliquot of each solution into a separate porcelain evaporating dish. Beginning with the evaporation step, follow the analysis procedure of section 11.2 until the solution has been transferred to the 100-ml volumetric flask and diluted to the mark. Measure the absorbance of each solution at the optimum wavelength as determined in section 10.2.1. This calibration procedure must be repeated on each day that samples are analyzed. Calculate the spectrophotometer calibration factor as shown in section 12.2.

10.1.3 Spectrophotometer Calibration Quality Control. Multiply the absorbance value obtained for each standard by the K_c factor (reciprocal of the least squares slope) to determine the distance each calibration point lies from the theoretical calibration line. The difference between the calculated concentration values and the actual concentrations (*i.e.*, 100, 200, 300, and 400 µg NO_2) should be less than 7 percent for all standards.

10.2 Barometer. Calibrate against a mercury barometer or NIST-traceable barometer prior to the field test.

10.3 Temperature Gauge. Calibrate dial thermometers against mercury-in-glass thermometers. An alternative mercury-free thermometer may be used if the thermometer is, at a minimum, equivalent in terms of performance or suitably effective for the specific temperature measurement application.

10.4 Vacuum Gauge. Calibrate mechanical gauges, if used, against a mercury manometer such as that specified in section 6.1.6.

10.5 Analytical Balance. Calibrate against standard weights.

11.0 Analytical Procedures

11.1 Sample Loss Check. Note the level of the liquid in the container, and confirm whether any sample was lost during shipment. Note this on the analytical data sheet. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results.

11.2 Sample Preparation. Immediately prior to analysis, transfer the contents of the shipping container to a 50 ml volumetric flask, and rinse the container twice with 5 ml portions of water. Add the rinse water to the flask, and dilute to mark with water; mix thoroughly. Pipette a 25-ml aliquot into the porcelain evaporating dish. Return any unused portion of the sample to the polyethylene storage bottle. Evaporate the 25-ml aliquot to dryness on a steam bath, and allow to cool. Add 2 ml phenoldisulfonic acid solution to the dried residue, and triturate thoroughly with a polyethylene policeman. Make sure the solution contacts all the residue. Add 1 ml water and 4 drops of concentrated sulfuric acid. Heat the solution on a steam bath for 3 minutes with occasional stirring. Allow the solution to cool, add 20 ml water, mix well by stirring, and add concentrated ammonium hydroxide, dropwise, with constant stirring, until the pH is 10 (as determined by pH paper). If the sample contains solids, these must be removed by filtration (centrifugation is an acceptable alternative, subject to the approval of the Administrator) as follows: Filter through Whatman No. 41 filter paper into a 100-ml volumetric flask. Rinse the evaporating dish with three 5-ml portions of water. Filter these three rinses. Wash the filter with at least three 15-ml portions of water. Add the filter washings to the contents of the volumetric flask, and dilute to the mark with water. If solids are absent, the solution can be transferred directly to the 100-ml volumetric flask and diluted to the mark with water.

11.3 Sample Analysis. Mix the contents of the flask thoroughly, and measure the absorbance at the optimum wavelength used for the standards (Section 10.2.1), using the blank solution as a zero reference. Dilute the sample and the blank with equal volumes of water if the absorbance exceeds A_4, the absorbance of the 400-µg NO_2 standard (see section 10.2.2).

12.0 Data Analysis and Calculations

Carry out the calculations, retaining at least one extra significant figure beyond that of the acquired data. Round off figures after final calculations.

12.1 12.1 Nomenclature

A = Absorbance of sample.
A_1 = Absorbance of the 100-µg NO_2 standard.
A_2 = Absorbance of the 200-µg NO_2 standard.
A_3 = Absorbance of the 300-µg NO_2 standard.
A_4 = Absorbance of the 400-µg NO_2 standard.
C = Concentration of NO_X as NO_2, dry basis, corrected to standard conditions, mg/dsm^3 (lb/dscf).
F = Dilution factor (*i.e.*, 25/5, 25/10, *etc.*, required only if sample dilution was needed to reduce the absorbance into the range of the calibration).
K_c = Spectrophotometer calibration factor.
M = Mass of NO_X as NO_2 in gas sample, µg.
P_f = Final absolute pressure of flask, mm Hg (in. Hg).
P_i = Initial absolute pressure of flask, mm Hg (in. Hg).
P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
T_f = Final absolute temperature of flask, °K (°R).
T_i = Initial absolute temperature of flask, °K (°R).
T_{std} = Standard absolute temperature, 293 °K (528°R).
V_{sc} = Sample volume at standard conditions (dry basis), ml.
V_f = Volume of flask and valve, ml.
V_a = Volume of absorbing solution, 25 ml.

12.2 Spectrophotometer Calibration Factor.

$$K_c = 100 \frac{A_1 + 2A_2 + 3A_3 + 4A_4}{A_1^2 + A_2^2 + A_3^2 + A_4^2} \qquad \text{Eq. 7-1}$$

12.3 Sample Volume, Dry Basis, Corrected to Standard Conditions.

$$V_{sc} = \left(V_f - V_a\right)\frac{T_{std}}{P_{std}}\left[\frac{P_f}{T_f} - \frac{P_i}{T_i}\right] \qquad \text{Eq. 7-2}$$

$$= K_1\left(V_f - 25\right)\left[\frac{P_f}{T_f} - \frac{P_i}{T_i}\right]$$

Where:

K_1 = 0.3858 °K/mm Hg for metric units,
K_1 = 17.65 °R/in. Hg for English units.

12.4 Total μg NO_2 per sample.

$$m = 2K_cAF \qquad \text{Eq. 7-3}$$

Where:

2 = 50/25, the aliquot factor.

NOTE: If other than a 25-ml aliquot is used for analysis, the factor 2 must be replaced by a corresponding factor.

12.5 Sample Concentration, Dry Basis, Corrected to Standard Conditions.

$$C = K_2\left(m/V_{sc}\right) \qquad \text{Eq. 7-4}$$

Where:

K2 = 10^3 (mg/m^3)/(μg/ml) for metric units,
K_2 = 6.242×10^{-5} (lb/scf)/(μg/ml) for English units.

13.0 Method Performance

13.1 Range. The analytical range of the method has been determined to be 2 to 400 milligrams NO_X (as NO_2) per dry standard cubic meter, without having to dilute the sample.

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 References

1. Standard Methods of Chemical Analysis. 6th ed. New York, D. Van Nostrand Co., Inc. 1962. Vol. 1, pp. 329–330.

2. Standard Method of Test for Oxides of Nitrogen in Gaseous Combustion Products (Phenoldisulfonic Acid Procedure). In: 1968 Book of ASTM Standards, Part 26. Philadelphia, PA. 1968. ASTM Designation D 1608–60, pp. 725–729.

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6. Hamil, H.F. and R.E. Thomas. Collaborative Study of Method for the Determination of Nitrogen Oxide Emissions from Stationary Sources (Nitric Acid Plants). Southwest Research Institute Report for Environmental Protection Agency. Research Triangle Park, NC. May 8, 1974.

7. Stack Sampling Safety Manual (Draft). U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. September 1978.

17.0 Tables, Diagrams, Flowcharts, and Validation Data

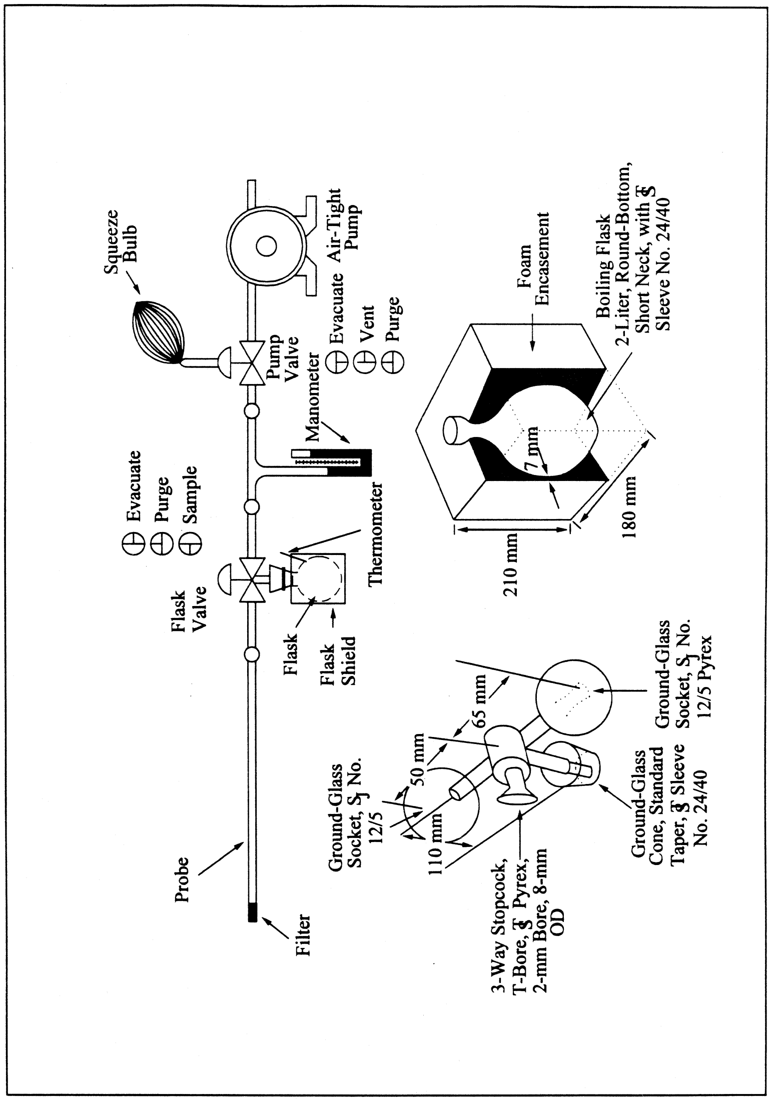

Figure 7-1. Sampling Train, Flask Valve, and Flask.

METHOD 7A—DETERMINATION OF NITROGEN OXIDE EMISSIONS FROM STATIONARY SOURCES (ION CHROMATOGRAPHIC METHOD)

NOTE: This method does not include all of the specifications (*e.g.*, equipment and supplies) and procedures (*e.g.*, sampling and analytical) essential to its performance. Some material is incorporated by reference from other methods in this part. Therefore, to obtain reliable results, persons using this method should have a thorough knowledge of at least the following additional test methods: Method 1, Method 3, Method 5, and Method 7.

1.0 Scope and Application

1.1 Analytes.

Analyte	CAS No.	Sensitivity
Nitrogen oxides (NO_X), as NO_2, including:		
Nitric oxide (NO)	10102–43–9	
Nitrogen dioxide (NO_2)	10102–44–0	65–655 ppmv

1.2 Applicability. This method is applicable for the determination of NO_X emissions from stationary sources.

1.3 Data Quality Objectives. Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods.

2.0 Summary of Method

A grab sample is collected in an evacuated flask containing a dilute sulfuric acid-hydrogen peroxide absorbing solution. The nitrogen oxides, excluding nitrous oxide (N_2O), are oxidized to nitrate and measured by ion chromatography.

3.0 Definitions [Reserved]

4.0 Interferences

Biased results have been observed when sampling under conditions of high sulfur dioxide concentrations. At or above 2100 ppm SO_2, use five times the H_2O_2 concentration of the Method 7 absorbing solution. Laboratory tests have shown that high concentrations of SO_2 (about 2100 ppm) cause low results in Method 7 and 7A. Increasing the H_2O_2 concentration to five times the original concentration eliminates this bias. However, when no SO_2 is present, increasing the concentration by five times results in a low bias.

5.0 Safety

5.1 This method may involve hazardous materials, operations, and equipment. This test method may not address all of the safety problems associated with its use. It is the responsibility of the user of this test method to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to performing this test method.

5.2 Corrosive reagents. The following reagents are hazardous. Personal protective equipment and safe procedures are useful in preventing chemical splashes. If contact occurs, immediately flush with copious amounts of water at least 15 minutes. Remove clothing under shower and decontaminate. Treat residual chemical burns as thermal burns.

5.2.1 Hydrogen Peroxide (H_2O_2). Irritating to eyes, skin, nose, and lungs.

5.2.2 Sulfuric Acid (H_2SO_4). Rapidly destructive to body tissue. Will cause third degree burns. Eye damage may result in blindness. Inhalation may be fatal from spasm of the larynx, usually within 30 minutes. May cause lung tissue damage with edema. 3 mg/m^3 will cause lung damage in uninitiated. 1 mg/m^3 for 8 hours will cause lung damage or, in higher concentrations, death. Provide ventilation to limit inhalation. Reacts violently with metals and organics.

6.0 Equipment and Supplies

6.1 Sample Collection. Same as in Method 7, section 6.1.

6.2 Sample Recovery. Same as in Method 7, section 6.2, except the stirring rod and pH paper are not needed.

6.3 Analysis. For the analysis, the following equipment and supplies are required. Alternative instrumentation and procedures will be allowed provided the calibration precision requirement in section 10.1.2 can be met.

6.3.1 Volumetric Pipets. Class A;1-, 2-, 4-, 5-ml (two for the set of standards and one per sample), 6-, 10-, and graduated 5-ml sizes.

6.3.2 Volumetric Flasks. 50-ml (two per sample and one per standard), 200-ml, and 1-liter sizes.

6.3.3 Analytical Balance. To measure to within 0.1 mg.

6.3.4 Ion Chromatograph. The ion chromatograph should have at least the following components:

6.3.4.1 Columns. An anion separation or other column capable of resolving the nitrate ion from sulfate and other species present and a standard anion suppressor column (optional). Suppressor columns are produced as proprietary items; however, one can be produced in the laboratory using the resin available from BioRad Company, 32nd and Griffin Streets, Richmond, California. Peak resolution can be optimized by varying the eluent strength or column flow rate, or by experimenting with alternative columns that may offer more efficient separation. When using guard columns with the stronger reagent to protect the separation column, the analyst should allow rest periods between injection intervals to purge possible sulfate buildup in the guard column.

6.3.4.2 Pump. Capable of maintaining a steady flow as required by the system.

6.3.4.3 Flow Gauges. Capable of measuring the specified system flow rate.

6.3.4.4 Conductivity Detector.

6.3.4.5 Recorder. Compatible with the output voltage range of the detector.

7.0 Reagents and Standards

Unless otherwise indicated, it is intended that all reagents conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available; otherwise, use the best available grade.

7.1 Sample Collection. Same as Method 7, section 7.1.

7.2 Sample Recovery. Same as Method 7, section 7.1.1.

7.3 Analysis. The following reagents and standards are required for analysis:

7.3.1 Water. Same as Method 7, section 7.1.1.

7.3.2 Stock Standard Solution, 1 mg NO_2/ml. Dry an adequate amount of sodium nitrate ($NaNO_3$) at 105 to 110 °C (221 to 230 °F) for a minimum of 2 hours just before preparing the standard solution. Then dissolve exactly 1.847 g of dried $NaNO_3$ in water, and dilute to 1 liter in a volumetric flask. Mix well. This solution is stable for 1 month and should not be used beyond this time.

7.3.3 Working Standard Solution, 25 μg/ml. Dilute 5 ml of the standard solution to 200 ml with water in a volumetric flask, and mix well.

7.3.4 Eluent Solution. Weigh 1.018 g of sodium carbonate (Na_2CO_3) and 1.008 g of sodium bicarbonate ($NaHCO_3$), and dissolve in 4 liters of water. This solution is 0.0024 M Na_2CO_3/0.003 M $NaHCO_3$. Other eluents appropriate to the column type and capable of resolving nitrate ion from sulfate and other species present may be used.

8.0 Sample Collection, Preservation, Storage, and Transport

8.1 Sampling. Same as in Method 7, section 8.1.

8.2 Sample Recovery. Same as in Method 7, section 8.2, except delete the steps on adjusting and checking the pH of the sample. Do not store the samples more than 4 days between collection and analysis.

9.0 Quality Control

Section	Quality control measure	Effect
10.1	Ion chromatographn calibration	Ensure linearity of ion chromatograph response to standards.

10.0 Calibration and Standardizations

10.1 Ion Chromatograph.

10.1.1 Determination of Ion Chromatograph Calibration Factor S. Prepare a series of five standards by adding 1.0, 2.0, 4.0, 6.0, and 10.0 ml of working standard solution (25 μg/ml) to a series of five 50-ml volumetric flasks. (The standard masses will equal 25, 50, 100, 150, and 250 μg.) Dilute each flask to the mark with water, and mix well. Analyze with the samples as described in section 11.2, and subtract the blank from each value. Prepare or calculate a linear regression plot of the standard masses in μg (x-axis) versus their peak height responses in millimeters (y-axis). (Take peak height measurements with symmetrical peaks; in all other cases, calculate peak areas.) From this curve, or equation, determine the slope, and calculate its reciprocal to denote as the calibration factor, S.

10.1.2 Ion Chromatograph Calibration Quality Control. If any point on the calibration curve deviates from the line by more than 7 percent of the concentration at that point, remake and reanalyze that standard. This deviation can be determined by multiplying S times the peak height response for each standard. The resultant concentrations must not differ by more than 7 percent from each known standard mass (*i.e.*, 25, 50, 100, 150, and 250 μg).

10.2 Conductivity Detector. Calibrate according to manufacturer's specifications prior to initial use.

10.3 Barometer. Calibrate against a mercury barometer.

10.4 Temperature Gauge. Calibrate dial thermometers against mercury-in-glass thermometers. An alternative mercury-free thermometer may be used if the thermometer is, at a minimum, equivalent in terms of performance or suitably effective for the specific temperature measurement application.

10.5 Vacuum Gauge. Calibrate mechanical gauges, if used, against a mercury manometer such as that specified in section 6.1.6 of Method 7.

10.6 Analytical Balance. Calibrate against standard weights.

11.0 Analytical Procedures

11.1 Sample Preparation.

11.1.1 Note on the analytical data sheet, the level of the liquid in the container, and whether any sample was lost during shipment. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Immediately before analysis, transfer the contents of the shipping container to a 50-ml volumetric flask, and rinse the container twice with 5 ml portions of water. Add the rinse water to the flask, and dilute to the mark with water. Mix thoroughly.

11.1.2 Pipet a 5-ml aliquot of the sample into a 50-ml volumetric flask, and dilute to the mark with water. Mix thoroughly. For each set of determinations, prepare a reagent blank by diluting 5 ml of absorbing solution to 50 ml with water. (Alternatively, eluent solution may be used instead of water in all sample, standard, and blank dilutions.)

11.2 Analysis.

11.2.1 Prepare a standard calibration curve according to section 10.1.1. Analyze the set of standards followed by the set of samples using the same injection volume for both standards and samples. Repeat this analysis sequence followed by a final analysis of the standard set. Average the results. The two sample values must agree within 5 percent of their mean for the analysis to be valid. Perform this duplicate analysis sequence on the same day. Dilute any sample and the blank with equal volumes of water if the concentration exceeds that of the highest standard.

11.2.2 Document each sample chromatogram by listing the following analytical parameters: injection point, injection volume, nitrate and sulfate retention times, flow rate, detector sensitivity setting, and recorder chart speed.

12.0 Data Analysis and Calculations

Carry out the calculations, retaining at least one extra significant figure beyond that of the acquired data. Round off figures after final calculations.

12.1 Sample Volume. Calculate the sample volume Vsc (in ml), on a dry basis, corrected to standard conditions, using Equation 7–2 of Method 7.

12.2 Sample Concentration of NO_X as NO_2.

12.2.1 Calculate the sample concentration C (in mg/dscm) as follows:

$$C = (H)(S)(F)\left(10^4\right)/V_{sc} \qquad \text{Eq. 7A-1}$$

Where:

H = Sample peak height, mm.
S = Calibration factor, μg/mm.
F = Dilution factor (required only if sample dilution was needed to reduce the concentration into the range of calibration), dimensionless.
10^4 = 1:10 dilution times conversion factor of: $(mg/10^3\ \mu g)(10^6\ ml/m^3)$.

12.2.2 If desired, the concentration of NO_2 may be calculated as ppm NO_2 at standard conditions as follows:

$$\text{ppm } NO_2 = 0.5228C \qquad \text{Eq. 7A-2}$$

Where:

0.5228 = ml/mg NO_2.

13.0 Method Performance

13.1 Range. The analytical range of the method is from 125 to 1250 mg NO_X/m^3 as NO_2 (65 to 655 ppmv), and higher concentrations may be analyzed by diluting the sample. The lower detection limit is approximately 19 mg/m^3 (10 ppmv), but may vary among instruments.

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 References

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17.0 Tables, Diagrams, Flowcharts, and Validation Data [Reserved]

METHOD 7B—DETERMINATION OF NITROGEN OXIDE EMISSIONS FROM STATIONARY SOURCES (ULTRAVIOLET SPECTROPHOTOMETRIC METHOD)

NOTE: This method does not include all of the specifications (*e.g.*, equipment and supplies) and procedures (*e.g.*, sampling and analytical) essential to its performance. Some material is incorporated by reference from other methods in this part. Therefore, to obtain reliable results, persons using this method should have a thorough knowledge of at least the following additional test methods: Method 1, Method 5, and Method 7.

1.0 Scope and Application

1.1 Analytes.

Analyte	CAS No.	Sensitivity
Nitrogen oxides (NO_X), as NO_2, including:		

Analyte	CAS No.	Sensitivity
Nitric oxide (NO)	10102–43–9	
Nitrogen dioxide (NO_2)	10102–44–0	30–786 ppmv

1.2 Applicability. This method is applicable for the determination of NO_X emissions from nitric acid plants.

1.3 Data Quality Objectives. Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods.

2.0 Summary of Method

2.1 A grab sample is collected in an evacuated flask containing a dilute sulfuric acid-hydrogen peroxide absorbing solution; the NO_X, excluding nitrous oxide (N_2O), are measured by ultraviolet spectrophotometry.

3.0 Definition [Reserved]

4.0 Interferences [Reserved]

5.0 Safety

5.1 This method may involve hazardous materials, operations, and equipment. This test method may not address all of the safety problems associated with its use. It is the responsibility of the user of this test method to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to performing this test method.

5.2 Corrosive reagents. The following reagents are hazardous. Personal protective equipment and safe procedures are useful in preventing chemical splashes. If contact occurs, immediately flush with copious amounts of water at least 15 minutes. Remove clothing under shower and decontaminate. Treat residual chemical burn as thermal burn.

5.2.1 Hydrogen Peroxide (H_2O_2). Irritating to eyes, skin, nose, and lungs.

5.2.2 Sodium Hydroxide (NaOH). Causes severe damage to eyes and skin. Inhalation causes irritation to nose, throat, and lungs. Reacts exothermically with limited amounts of water.

5.2.3 Sulfuric Acid (H_2SO_4). Rapidly destructive to body tissue. Will cause third degree burns. Eye damage may result in blindness. Inhalation may be fatal from spasm of the larynx, usually within 30 minutes. May cause lung tissue damage with edema. 3 mg/m^3 will cause lung damage in uninitiated. 1 mg/m^3 for 8 hours will cause lung damage or, in higher concentrations, death. Provide ventilation to limit inhalation. Reacts violently with metals and organics.

6.0 Equipment and Supplies

6.1 Sample Collection. Same as Method 7, section 6.1.

6.2 Sample Recovery. The following items are required for sample recovery:

6.2.1 Wash Bottle. Polyethylene or glass.

6.2.2 Volumetric Flasks. 100-ml (one for each sample).

6.3 Analysis. The following items are required for analysis:

6.3.1 Volumetric Pipettes. 5-, 10-, 15-, and 20-ml to make standards and sample dilutions.

6.3.2 Volumetric Flasks. 1000- and 100-ml for preparing standards and dilution of samples.

6.3.3 Spectrophotometer. To measure ultraviolet absorbance at 210 nm.

6.3.4 Analytical Balance. To measure to within 0.1 mg.

7.0 Reagents and Standards

NOTE: Unless otherwise indicated, all reagents are to conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Otherwise, use the best available grade.

7.1 Sample Collection. Same as Method 7, section 7.1. It is important that the amount of hydrogen peroxide in the absorbing solution not be increased. Higher concentrations of peroxide may interfere with sample analysis.

7.2 Sample Recovery. Same as Method 7, section 7.2.

7.3 Analysis. Same as Method 7, sections 7.3.1, 7.3.3, and 7.3.4, with the addition of the following:

7.3.1 Working Standard KNO_3 Solution. Dilute 10 ml of the standard solution to 1000 ml with water. One milliliter of the working standard is equivalent to 10 μg NO_2.

8.0 Sample Collection, Preservation, Storage, and Transport

8.1 Sample Collection. Same as Method 7, section 8.1.

8.2 Sample Recovery.

8.2.1 Let the flask sit for a minimum of 16 hours, and then shake the contents for 2 minutes.

8.2.2 Connect the flask to a mercury filled U-tube manometer. Open the valve from the flask to the manometer, and record the flask temperature (T_f), the barometric pressure, and the difference between the mercury levels in the manometer. The absolute internal pressure in the flask (P_f) is the barometric pressure less the manometer reading.

8.2.3 Transfer the contents of the flask to a leak-free wash bottle. Rinse the flask three times with 10-ml portions of water, and add to the bottle. Mark the height of the liquid level so that the container can be checked for leakage after transport. Label the container to identify clearly its contents. Seal the container for shipping.

9.0 Quality Control

Section	Quality control measure	Effect
10.1	Spectrophotometer calibration	Ensures linearity of spectrophotometer response to standards.

10.0 Calibration and Standardizations

Same as Method 7, sections 10.2 through 10.5, with the addition of the following:

10.1 Determination of Spectrophotometer Standard Curve. Add 0 ml, 5 ml, 10 ml, 15 ml, and 20 ml of the KNO_3 working standard solution (1 ml = 10 μg NO_2) to a series of five 100-ml volumetric flasks. To each flask, add 5 ml of absorbing solution. Dilute to the mark with water. The resulting solutions contain 0.0, 50, 100, 150, and 200 μg NO_2, respectively. Measure the absorbance by ultraviolet spectrophotometry at 210 nm, using the blank as a zero reference. Prepare a standard curve plotting absorbance vs. μg NO_2.

NOTE: If other than a 20-ml aliquot of sample is used for analysis, then the amount of absorbing solution in the blank and standards must be adjusted such that the same amount of absorbing solution is in the blank and standards as is in the aliquot of sample used.

10.1.1 Calculate the spectrophotometer calibration factor as follows:

$$K_c = \frac{\sum_{i=1}^{n} M_i A_i}{\sum_{i=1}^{n} A_i^2} \qquad \text{Eq. 7B-1}$$

Where:

Mi = Mass of NO_2 in standard i, μg.

Ai = Absorbance of NO_2 standard i.

n = Total number of calibration standards.

10.1.2 For the set of calibration standards specified here, Equation 7B–1 simplifies to the following:

$$K_c = 50\,\frac{A_1 + 2A_2 + 3A_3 + 4A_4}{A_1^2 + A_2^2 + A_3^2 + A_4^2} \qquad \text{Eq. 7B-2}$$

10.2 Spectrophotometer Calibration Quality Control. Multiply the absorbance value obtained for each standard by the K_c factor (reciprocal of the least squares slope) to determine the distance each calibration point lies from the theoretical calibration line. The difference between the calculated concentration values and the actual concentrations (*i.e.*, 50, 100, 150, and 200 μg NO_2) should be less than 7 percent for all standards.

11.0 Analytical Procedures

11.1 Sample Loss Check. Note the level of the liquid in the container, and confirm whether any sample was lost during shipment. Note this on the analytical data sheet. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results.

11.2 Sample Preparation. Immediately prior to analysis, transfer the contents of the shipping container to a 100-ml volumetric flask, and rinse the container twice with 5-ml portions of water. Add the rinse water to the flask, and dilute to mark with water.

11.3 Sample Analysis. Mix the contents of the flask thoroughly and pipette a 20 ml-aliquot of sample into a 100-ml volumetric flask. Dilute to the mark with water. Using the blank as zero reference, read the absorbance of the sample at 210 nm.

11.4 Audit Sample Analysis. Same as Method 7, section 11.4, except that a set of audit samples must be analyzed with each set of compliance samples or once per analysis day, or once per week when averaging continuous samples.

12.0 Data Analysis and Calculations

Same as Method 7, section 12.0, except replace section 12.3 with the following:

12.1 Total μg NO_2 Per Sample.

$$m = 5\,K_c\,A\,F \qquad \text{Eq. 7B-3}$$

Where:

5 = 100/20, the aliquot factor.

Note: If other than a 20-ml aliquot is used for analysis, the factor 5 must be replaced by a corresponding factor.

13.0 Method Performance

13.1 Range. The analytical range of the method as outlined has been determined to be 57 to 1500 milligrams NO_X (as NO_2) per dry standard cubic meter, or 30 to 786 parts per million by volume (ppmv) NO_X.

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 References

1. National Institute for Occupational Safety and Health. Recommendations for Occupational Exposure to Nitric Acid. In: Occupational Safety and Health Reporter. Washington, D.C. Bureau of National Affairs, Inc. 1976. p. 149.

2. Rennie, P.J., A.M. Sumner, and F.B. Basketter. Determination of Nitrate in Raw, Potable, and Waste Waters by Ultraviolet Spectrophotometry. Analyst. *104*:837. September 1979.

17.0 Tables, Diagrams, Flowcharts, and Validation Data [Reserved]

Method 7C—Determination of Nitrogen Oxide Emissions From Stationary Sources (Alkaline Permanganate/Colorimetric Method)

Note: This method does not include all of the specifications (*e.g.*, equipment and supplies) and procedures (*e.g.*, sampling and analytical) essential to its performance. Some material is incorporated by reference from other methods in this part. Therefore, to obtain reliable results, persons using this method should have a thorough knowledge of at least the following additional test methods: Method 1, Method 3, Method 6 and Method 7.

1.0 Scope and Application

1.1 Analytes.

Analyte	CAS no.	Sensitivity
Nitrogen oxides (NO_X), as NO_2, including:		
Nitric oxide (NO)	10102–43–9	
Nitrogen dioxide (NO_2)	10102–44–07	ppmv

1.2 Applicability. This method applies to the measurement of NO_X emissions from fossil-fuel fired steam generators, electric utility plants, nitric acid plants, or other sources as specified in the regulations.

1.3 Data Quality Objectives. Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods.

2.0 Summary of Method

An integrated gas sample is extracted from the stack and passed through impingers containing an alkaline potassium permanganate solution; NO_X (NO + NO_2) emissions are oxidized to NO_2 and NO_3. Then NO_3^- is reduced to NO_2^- with cadmium, and the NO_2^- is analyzed colorimetrically.

3.0 Definitions [Reserved]

4.0 Interferences

Possible interferents are sulfur dioxides (SO_2) and ammonia (NH_3).

4.1 High concentrations of SO_2 could interfere because SO_2 consumes MnO_4 (as does NO_X) and, therefore, could reduce the NO_X collection efficiency. However, when sampling emissions from a coal-fired electric utility plant burning 2.1 percent sulfur coal with no control of SO_2 emissions, collection efficiency was not reduced. In fact, calculations show that sampling 3000 ppm SO_2 will reduce the MnO_4 concentration by only 5 percent if all the SO_2 is consumed in the first impinger.

4.2 Ammonia (NH_3) is slowly oxidized to NO_3^- by the absorbing solution. At 100 ppm NH_3 in the gas stream, an interference of 6 ppm NO_X (11 mg NO_2/m^3) was observed when the sample was analyzed 10 days after collection. Therefore, the method may not be applicable to plants using NH_3 injection to control NO_X emissions unless means are taken to correct the results. An equation has been developed to allow quantification of the interference and is discussed in Reference 5 of section 16.0.

5.0 Safety

5.1 Disclaimer. This method may involve hazardous materials, operations, and equipment. This test method may not address all of the safety problems associated with its use. It is the responsibility of the user of this test method to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to performing this test method.

5.2 Corrosive Reagents. The following reagents are hazardous. Personal protective equipment and safe procedures are useful in preventing chemical splashes. If contact occurs, immediately flush with copious amounts of water for at least 15 minutes. Remove clothing under shower and decontaminate. Treat residual chemical burns as thermal burns.

5.2.1 Hydrochloric Acid (HCl). Highly toxic and corrosive. Causes severe damage to skin. Vapors are highly irritating to eyes, skin, nose, and lungs, causing severe damage. May cause bronchitis, pneumonia, or edema of lungs. Exposure to vapor concentrations of 0.13 to 0.2 percent can be lethal in minutes. Will react with metals, producing hydrogen.

5.2.2 Oxalic Acid $(COOH)_2$. Poisonous. Irritating to eyes, skin, nose, and throat.

5.2.3 Sodium Hydroxide (NaOH). Causes severe damage to eye tissues and to skin. Inhalation causes irritation to nose, throat, and lungs. Reacts exothermically with small amounts of water.

5.2.4 Potassium Permanganate $(KMnO_4)$. Caustic, strong oxidizer. Avoid bodily contact with.

6.0 Equipment and Supplies

6.1 Sample Collection and Sample Recovery. A schematic of the Method 7C sampling train is shown in Figure 7C–1, and component parts are discussed below. Alternative apparatus and procedures are allowed provided acceptable accuracy and precision can be demonstrated to the satisfaction of the Administrator.

6.1.1 Probe. Borosilicate glass tubing, sufficiently heated to prevent water condensation and equipped with an in-stack or heated out-of-stack filter to remove particulate matter (a plug of glass wool is satisfactory for this purpose). Stainless steel or Teflon tubing may also be used for the probe.

6.1.2 Impingers. Three restricted-orifice glass impingers, having the specifications given in Figure 7C–2, are required for each sampling train. The impingers must be connected in series with leak-free glass connectors. Stopcock grease may be used, if necessary, to prevent leakage. (The impingers can be fabricated by a glass blower if not available commercially.)

6.1.3 Glass Wool, Stopcock Grease, Drying Tube, Valve, Pump, Barometer, and Vacuum Gauge and Rotameter. Same as in Method 6, sections 6.1.1.3, 6.1.1.4, 6.1.1.6, 6.1.1.7, 6.1.1.8, 6.1.2, and 6.1.3, respectively.

6.1.4 Rate Meter. Rotameter, or equivalent, accurate to within 2 percent at the selected flow rate of between 400 and 500 ml/min (0.014 to 0.018 cfm). For rotameters, a range of 0 to 1 liter/min (0 to 0.035 cfm) is recommended.

6.1.5 Volume Meter. Dry gas meter (DGM) capable of measuring the sample volume under the sampling conditions of 400 to 500 ml/min (0.014 to 0.018 cfm) for 60 minutes within an accuracy of 2 percent.

6.1.6 Filter. To remove NO_X from ambient air, prepared by adding 20 g of 5-angstrom molecular sieve to a cylindrical tube (*e.g.*, a polyethylene drying tube).

6.1.7 Polyethylene Bottles. 1-liter, for sample recovery.

6.1.8 Funnel and Stirring Rods. For sample recovery.

6.2 Sample Preparation and Analysis.

6.2.1 Hot Plate. Stirring type with 50- by 10-mm Teflon-coated stirring bars.

6.2.2 Beakers. 400-, 600-, and 1000-ml capacities.

6.2.3 Filtering Flask. 500-ml capacity with side arm.

6.2.4 Buchner Funnel. 75-mm ID, with spout equipped with a 13-mm ID by 90-mm long piece of Teflon tubing to minimize possibility of aspirating sample solution during filtration.

6.2.5 Filter Paper. Whatman GF/C, 7.0-cm diameter.

6.2.6 Stirring Rods.

6.2.7 Volumetric Flasks. 100-, 200- or 250-, 500-, and 1000-ml capacity.

6.2.8 Watch Glasses. To cover 600- and 1000-ml beakers.

6.2.9 Graduated Cylinders. 50- and 250-ml capacities.

6.2.10 Pipettes. Class A.

6.2.11 pH Meter. To measure pH from 0.5 to 12.0.

6.2.12 Burette. 50-ml with a micrometer type stopcock. (The stopcock is Catalog No. 8225–t–05, Ace Glass, Inc., Post Office Box 996, Louisville, Kentucky 50201.) Place a glass wool plug in bottom of burette. Cut off burette at a height of 43 cm (17 in.) from the top of plug, and have a blower attach a glass funnel to top of burette such that the diameter of the burette remains essentially unchanged. Other means of attaching the funnel are acceptable.

6.2.13 Glass Funnel. 75-mm ID at the top.

6.2.14 Spectrophotometer. Capable of measuring absorbance at 540 nm; 1-cm cells are adequate.

6.2.15 Metal Thermometers. Bimetallic thermometers, range 0 to 150 °C (32 to 300 °F).

6.2.16 Culture Tubes. 20-by 150-mm, Kimax No. 45048.

6.2.17 Parafilm ''M.'' Obtained from American Can Company, Greenwich, Connecticut 06830.

6.2.18 CO_2 Measurement Equipment. Same as in Method 3, section 6.0.

7.0 Reagents and Standards

Unless otherwise indicated, it is intended that all reagents conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available; otherwise, use the best available grade.

7.1 Sample Collection.

7.1.1 Water. Deionized distilled to conform to ASTM Specification D 1193–77 or 91 Type 3 (incorporated by reference—see § 60.17).

7.1.2 Potassium Permanganate, 4.0 Percent (w/w), Sodium Hydroxide, 2.0 Percent (w/w) solution ($KMnO_4$/NaOH solution). Dissolve 40.0 g of $KMnO_4$ and 20.0 g of NaOH in 940 ml of water.

7.2 Sample Preparation and Analysis.

7.2.1 Water. Same as in section 7.1.1.

7.2.2 Oxalic Acid Solution. Dissolve 48 g of oxalic acid [$(COOH)_2 \cdot 2H_2O$] in water, and dilute to 500 ml. Do not heat the solution.

7.2.3 Sodium Hydroxide, 0.5 N. Dissolve 20 g of NaOH in water, and dilute to 1 liter.

7.2.4 Sodium Hydroxide, 10 N. Dissolve 40 g of NaOH in water, and dilute to 100 ml.

7.2.5 Ethylenediamine Tetraacetic Acid (EDTA) Solution, 6.5 percent (w/v). Dissolve 6.5 g of EDTA (disodium salt) in water, and dilute to 100 ml. Dissolution is best accomplished by using a magnetic stirrer.

7.2.6 Column Rinse Solution. Add 20 ml of 6.5 percent EDTA solution to 960 ml of water, and adjust the pH to between 11.7 and 12.0 with 0.5 N NaOH.

7.2.7 Hydrochloric Acid (HCl), 2 N. Add 86 ml of concentrated HCl to a 500 ml-volumetric flask containing water, dilute to volume, and mix well. Store in a glass-stoppered bottle.

7.2.8 Sulfanilamide Solution. Add 20 g of sulfanilamide (melting point 165 to 167 °C (329 to 333 °F)) to 700 ml of water. Add, with mixing, 50 ml concentrated phosphoric acid (85 percent), and dilute to 1000 ml. This solution is stable for at least 1 month, if refrigerated.

7.2.9 N-(1-Naphthyl)-Ethylenediamine Dihydrochloride (NEDA) Solution. Dissolve 0.5 g of NEDA in 500 ml of water. An aqueous solution should have one absorption peak at 320 nm over the range of 260 to 400 nm. NEDA that shows more than one absorption peak over this range is impure and should not be used. This solution is stable for at least 1 month if protected from light and refrigerated.

7.2.10 Cadmium. Obtained from Matheson Coleman and Bell, 2909 Highland Avenue, Norwood, Ohio 45212, as EM Laboratories Catalog No. 2001. Prepare by rinsing in 2 N HCl for 5 minutes until the color is silver-grey. Then rinse the cadmium with water until the rinsings are neutral when tested with pH paper. CAUTION: H_2 is liberated during preparation. Prepare in an exhaust hood away from any flame or combustion source.

7.2.11 Sodium Sulfite ($NaNO_2$) Standard Solution, Nominal Concentration, 1000 μg NO_2^-/ml. Desiccate NaNO2 overnight. Accurately weigh 1.4 to 1.6 g of $NaNO_2$ (assay of 97 percent $NaNO_2$ or greater), dissolve in water, and dilute to 1 liter. Calculate the exact NO_2-concentration using Equation 7C–1 in section 12.2. This solution is stable for at least 6 months under laboratory conditions.

7.2.12 Potassium Nitrate (KNO_3) Standard Solution. Dry KNO_3 at 110 °C (230 °F) for 2 hours, and cool in a desiccator. Accurately weigh 9 to 10 g of KNO_3 to within 0.1 mg, dissolve in water, and dilute to 1 liter. Calculate the exact NO_3^- concentration using Equation 7C–2 in section 12.3. This solution is stable for 2 months without preservative under laboratory conditions.

7.2.13 Spiking Solution. Pipette 7 ml of the KNO_3 standard into a 100-ml volumetric flask, and dilute to volume.

7.2.14 Blank Solution. Dissolve 2.4 g of $KMnO_4$ and 1.2 g of NaOH in 96 ml of water. Alternatively, dilute 60 ml of $KMnO_4$/NaOH solution to 100 ml.

8.0 Sample Collection, Preservation, Storage, and Transport

8.1 Preparation of Sampling Train. Add 200 ml of $KMnO_4$/NaOH solution (Section 7.1.2) to each of three impingers, and assemble the train as shown in Figure 7C–1. Adjust the probe heater to a temperature sufficient to prevent water condensation.

8.2 Leak-Checks. Same as in Method 6, section 8.2.

8.3 Sample Collection.

8.3.1 Record the initial DGM reading and barometric pressure. Determine the sampling point or points according to the appropriate regulations (*e.g.*, § 60.46(b)(5) of 40 CFR Part 60). Position the tip of the probe at the sampling point, connect the probe to the first impinger, and start the pump. Adjust the sample flow to a value between 400 and 500 ml/min (0.014 and 0.018 cfm). CAUTION: DO NOT EXCEED THESE FLOW RATES. Once adjusted, maintain a constant flow rate during the entire sampling run. Sample for 60 minutes. For relative accuracy (RA) testing of continuous emission monitors, the minimum sampling time is 1 hour, sampling 20 minutes at each traverse point.

NOTE: When the SO_2 concentration is greater than 1200 ppm, the sampling time may have to be reduced to 30 minutes to eliminate plugging of the impinger orifice with MnO_2. For RA tests with SO_2 greater than 1200 ppm, sample for 30 minutes (10 minutes at each point).

8.3.2 Record the DGM temperature, and check the flow rate at least every 5 minutes. At the conclusion of each run, turn off the pump, remove the probe from the stack, and record the final readings. Divide the sample volume by the sampling time to determine the average flow rate. Conduct the mandatory post-test leak-check. If a leak is found, void the test run, or use procedures acceptable to the Administrator to adjust the sample volume for the leakage.

8.4 CO_2 Measurement. During sampling, measure the CO_2 content of the stack gas near the sampling point using Method 3. The single-point grab sampling procedure is adequate, provided the measurements are made at least three times (near the start, midway, and before the end of a run), and the average CO_2 concentration is computed. The Orsat or Fyrite analyzer may be used for this analysis.

8.5 Sample Recovery. Disconnect the impingers. Pour the contents of the impingers into a 1-liter polyethylene bottle using a funnel and a stirring rod (or other means) to prevent spillage. Complete the quantitative transfer by rinsing the impingers and connecting tubes with water until the rinsings are clear to light pink, and add the rinsings to the bottle. Mix the sample, and mark the solution level. Seal and identify the sample container.

9.0 Quality Control

Section	Quality control measure	Effect
8.2, 10.1–10.3	Sampling equipment leak-check and calibration.	Ensure accurate measurement of sample volume.
10.4	Spectrophotometer calibration	Ensure linearity of spectrophotometer response to standards
11.3	Spiked sample analysis.	Ensure reduction efficiency of column.

10.0 Calibration and Standardizations

10.1 Volume Metering System. Same as Method 6, section 10.1. For detailed instructions on carrying out these calibrations, it is suggested that section 3.5.2 of Reference 4 of section 16.0 be consulted.

10.2 Temperature Sensors and Barometer. Same as in Method 6, sections 10.2 and 10.4, respectively.

10.3 Check of Rate Meter Calibration Accuracy (Optional). Disconnect the probe from the first impinger, and connect the filter. Start the pump, and adjust the rate meter to read between 400 and 500 ml/min (0.014 and 0.018 cfm). After the flow rate has stabilized, start measuring the volume sampled, as recorded by the dry gas meter and the sampling time. Collect enough volume to measure accurately the flow rate. Then calculate the flow rate. This average flow rate must be less than 500 ml/min (0.018 cfm) for the sample to be valid; therefore, it is recommended that the flow rate be checked as above prior to each test.

10.4 Spectrophotometer.

10.4.1 Dilute 5.0 ml of the $NaNO_2$ standard solution to 200 ml with water. This solution nominally contains 25 μg NO_2^-/ml. Use this solution to prepare calibration standards to cover the range of 0.25 to 3.00 μg NO_2^-/ml. Prepare a minimum of three standards each for the linear and slightly nonlinear (described below) range of the curve. Use pipettes for all additions.

10.4.2 Measure the absorbance of the standards and a water blank as instructed in section 11.5. Plot the net absorbance vs. μg NO_2^-/ml. Draw a smooth curve through the points. The curve should be linear up to an absorbance of approximately 1.2 with a slope of approximately 0.53 absorbance units/μg NO_2^-/ml. The curve should pass through the origin. The curve is slightly nonlinear from an absorbance of 1.2 to 1.6.

11.0 Analytical Procedures

11.1 Sample Stability. Collected samples are stable for at least four weeks; thus, analysis must occur within 4 weeks of collection.

11.2 Sample Preparation.

11.2.1 Prepare a cadmium reduction column as follows: Fill the burette with water. Add freshly prepared cadmium slowly, with tapping, until no further settling occurs. The height of the cadmium column should be 39 cm (15 in). When not in use, store the column under rinse solution.

NOTE: The column should not contain any bands of cadmium fines. This may occur if regenerated cadmium is used and will greatly reduce the column lifetime.

11.2.2 Note the level of liquid in the sample container, and determine whether any sample was lost during shipment. If a noticeable amount of leakage has occurred, the volume lost can be determined from the difference between initial and final solution levels, and this value can then be used to correct the analytical result. Quantitatively transfer the contents to a 1-liter volumetric flask, and dilute to volume.

11.2.3 Take a 100-ml aliquot of the sample and blank (unexposed $KMnO_4$/NaOH) solutions, and transfer to 400-ml beakers containing magnetic stirring bars. Using a pH meter, add concentrated H_2SO_4 with stirring until a pH of 0.7 is obtained. Allow the solutions to stand for 15 minutes. Cover the beakers with watch glasses, and bring the temperature of the solutions to 50 °C (122 °F). Keep the temperature below 60 °C (140 °F). Dissolve 4.8 g of oxalic acid in a minimum volume of water, approximately 50 ml, at room temperature. Do not heat the solution. Add this solution slowly, in increments, until the $KMnO_4$ solution becomes colorless. If the color is not completely removed, prepare some more of the above oxalic acid solution, and add until a colorless solution is obtained. Add an excess of oxalic acid by dissolving 1.6 g of oxalic acid in 50 ml of water, and add 6 ml of this solution to the colorless solution. If suspended matter is present, add concentrated H_2SO_4 until a clear solution is obtained.

11.2.4 Allow the samples to cool to near room temperature, being sure that the samples are still clear. Adjust the pH to between 11.7 and 12.0 with 10 N NaOH. Quantitatively transfer the mixture to a Buchner funnel containing GF/C filter paper, and filter the precipitate. Filter the mixture into a 500-ml filtering flask. Wash the solid material four times with water. When filtration is complete, wash the Teflon tubing, quantitatively transfer the filtrate to a 500-ml volumetric flask, and dilute to volume. The samples are now ready for cadmium reduction. Pipette a 50-ml aliquot of the sample into a 150-ml beaker, and add a magnetic stirring bar. Pipette in 1.0 ml of 6.5 percent EDTA solution, and mix.

11.3 Determine the correct stopcock setting to establish a flow rate of 7 to 9 ml/min of column rinse solution through the cadmium reduction column. Use a 50-ml graduated cylinder to collect and measure the solution volume. After the last of the rinse solution has passed from the funnel into the burette, but before air entrapment can occur, start adding the sample, and collect it in a 250-ml graduated cylinder. Complete the quantitative transfer of the sample to the column as the sample passes through the column. After the last of the sample has passed from the funnel into the burette, start adding 60 ml of column rinse solution, and collect the rinse solution until the solution just disappears from the funnel. Quantitatively transfer the sample to a 200-ml volumetric flask (a 250-ml flask may be required), and dilute to volume. The samples are now ready for NO_2-analysis.

NOTE: Two spiked samples should be run with every group of samples passed through the column. To do this, prepare two additional 50-ml aliquots of the sample suspected to have the highest NO_2-concentration, and add 1 ml of the spiking solution to these aliquots. If the spike recovery or column efficiency (see section 12.2) is below 95 percent, prepare a new column, and repeat the cadmium reduction.

11.5 Sample Analysis. Pipette 10 ml of sample into a culture tube. Pipette in 10 ml of sulfanilamide solution and 1.4 ml of NEDA solution. Cover the culture tube with parafilm, and mix the solution. Prepare a blank in the same manner using the sample from treatment of the unexposed $KMnO_4$/NaOH solution. Also, prepare a calibration standard to check the slope of the calibration curve. After a 10-minute color development interval, measure the absorbance at 540 nm against water. Read μg NO_2^-/ml from the calibration curve. If the absorbance is greater than that of the highest calibration standard, use less than 10 ml of sample, and repeat the analysis. Determine the NO_2^-concentration using the calibration curve obtained in section 10.4.

NOTE: Some test tubes give a high blank NO_2^- value but culture tubes do not.

11.6 Audit Sample Analysis. Same as in Method 7, section 11.4.

12.0 Data Analysis and Calculations

Carry out calculations, retaining at least one extra significant figure beyond that of the acquired data. Round off figures after final calculation.

12.1 Nomenclature.

B = Analysis of blank, μg NO_2^-/ml.
C = Concentration of NO_X as NO_2, dry basis, mg/dsm³.
E = Column efficiency, dimensionless
$K_2 = 10^{-3}$ mg/μg.
m = Mass of NO_X, as NO_2, in sample, μg.
P_{bar} = Barometric pressure, mm Hg (in. Hg).
P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
s = Concentration of spiking solution, μg NO_3/ml.
S = Analysis of sample, μg NO_2^-/ml.
T_m = Average dry gas meter absolute temperature, °K.
T_{std} = Standard absolute temperature, 293 °K (528 °R).
$V_{m(std)}$ = Dry gas volume measured by the dry gas meter, corrected to standard conditions, dscm (dscf).
V_m = Dry gas volume as measured by the dry gas meter, scm (scf).
x = Analysis of spiked sample, μg NO_2^-/ml.
X = Correction factor for CO_2 collection = $100/(100 - \%CO_2(V/V))$.
y = Analysis of unspiked sample, μg NO_2^-/ml.
Y = Dry gas meter calibration factor.
1.0 ppm NO = 1.247 mg NO/m³ at STP.
1.0 ppm NO_2 = 1.912 mg NO_2/m³ at STP.
1 ft³ = 2.832×10^{-2} m³.

12.2 NO_2 Concentration. Calculate the NO_2 concentration of the solution (see section 7.2.11) using the following equation:

$$\frac{\mu g\ NO_2^-}{ml} = g\ NaNO_2 \times \frac{\text{purity, }\%}{100} \times 10^3 \times \frac{46.01}{69.01} \qquad \text{Eq. 7C-1}$$

12.3 NO_3 Concentration. Calculate the NO_3 concentration of the KNO_3 solution (see section 7.2.12) using the following equation:

$$\frac{\mu g\ NO_3^-}{ml} = g\ KNO_3 \times \left(10^3\right) \times \frac{62.01}{101.10} \qquad \text{Eq. 7C-2}$$

12.4 Sample Volume, Dry Basis, Corrected to Standard Conditions.

$$V_{m(std)} = V_m\ X\ Y \frac{T_{std}}{T_m}\ \frac{P_{bar}}{P_{std}} \qquad \text{Eq. 7C-3}$$

$$= K_1\ X\ Y\ V_m\ \frac{P_{bar}}{T_m}$$

Where:

K_1 = 0.3855 °K/mm Hg for metric units.

K_1 = 17.65 °R/in. Hg for English units.

12.5 Efficiency of Cadmium Reduction Column. Calculate this value as follows:

$$E = \frac{200\ (x - y)}{1.0\ s\ \frac{46.01}{62.01}} = \frac{269.6\ (x - y)}{s} \qquad \text{Eq. 7C-4}$$

Where:

200 = Final volume of sample and blank after passing through the column, ml.

1.0 = Volume of spiking solution added, ml.

46.01=μg NO_2^-/μmole.

62.01=μg NO_3^-/μmole.

12.6 Total μg NO_2.

$$m = 200\ \left(\frac{500}{50}\right)\left(\frac{1000}{100}\right)\left(\frac{(S - B)}{E}\right) = \frac{(2 \times 10^4)(S - B)}{E} \qquad \text{Eq. 7C-5}$$

Where:

500 = Total volume of prepared sample, ml.

50 = Aliquot of prepared sample processed through cadmium column, ml.

100 = Aliquot of $KMnO_4$/NaOH solution, ml.

1000 = Total volume of $KMnO_4$/NaOH solution, ml.

12.7 Sample Concentration.

$$C = K_2 \frac{m}{V_{m(std)}} \qquad \text{Eq. 7C-6}$$

13.0 Method Performance

13.1 Precision. The intra-laboratory relative standard deviation for a single measurement is 2.8 and 2.9 percent at 201 and 268 ppm NO_X, respectively.

13.2 Bias. The method does not exhibit any bias relative to Method 7.

13.3 Range. The lower detectable limit is 13 mg NO_X/m^3, as NO_2 (7 ppm NO_X) when sampling at 500 ml/min for 1 hour. No upper limit has been established; however, when using the recommended sampling conditions, the method has been found to collect NO_X emissions quantitatively up to 1782 mg NO_X/m^3, as NO_2 (932 ppm NO_X).

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 References

1. Margeson, J.H., W.J. Mitchell, J.C. Suggs, and M.R. Midgett. Integrated Sampling and Analysis Methods for Determining NO_X Emissions at Electric Utility Plants. U.S. Environmental Protection Agency, Research Triangle Park, NC. Journal of the Air Pollution Control Association. *32*:1210–1215. 1982.

2. Memorandum and attachment from J.H. Margeson, Source Branch, Quality Assurance Division, Environmental Monitoring Systems Laboratory, to The Record, EPA. March 30, 1983. NH_3 Interference in Methods 7C and 7D.

3. Margeson, J.H., J.C. Suggs, and M.R. Midgett. Reduction of Nitrate to Nitrite with Cadmium. Anal. Chem. *52*:1955–57. 1980.

4. Quality Assurance Handbook for Air Pollution Measurement Systems. Volume III—Stationary Source Specific Methods. U.S.

Environmental Protection Agency. Research Triangle Park, NC. Publication No. EPA–600/4–77–027b. August 1977.

5. Margeson, J.H., *et al.* An Integrated Method for Determining NO_X Emissions at Nitric Acid Plants. Analytical Chemistry. *47* (11):1801. 1975.

17.0 Tables, Diagrams, Flowcharts, and Validation Data

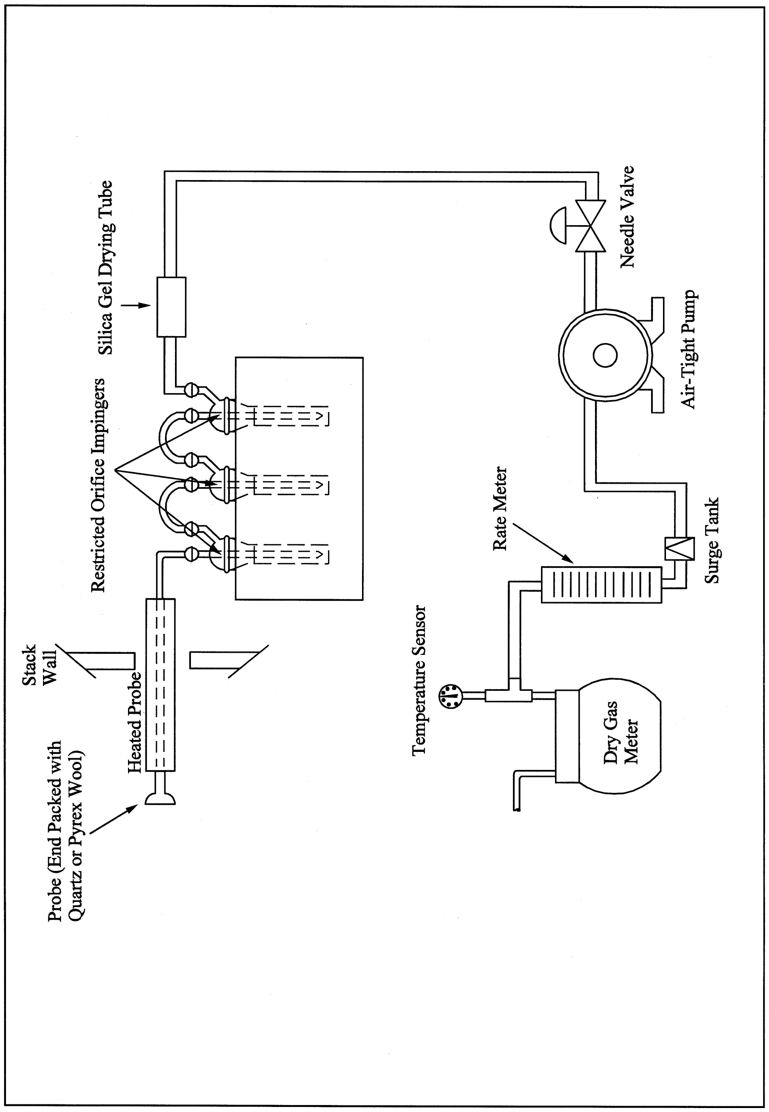


Figure 7C-1. NO_x Sampling Train.

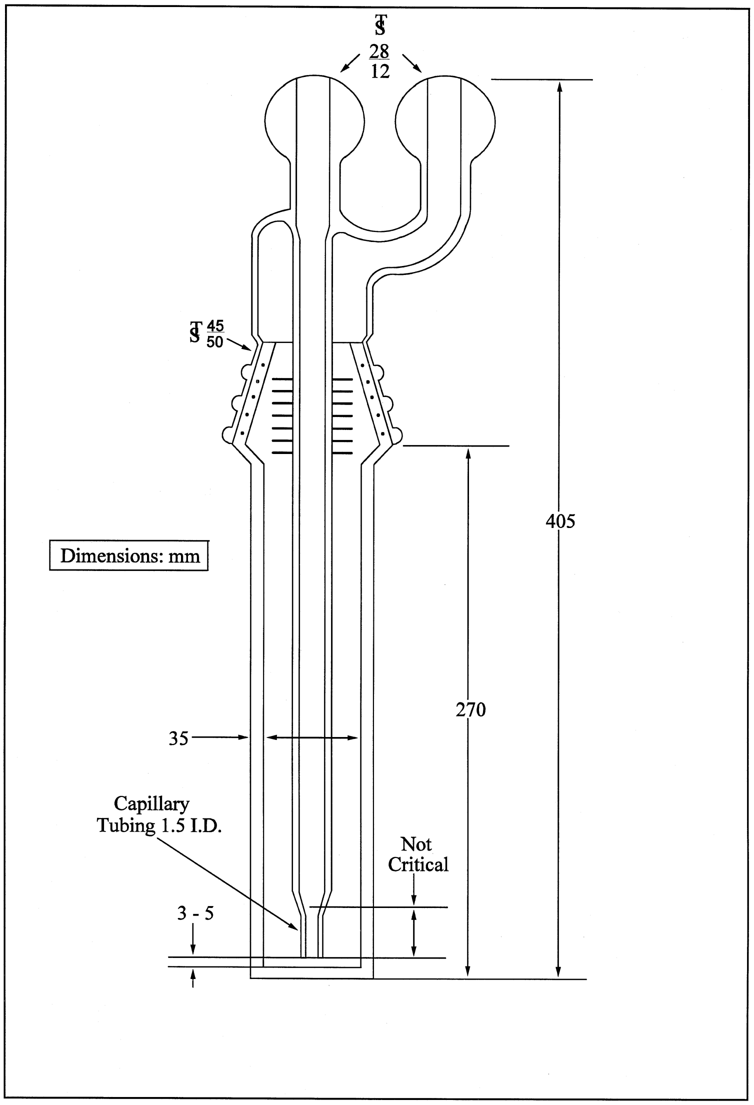


Figure 7C-2. Restricted-Orifice Impinger.

Method 7D—Determination of Nitrogen Oxide Emissions From Stationary Sources (Alkaline-Permanganate/Ion Chromatographic Method)

NOTE: This method is not inclusive with respect to specifications (*e.g.*, equipment and supplies) and procedures (*e.g.*, sampling and analytical) essential to its performance. Some material is incorporated by reference from other methods in this part. Therefore, to obtain reliable results, persons using this method should have a thorough knowledge of at least the following additional test methods: Method 1, Method 3, Method 6, Method 7, and Method 7C.

1.0 Scope and Application

1.1 Analytes.

Analyte	CAS No.	Sensitivity
Nitrogen oxides (NO_X), as NO_2, including:		
Nitric oxide (NO)	10102–43–9	
Nitrogen dioxide (NO_2)	10102–44–0	7 ppmv

1.2 Applicability. This method applies to the measurement of NO_X emissions from fossil-fuel fired steam generators, electric utility plants, nitric acid plants, or other sources as specified in the regulations.

1.3 Data Quality Objectives. Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods.

2.0 Summary of Method

An integrated gas sample is extracted from the stack and passed through impingers containing an alkaline-potassium permanganate solution; NO_X ($NO + NO_2$) emissions are oxidized to NO_3^-. Then NO_3^- is analyzed by ion chromatography.

3.0 Definitions [Reserved]

4.0 Interferences

Same as in Method 7C, section 4.0.

5.0 Safety

5.1 Disclaimer. This method may involve hazardous materials, operations, and equipment. This test method may not address all of the safety problems associated with its use. It is the responsibility of the user of this test method to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to performing this test method.

5.2 Corrosive reagents. The following reagents are hazardous. Personal protective equipment and safe procedures are useful in preventing chemical splashes. If contact occurs, immediately flush with copious amounts of water for at least 15 minutes. Remove clothing under shower and decontaminate. Treat residual chemical burns as thermal burns.

5.2.1 Hydrogen Peroxide (H_2O_2). Irritating to eyes, skin, nose, and lungs. 30% H_2O_2 is a strong oxidizing agent; avoid contact with skin, eyes, and combustible material. Wear gloves when handling.

5.2.2 Sodium Hydroxide (NaOH). Causes severe damage to eye tissues and to skin. Inhalation causes irritation to nose, throat, and lungs. Reacts exothermically with limited amounts of water.

5.2.3 Potassium Permanganate ($KMnO_4$). Caustic, strong oxidizer. Avoid bodily contact with.

6.0 Equipment and Supplies

6.1 Sample Collection and Sample Recovery. Same as Method 7C, section 6.1. A schematic of the sampling train used in performing this method is shown in Figure 7C–1 of Method 7C.

6.2 Sample Preparation and Analysis.

6.2.1 Magnetic Stirrer. With 25- by 10-mm Teflon-coated stirring bars.

6.2.2 Filtering Flask. 500-ml capacity with sidearm.

6.2.3 Buchner Funnel. 75-mm ID, with spout equipped with a 13-mm ID by 90-mm long piece of Teflon tubing to minimize possibility of aspirating sample solution during filtration.

6.2.4 Filter Paper. Whatman GF/C, 7.0-cm diameter.

6.2.5 Stirring Rods.

6.2.6 Volumetric Flask. 250-ml.

6.2.7 Pipettes. Class A.

6.2.8 Erlenmeyer Flasks. 250-ml.

6.2.9 Ion Chromatograph. Equipped with an anion separator column to separate NO_3^-, $H_3{}^+$ suppressor, and necessary auxiliary equipment. Nonsuppressed and other forms of ion chromatography may also be used provided that adequate resolution of NO_3^- is obtained. The system must also be able to resolve and detect NO_2^-.

7.0 Reagents and Standards

NOTE: Unless otherwise indicated, it is intended that all reagents conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available; otherwise, use the best available grade.

7.1 Sample Collection.

7.1.1 Water. Deionized distilled to conform to ASTM specification D 1193–77 or 91 Type 3 (incorporated by reference—see § 60.17).

7.1.2 Potassium Permanganate, 4.0 Percent (w/w), Sodium Hydroxide, 2.0 Percent (w/w). Dissolve 40.0 g of $KMnO_4$ and 20.0 g of NaOH in 940 ml of water.

7.2 Sample Preparation and Analysis.

7.2.1 Water. Same as in section 7.1.1.

7.2.2 Hydrogen Peroxide (H_2O_2), 5 Percent. Dilute 30 percent H_2O_2 1:5 (v/v) with water.

7.2.3 Blank Solution. Dissolve 2.4 g of $KMnO_4$ and 1.2 g of NaOH in 96 ml of water. Alternatively, dilute 60 ml of $KMnO_4$/NaOH solution to 100 ml.

7.2.4 KNO_3 Standard Solution. Dry KNO_3 at 110 °C for 2 hours, and cool in a desiccator. Accurately weigh 9 to 10 g of KNO_3 to within 0.1 mg, dissolve in water, and dilute to 1 liter. Calculate the exact NO_3^- concentration using Equation 7D–1 in section 12.2. This solution is stable for 2 months without preservative under laboratory conditions.

7.2.5 Eluent, 0.003 M $NaHCO_3$/0.0024 M Na_2CO_3. Dissolve 1.008 g $NaHCO_3$ and 1.018 g Na_2CO_3 in water, and dilute to 4 liters. Other eluents capable of resolving nitrate ion from sulfate and other species present may be used.

8.0 Sample Collection, Preservation, Transport, and Storage.

8.1 Sampling. Same as in Method 7C, section 8.1.

8.2 Sample Recovery. Same as in Method 7C, section 8.2.

8.3 Sample Preparation for Analysis.

NOTE: Samples must be analyzed within 28 days of collection.

8.3.1 Note the level of liquid in the sample container, and determine whether any sample was lost during shipment. If a noticeable amount of leakage has occurred, the volume lost can be determined from the difference between initial and final solution levels, and this value can then be used to correct the analytical result. Quantitatively transfer the contents to a 1-liter volumetric flask, and dilute to volume.

8.3.2 Sample preparation can be started 36 hours after collection. This time is necessary to ensure that all NO_2^- is converted to NO_3^- in the collection solution. Take a 50-ml aliquot of the sample and blank, and transfer to 250-ml Erlenmeyer flasks. Add a magnetic stirring bar. Adjust the stirring rate to as fast a rate as possible without loss of solution. Add 5 percent H_2O_2 in increments of approximately 5 ml using a 5-ml pipette. When the $KMnO_4$ color appears to have been removed, allow the precipitate to settle, and examine the supernatant liquid. If the liquid is clear, the H_2O_2 addition is complete. If the $KMnO_4$ color persists, add more H_2O_2, with stirring, until the supernatant liquid is clear.

NOTE: The faster the stirring rate, the less volume of H_2O_2 that will be required to remove the $KMnO_4$.) Quantitatively transfer the mixture to a Buchner funnel containing GF/C filter paper, and filter the precipitate. The spout of the Buchner funnel should be equipped with a 13-mm ID by 90-mm long piece of Teflon tubing. This modification minimizes the possibility of aspirating sample solution during filtration. Filter the mixture into a 500-ml filtering flask. Wash the solid material four times with water. When filtration is complete, wash the Teflon tubing, quantitatively transfer the filtrate to a 250-ml volumetric flask, and dilute to volume. The sample and blank are now ready for NO_3^- analysis.

9.0 Quality Control

Section	Quality control measure	Effect
8.2, 10.1–10.3	Sampling equipment leak-check and calibration.	Ensure accurate measurement of sample volume.
10.4	Spectrophotometer calibration	Ensure linearity of spectrophotometer response to standards.
11.3	Spiked sample analysis	Ensure reduction efficiency of column.

10.0 Calibration and Standardizations

10.1 Dry Gas Meter (DGM) System.

10.1.1 Initial Calibration. Same as in Method 6, section 10.1.1. For detailed instructions on carrying out this calibration, it is suggested that section 3.5.2 of Citation 4 in section 16.0 of Method 7C be consulted.

10.1.2 Post-Test Calibration Check. Same as in Method 6, section 10.1.2.

10.2 Thermometers for DGM and Barometer. Same as in Method 6, sections 10.2 and 10.4, respectively.

10.3 Ion Chromatograph.

10.3.1 Dilute a given volume (1.0 ml or greater) of the KNO_3 standard solution to a convenient volume with water, and use this solution to prepare calibration standards. Prepare at least four standards to cover the range of the samples being analyzed. Use pipettes for all additions. Run standards as instructed in section 11.2. Determine peak height or area, and plot the individual values versus concentration in μg NO_3^-/ml.

10.3.2 Do not force the curve through zero. Draw a smooth curve through the points. The curve should be linear. With the linear curve, use linear regression to determine the calibration equation.

11.0 Analytical Procedures

11.1 The following chromatographic conditions are recommended: 0.003 M $NaHCO_3$/0.0024 Na_2CO_3 eluent solution (Section 7.2.5), full scale range, 3 μMHO; sample loop, 0.5 ml; flow rate, 2.5 ml/min. These conditions should give a NO_3^- retention time of approximately 15 minutes (Figure 7D–1).

11.2 Establish a stable baseline. Inject a sample of water, and determine whether any NO_3^- appears in the chromatogram. If NO_3^- is present, repeat the water load/injection procedure approximately five times; then reinject a water sample and observe the chromatogram. When no NO_3^- is present, the instrument is ready for use. Inject calibration standards. Then inject samples and a blank. Repeat the injection of the calibration standards (to compensate for any drift in response of the instrument). Measure the NO_3^- peak height or peak area, and determine the sample concentration from the calibration curve.

12.0 Data Analysis and Calculations

Carry out calculations, retaining at least one extra significant figure beyond that of the acquired data. Round off figures after final calculation.

12.1 Nomenclature. Same as in Method 7C, section 12.1.

12.2 NO_3^- concentration. Calculate the NO_3^- concentration in the KNO_3 standard solution (see section 7.2.4) using the following equation:

$$\frac{\mu g\ NO_3^-}{ml} = g\ of\ KNO_3 \times 10^3 \times \frac{62.01}{101.10} \qquad \text{Eq. 7D-1}$$

12.3 Sample Volume, Dry Basis, Corrected to Standard Conditions. Same as in Method 7C, section 12.4.

12.4 Total μg NO_2 Per Sample.

$$\begin{aligned} m &= 250\left(\frac{1000}{50}\right)\left(\frac{46.01}{62.01}\right)(S-B) \qquad \text{Eq. 7D-2} \\ &= 3710\ (S-B) \end{aligned}$$

Where:

250 = Volume of prepared sample, ml.

1000 = Total volume of $KMnO_4$ solution, ml.

50 = Aliquot of $KMnO_4$/NaOH solution, ml.

46.01 = Molecular weight of NO_3^-.

62.01 = Molecular weight of NO_3^-.

12.5 Sample Concentration. Same as in Method 7C, section 12.7.

13.0 Method Performance

13.1 Precision. The intra-laboratory relative standard deviation for a single measurement is approximately 6 percent at 200 to 270 ppm NO_X.

13.2 Bias. The method does not exhibit any bias relative to Method 7.

13.3 Range. The lower detectable limit is similar to that of Method 7C. No upper limit has been established; however, when using the recommended sampling conditions, the method has been found to collect NO_X emissions quantitatively up to 1782 mg NO_X/m^3, as NO_2 (932 ppm NO_X).

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 References

Same as Method 7C, section 16.0, References 1, 2, 4, and 5.

17.0 Tables, Diagrams, Flowcharts, and Validation Data

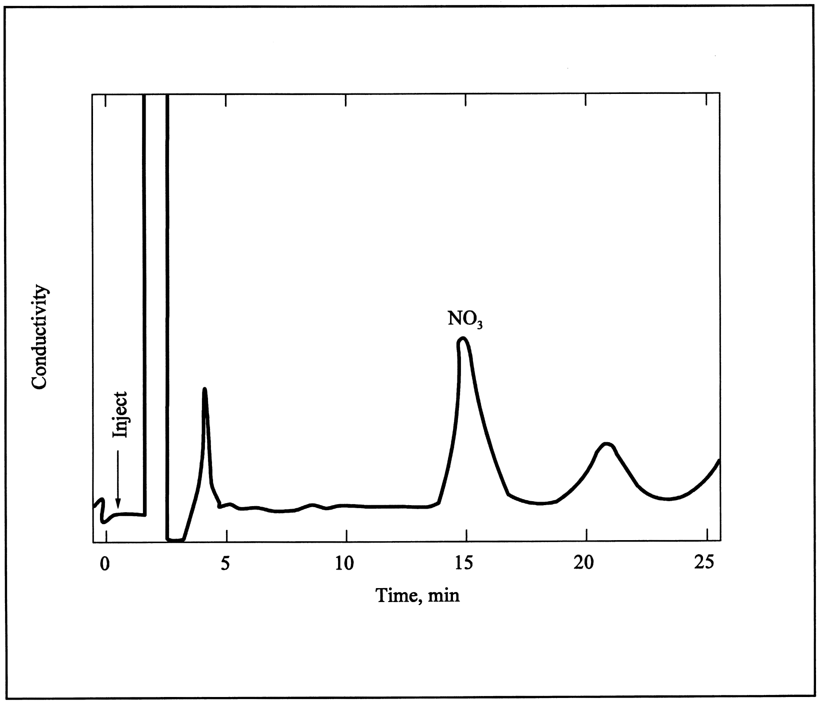


Figure 7D-1. Ion Chromatograph of a Prepared Sample.

METHOD 7E—DETERMINATION OF NITROGEN OXIDES EMISSIONS FROM STATIONARY SOURCES (INSTRUMENTAL ANALYZER PROCEDURE)

1.0 Scope and Application

What is Method 7E?

Method 7E is a procedure for measuring nitrogen oxides (NO_X) in stationary source emissions using a continuous instrumental analyzer. Quality assurance and quality control requirements are included to assure that you, the tester, collect data of known quality. You must document your adherence to these specific requirements for equipment, supplies, sample collection and analysis, calculations, and data analysis. This method does not completely describe all equipment, supplies, and sampling and analytical procedures you will need but refers to other methods for some of the details. Therefore, to obtain reliable results, you should also have a thorough knowledge of these additional test methods which are found in appendix A to this part:

(a) Method 1—Sample and Velocity Traverses for Stationary Sources.

(b) Method 4—Determination of Moisture Content in Stack Gases.

1.1 Analytes. What does this method determine? This method measures the concentration of nitrogen oxides as NO_2.

Analyte	CAS No.	Sensitivity
Nitric oxide (NO)	10102–43–9	Typically <2% of
Nitrogen dioxide (NO_2)	10102–44–0	Calibration Span.

1.2 Applicability. When is this method required? The use of Method 7E may be required by specific New Source Performance Standards, Clean Air Marketing rules, State Implementation Plans, and permits where measurement of NO_X concentrations in stationary source emissions is required, either to determine compliance with an applicable emissions standard or to conduct performance testing of a continuous monitoring system (CEMS). Other regulations may also require the use of Method 7E.

1.3 Data Quality Objectives (DQO). How good must my collected data be? Method 7E is designed to provide high-quality data for determining compliance with Federal and State emission standards and for relative accuracy testing of CEMS. In these and other applications, the principal objective is to ensure the accuracy of the data at the actual emission levels encountered. To meet this objective, the use of EPA traceability protocol calibration gases and measurement system performance tests are required.

1.4 Data Quality Assessment for Low Emitters. Is performance relief granted when testing low-emission units? Yes. For low-emitting sources, there are alternative performance specifications for analyzer calibration error, system bias, drift, and response time. Also, the alternative dynamic spiking procedure in section 16 may provide performance relief for certain low-emitting units.

2.0 Summary of Method

In this method, a sample of the effluent gas is continuously sampled and conveyed to the analyzer for measuring the concentration of NO_X. You may measure NO and NO_2 separately or simultaneously together but, for the purposes of this method, NO_X is the sum of NO and NO_2. You must meet the performance requirements of this method to validate your data.

3.0 Definitions

3.1 Analyzer Calibration Error, for non-dilution systems, means the difference between the manufacturer certified concentration of a calibration gas and the measured concentration of the same gas when it is introduced into the analyzer in direct calibration mode.

3.2 Calibration Curve means the relationship between an analyzer's response to the injection of a series of calibration gases and the actual concentrations of those gases.

3.3 Calibration Gas means the gas mixture containing NO_X at a known concentration and produced and certified in accordance with ''EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards,'' September 1997, as amended August 25, 1999, EPA–600/R–97/121 or more recent updates. The tests for analyzer calibration error, drift, and system bias require the use of calibration gas prepared according to this protocol. If a zero gas is used for the low-level gas, it must meet the requirements under the definition for ''zero air material'' in 40 CFR 72.2 in place of being prepared by the traceability protocol.

3.3.1 Low-Level Gas means a calibration gas with a concentration that is less than 20 percent of the calibration span and may be a zero gas.

3.3.2 Mid-Level Gas means a calibration gas with a concentration that is 40 to 60 percent of the calibration span.

3.3.3 High-Level Gas means a calibration gas with a concentration that is equal to the calibration span.

3.4 Calibration Span means the upper limit of the analyzer's calibration that is set by the choice of high-level calibration gas. No valid run average concentration may exceed the calibration span. To the extent practicable, the measured emissions should be between 20 to 100 percent of the selected calibration span. This may not be practicable in some cases of low-concentration measurements or testing for compliance with an emission limit when emissions are substantially less than the limit. In such cases, calibration spans that are practicable to achieving the data quality objectives without being excessively high should be chosen.

3.5 Centroidal Area means the central area of the stack or duct that is no greater than 1 percent of the stack or duct cross section. This area has the same geometric shape as the stack or duct.

3.6 Converter Efficiency Gas means a calibration gas with a known NO or NO_2 concentration and of Traceability Protocol quality.

3.7 Data Recorder means the equipment that permanently records the concentrations reported by the analyzer.

3.8 Direct Calibration Mode means introducing the calibration gases directly into the analyzer (or into the assembled measurement system at a point downstream of all sample conditioning equipment) according to manufacturer's recommended calibration procedure. This mode of calibration applies to non-dilution-type measurement systems.

3.9 Drift means the difference between the pre- and post-run system bias (or system calibration error) checks at a specific calibration gas concentration level (*i.e.* low-, mid- or high-).

3.10 Gas Analyzer means the equipment that senses the gas being measured and generates an output proportional to its concentration.

3.11 Interference Check means the test to detect analyzer responses to compounds other than the compound of interest, usually a gas present in the measured gas stream, that is not adequately accounted for in the calibration procedure and may cause measurement bias.

3.12 Low-Concentration Analyzer means any analyzer that operates with a calibration span of 20 ppm NO_X or lower. Each analyzer model used routinely to measure low NO_X concentrations must pass a manufacturer's stability test (MST). An MST subjects the analyzer to a range of line voltages and temperatures that reflect potential field conditions to demonstrate its stability following procedures similar to those provided in 40 CFR 53.23. Ambient-level analyzers are exempt from the MST requirements of section 16.3. A copy of this information must be included in each test report. Table 7E–5 lists the criteria to be met.

3.13 Measurement System means all of the equipment used to determine the NO_X concentration. The measurement system comprises six major subsystems: Sample acquisition, sample transport, sample conditioning, calibration gas manifold, gas analyzer, and data recorder.

3.14 Response Time means the time it takes the measurement system to respond to a change in gas concentration occurring at the sampling point when the system is operating normally at its target sample flow rate or dilution ratio.

3.15 Run means a series of gas samples taken successively from the stack or duct. A test normally consists of a specific number of runs.

3.16 System Bias means the difference between a calibration gas measured in direct calibration mode and in system calibration mode. System bias is determined before and after each run at the low- and mid- or high-concentration levels. For dilution-type systems, pre- and post-run system calibration error is measured rather than system bias.

3.17 System Calibration Error applies to dilution-type systems and means the difference between the measured concentration of low-, mid-, or high-level calibration gas and the certified concentration for each gas when introduced in system calibration mode. For dilution-type systems, a 3-point system calibration error test is conducted in lieu of the analyzer calibration error test, and 2-point system calibration error tests are conducted in lieu of system bias tests.

3.18 System Calibration Mode means introducing the calibration gases into the measurement system at the probe, upstream of the filter and all sample conditioning components.

3.19 Test refers to the series of runs required by the applicable regulation.

4.0 Interferences

Note that interferences may vary among instruments and that instrument-specific interferences must be evaluated through the interference test.

5.0 Safety

What safety measures should I consider when using this method? This method may require you to work with hazardous materials and in hazardous conditions. We encourage you to establish safety procedures before using the method. Among other precautions, you should become familiar with the safety recommendations in the gas analyzer user's manual. Occupational Safety and Health Administration (OSHA) regulations concerning cylinder and noxious gases may apply. Nitric oxide and NO_2 are toxic and dangerous gases. Nitric oxide is immediately converted to NO_2 upon reaction with air. Nitrogen dioxide is a highly poisonous and insidious gas. Inflammation of the lungs from exposure may cause only slight pain or pass unnoticed, but the resulting edema several days later may cause death. A concentration of 100 ppm is dangerous for even a short exposure, and 200 ppm may be fatal. Calibration gases must be handled with utmost care and with adequate ventilation. Emission-level exposure to these gases should be avoided.

6.0 Equipment and Supplies

The performance criteria in this method will be met or exceeded if you are properly using equipment designed for this application.

6.1 What do I need for the measurement system? You may use any equipment and supplies meeting the following specifications:

(1) Sampling system components that are not evaluated in the system bias or system calibration error test must be glass, Teflon, or stainless steel. Other materials are potentially acceptable, subject to approval by the Administrator.

(2) The interference, calibration error, and system bias criteria must be met.

(3) Sample flow rate must be maintained within 10 percent of the flow rate at which the system response time was measured.

(4) All system components (excluding sample conditioning components, if used) must maintain the sample temperature above the moisture dew point. Ensure minimal contact between any condensate and the sample gas. Section 6.2 provides example equipment specifications for a NO_X measurement system. Figure 7E–1 is a diagram of an example dry-basis measurement system that is likely to meet the method requirements and is provided as guidance. For wet-basis systems, you may use alternative equipment and supplies as needed (some of which are described in Section 6.2), provided that the measurement system meets the applicable performance specifications of this method.

6.2 Measurement System Components

6.2.1 Sample Probe. Glass, stainless steel, or other approved material, of sufficient length to traverse the sample points.

6.2.2 Particulate Filter. An in-stack or out-of-stack filter. The filter must be made of material that is non-reactive to the gas being sampled. The filter media for out-of-stack filters must be included in the system bias test. The particulate filter requirement may be waived in applications where no significant particulate matter is expected (*e.g.*, for emission testing of a combustion turbine firing natural gas).

6.2.3 Sample Line. The sample line from the probe to the conditioning system/sample pump should be made of Teflon or other material that does not absorb or otherwise alter the sample gas. For a dry-basis measurement system (as shown in Figure 7E–1), the temperature of the sample line must be maintained at a sufficiently high level to prevent condensation before the sample conditioning components. For wet-basis measurement systems, the temperature of the sample line must be maintained at a sufficiently high level to prevent condensation before the analyzer.

6.2.4 Conditioning Equipment. For dry basis measurements, a condenser, dryer or other suitable device is required to remove moisture continuously from the sample gas. Any equipment needed to heat the probe or sample line to avoid condensation prior to the sample conditioning component is also required.

For wet basis systems, you must keep the sample above its dew point either by: (1) Heating the sample line and all sample transport components up to the inlet of the analyzer (and, for hot-wet extractive systems, also heating the analyzer) or (2) by diluting the sample prior to analysis using a dilution probe system. The components required to do either of the above are considered to be conditioning equipment.

6.2.5 Sampling Pump. For systems similar to the one shown in Figure 7E–1, a leak-free pump is needed to pull the sample gas through the system at a flow rate sufficient to minimize the response time of the measurement system. The pump may be constructed of any material that is non-reactive to the gas being sampled. For dilution-type measurement systems, an ejector pump (eductor) is used to create a vacuum that draws the sample through a critical orifice at a constant rate.

6.2.6 Calibration Gas Manifold. Prepare a system to allow the introduction of calibration gases either directly to the gas analyzer in direct calibration mode or into the measurement system, at the probe, in system calibration mode, or both, depending upon the type of system used. In system calibration mode, the system should be able to flood the sampling probe and vent excess gas. Alternatively, calibration gases may be introduced at the calibration valve following the probe. Maintain a constant pressure in the gas manifold. For in-stack dilution-type systems, a gas dilution subsystem is required to transport large volumes of purified air to the sample probe and a probe controller is needed to maintain the proper dilution ratio.

6.2.7 Sample Gas Manifold. For the type of system shown in Figure 7E–1, the sample gas manifold diverts a portion of the sample to the analyzer, delivering the remainder to the by-pass discharge vent. The manifold should also be able to introduce calibration gases directly to the analyzer (except for dilution-type systems). The manifold must be made of material that is non-reactive to the gas sampled or the calibration gas and be configured to safely discharge the bypass gas.

6.2.8 NO_X Analyzer. An instrument that continuously measures NO_X in the gas stream and meets the applicable specifications in section 13.0. An analyzer that operates on the principle of chemiluminescence with an NO_2 to NO converter is one example of an analyzer that has been used successfully in the past. Analyzers operating on other principles may also be used provided the performance criteria in section 13.0 are met.

6.2.8.1 Dual Range Analyzers. For certain applications, a wide range of gas concentrations may be encountered, necessitating the use of two measurement ranges. Dual-range analyzers are readily available for these applications. These analyzers are often equipped with automated range-switching capability, so that when readings exceed the full-scale of the low measurement range, they are recorded on the high range. As an alternative to using a dual-range analyzer, you may use two segments of a single, large measurement scale to serve as the low and high ranges. In all cases, when two ranges are used, you must quality-assure both ranges using the proper sets of calibration gases. You must also meet the interference, calibration error, system bias, and drift checks. However, we caution that when you use two segments of a large measurement scale for dual range purposes, it may be difficult to meet the performance specifications on the low range due to signal-to-noise ratio considerations.

6.2.8.2 Low Concentration Analyzer. When an analyzer is routinely calibrated with a calibration span of 20 ppmv or less, the manufacturer's stability test (MST) is required. See Table 7E–5 for test parameters.

6.2.9 Data Recording. A strip chart recorder, computerized data acquisition system, digital recorder, or data logger for recording measurement data may be used.

7.0 Reagents and Standards

7.1 Calibration Gas. What calibration gases do I need? Your calibration gas must be NO in N_2 and certified (or recertified) within an uncertainty of 2.0 percent in accordance with ''EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards'' September 1997, as amended August 25, 1999, EPA–600/R–97/121. Blended gases meeting the Traceability Protocol are allowed if the additional gas components are shown not to interfere with the analysis. If a zero gas is used for the low-level gas, it must meet the requirements under the definition for ''zero air material'' in 40 CFR 72.2. The calibration gas must not be used after its expiration date. Except for applications under part 75 of this chapter, it is acceptable to prepare calibration gas mixtures from EPA Traceability Protocol gases in accordance with Method 205 in appendix M to part 51 of this chapter. For part 75 applications, the use of Method 205 is subject to the approval of the Administrator. The goal and recommendation for selecting calibration gases is to bracket the sample concentrations. The following calibration gas concentrations are required:

7.1.1 *High-Level Gas*. This concentration is chosen to set the calibration span as defined in Section 3.4.

7.1.2 Mid-Level Gas. 40 to 60 percent of the calibration span.

7.1.3 Low-Level Gas. Less than 20 percent of the calibration span.

7.1.4 Converter Efficiency Gas. What reagents do I need for the converter efficiency test? The converter efficiency gas is a manufacturer-certified gas with a concentration sufficient to show NO_2 conversion at the concentrations encountered in the source. A test gas concentration in the 40 to 60 ppm range is suggested, but other concentrations may be more appropriate to specific sources. For the test described in section 8.2.4.1, NO_2 is required. For the alternative converter efficiency tests in section 16.2, NO is required.

7.2 Interference Check. What reagents do I need for the interference check? Use the appropriate test gases listed in Table 7E–3 or others not listed that can potentially interfere (as indicated by the test facility type, instrument manufacturer, etc.) to conduct the interference check. These gases should be manufacturer certified but do not have to be prepared by the EPA traceability protocol.

8.0 Sample Collection, Preservation, Storage, and Transport

Emission Test Procedure

Since you are allowed to choose different options to comply with some of the performance criteria, it is your responsibility to identify the specific options you have chosen, to document that the performance criteria for that option have been met, and to identify any deviations from the method.

8.1 What sampling site and sampling points do I select?

8.1.1 Unless otherwise specified in an applicable regulation or by the Administrator, when this method is used to determine compliance with an emission standard, conduct a stratification test as described in section 8.1.2 to determine the sampling traverse points to be used. For performance testing of continuous emission monitoring systems, follow the sampling site selection and traverse point layout procedures described in the appropriate performance specification or applicable regulation (e.g., Performance Specification 2 in appendix B to this part).

8.1.2 Determination of Stratification. Perform a stratification test at each test site to determine the appropriate number of sample traverse points. If testing for multiple pollutants or diluents at the same site, a stratification test using only one pollutant or diluent satisfies this requirement. A stratification test is not required for small stacks that are less than 4 inches in diameter. To test for stratification, use a probe of appropriate length to measure the NO_X (or pollutant of interest) concentration at 12 traverse points located according to Table 1–1 or Table 1–2 of Method 1. Alternatively, you may measure at three points on a line passing through the centroidal area. Space the three points at 16.7, 50.0, and 83.3 percent of the measurement line. Sample for a minimum of twice the system response time (see section 8.2.6) at each traverse point. Calculate the individual point and mean NO_X concentrations. If the concentration at each traverse point differs from the mean concentration for all traverse points by no more than: ±5.0 percent of the mean concentration; or ±0.5 ppm (whichever is less restrictive), the gas stream is considered unstratified, and you may collect samples from a single point that most closely matches the mean. If the 5.0 percent or 0.5 ppm criterion is not met, but the concentration at each traverse point differs from the mean concentration for all traverse points by not more than: ±10.0 percent of the mean concentration; or ±1.0 ppm (whichever is less restrictive), the gas stream is considered to be minimally stratified and you may take samples from three points. Space the three points at 16.7, 50.0, and 83.3 percent of the measurement line. Alternatively, if a 12-point stratification test was performed and the emissions were shown to be minimally stratified (all points within ± 10.0 percent of their mean or within ±1.0 ppm), and if the stack diameter (or equivalent diameter, for a rectangular stack or duct) is greater than 2.4 meters (7.8 ft), then you may use 3-point sampling and locate the three points along the measurement line exhibiting the highest average concentration during the stratification test at 0.4, 1.2 and 2.0 meters from the stack or duct wall. If the gas stream is found to be stratified because the 10.0 percent or 1.0 ppm criterion for a 3-point test is not met, locate 12 traverse points for the test in accordance with Table 1–1 or Table 1–2 of Method 1.

8.2 Initial Measurement System Performance Tests. What initial performance criteria must my system meet before I begin collecting samples? Before measuring emissions, perform the following procedures:

(a) Calibration gas verification,
(b) Measurement system preparation,
(c) Calibration error test,
(d) NO_2 to NO conversion efficiency test, if applicable,
(e) System bias check,
(f) System response time test, and
(g) Interference check

8.2.1 Calibration Gas Verification. How must I verify the concentrations of my calibration gases? Obtain a certificate from the gas manufacturer documenting the quality of the gas. Confirm that the manufacturer certification is complete and current. Ensure that your calibration gas certifications have not expired. This documentation should be available on-site for inspection. To the extent practicable, select a high-level gas concentration that will result in the measured emissions being between 20 and 100 percent of the calibration span.

8.2.2 Measurement System Preparation. How do I prepare my measurement system? Assemble, prepare, and precondition the measurement system according to your standard operating procedure. Adjust the system to achieve the correct sampling rate or dilution ratio (as applicable).

8.2.3 Calibration Error Test. How do I confirm my analyzer calibration is correct? After you have assembled, prepared and calibrated your sampling system and analyzer, you must conduct a 3-point analyzer calibration error test (or a 3-point system calibration error test for dilution systems) before the first run and again after any failed system bias test (or 2-point system calibration error test for dilution systems) or failed drift test. Introduce the low-, mid-, and high-level calibration gases sequentially. For non-dilution-type measurement systems, introduce the gases in direct calibration mode. For dilution-type measurement systems, introduce the gases in system calibration mode.

(1) For non-dilution systems, you may adjust the system to maintain the correct flow rate at the analyzer during the test, but you may not make adjustments for any other purpose. For dilution systems, you must operate the measurement system at the appropriate dilution ratio during all system calibration error checks, and may make only the adjustments necessary to maintain the proper ratio.

(2) Record the analyzer's response to each calibration gas on a form similar to Table 7E–1. For each calibration gas, calculate the analyzer calibration error using Equation 7E–1 in section 12.2 or the system calibration error using Equation 7E–3 in section 12.4 (as applicable). The calibration error specification in section 13.1 must be met for the low-, mid-, and high-level gases. If the calibration error specification is not met, take corrective action and repeat the test until an acceptable 3-point calibration is achieved.

8.2.4 NO_2 to NO Conversion Efficiency Test. Before or after each field test, you must conduct an NO_2 to NO conversion efficiency test if your system converts NO_2 to NO before analyzing for NO_X. You may risk testing multiple facilities before performing this test provided you pass this test at the conclusion of the final facility test. A failed final conversion efficiency test in this case will invalidate all tests performed subsequent to the test in which the converter efficiency test was passed. Follow the procedures in section 8.2.4.1, or 8.2.4.2. If desired, the converter efficiency factor derived from this test may be used to correct the test results for converter efficiency if the NO_2 fraction in the measured test gas is known. Use Equation 7E–8 in section 12.8 for this correction.

8.2.4.1 Introduce NO_2 converter efficiency gas to the analyzer in direct calibration mode and record the NO_X concentration displayed by the analyzer. Calculate the converter efficiency using Equation 7E–7 in section 12.7. The specification for converter efficiency in section 13.5 must be met. The user is cautioned that state-of-the-art NO_2 calibration gases may have limited shelf lives, and this could affect the ability to pass the 90-percent conversion efficiency requirement.

8.2.4.2 Alternatively, either of the procedures for determining conversion efficiency using NO in section 16.2 may be used.

8.2.5 Initial System Bias and System Calibration Error Checks. Before sampling begins, determine whether the high-level or mid-level calibration gas best approximates the emissions and use it as the upscale gas. Introduce the upscale gas at the probe upstream of all sample conditioning components in system calibration mode. Record the time it takes for the measured concentration to increase to a value that is at least 95 percent or within 0.5 ppm (whichever is less restrictive) of a stable response for both the low-level and upscale gases. Continue to observe the gas concentration reading until it has reached a final, stable value. Record this value on a form similar to Table 7E–2.

(1) Next, introduce the low-level gas in system calibration mode and record the time required for the concentration response to decrease to a value that is within 5.0 percent or 0.5 ppm (whichever is less restrictive) of the certified low-range gas concentration. If the low-level gas is a zero gas, use the procedures described above and observe the change in concentration until the response is 0.5 ppm or 5.0 percent of the upscale gas concentration (whichever is less restrictive).

(2) Continue to observe the low-level gas reading until it has reached a final, stable value and record the result on a form similar to Table 7E–2. Operate the measurement system at the normal sampling rate during all system bias checks. Make only the adjustments necessary to achieve proper calibration gas flow rates at the analyzer.

(3) From these data, calculate the measurement system response time (see section 8.2.6) and then calculate the initial system bias using Equation 7E–2 in section 12.3. For dilution systems, calculate the system calibration error in lieu of system bias using

equation 7E–3 in section 12.4. See section 13.2 for acceptable performance criteria for system bias and system calibration error. If the initial system bias (or system calibration error) specification is not met, take corrective action. Then, you must repeat the applicable calibration error test from section 8.2.3 and the initial system bias (or 2-point system calibration error) check until acceptable results are achieved, after which you may begin sampling.

(NOTE: For dilution-type systems, data from the 3-point system calibration error test described in section 8.2.3 may be used to meet the initial 2-point system calibration error test requirement of this section, if the calibration gases were injected as described in this section, and if response time data were recorded).

8.2.6 Measurement System Response Time. As described in section 8.2.5, you must determine the measurement system response time during the initial system bias (or 2-point system calibration error) check. Observe the times required to achieve 95 percent of a stable response for both the low-level and upscale gases. The longer interval is the response time.

8.2.7 Interference Check. Conduct an interference response test of the gas analyzer prior to its initial use in the field. If you have multiple analyzers of the same make and model, you need only perform this alternative interference check on one analyzer. You may also meet the interference check requirement if the instrument manufacturer performs this or a similar check on an analyzer of the same make and model of the analyzer that you use and provides you with documented results.

(1) You may introduce the appropriate interference test gases (that are potentially encountered during a test; see examples in Table 7E–3) into the analyzer separately or as mixtures. Test the analyzer with the interference gas alone at the highest concentration expected at a test source and again with the interference gas and NO_X at a representative NO_X test concentration. For analyzers measuring NO_X greater than 20 ppm, use a calibration gas with a NO_X concentration of 80 to 100 ppm and set this concentration equal to the calibration span. For analyzers measuring less than 20 ppm NO_X, select an NO concentration for the calibration span that reflects the emission levels at the sources to be tested, and perform the interference check at that level. Measure the total interference response of the analyzer to these gases in ppmv. Record the responses and determine the interference using Table 7E–4. The specification in section 13.4 must be met.

(2) A copy of this data, including the date completed and signed certification, must be available for inspection at the test site and included with each test report. This interference test is valid for the life of the instrument unless major analytical components (*e.g.*, the detector) are replaced with different model parts. If major components are replaced with different model parts, the interference gas check must be repeated before returning the analyzer to service. If major components are replaced, the interference gas check must be repeated before returning the analyzer to service. The tester must ensure that any specific technology, equipment, or procedures that are intended to remove interference effects are operating properly during testing.

8.3 Dilution-Type Systems—Special Considerations. When a dilution-type measurement system is used, there are three important considerations that must be taken into account to ensure the quality of the emissions data. First, the critical orifice size and dilution ratio must be selected properly so that the sample dew point will be below the sample line and analyzer temperatures. Second, a high-quality, accurate probe controller must be used to maintain the dilution ratio during the test. The probe controller should be capable of monitoring the dilution air pressure, eductor vacuum, and sample flow rates. Third, differences between the molecular weight of calibration gas mixtures and the stack gas molecular weight must be addressed because these can affect the dilution ratio and introduce measurement bias.

8.4 Sample Collection.

(1) Position the probe at the first sampling point. Purge the system for at least two times the response time before recording any data. Then, traverse all required sampling points, sampling at each point for an equal length of time and maintaining the appropriate sample flow rate or dilution ratio (as applicable). You must record at least one valid data point per minute during the test run.

(2) Each time the probe is removed from the stack and replaced, you must recondition the sampling system for at least two times the system response time prior to your next recording. If the average of any run exceeds the calibration span value, that run is invalid.

(3) You may satisfy the multipoint traverse requirement by sampling sequentially using a single-hole probe or a multi-hole probe designed to sample at the prescribed points with a flow within 10 percent of mean flow rate. Notwithstanding, for applications under part 75 of this chapter, the use of multi-hole probes is subject to the approval of the Administrator.

8.5 Post-Run System Bias Check and Drift Assessment.

How do I confirm that each sample I collect is valid? After each run, repeat the system bias check or 2-point system calibration error check (for dilution systems) to validate the run. Do not make adjustments to the measurement system (other than to maintain the target sampling rate or dilution ratio) between the end of the run and the completion of the post-run system bias or system calibration error check. Note that for all post-run system bias or 2-point system calibration error checks, you may inject the low-level gas first and the upscale gas last, or vice-versa. You may risk sampling for multiple runs before performing the post-run bias or system calibration error check provided you pass this test at the conclusion of the group of runs. A failed final test in this case will invalidate all runs subsequent to the last passed test.

(1) If you do not pass the post-run system bias (or system calibration error) check, then the run is invalid. You must diagnose and fix the problem and pass another calibration error test (Section 8.2.3) and system bias (or 2-point system calibration error) check (Section 8.2.5) before repeating the run. Record the system bias (or system calibration error) results on a form similar to Table 7E–2.

(2) After each run, calculate the low-level and upscale drift, using Equation 7E–4 in section 12.5. If the post-run low- and upscale bias (or 2-point system calibration error) checks are passed, but the low-or upscale drift exceeds the specification in section 13.3, the run data are valid, but a 3-point calibration error test and a system bias (or 2-point system calibration error) check must be performed and passed before any more test runs are done.

(3) For dilution systems, data from a 3-point system calibration error test may be used to met the pre-run 2-point system calibration error requirement for the first run in a test sequence. Also, the post-run bias (or 2-point calibration error) check data may be used as the pre-run data for the next run in the test sequence at the discretion of the tester.

8.6 Alternative Interference and System Bias Checks (Dynamic Spike Procedure). If I want to use the dynamic spike procedure to validate my data, what procedure should I follow? Except for applications under part 75 of this chapter, you may use the dynamic spiking procedure and requirements provided in section 16.1 during each test as an alternative to the interference check and the pre- and post-run system bias checks. The calibration error test is still required under this option. Use of the dynamic spiking procedure for Part 75 applications is subject to the approval of the Administrator.

8.7 Moisture correction. You must determine the moisture content of the flue gas and correct the measured gas concentrations to a dry basis using Method 4 or other appropriate methods, subject to the approval of the Administrator, when the moisture basis (wet or dry) of the measurements made with this method is different from the moisture basis of either: (1) The applicable emissions limit; or (2) the CEMS being evaluated for relative accuracy. Moisture correction is also required if the applicable limit is in lb/mmBtu and the moisture basis of the Method 7E NO_X analyzer is different from the moisture basis of the Method 3A diluent gas (CO_2 or O_2) analyzer.

9.0 Quality Control

What quality control measures must I take?

The following table is a summary of the mandatory, suggested, and alternative quality assurance and quality control measures and the associated frequency and acceptance criteria. All of the QC data, along with the sample run data, must be documented and included in the test report.

SUMMARY TABLE OF AQ/QC

Status	Process or element	QA/QC specification	Acceptance criteria	Checking frequency
S	Identify Data User		Regulatory Agency or other primary end user of data.	Before designing test.
S	Analyzer Design	Analyzer resolution or sensitivity.	<2.0% of full-scale range	Manufacturer design.
M		Interference gas check.	Sum of responses ≤2.5% of calibration span Alternatively, sum of responses: ≤0.5 ppmv for calibration spans of 5 to 10 ppmv. ≤0.2 ppmv for calibration spans <5 ppmv. See Table 7E-3.	
M	Calibration Gases	Traceability protocol (G1, G2).	Valid certificate required Uncertainty ≤2.0% of tag value.	
M		High-level gas	Equal to the calibration span	Each test.
M		Mid-level gas	40 to 60% of calibration span	Each test.
M		Low-level gas	<20% of calibration span	Each test.
S	Data Recorder Design.	Data resolution	≤0.5% of full-scale range	Manufacturer design.
S	Sample Extraction	Probe material	SS or quartz if stack >500 °F	East test.
M	Sample Extraction	Probe, filter and sample line temperature.	For dry-basis analyzers, keep sample above the dew point by heating, prior to sample conditioning.	Each run.

SUMMARY TABLE OF AQ/QC—Continued

Status	Process or element	QA/QC specification	Acceptance criteria	Checking frequency
			For wet-basis analyzers, keep sample above dew point at all times, by heating or dilution.	
S	Sample Extraction	Calibration valve material.	SS	Each test.
S	Sample Extraction	Sample pump material.	Inert to sample constituents	Each test.
S	Sample Extraction	Manifolding material	Inert to sample constituents	Each test.
S	Moisture Removal	Equipment efficiency	<5% target compound removal	Verified through system bias check.
S	Particulate Removal	Filter inertness	Pass system bias check	Each bias check.
M	Analyzer & Calibration Gas Performance.	Analyzer calibration error (of 3-point system calibration error for dilution systems).	Within ±2.0 percent of the calibration span of the analyzer for the low-, mid-, and high-level calibration gases. Alternative specification: ≤0.5 ppmv absolute difference.	Before initial run and after a failed system bias test or drift test.
M	System Performance	System bias (or pre- and post-run 2-point system calibration error for dilution (Systems).	Within ±5.0% of the analyzer calibration span for low-sacle and upscale calibration gases. Alternative specification: ≤0.5 ppmv absolute difference.	Before and after each run.
M	System Performance	System response time.	Determines minimum sampling time per point.	During initial sampling system bias test.
M	System Performance	Drift	≤3.0% of calibration span for low-level and mid- or high-level gases. Alternative specification: ≤0.5 ppmv absolute difference.	After each test run.
M	System Performance	NO_2-NO conversion efficiency.	≥90% of certified test gas concentration	Before or after each test.
M	System Performance	Purge time	≥2 times system response time	Before starting the first run and when probe is removed from and re-inserted into the stack.
M	System Performance	Minimum sample time at each point.	Two times the system response time	Each sample point.
M	System Performance	Stable sample flow rate (surrogate for maintaining system response time).	Within 10% of flow rate established during system response time check.	Each run.
M	Sample Point Selection.	Stratification test	All points within: ±5% of mean for 1-point sampling. ±10% of mean for 3-point. Alternatively, all points within: ±0.5 ppm of mean for 1-point sampling. ±1.0 ppm of mean for 3-point sampling.	Prior to first run.
A	Multiple sample points simultaneously.	No. of openings in probe.	Multi-hole probe with verifiable constant flow through all holes within 10% of mean flow rate (requires Administrative approval for Part 75).	Each run.
M	Data Recording	Frequency	≤1 minute average	During run.
S	Data Parameters	Sample concentration range.	All 1-minute averages within calibration span.	Each run.
M	Date Parameters	Average concentration for the run.	Run average ≤calibration span	Each run.

S = Suggest.
M = Mandatory.
A = Alternative.
Agency.

10.0 Calibration and Standardization

What measurement system calibrations are required?

(1) The initial 3-point calibration error test as described in section 8.2.3 and the system bias (or system calibration error) checks described in section 8.2.5 are required and must meet the specifications in section 13 before you start the test. Make all necessary adjustments to calibrate the gas analyzer and data recorder. Then, after the test commences, the system bias or system calibration error checks described in section 8.5 are required before and after each run. Your analyzer must be calibrated for all species of NO_X that it detects. Analyzers that measure NO and NO_2 separately without using a converter must be calibrated with both NO and NO_2.

(2) You must include a copy of the manufacturer's certification of the calibration gases used in the testing as part of the test report. This certification must include the 13 documentation requirements in the EPA Traceability Protocol For Assay and Certification of Gaseous Calibration Standards, September 1997, as amended August 25, 1999. When Method 205 is used to produce diluted calibration gases, you must document that the specifications for the gas dilution system are met for the test. You must also include the date of the most recent dilution system calibration against flow standards and the name of the person or manufacturer who carried out the calibration in the test report.

11.0 Analytical Procedures

Because sample collection and analysis are performed together (see section 8), additional discussion of the analytical procedure is not necessary.

12.0 Calculations and Data Analysis

You must follow the procedures for calculations and data analysis listed in this section.

12.1 *Nomenclature.* The terms used in the equations are defined as follows:

ACE = Analyzer calibration error, percent of calibration span.

B_{WS} = Moisture content of sample gas as measured by Method 4 or other approved method, percent/100.

C_{Avg} = Average unadjusted gas concentration indicated by data recorder for the test run, ppmv.

C_D = Pollutant concentration adjusted to dry conditions, ppmv.

C_{Dir} = Measured concentration of a calibration gas (low, mid, or high) when introduced in direct calibration mode, ppmv.

C_{Gas} = Average effluent gas concentration adjusted for bias, ppmv.

C_M = Average of initial and final system calibration bias (or 2-point system calibration error) check responses for the upscale calibration gas, ppmv.

C_{MA} = Actual concentration of the upscale calibration gas, ppmv.

C_{Native} = NO_X concentration in the stack gas as calculated in section 12.6, ppmv.

C_O = Average of the initial and final system calibration bias (or 2-point system calibration error) check responses from the low-level (or zero) calibration gas, ppmv.

C_{OA} = Actual concentration of the low-level calibration gas, ppmv.

C_S = Measured concentration of a calibration gas (low, mid, or high) when introduced in system calibration mode, ppmv.

C_{SS} = Concentration of NO_X measured in the spiked sample, ppmv.

C_{Spike} = Concentration of NO_X in the undiluted spike gas, ppmv.

C_{Calc} = Calculated concentration of NO_X in the spike gas diluted in the sample, ppmv.

C_V = Manufacturer certified concentration of a calibration gas (low, mid, or high), ppmv.

C_W = Pollutant concentration measured under moist sample conditions, wet basis, ppmv.

CS = Calibration span, ppmv.

D = Drift assessment, percent of calibration span.

DF = Dilution system dilution factor or spike gas dilution factor, dimensionless.

Eff_{NO2} = NO_2 to NO converter efficiency, percent.

NO_{XCorr} = The NO_X concentration corrected for the converter efficiency, ppmv.

NOX_{Final} = The final NO_X concentration observed during the converter efficiency test in section 16.2.2, ppmv.

NO_{XPeak} = The highest NO_X concentration observed during the converter efficiency test in section 16.2.2, ppmv.

Q_{Spike} = Flow rate of spike gas introduced in system calibration mode, L/min.

Q_{Total} = Total sample flow rate during the spike test, L/min.

R = Spike recovery, percent.

SB = System bias, percent of calibration span.

SB_i = Pre-run system bias, percent of calibration span.

SB_{final} = Post-run system bias, percent of calibration span.

SCE = System calibration error, percent of calibration span.

SCE_i = Pre-run system calibration error, percent of calibration span.

SCE_{Final} = Post-run system calibration error, percent of calibration span.

12.2 Analyzer Calibration Error. For non-dilution systems, use Equation 7E–1 to calculate the analyzer calibration error for the low-, mid-, and high-level calibration gases.

$$ACE = \frac{C_{Dir} - C_v}{CS} \times 100 \qquad \text{Eq. 7E-1}$$

12.3 System Bias. For non-dilution systems, use Equation 7E–2 to calculate the system bias separately for the low-level and upscale calibration gases.

$$SB = \frac{C_S - C_{Dir}}{CS} \times 100 \qquad \text{Eq. 7E-2}$$

12.4 System Calibration Error. Use Equation 7E–3 to calculate the system calibration error for dilution systems. Equation 7E–3 applies to both the initial 3-point system calibration error test and the subsequent 2-point calibration error checks between test runs. In this equation, the term "C_s" refers to the diluted calibration gas concentration measured by the analyzer.

$$SCE = \frac{\left(C_S \quad DF\right) - C_V}{CS} \times 100 \qquad \text{Eq. 7E-3}$$

12.5 Drift Assessment. Use Equation 7E–4 to separately calculate the low-level and upscale drift over each test run. For dilution systems, replace "SB_{final}" and "SB_i" with "SCE_{final}" and "SCE_i", respectively, to calculate and evaluate drift.

$$D = \left|SB_{final} - SB_i\right| \qquad \text{Eq. 7E-4}$$

12.6 Effluent Gas Concentration. For each test run, calculate C_{avg}, the arithmetic average of all valid NO_X concentration values (*e.g.*, 1-minute averages). Then adjust the value of C_{avg} for bias using Equation 7E–5a if you use a non-zero gas as your low-level calibration gas, or Equation 7E–5b if you use a zero gas as your low-level calibration gas.

$$C_{Gas} = \left(C_{Avg} - C_M\right)\frac{C_{MA} - C_{OA}}{C_M - C_O} + C_{MA} \qquad \text{Eq. 7E-5a}$$

$$C_{Gas} = \left(C_{Avg} - C_O\right)\frac{C_{MA}}{C_M - C_O} \qquad \text{Eq. 7E-5b}$$

12.7 NO_2—NO Conversion Efficiency. If the NO_X converter efficiency test described in section 8.2.4.1 is performed, calculate the efficiency using Equation 7E–7.

$$Eff_{NO2} = \frac{C_{Dir}}{C_V} \times 100 \qquad \text{Eq. 7E-7}$$

12.8 NO_2—NO Conversion Efficiency Correction. If desired, calculate the total NO_X concentration with a correction for converter efficiency using Equation 7E–8.

$$NO_{x\,Corr} = NO + \left(\frac{(NO_x - NO)}{Eff_{NO_2}} x\ 100\right) \qquad \text{Eq. 7E-8}$$

12.9 Alternative NO_2 Converter Efficiency. If the alternative procedure of section 16.2.2 is used, determine the NO_X concentration decrease from NO_{XPeak} after the minimum 30-minute test interval using Equation 7E–9.

This decrease from NO_{XPeak} must meet the requirement in section 13.5 for the converter to be acceptable.

$$\% Decrease = \frac{NO_{XPeak} - NO_{XFinal}}{NO_{XPeak}} \times 100 \qquad \text{Eq. 7E-9}$$

12.10 Moisture Correction. Use Equation 7E–10 if your measurements need to be corrected to a dry basis.

$$C_D = \frac{C_W}{1 - B_{WS}} \qquad \text{Eq. 7E-10}$$

12.11 Calculated Spike Gas Concentration and Spike Recovery for the Example Alternative Dynamic Spiking Procedure in section 16.1.3. Use Equation 7E–11 to determine the calculated spike gas concentration. Use Equation 7E–12 to calculate the spike recovery.

$$C_{Calc} = \frac{\left(C_{Spike}\right)\left(Q_{Spike}\right)}{Q_{Total}} \qquad \text{Eq. 7E-11}$$

$$R = \frac{DF\left(C_{ss} - C_{native}\right) + C_{native}}{C_{Spike}} \times 100 \qquad \text{Eq. } 7E\text{-}12$$

13.0 Method Performance

13.1 Calibration Error. This specification is applicable to both the analyzer calibration error and the 3-point system calibration error tests described in section 8.2.3. At each calibration gas level (low, mid, and high) the calibration error must either be within ±2.0 percent of the calibration span. Alternatively, the results are acceptable if $|C_{dir} - C_v|$ or $|C_s - C_v|$ (as applicable) is ≤0.5 ppmv.

13.2 System Bias. This specification is applicable to both the system bias and 2-point system calibration error tests described in section 8.2.5 and 8.5. The pre- and post-run system bias (or system calibration error) must be within ±5.0 percent of the calibration span for the low-level and upscale calibration gases. Alternatively, the results are acceptable if $| C_s - C_{dir} |$ is ≤0.5 ppmv or if $| C_s - C_v |$ is ≤0.5 ppmv (as applicable).

13.3 Drift. For each run, the low-level and upscale drift must be less than or equal to 3.0 percent of the calibration span. The drift is also acceptable if the pre- and post-run bias (or the pre- and post-run system calibration error) responses do not differ by more than 0.5 ppmv at each gas concentration (i.e. $| C_{s\ post\text{-}run} - C_{s\ pre\text{-}run} |$ ≤0.5 ppmv).

13.4 Interference Check. The total interference response (i.e., the sum of the interference responses of all tested gaseous components) must not be greater than 2.50 percent of the calibration span for the analyzer tested. In summing the interferences, use the larger of the absolute values obtained for the interferent tested with and without the pollutant present. The results are also acceptable if the sum of the responses does not exceed 0.5 ppmv for a calibration span of 5 to 10 ppmv, or 0.2 ppmv for a calibration span <5 ppmv.

13.5 NO_2 to NO Conversion Efficiency Test (as applicable). The NO_2 to NO conversion efficiency, calculated according to Equation 7E–7, must be greater than or equal to 90 percent. The alternative conversion efficiency check, described in section 16.2.2 and calculated according to Equation 7E–9, must not result in a decrease from NO_{XPeak} by more than 2.0 percent.

13.6 Alternative Dynamic Spike Procedure. Recoveries of both pre-test spikes and post-test spikes must be within 100 ±10 percent. If the absolute difference between the calculated spike value and measured spike value is equal to or less than 0.20 ppmv, then the requirements of the ADSC are met.

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 Alternative Procedures

16.1 Dynamic Spike Procedure. Except for applications under part 75 of this chapter, you may use a dynamic spiking procedure to validate your test data for a specific test matrix in place of the interference check and pre- and post-run system bias checks. For part 75 applications, use of this procedure is subject to the approval of the Administrator.

Best results are obtained for this procedure when source emissions are steady and not varying. Fluctuating emissions may render this alternative procedure difficult to pass. To use this alternative, you must meet the following requirements.

16.1.1 Procedure Documentation. You must detail the procedure you followed in the test report, including how the spike was measured, added, verified during the run, and calculated after the test.

16.1.2 Spiking Procedure Requirements. The spikes must be prepared from EPA Traceability Protocol gases. Your procedure must be designed to spike field samples at two target levels both before and after the test. Your target spike levels should bracket the average sample NO_X concentrations. The higher target concentration must be less than the calibration span. You must collect at least 5 data points for each target concentration. The spiking procedure must be performed before the first run and repeated after the last run of the test program.

16.1.3 Example Spiking Procedure. Determine the NO concentration needed to generate concentrations that are 50 and 150 percent of the anticipated NO_X concentration in the stack at the total sampling flow rate while keeping the spike flow rate at or below 10 percent of this total. Use a mass flow meter (accurate within 2.0 percent) to generate these NO spike gas concentrations at a constant flow rate. Use Equation 7E–11 in section 12.11 to determine the calculated spike concentration in the collected sample.

(1) Prepare the measurement system and conduct the analyzer calibration error test as described in sections 8.2.2 and 8.2.3. Following the sampling procedures in section 8.1, determine the stack NO_X concentration and use this concentration as the average stack concentration (C_{avg}) for the first spike level, or if desired, for both pre-test spike levels. Introduce the first level spike gas into the system in system calibration mode and begin sample collection. Wait for at least two times the system response time before measuring the spiked sample concentration. Then record at least five successive 1-minute averages of the spiked sample gas. Monitor the spike gas flow rate and maintain at the determined addition rate. Average the five 1-minute averages and determine the spike recovery using Equation 7E–12. Repeat this procedure for the other pre-test spike level. The recovery at each level must be within the limits in section 13.6 before proceeding with the test.

(2) Conduct the number of runs required for the test. Then repeat the above procedure for the post-test spike evaluation. The last run of the test may serve as the average stack concentration for the post-test spike test calculations. The results of the post-test spikes must meet the limits in section 13.6.

16.2 Alternative NO_2 to NO Conversion Efficiency Procedures. You may use either of the following procedures to determine converter efficiency in place of the procedure in section 8.2.4.1.

16.2.1 The procedure for determining conversion efficiency using NO in 40 CFR 86.123–78.

16.2.2 Bag Procedure. Perform the analyzer calibration error test to document the calibration (both NO and NO_X modes, as applicable). Fill a Tedlar or equivalent bag approximately half full with either ambient air, pure oxygen, or an oxygen standard gas with at least 19.5 percent by volume oxygen content. Fill the remainder of the bag with mid- to high-level NO in N_2 (or other appropriate concentration) calibration gas. (Note that the concentration of the NO standard should be sufficiently high enough for the diluted concentration to be easily and accurately measured on the scale used. The size of the bag should be large enough to accommodate the procedure and time required. Verify through the manufacturer that the Tedlar alternative is suitable for NO and make this verifed information available for inspection.)

(1) Immediately attach the bag to the inlet of the NO_X analyzer (or external converter if used). In the case of a dilution-system, introduce the gas at a point upstream of the dilution assembly. Measure the NO_X concentration for a period of 30 minutes. If the NO_X concentration drops more than 2 percent absolute from the peak value observed, then the NO_2 converter has failed to meet the criteria of this test. Take corrective action. The highest NO_X value observed is considered to be NO_{XPeak}. The final NO_X value observed is considered to be NO_{Xfinal}.

(2) [Reserved]

16.3 Manufacturer's Stability Test. A manufacturer's stability test is required for all analyzers that routinely measure emissions below 20 ppmv and is optional but recommended for other analyzers. This test evaluates each analyzer model by subjecting it to the tests listed in Table 7E–5 following procedures similar to those in 40 CFR 53.23 for thermal stability and insensitivity to supply voltage variations. If the analyzer will be used under temperature conditions that are outside the test conditions in Table B–4 of Part 53.23, alternative test temperatures that better reflect the analyzer field environment should be used. Alternative procedures or documentation that establish the analyzer's stability over the appropriate line voltages and temperatures are acceptable.

17.0 References

1. "ERA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards" September 1997 as amended, ERA–600/R–97/121.

18.0 Tables, Diagrams, Flowcharts, and Validation Data

Figure 7E-1. Measurement System

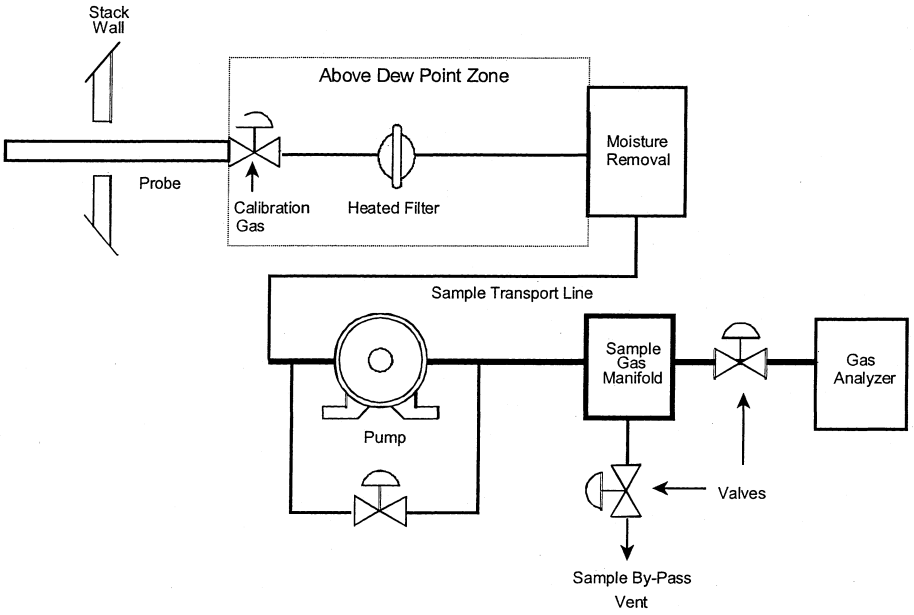
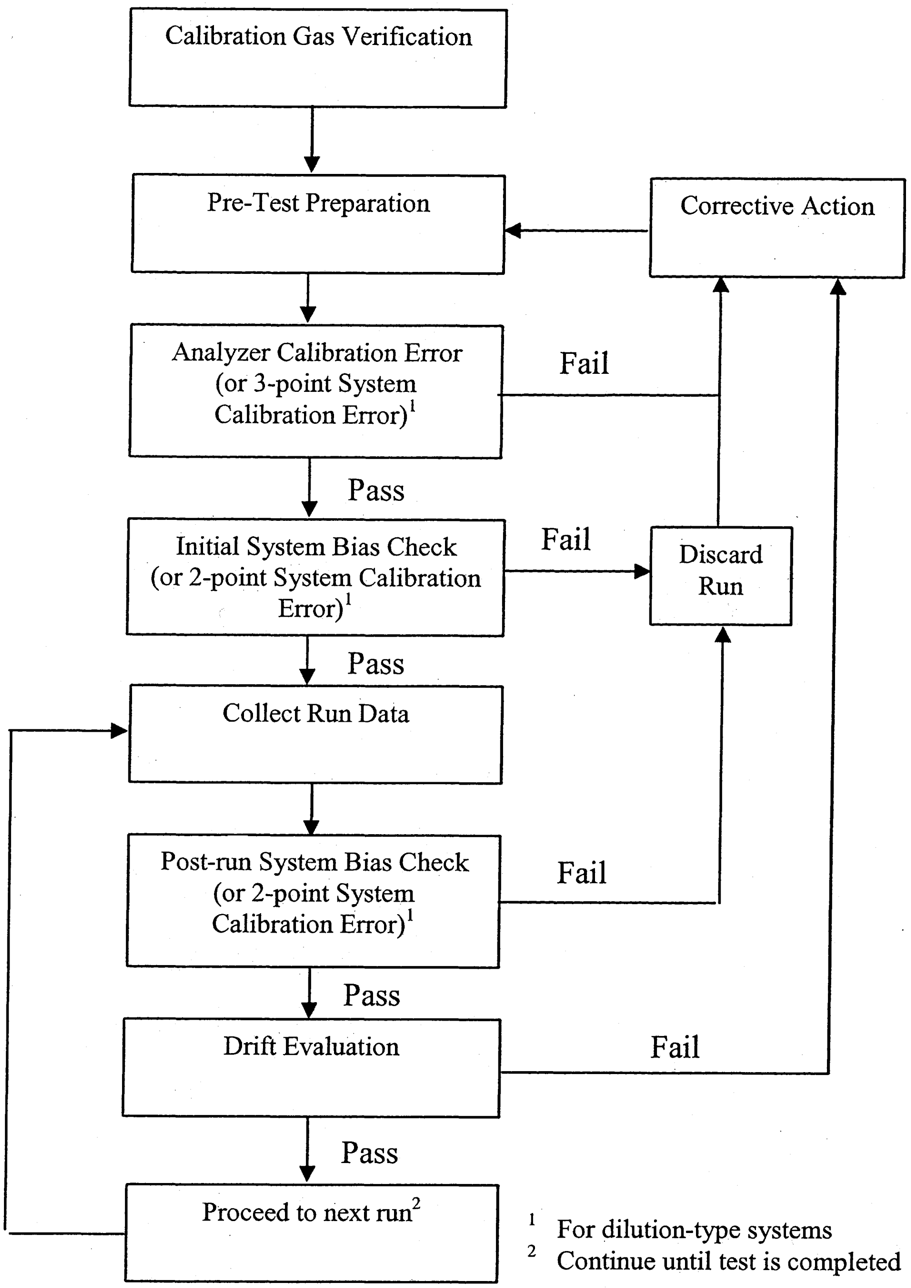


Figure 7E-2. Testing Flow Chart



[1] For dilution-type systems

[2] Continue until test is completed

Table 7E-1 - Analyzer (or System) Calibration Error Data

Source Identification: ______________
Test personnel: ____________________
Date: ______________________________
Time:_______________________________

Analyzer[1] or System[2] calibration error data for sampling runs:_________________________
Analyzer Model No.______________________
Serial No._________________________________
Calibration Span (CS):________

	Manufacturer Certified Cylinder Value (indicate units) A	Analyzer calibration response (indicate units) B	Absolute difference (indicate units) A-B	Calibration Error (percent of calibration span) $\frac{A-B}{CS} \times 100$
Low-level (or zero) calibration gas	....	....	....	....
Mid-level calibration gas	....	....	....	....
High-level calibration gas	....	....	....	....

[1] Refers to data from the analyzer calibration error test of a non-dilution system.
[2] Refers to data from a 3-point system calibration error test of a dilution system.

Table 7E-2 - System Bias (or System Calibration Error) and Drift Data

Source Identification:____________________ Run Number: ____________
Test personnel: ____________________________Calibration Span:_________
Date: ____________________________________ ____ Response Time: ___________
Analyzer Model No. _________________________Serial No.________________

		Initial values		Final values		
Calibration Gas Level	Certified Calibration gas value (indicate units)	System Response (indicate units)	System Bias[1] or Calibration Error[2] (% of calibration span)	System response (indicate units)	System Bias[1] or Calibration Error[2] (% of calibration span)	Drift (% of calibration span)
Low-level gas..........	....	....	....	....	....	
Upscale (high- or mid-) level gas..........	....	....	....	....	....	

[1] Refers to the pre- and post-run system bias checks of a non-dilution system.
[2] Refers to the pre- and post-run system calibration error checks of a dilution system.

TABLE 7E–3—EXAMPLE INTERFERENCE CHECK GAS CONCENTRATIONS

Potential interferent gas [1]	Concentrations [2] sample conditioning type	
	Hot wet	Dried
CO_2	5 and 15%	5 and 15%
H_2O	25%	1%
NO	15 ppmv	15 ppmv
NO_2	15 ppmv	15 ppmv
N_2O	10 ppmv	10 ppmv
CO	50 ppmv	50 ppmv
NH_3	10 ppmv	10 ppmv
CH_4	50 ppmv	50 ppmv
SO_2	20 ppmv	20 ppmv
H_2	50 ppmv	50 ppmv
HCl	10 ppmv	10 ppmv

[1] Any applicable gas may be eliminated or tested at a reduced level if the manufacturer has provided reliable means for limiting or scrubbing that gas to a specified level.

[2] As practicable, gas concentrations should be the highest expected at test sites.

TABLE 7E–4—INTERFERENCE RESPONSE

Date of Test: ________________________

Analyzer Type: ________________________

Model No.: ________________________

Serial No: ________________________

Calibration Span: ________________________

Test gas type	Concentration (ppm)	Analyzer response
	Sum of Responses	
	% of Calibration Span	

TABLE 7E–5—MANUFACTURER STABILITY TEST

Test description	Acceptance criteria (note 1)
Thermal Stability	Temperature range when drift does not exceed 3.0% of analyzer range over a 12-hour run when measured with NO_X present @ 80% of calibration span.
Fault Conditions	Identify conditions which, when they occur, result in performance which is not in compliance with the Manufacturer's Stability Test criteria. These are to be indicated visually or electrically to alert the operator of the problem.
Insensitivity to Supply Voltage Variations.	±10.0% (or manufacturers alternative) variation from nominal voltage must produce a drift of ≤2.0% of calibration span for either zero or concentration ≥80% NO_X present.
Analyzer Calibration Error.	For a low-, medium-, and high-calibration gas, the difference between the manufacturer certified value and the analyzer response in direct calibration mode, no more than 2.0% of calibration span.

Note 1: If the instrument is to be used as a Low Range analyzer, all tests must be performed at a calibration span of 20 ppm or less.

METHOD 8—DETERMINATION OF SULFURIC ACID AND SULFUR DIOXIDE EMISSIONS FROM STATIONARY SOURCES

NOTE: This method does not include all of the specifications (*e.g.*, equipment and supplies) and procedures (*e.g.*, sampling and analytical) essential to its performance. Some material is incorporated by reference from other methods in this part. Therefore, to obtain reliable results, persons using this method should have a thorough knowledge of at least the following additional test methods: Method 1, Method 2, Method 3, Method 5, and Method 6.

1.0 Scope and Application

1.1 Analytes.

Analyte	CAS No.	Sensitivity
Sulfuric acid, including: Sulfuric acid (H_2SO_4) mist, Sulfur trioxide (SO_3).	7664–93–9, 7449–11–9	0.05 mg/m^3 (0.03 × 10^{-7} lb/ft^3).
Sulfur dioxide (SO_2)	7449–09–5	1.2 mg/m^3 (3 × 10^{-9} lb/ft^3).

1.2 Applicability. This method is applicable for the determination of H_2SO_4 (including H_2SO_4 mist and SO_3) and gaseous SO_2 emissions from stationary sources.

NOTE: Filterable particulate matter may be determined along with H_2SO_4 and SO_2 (subject to the approval of the Administrator) by inserting a heated glass fiber filter between the probe and isopropanol impinger (see section 6.1.1 of Method 6). If this option is chosen, particulate analysis is gravimetric only; sulfuric acid is not determined separately.

1.3 Data Quality Objectives. Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods.

2.0 Summary of Method

A gas sample is extracted isokinetically from the stack. The H_2SO_4 and the SO_2 are separated, and both fractions are measured separately by the barium-thorin titration method.

3.0 Definitions [Reserved]

4.0 Interferences

4.1 Possible interfering agents of this method are fluorides, free ammonia, and dimethyl aniline. If any of these interfering agents is present (this can be determined by knowledge of the process), alternative methods, subject to the approval of the Administrator, are required.

5.0 Safety

5.1 Disclaimer. This method may involve hazardous materials, operations, and equipment. This test method may not address all of the safety problems associated with its use. It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to performing this test method.

5.2 Corrosive reagents. Same as Method 6, section 5.2.

6.0 Equipment and Supplies

6.1 Sample Collection. Same as Method 5, section 6.1, with the following additions and exceptions:

6.1.1 Sampling Train. A schematic of the sampling train used in this method is shown in Figure 8–1; it is similar to the Method 5 sampling train, except that the filter position is different, and the filter holder does not have to be heated. See Method 5, section 6.1.1, for details and guidelines on operation and maintenance.

6.1.1.1 Probe Liner. Borosilicate or quartz glass, with a heating system to prevent visible condensation during sampling. Do not use metal probe liners.

6.1.1.2 Filter Holder. Borosilicate glass, with a glass frit filter support and a silicone rubber gasket. Other gasket materials (*e.g.*, Teflon or Viton) may be used, subject to the approval of the Administrator. The holder design shall provide a positive seal against leakage from the outside or around the filter. The filter holder shall be placed between the first and second impingers. Do not heat the filter holder.

6.1.1.3 Impingers. Four, of the Greenburg-Smith design, as shown in Figure 8–1. The first and third impingers must have standard tips. The second and fourth impingers must be modified by replacing the insert with an approximately 13-mm (½-in.) ID glass tube, having an unconstricted tip located 13 mm (½ in.) from the bottom of the impinger. Similar collection systems, subject to the approval of the Administrator, may be used.

6.1.1.4 Temperature Sensor. Thermometer, or equivalent, to measure the temperature of the gas leaving the impinger train to within 1 °C (2 °F).

6.2 Sample Recovery. The following items are required for sample recovery:

6.2.1 Wash Bottles. Two polyethylene or glass bottles, 500-ml.

6.2.2 Graduated Cylinders. Two graduated cylinders (volumetric flasks may be used), 250-ml, 1-liter.

6.2.3 Storage Bottles. Leak-free polyethylene bottles, 1-liter size (two for each sampling run).

6.2.4 Trip Balance. 500-g capacity, to measure to ±0.5 g (necessary only if a moisture content analysis is to be done).

6.3 Analysis. The following items are required for sample analysis:

6.3.1 Pipettes. Volumetric 10-ml, 100-ml.

6.3.2 Burette. 50-ml.

6.3.3 Erlenmeyer Flask. 250-ml (one for each sample, blank, and standard).

6.3.4 Graduated Cylinder. 100-ml.

6.3.5 Dropping Bottle. To add indicator solution, 125-ml size.

7.0 Reagents and Standards

NOTE: Unless otherwise indicated, all reagents are to conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Otherwise, use the best available grade.

7.1 Sample Collection. The following reagents are required for sample collection:

7.1.1 Filters and Silica Gel. Same as in Method 5, sections 7.1.1 and 7.1.2, respectively.

7.1.2 Water. Same as in Method 6, section 7.1.1.

7.1.3 Isopropanol, 80 Percent by Volume. Mix 800 ml of isopropanol with 200 ml of water.

NOTE: Check for peroxide impurities using the procedure outlined in Method 6, section 7.1.2.1.

7.1.4 Hydrogen Peroxide (H^2O^2), 3 Percent by Volume. Dilute 100 ml of 30 percent H_2O_2) to 1 liter with water. Prepare fresh daily.

7.1.5 Crushed Ice.

7.2 Sample Recovery. The reagents and standards required for sample recovery are:

7.2.1 Water. Same as in section 7.1.2.

7.2.2 Isopropanol, 80 Percent. Same as in section 7.1.3.

7.3 Sample Analysis. Same as Method 6, section 7.3.

8.0 Sample Collection, Preservation, Storage, and Transport

8.1 Pretest Preparation. Same as Method 5, section 8.1, except that filters should be inspected but need not be desiccated, weighed, or identified. If the effluent gas can be considered dry (i.e., moisture-free), the silica gel need not be weighed.

8.2 Preliminary Determinations. Same as Method 5, section 8.2.

8.3 Preparation of Sampling Train. Same as Method 5, section 8.3, with the following exceptions:

8.3.1 Use Figure 8–1 instead of Figure 5–1.

8.3.2 Replace the second sentence of Method 5, section 8.3.1 with: Place 100 ml of 80 percent isopropanol in the first impinger, 100 ml of 3 percent H_2O_2 in both the second and third impingers; retain a portion of each reagent for use as a blank solution. Place about 200 g of silica gel in the fourth impinger.

8.3.3 Ignore any other statements in section 8.3 of Method 5 that are obviously not applicable to the performance of Method 8.

NOTE: If moisture content is to be determined by impinger analysis, weigh each of the first three impingers (plus absorbing solution) to the nearest 0.5 g, and record these weights. Weigh also the silica gel (or silica gel plus container) to the nearest 0.5 g, and record.)

8.4 Metering System Leak-Check Procedure. Same as Method 5, section 8.4.1.

8.5 Pretest Leak-Check Procedure. Follow the basic procedure in Method 5, section 8.4.2, noting that the probe heater shall be adjusted to the minimum temperature required to prevent condensation, and also that verbage such as ''* * * plugging the inlet to the filter holder * * * '' found in section 8.4.2.2 of Method 5 shall be replaced by '' * * * plugging the inlet to the first impinger * * * ''. The pretest leak-check is recommended, but is not required.

8.6 Sampling Train Operation. Follow the basic procedures in Method 5, section 8.5, in conjunction with the following special instructions:

8.6.1 Record the data on a sheet similar to that shown in Figure 8–2 (alternatively, Figure 5–2 in Method 5 may be used). The sampling rate shall not exceed 0.030 m^3/min (1.0 cfm) during the run. Periodically during the test, observe the connecting line between the probe and first impinger for signs of condensation. If condensation does occur, adjust the probe heater setting upward to the minimum temperature required to prevent condensation. If component changes become necessary during a run, a leak-check shall be performed immediately before each change, according to the procedure outlined in section 8.4.3 of Method 5 (with appropriate modifications, as mentioned in section 8.5 of this method); record all leak rates. If the leakage rate(s) exceeds the specified rate, the tester shall either void the run or plan to correct the sample volume as outlined in section 12.3 of Method 5. Leak-checks immediately after component changes are recommended, but not required. If these leak-checks are performed, the procedure in section 8.4.2 of Method 5 (with appropriate modifications) shall be used.

8.6.2 After turning off the pump and recording the final readings at the conclusion of each run, remove the probe from the stack. Conduct a post-test (mandatory) leak-check as outlined in section 8.4.4 of Method 5 (with appropriate modifications), and record the leak rate. If the post-test leakage rate exceeds the specified acceptable rate, either correct the sample volume, as outlined in section 12.3 of Method 5, or void the run.

8.6.3 Drain the ice bath and, with the probe disconnected, purge the remaining part of the train by drawing clean ambient air through the system for 15 minutes at the average flow rate used for sampling.

NOTE: Clean ambient air can be provided by passing air through a charcoal filter. Alternatively, ambient air (without cleaning) may be used.

8.7 Calculation of Percent Isokinetic. Same as Method 5, section 8.6.

8.8 Sample Recovery. Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool. Treat the samples as follows:

8.8.1 Container No. 1.

8.8.1.1 If a moisture content analysis is to be performed, clean and weigh the first impinger (plus contents) to the nearest 0.5 g, and record this weight.

8.8.1.2 Transfer the contents of the first impinger to a 250-ml graduated cylinder. Rinse the probe, first impinger, all connecting glassware before the filter, and the front half of the filter holder with 80 percent isopropanol. Add the isopropanol rinse solution to the cylinder. Dilute the contents of the cylinder to 225 ml with 80 percent isopropanol, and transfer the cylinder contents to the storage container. Rinse the cylinder with 25 ml of 80 percent isopropanol, and transfer the rinse to the storage container. Add the filter to the solution in the storage container and mix. Seal the container to protect the solution against evaporation. Mark the level of liquid on the container, and identify the sample container.

8.8.2 Container No. 2.

8.8.2.1 If a moisture content analysis is to be performed, clean and weigh the second and third impingers (plus contents) to the nearest 0.5 g, and record the weights. Also, weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g, and record the weight.

8.8.2.2 Transfer the solutions from the second and third impingers to a 1-liter graduated cylinder. Rinse all connecting glassware (including back half of filter holder) between the filter and silica gel impinger with water, and add this rinse water to the cylinder. Dilute the contents of the cylinder to 950 ml with water. Transfer the solution to a storage container. Rinse the cylinder with 50 ml of water, and transfer the rinse to the storage container. Mark the level of liquid on the container. Seal and identify the sample container.

9.0 Quality Control

9.1 Miscellaneous Quality Control Measures.

Section	Quality control measure	Effect
7.1.3	Isopropanol check	Ensure acceptable level of peroxide impurities in isopropanol.
8.4, 8.5, 10.1	Sampling equipment leak-check and calibration.	Ensure accurate measurement of stack gas flow rate, sample volume.
10.2	Barium standard solution standardization	Ensure normality determination.
11.2	Replicate titrations	Ensure precision of titration determinations.

9.2 Volume Metering System Checks. Same as Method 5, section 9.2.

10.0 Calibration and Standardization

10.1 Sampling Equipment. Same as Method 5, section 10.0.

10.2 Barium Standard Solution. Same as Method 6, section 10.5.

11.0 Analytical Procedure

11.1. Sample Loss. Same as Method 6, section 11.1.

11.2. Sample Analysis.

11.2.1 Container No. 1. Shake the container holding the isopropanol solution and the filter. If the filter breaks up, allow the fragments to settle for a few minutes before removing a sample aliquot. Pipette a 100-ml aliquot of this solution into a 250-ml Erlenmeyer flask, add 2 to 4 drops of thorin indicator, and titrate to a pink endpoint using 0.0100 N barium standard solution. Repeat the titration with a second aliquot of sample, and average the titration values. Replicate titrations must agree within 1 percent or 0.2 ml, whichever is greater.

11.2.2 Container No. 2. Thoroughly mix the solution in the container holding the contents of the second and third impingers. Pipette a 10-ml aliquot of sample into a 250-ml Erlenmeyer flask. Add 40 ml of isopropanol, 2 to 4 drops of thorin indicator, and titrate to a pink endpoint using 0.0100 N barium standard solution. Repeat the titration with a second aliquot of sample, and average the titration values. Replicate titrations must agree within 1 percent or 0.2 ml, whichever is greater.

11.2.3 Blanks. Prepare blanks by adding 2 to 4 drops of thorin indicator to 100 ml of 80 percent isopropanol. Titrate the blanks in the same manner as the samples.

12.0 Data Analysis and Calculations

Carry out calculations retaining at least one extra significant figure beyond that of the acquired data. Round off figures after final calculation.

12.1 Nomenclature. Same as Method 5, section 12.1, with the following additions and exceptions:

$C_{H_2SO_4}$ = Sulfuric acid (including SO_3) concentration, g/dscm (lb/dscf).
C_{SO_2} = Sulfur dioxide concentration, g/dscm (lb/dscf).
N = Normality of barium perchlorate titrant, meq/ml.
V_a = Volume of sample aliquot titrated, 100 ml for H_2SO_4 and 10 ml for SO_2.
V_{soln} = Total volume of solution in which the sample is contained, 1000 ml for the SO_2 sample and 250 ml for the H_2SO_4 sample.
V_t = Volume of barium standard solution titrant used for the sample, ml.
V_{tb} = Volume of barium standard solution titrant used for the blank, ml.

12.2 Average Dry Gas Meter Temperature and Average Orifice Pressure Drop. See data sheet (Figure 8–2).

12.3 Dry Gas Volume. Same as Method 5, section 12.3.

12.4 Volume of Water Vapor Condensed and Moisture Content. Calculate the volume of water vapor using Equation 5–2 of Method 5; the weight of water collected in the impingers and silica gel can be converted directly to milliliters (the specific gravity of water is 1 g/ml). Calculate the moisture content of the stack gas (B_{ws}) using Equation 5–3 of Method 5. The note in section 12.5 of Method 5 also applies to this method. Note that if the effluent gas stream can be considered dry, the volume of water vapor and moisture content need not be calculated.

12.5 Sulfuric Acid Mist (Including SO_3) Concentration.

$$C_{H_2SO_4} = K_3\left[N\left(V_t - V_{tb}\right)\left(V_{soln}/V_a\right)\right]/V_{m(std)} \qquad \text{Eq. 8-1}$$

Where:

K_3 = 0.04904 g/meq for metric units,

$K_3 = 1.081 \times 10^{-4}$ lb/meq for English units.

12.6 Sulfur Dioxide Concentration.

$$C_{SO_2} = K_4\left[N\left(V_t - V_{tb}\right)\left(V_{soln}/V_a\right)\right]/V_{m(std)} \qquad \text{Eq. 8-2}$$

Where:

K_4 = 0.03203 g/meq for metric units,

$K_4 = 7.061 \times 10^{-5}$ lb/meq for English units.

12.7 Isokinetic Variation. Same as Method 5, section 12.11.

12.8 Stack Gas Velocity and Volumetric Flow Rate. Calculate the average stack gas velocity and volumetric flow rate, if needed, using data obtained in this method and the equations in sections 12.6 and 12.7 of Method 2.

13.0 Method Performance

13.1 Analytical Range. Collaborative tests have shown that the minimum detectable limits of the method are 0.06 mg/m^3 (4×10^{-9} lb/ft^3) for H_2SO_4 and 1.2 mg/m^3 (74×10^{-9} lb/ft^3) for SO_2. No upper limits have been established. Based on theoretical calculations for 200 ml of 3 percent H_2O_2 solution, the upper concentration limit for SO_2 in a 1.0 m^3 (35.3 ft^3) gas sample is about 12,000 mg/m^3 (7.7×10^{-4} lb/ft^3). The upper limit can be extended by increasing the quantity of peroxide solution in the impingers.

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 References

Same as section 17.0 of Methods 5 and 6.

17.0 Tables, Diagrams, Flowcharts, and Validation Data

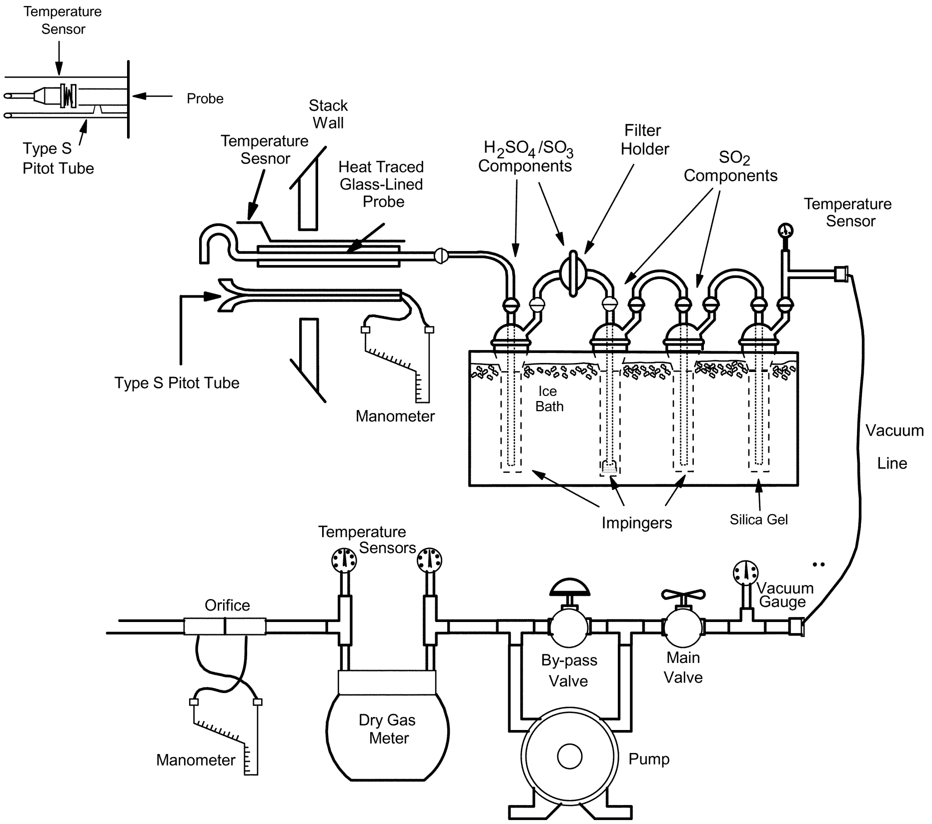
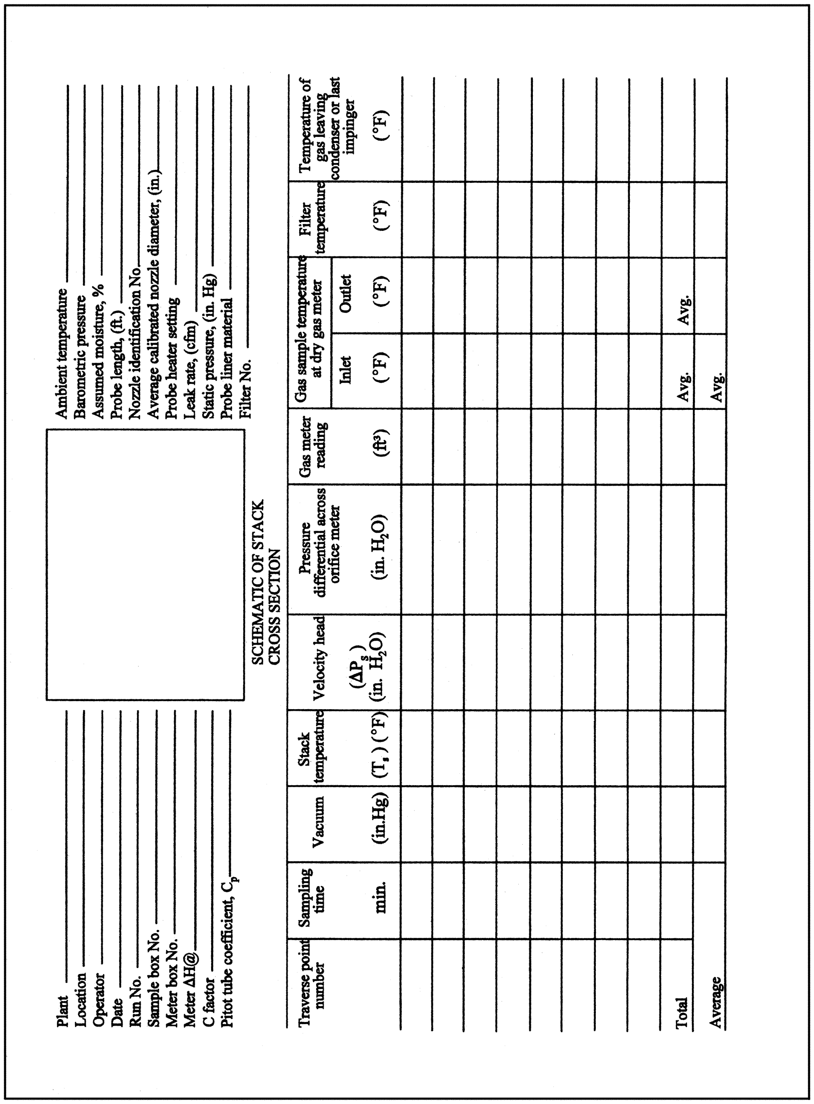


Figure 8-1. Sulfuric Acid Sampling Train



Plant ______
Location ______
Operator ______
Date ______
Run No. ______
Sample box No. ______
Meter box No. ______
Meter ΔH@ ______
C factor ______
Pitot tube coefficient, C_p ______

SCHEMATIC OF STACK CROSS SECTION

Ambient temperature ______
Barometric pressure ______
Assumed moisture, % ______
Probe length, (ft.) ______
Nozzle identification No. ______
Average calibrated nozzle diameter, (in.) ______
Probe heater setting ______
Leak rate, (cfm) ______
Static pressure, (in. Hg) ______
Probe liner material ______
Filter No. ______

Traverse point number	Sampling time	Vacuum	Stack temperature	Velocity head	Pressure differential across orifice meter	Gas meter reading	Gas sample temperature at dry gas meter		Filter temperature	Temperature of gas leaving condenser or last impinger
							Inlet	Outlet		
	min.	(in.Hg)	(T_s) (°F)	(ΔP_s) (in. H_2O)	(in. H_2O)	(ft³)	(°F)	(°F)	(°F)	(°F)
Total							Avg.	Avg.		
Average							Avg.			

Figure 8-2. Field Data Sheet.

METHOD 9—VISUAL DETERMINATION OF THE OPACITY OF EMISSIONS FROM STATIONARY SOURCES

Many stationary sources discharge visible emissions into the atmosphere; these emissions are usually in the shape of a plume. This method involves the determination of plume opacity by qualified observers. The method includes procedures for the training and certification of observers, and procedures to be used in the field for determination of plume opacity. The appearance of a plume as viewed by an observer depends upon a number of variables, some of which may be controllable and some of which may not be controllable in the field. Variables which can be controlled to an extent to which they no longer exert a significant influence upon plume appearance include: Angle of the observer with respect to the plume; angle of the observer with respect to the sun; point of observation of attached and detached steam plume; and angle of the observer with respect to a plume emitted from a rectangular stack with a large length to width ratio. The method includes specific criteria applicable to these variables.

Other variables which may not be controllable in the field are luminescence and color contrast between the plume and the background against which the plume is viewed. These variables exert an influence upon the appearance of a plume as viewed by an observer, and can affect the ability of the observer to accurately assign opacity values to the observed plume. Studies of the theory of plume opacity and field studies have demonstrated that a plume is most visible and presents the greatest apparent opacity when viewed against a contrasting background. It follows from this, and is confirmed by field trials, that the opacity of a plume, viewed under conditions where a contrasting background is present can be assigned with the greatest degree of accuracy. However, the potential for a positive error is also the greatest when a plume is viewed under such contrasting conditions. Under conditions presenting a less contrasting background, the apparent opacity of a plume is less and approaches zero as the color and luminescence contrast decrease toward zero. As a result, significant negative bias and negative errors can be made when a plume is viewed under less contrasting conditions. A negative bias decreases rather than increases the possibility that a plant operator will be cited for a violation of opacity standards due to observer error.

Studies have been undertaken to determine the magnitude of positive errors which can be made by qualified observers while reading plumes under contrasting conditions and using the procedures set forth in this method. The results of these studies (field trials) which involve a total of 769 sets of 25 readings each are as follows:

(1) For black plumes (133 sets at a smoke generator), 100 percent of the sets were read with a positive error[1] of less than 7.5 percent opacity; 99 percent were read with a positive error of less than 5 percent opacity.

(2) For white plumes (170 sets at a smoke generator, 168 sets at a coal-fired power plant, 298 sets at a sulfuric acid plant), 99 percent of the sets were read with a positive error of less than 7.5 percent opacity; 95 percent were read with a positive error of less than 5 percent opacity.

The positive observational error associated with an average of twenty-five readings is therefore established. The accuracy of the method must be taken into account when determining possible violations of applicable opacity standards.

1. Principle and Applicability

1.1 Principle. The opacity of emissions from stationary sources is determined visually by a qualified observer.

1.2 Applicability. This method is applicable for the determination of the opacity of emissions from stationary sources pursuant to §60.11(b) and for qualifying observers for visually determining opacity of emissions.

2. Procedures

The observer qualified in accordance with section 3 of this method shall use the following procedures for visually determining the opacity of emissions:

2.1 Position. The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. Consistent with maintaining the above requirement, the observer shall, as much as possible, make his observations from a position such that his line of vision is approximately perpendicular to the plume direction, and when observing opacity of emissions from rectangular outlets (e.g., roof monitors, open baghouses, noncircular stacks), approximately perpendicular to the longer axis of the outlet. The observer's line of sight should not include more than one plume at a time when multiple stacks are involved, and in any case the observer should make his observations with his line of sight perpendicular to the longer axis of such a set of multiple stacks (e.g., stub stacks on baghouses).

2.2 Field Records. The observer shall record the name of the plant, emission location, type facility, observer's name and affiliation, a sketch of the observer's position relative to the source, and the date on a field data sheet (Figure 9–1). The time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky condition (presence and color of clouds), and plume background are recorded on a field data sheet at the time opacity readings are initiated and completed.

2.3 Observations. Opacity observations shall be made at the point of greatest opacity in that portion of the plume where condensed water vapor is not present. The observer shall not look continuously at the plume, but instead shall observe the plume momentarily at 15-second intervals.

2.3.1 Attached Steam Plumes. When condensed water vapor is present within the

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[1] For a set, positive error = average opacity determined by observers' 25 observations—average opacity determined from transmissometer's 25 recordings.

plume as it emerges from the emission outlet, opacity observations shall be made beyond the point in the plume at which condensed water vapor is no longer visible. The observer shall record the approximate distance from the emission outlet to the point in the plume at which the observations are made.

2.3.2 Detached Steam Plume. When water vapor in the plume condenses and becomes visible at a distinct distance from the emission outlet, the opacity of emissions should be evaluated at the emission outlet prior to the condensation of water vapor and the formation of the steam plume.

2.4 Recording Observations. Opacity observations shall be recorded to the nearest 5 percent at 15-second intervals on an observational record sheet. (See Figure 9–2 for an example.) A minimum of 24 observations shall be recorded. Each momentary observation recorded shall be deemed to represent the average opacity of emissions for a 15-second period.

2.5 Data Reduction. Opacity shall be determined as an average of 24 consecutive observations recorded at 15-second intervals. Divide the observations recorded on the record sheet into sets of 24 consecutive observations. A set is composed of any 24 consecutive observations. Sets need not be consecutive in time and in no case shall two sets overlap. For each set of 24 observations, calculate the average by summing the opacity of the 24 observations and dividing this sum by 24. If an applicable standard specifies an averaging time requiring more than 24 observations, calculate the average for all observations made during the specified time period. Record the average opacity on a record sheet. (See Figure 9–1 for an example.)

3. Qualifications and Testing

3.1 Certification Requirements. To receive certification as a qualified observer, a candidate must be tested and demonstrate the ability to assign opacity readings in 5 percent increments to 25 different black plumes and 25 different white plumes, with an error not to exceed 15 percent opacity on any one reading and an average error not to exceed 7.5 percent opacity in each category. Candidates shall be tested according to the procedures described in section 3.2. Smoke generators used pursuant to section 3.2 shall be equipped with a smoke meter which meets the requirements of section 3.3.

The certification shall be valid for a period of 6 months, at which time the qualification procedure must be repeated by any observer in order to retain certification.

3.2 Certification Procedure. The certification test consists of showing the candidate a complete run of 50 plumes—25 black plumes and 25 white plumes—generated by a smoke generator. Plumes within each set of 25 black and 25 white runs shall be presented in random order. The candidate assigns an opacity value to each plume and records his observation on a suitable form. At the completion of each run of 50 readings, the score of the candidate is determined. If a candidate fails to qualify, the complete run of 50 readings must be repeated in any retest. The smoke test may be administered as part of a smoke school or training program, and may be preceded by training or familiarization runs of the smoke generator during which candidates are shown black and white plumes of known opacity.

3.3 Smoke Generator Specifications. Any smoke generator used for the purposes of section 3.2 shall be equipped with a smoke meter installed to measure opacity across the diameter of the smoke generator stack. The smoke meter output shall display instack opacity based upon a pathlength equal to the stack exit diameter, on a full 0 to 100 percent chart recorder scale. The smoke meter optical design and performance shall meet the specifications shown in Table 9–1. The smoke meter shall be calibrated as prescribed in section 3.3.1 prior to the conduct of each smoke reading test. At the completion of each test, the zero and span drift shall be checked and if the drift exceeds ±1 percent opacity, the condition shall be corrected prior to conducting any subsequent test runs. The smoke meter shall be demonstrated, at the time of installation, to meet the specifications listed in Table 9–1. This demonstration shall be repeated following any subsequent repair or replacement of the photocell or associated electronic circuitry including the chart recorder or output meter, or every 6 months, whichever occurs first.

TABLE 9–1—SMOKE METER DESIGN AND PERFORMANCE SPECIFICATIONS

Parameter	Specification
a. Light source	Incandescent lamp operated at nominal rated voltage.
b. Spectral response of photocell.	Photopic (daylight spectral response of the human eye—Citation 3).
c. Angle of view	15° maximum total angle.
d. Angle of projection	15° maximum total angle.
e. Calibration error	±3% opacity, maximum.
f. Zero and span drift	±1% opacity, 30 minutes.
g. Response time	5 seconds.

3.3.1 Calibration. The smoke meter is calibrated after allowing a minimum of 30 minutes warmup by alternately producing simulated opacity of 0 percent and 100 percent. When stable response at 0 percent or 100 percent is noted, the smoke meter is adjusted to produce an output of 0 percent or 100 percent, as appropriate. This calibration shall be repeated until stable 0 percent and 100 percent readings are produced without adjustment. Simulated 0 percent and 100 percent opacity values may be produced by alternately switching the power to the light source on and off while the smoke generator is not producing smoke.

3.3.2 Smoke Meter Evaluation. The smoke meter design and performance are to be evaluated as follows:

3.3.2.1 Light Source. Verify from manufacturer's data and from voltage measurements made at the lamp, as installed, that the lamp is operated within ±5 percent of the nominal rated voltage.

3.3.2.2 Spectral Response of Photocell. Verify from manufacturer's data that the photocell has a photopic response; i.e., the spectral sensitivity of the cell shall closely approximate the standard spectral-luminosity curve for photopic vision which is referenced in (b) of Table 9–1.

FIGURE 9-1

RECORD OF VISUAL DETERMINATION OF OPACITY PAGE___of___

COMPANY__________
LOCATION__________
TEST NUMBER__________
DATE__________
TYPE FACILITY__________
CONTROL DEVICE__________

HOURS OF OBSERVATION__________
OBSERVER__________
OBSERVER CERTIFICATION DATE__________
OBSERVER AFFILIATION__________
POINT OF EMISSIONS__________
HEIGHT OF DISCHARGE POINT__________

	Initial			Final
CLOCK TIME				
OBSERVER LOCATION Distance to Discharge				
Direction from Discharge				
Height of Observation Point				
BACKGROUND DESCRIPTION				
WEATHER CONDITIONS Wind Direction				
Wind Speed				
Ambient Temperature				
SKY CONDITIONS (clear, overcast, % clouds, etc.)				
PLUME DESCRIPTION Color				
Distance Visible				
OTHER INFORMATION				

SUMMARY OF AVERAGE OPACITY

Set Number	Time	Opacity	
	Start--End	Sum	Average

Readings ranged from ____ to ____ % opacity

The source was/was not in compliance with ____ at the time evaluation was made.

FIGURE 9-2—OBSERVATION RECORD

Page ____ of ____

Company ....
Location ....
Test Number ....
Date.

Observer ....
Type facility ....
Point of emissions ....

Hr.	Min.	Seconds				Steam plume (check if applicable)		Comments
		0	15	30	45	Attached	Detached	
	0							
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
	17							
	18							
	19							
	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							
	29							

FIGURE 9–2—OBSERVATION RECORD (CONTINUED)

Page ____ of ____

Company ....
Observer ....
Location ....
Type facility ....
Test Number ....
Point of emissions ....
Date.

Hr.	Min.	Seconds				Steam plume (check if applicable)		Comments
		0	15	30	45	Attached	Detached	
	30							

Hr.	Min.	Seconds				Steam plume (check if applicable)		Comments
		0	15	30	45	Attached	Detached	
	31							
	32							
	33							
	34							
	35							
	36							
	37							
	38							
	39							
	40							
	41							
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	59							

3.3.2.3 Angle of View. Check construction geometry to ensure that the total angle of view of the smoke plume, as seen by the photocell, does not exceed 15°. The total angle of view may be calculated from: $\theta = 2 \tan^{-1} d/2L$, where θ = total angle of view; d = the sum of the photocell diameter + the diameter of the limiting aperture; and L = the distance from the photocell to the limiting aperture. The limiting aperture is the point in the path between the photocell and the smoke plume where the angle of view is most restricted. In smoke generator smoke meters this is normally an orifice plate.

3.3.2.4 Angle of Projection. Check construction geometry to ensure that the total angle of projection of the lamp on the smoke plume does not exceed 15°. The total angle of projection may be calculated from: $\theta = 2 \tan^{-1} d/2L$, where θ = total angle of projection; d = the sum of the length of the lamp filament + the diameter of the limiting aperture; and L = the distance from the lamp to the limiting aperture.

3.3.2.5 Calibration Error. Using neutral-density filters of known opacity, check the error between the actual response and the theoretical linear response of the smoke meter. This check is accomplished by first calibrating the smoke meter according to 3.3.1 and then inserting a series of three neutral-density filters of nominal opacity of 20, 50, and 75 percent in the smoke meter pathlength. Filters calibrated within ±2 percent shall be used. Care should be taken when inserting the filters to prevent stray light from affecting the meter. Make a total of five nonconsecutive readings for each filter. The maximum error on any one reading shall be 3 percent opacity.

3.3.2.6 Zero and Span Drift. Determine the zero and span drift by calibrating and operating the smoke generator in a normal manner over a 1-hour period. The drift is measured by checking the zero and span at the end of this period.

3.3.2.7 Response Time. Determine the response time by producing the series of five simulated 0 percent and 100 percent opacity values and observing the time required to reach stable response. Opacity values of 0 percent and 100 percent may be simulated by alternately switching the power to the light source off and on while the smoke generator is not operating.

4. Bibliography

1. Air Pollution Control District Rules and Regulations, Los Angeles County Air Pollution Control District, Regulation IV, Prohibitions, Rule 50.

2. Weisburd, Melvin I., Field Operations and Enforcement Manual for Air, U.S. Environmental Protection Agency, Research Triangle Park, NC. APTD–1100, August 1972, pp. 4.1–4.36.

3. Condon, E.U., and Odishaw, H., Handbook of Physics, McGraw-Hill Co., New York, NY, 1958, Table 3.1, p. 6–52.

ALTERNATE METHOD 1—DETERMINATION OF THE OPACITY OF EMISSIONS FROM STATIONARY SOURCES REMOTELY BY LIDAR

This alternate method provides the quantitative determination of the opacity of an emissions plume remotely by a mobile lidar system (laser radar; Light Detection and Ranging). The method includes procedures for the calibration of the lidar and procedures to be used in the field for the lidar determination of plume opacity. The lidar is used to measure plume opacity during either day or nighttime hours because it contains its own pulsed light source or transmitter. The operation of the lidar is not dependent upon ambient lighting conditions (light, dark, sunny or cloudy).

The lidar mechanism or technique is applicable to measuring plume opacity at numerous wavelengths of laser radiation. However, the performance evaluation and calibration test results given in support of this method apply only to a lidar that employs a ruby (red light) laser [Reference 5.1].

1. Principle and Applicability

1.1 Principle. The opacity of visible emissions from stationary sources (stacks, roof vents, etc.) is measured remotely by a mobile lidar (laser radar).

1.2 Applicability. This method is applicable for the remote measurement of the opacity of visible emissions from stationary sources during both nighttime and daylight conditions, pursuant to 40 CFR §60.11(b). It is also applicable for the calibration and performance verification of the mobile lidar for the measurement of the opacity of emissions. A performance/design specification for a basic lidar system is also incorporated into this method.

1.3 Definitions.

Azimuth angle: The angle in the horizontal plane that designates where the laser beam is pointed. It is measured from an arbitrary fixed reference line in that plane.

Backscatter: The scattering of laser light in a direction opposite to that of the incident laser beam due to reflection from particulates along the beam's atmospheric path which may include a smoke plume.

Backscatter signal: The general term for the lidar return signal which results from laser light being backscattered by atmospheric and smoke plume particulates.

Convergence distance: The distance from the lidar to the point of overlap of the lidar receiver's field-of-view and the laser beam.

Elevation angle: The angle of inclination of the laser beam referenced to the horizontal plane.

Far region: The region of the atmosphere's path along the lidar line-of-sight beyond or behind the plume being measured.

Lidar: Acronym for Light Detection and Ranging.

Lidar range: The range or distance from the lidar to a point of interest along the lidar line-of-sight.

Near region: The region of the atmospheric path along the lidar line-of-sight between the lidar's convergence distance and the plume being measured.

Opacity: One minus the optical transmittance of a smoke plume, screen target, etc.

Pick interval: The time or range intervals in the lidar backscatter signal whose minimum average amplitude is used to calculate opacity. Two pick intervals are required, one in the near region and one in the far region.

Plume: The plume being measured by lidar.

Plume signal: The backscatter signal resulting from the laser light pulse passing through a plume.

$1/R^2$Correction: The correction made for the systematic decrease in lidar backscatter signal amplitude with range.

Reference signal: The backscatter signal resulting from the laser light pulse passing through ambient air.

Sample interval: The time period between successive samples for a digital signal or between successive measurements for an analog signal.

Signal spike: An abrupt, momentary increase and decrease in signal amplitude.

Source: The source being tested by lidar.

Time reference: The time (t_o) when the laser pulse emerges from the laser, used as the reference in all lidar time or range measurements.

2. Procedures

The mobile lidar calibrated in accordance with Paragraph 3 of this method shall use the following procedures for remotely measuring the opacity of stationary source emissions:

2.1 Lidar Position. The lidar shall be positioned at a distance from the plume sufficient to provide an unobstructed view of the source emissions. The plume must be at a range of at least 50 meters or three consecutive pick intervals (whichever is greater) from the lidar's transmitter/receiver convergence distance along the line-of-sight. The maximum effective opacity measurement distance of the lidar is a function of local atmospheric conditions, laser beam diameter, and plume diameter. The test position of the lidar shall be selected so that the diameter of the laser beam at the measurement point within the plume shall be no larger than three-fourths the plume diameter. The beam diameter is calculated by Equation (AM1–1):

$$D(\text{lidar}) = A + R\varphi \leq 0.75\ D(\text{Plume}) \quad (\text{AM1–1})$$

Where:

D(Plume) = diameter of the plume (cm),

φ = laser beam divergence measured in radians

R = range from the lidar to the source (cm)

D(Lidar) = diameter of the laser beam at range R (cm),

A = diameter of the laser beam or pulse where it leaves the laser.

The lidar range, R, is obtained by aiming and firing the laser at the emissions source structure immediately below the outlet. The range value is then determined from the backscatter signal which consists of a signal spike (return from source structure) and the atmospheric backscatter signal [Reference 5.1]. This backscatter signal should be recorded.

When there is more than one source of emissions in the immediate vicinity of the plume, the lidar shall be positioned so that the laser beam passes through only a single plume, free from any interference of the other plumes for a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the plume along the line-of-sight (determined from the backscatter signals). The lidar shall initially be positioned so that its line-of-sight is approximately perpendicular to the plume.

When measuring the opacity of emissions from rectangular outlets (e.g., roof monitors, open baghouses, noncircular stacks, etc.), the lidar shall be placed in a position so that its line-of-sight is approximately perpendicular to the longer (major) axis of the outlet.

2.2 Lidar Operational Restrictions. The lidar receiver shall not be aimed within an angle of ±15° (cone angle) of the sun.

This method shall not be used to make opacity measurements if thunderstorms, snowstorms, hail storms, high wind, high-ambient dust levels, fog or other atmospheric conditions cause the reference signals to consistently exceed the limits specified in section 2.3.

2.3 Reference Signal Requirements. Once placed in its proper position for opacity measurement, the laser is aimed and fired with the line-of-sight near the outlet height and rotated horizontally to a position clear of the source structure and the associated plume. The backscatter signal obtained from this position is called the ambient-air or reference signal. The lidar operator shall inspect this signal [Section V of Reference 5.1] to: (1) determine if the lidar line-of-sight is free from interference from other plumes and from physical obstructions such as cables, power lines, etc., for a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the plume, and (2) obtain a qualitative measure of the homogeneity of the ambient air by noting any signal spikes.

Should there be any signal spikes on the reference signal within a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the plume, the laser shall be fired three more times and the operator shall inspect the reference signals on the display. If the spike(s) remains, the azimuth angle shall be changed and the above procedures conducted again. If the spike(s) disappears in all three reference signals, the lidar line-of-sight is acceptable if there is shot-to-shot consistency and there is no interference from other plumes.

Shot-to-shot consistency of a series of reference signals over a period of twenty seconds is verified in either of two ways. (1) The lidar operator shall observe the reference signal amplitudes. For shot-to-shot consistency the ratio of R_f to R_n [amplitudes of the near and far region pick intervals (Section 2.6.1)] shall vary by not more than ±6% between shots; or (2) the lidar operator shall accept any one of the reference signals and treat the other two as plume signals; then the opacity for each of the subsequent reference signals is calculated (Equation AM1–2). For shot-to-shot consistency, the opacity values shall be within ±3% of 0% opacity and the associated S_o values less than or equal to 8% (full scale) [Section 2.6].

If a set of reference signals fails to meet the requirements of this section, then all plume signals [Section 2.4] from the last set of acceptable reference signals to the failed set shall be discarded.

2.3.1 Initial and Final Reference Signals. Three reference signals shall be obtained within a 90-second time period prior to any data run. A final set of three reference signals shall be obtained within three (3) minutes after the completion of the same data run.

2.3.2 Temporal Criterion for Additional Reference Signals. An additional set of reference signals shall be obtained during a data run if there is a change in wind direction or plume drift of 30° or more from the direction that was prevalent when the last set of reference signals was obtained. An additional set of reference signals shall also be obtained if there is an increase in value of S_{In} (near region standard deviation, Equation AM1–5) or S_{If} (far region standard deviation, Equation AM1–6) that is greater than 6% (full scale) over the respective values calculated from the immediately previous plume signal, and this increase in value remains for 30 seconds or longer. An additional set of reference signals shall also be obtained if there is a change in amplitude in either the near or the far region of the plume signal, that is greater than 6% of the near signal amplitude and this change in amplitude remains for 30 seconds or more.

2.4 Plume Signal Requirements. Once properly aimed, the lidar is placed in operation with the nominal pulse or firing rate of six pulses/minute (1 pulse/10 seconds). The lidar operator shall observe the plume backscatter signals to determine the need for additional reference signals as required by section 2.3.2. The plume signals are recorded from lidar start to stop and are called a data run. The length of a data run is determined by operator discretion. Short-term stops of the lidar to record additional reference signals do not constitute the end of a data run if plume signals are resumed within 90 seconds after the reference signals have been recorded, and the total stop or interrupt time does not exceed 3 minutes.

2.4.1 Non-hydrated Plumes. The laser shall be aimed at the region of the plume which displays the greatest opacity. The lidar operator must visually verify that the laser is aimed clearly above the source exit structure.

2.4.2 Hydrated Plumes. The lidar will be used to measure the opacity of hydrated or so-called steam plumes. As listed in the reference method, there are two types, i.e., attached and detached steam plumes.

2.4.2.1 Attached Steam Plumes. When condensed water vapor is present within a plume, lidar opacity measurements shall be made at a point within the residual plume where the condensed water vapor is no longer visible. The laser shall be aimed into the most dense region (region of highest opacity) of the residual plume.

During daylight hours the lidar operator locates the most dense portion of the residual plume visually. During nighttime hours a high-intensity spotlight, night vision scope, or low light level TV, etc., can be used as an aid to locate the residual plume. If visual determination is ineffective, the lidar may be used to locate the most dense region of the residual plume by repeatedly measuring opacity, along the longitudinal axis or center of the plume from the emissions outlet to a point just beyond the steam plume. The lidar operator should also observe color differences and plume reflectivity to ensure that the lidar is aimed completely within the residual plume. If the operator does not obtain a clear indication of the location of the residual plume, this method shall not be used.

Once the region of highest opacity of the residual plume has been located, aiming adjustments shall be made to the laser line-of-sight to correct for the following: movement to the region of highest opacity out of the lidar line-of-sight (away from the laser beam) for more than 15 seconds, expansion of the steam plume (air temperature lowers and/or relative humidity increases) so that it just begins to encroach on the field-of-view of the lidar's optical telescope receiver, or a decrease in the size of the steam plume (air temperature higher and/or relative humidity decreases) so that regions within the residual plume whose opacity is higher than the one being monitored, are present.

2.4.2.2 Detached Steam Plumes. When the water vapor in a hydrated plume condenses and becomes visible at a finite distance from the stack or source emissions outlet, the opacity of the emissions shall be measured in the region of the plume clearly above the emissions outlet and below condensation of the water vapor.

During daylight hours the lidar operators can visually determine if the steam plume is detached from the stack outlet. During nighttime hours a high-intensity spotlight, night vision scope, low light level TV, etc., can be used as an aid in determining if the steam plume is detached. If visual determination is ineffective, the lidar may be used to determine if the steam plume is detached by repeatedly measuring plume opacity from the outlet to the steam plume along the plume's longitudinal axis or center line. The lidar operator should also observe color differences and plume reflectivity to detect a detached plume. If the operator does not obtain a clear indication of the location of the detached plume, this method shall not be used to make opacity measurements between the outlet and the detached plume.

Once the determination of a detached steam plume has been confirmed, the laser shall be aimed into the region of highest opacity in the plume between the outlet and the formation of the steam plume. Aiming adjustments shall be made to the lidar's line-of-sight within the plume to correct for changes in the location of the most dense region of the plume due to changes in wind direction and speed or if the detached steam plume moves closer to the source outlet encroaching on the most dense region of the plume. If the detached steam plume should move too close to the source outlet for the lidar to make interference-free opacity measurements, this method shall not be used.

2.5 Field Records. In addition to the recording recommendations listed in other sections of this method the following records should be maintained. Each plume measured should be uniquely identified. The name of the facility, type of facility, emission source type, geographic location of the lidar with respect to the plume, and plume characteristics should be recorded. The date of the test, the time period that a source was monitored, the time (to the nearest second) of each opacity measurement, and the sample interval should also be recorded. The wind speed, wind direction, air temperature, relative humidity, visibility (measured at the lidar's position), and cloud cover should be recorded at the beginning and end of each time period for a given source. A small sketch depicting the location of the laser beam within the plume should be recorded.

If a detached or attached steam plume is present at the emissions source, this fact should be recorded. Figures AM1–I and AM1–II are examples of logbook forms that may be used to record this type of data. Magnetic tape or paper tape may also be used to record data.

LIDAR LOG CONTROL NUMBER TABULATION

Log Book Number-________

(Assign a CONTROL NUMBER to each individual source under test)

CONTROL NUMBER	DATE ASSIGNED	PROJECT	CITY, STATE

continued on next page

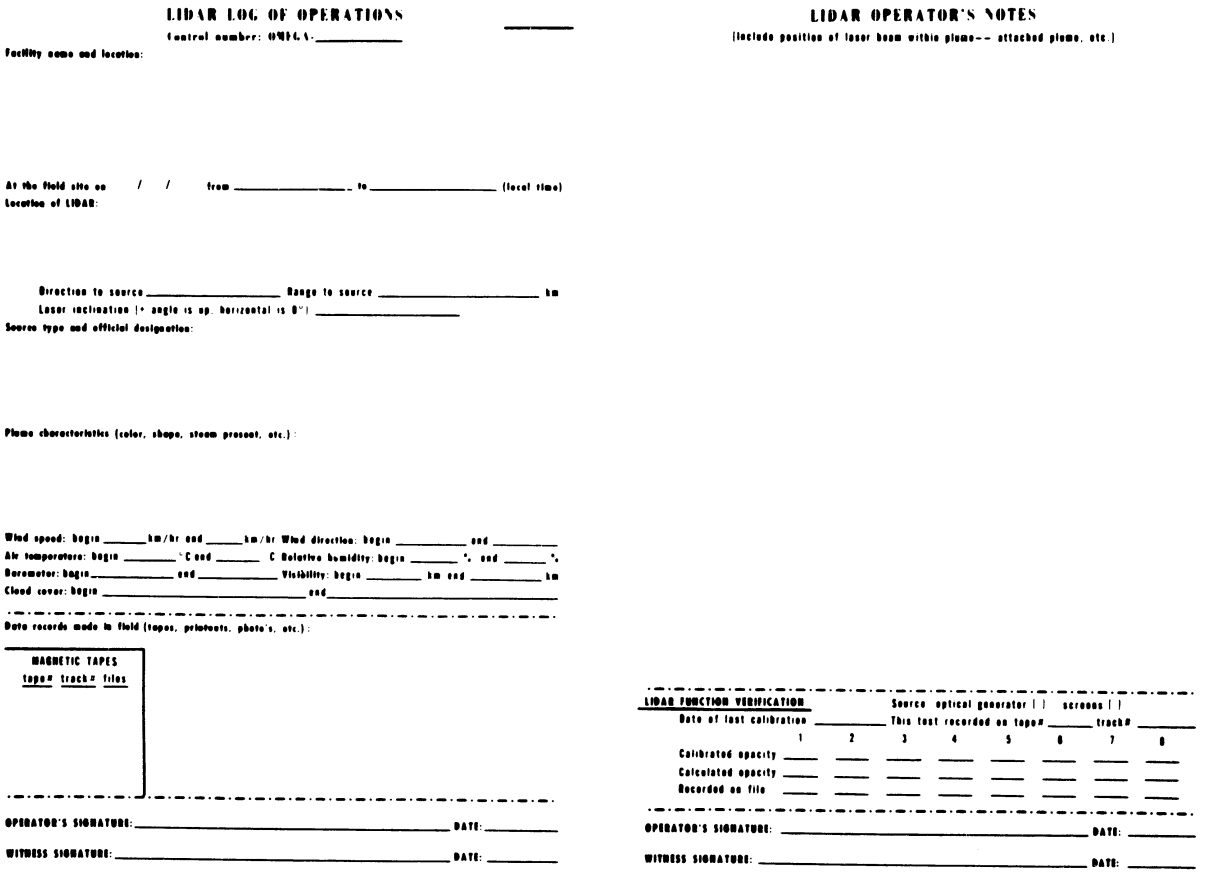
LIDAR LOG CONTROL NUMBER TABULATION (cont')

(Assign a CONTROL NUMBER to each individual source under test)

CONTROL NUMBER	DATE ASSIGNED	PROJECT	CITY, STATE

Next Log Book Number-________

Figure AM1-I Lidar Log Control Number Tabulation



LIDAR LOG OF OPERATIONS

Control number: OMEGA-____________ _________

Facility name and location:

At the field site on / / from ________________ to ________________ (local time)

Location of LIDAR:

Direction to source ______________ Range to source ________________ km

Laser inclination (+ angle is up, horizontal is 0°) ______________

Source type and official designation:

Plume characteristics (color, shape, steam present, etc.):

Wind speed: begin ______ km/hr end ______ km/hr Wind direction: begin ________ end ________

Air temperature: begin ______ °C end ______ C Relative humidity: begin ______ %, end ______ %

Barometer: begin ________ end ________ Visibility: begin ______ km end ______ km

Cloud cover: begin ________________ end ________________

Data records made in field (tapes, printouts, photo's, etc.):

MAGNETIC TAPES

tape#	track#	files

OPERATOR'S SIGNATURE: ________________________ DATE: ________

WITNESS SIGNATURE: ________________________ DATE: ________

LIDAR OPERATOR'S NOTES

(Include position of laser beam within plume-- attached plume, etc.)

LIDAR FUNCTION VERIFICATION Source optical generator ☐ screens ☐

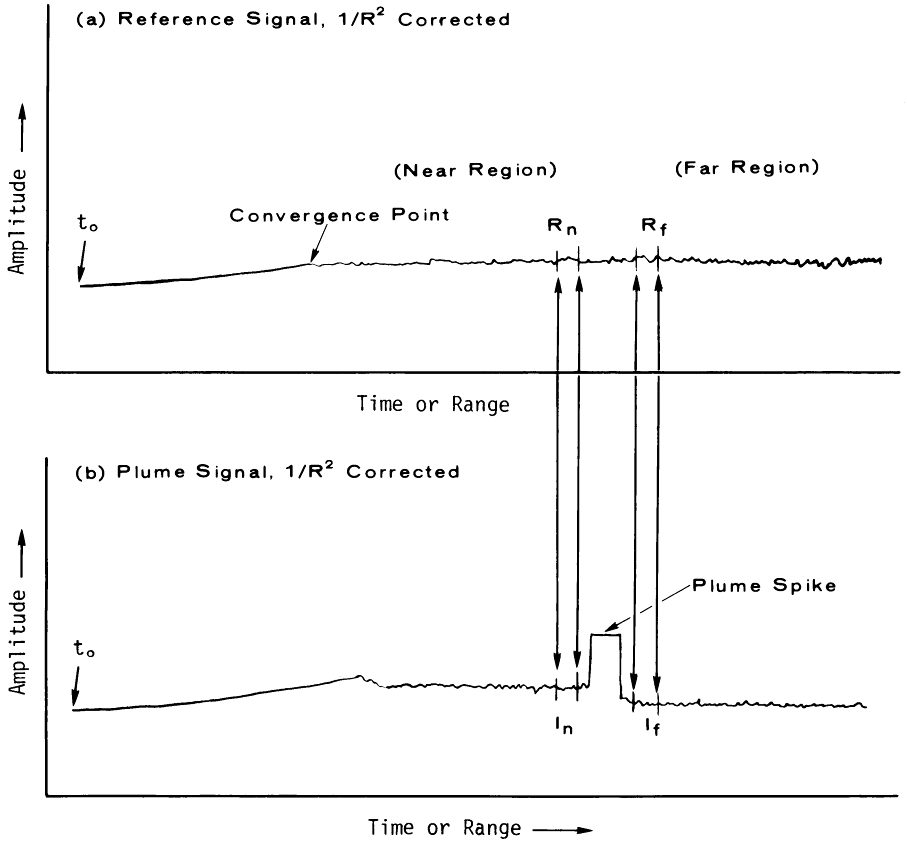
Date of last calibration ________ This test recorded on tape# ______ track# ______

	1	2	3	4	5	6	7	8
Calibrated opacity								
Calculated opacity								
Recorded on file								

OPERATOR'S SIGNATURE: ________________________ DATE: ________

WITNESS SIGNATURE: ________________________ DATE: ________

Figure AM1-II Lidar Log Of Operations



(a) Reference signal, $1/R^2$-corrected. This reference signal is for plume signal (b). R_n, R_f are chosen to coincide with I_n, I_f.

(b) Plume signal, $1/R^2$-corrected. The plume spike and the decrease in the backscatter signal amplitude in the far region are due to the opacity of the plume. I_n, I_f are chosen as indicated in Section 2.6.

Figure AM1-III. Plots of Lidar Backscatter Signals

2.6 Opacity Calculation and Data Analysis. Referring to the reference signal and plume signal in Figure AM1–III, the measured opacity (O_p) in percent for each lidar measurement is calculated using Equation AM1–2. ($O_p = 1 - T_p$; T_p is the plume transmittance.)

$$O_p = (100\%)\left[1 - \left(\frac{I_f}{R_f}\frac{R_n}{I_n}\right)^{\frac{1}{2}}\right], \qquad \text{(AM1-2)}$$

Where:

I_n = near-region pick interval signal amplitude, plume signal, $1/R^2$ corrected,

I_f = far-region pick interval signal amplitude, plume signal, $1/R^2$ corrected,

R_n = near-region pick interval signal amplitude, reference signal, $1/R^2$ corrected, and

R_f = far-region pick interval signal amplitude, reference signal, $1/R^2$ corrected.

The $1/R^2$ correction to the plume and reference signal amplitudes is made by multiplying the amplitude for each successive sample interval from the time reference, by the square of the lidar time (or range) associated with that sample interval [Reference 5.1].

The first step in selecting the pick intervals for Equation AM1–2 is to divide the plume signal amplitude by the reference signal amplitude at the same respective ranges to obtain a "normalized" signal. The pick intervals selected using this normalized signal, are a minimum of 15 m (100 nanoseconds) in length and consist of at least 5 contiguous sample intervals. In addition, the following criteria, listed in order of importance, govern pick interval selection. (1) The intervals shall be in a region of the normalized signal where the reference signal meets the requirements of section 2.3 and is everywhere greater than zero. (2) The intervals (near and far) with the minimum average amplitude are chosen. (3) If more than one interval with the same minimum average amplitude is found, the interval closest to the plume is chosen. (4) The standard deviation, S_o, for the calculated opacity shall be 8% or less. (S_o is calculated by Equation AM1–7).

If S_o is greater than 8%, then the far pick interval shall be changed to the next interval of minimal average amplitude. If S_o is still greater than 8%, then this procedure is repeated for the far pick interval. This procedure may be repeated once again for the near pick interval, but if S_o remains greater than 8%, the plume signal shall be discarded.

The reference signal pick intervals, R_n and R_f, must be chosen over the same time interval as the plume signal pick intervals, I_n and I_f, respectively [Figure AM1–III]. Other methods of selecting pick intervals may be used if they give equivalent results. Field-oriented examples of pick interval selection are available in Reference 5.1.

The average amplitudes for each of the pick intervals, I_n, I_f, R_n, R_f, shall be calculated by averaging the respective individual amplitudes of the sample intervals from the plume signal and the associated reference signal each corrected for $1/R^2$. The amplitude of I_n shall be calculated according to Equation (AM–3).

$$I_n = \frac{1}{m}\sum_{i=1}^{m} I_{ni}, \qquad \text{(AM1-3)}$$

Where:

I_{ni} = the amplitude of the ith sample interval (near-region),

Σ = sum of the individual amplitudes for the sample intervals,

m = number of sample intervals in the pick interval, and

I_n = average amplitude of the near-region pick interval.

Similarly, the amplitudes for I_f, R_n, and R_f are calculated with the three expressions in Equation (AM1–4).

$$I_f = \frac{1}{m}\sum_{i=1}^{m} I_{fi}, \quad R_n = \frac{1}{m}\sum_{i=1}^{m} R_{ni}, \quad R_f = \frac{1}{m}\sum_{i=1}^{m} R_{fi}. \qquad \text{(AM1-4)}$$

The standard deviation, S_{In}, of the set of amplitudes for the near-region pick interval, I_n, shall be calculated using Equation (AM1–5).

Similarly, the standard deviations S_{If}, S_{Rn}, and S_{Rf} are calculated with the three expressions in Equation (AM1–6).

$$S_{In} = \left[\sum_{i=1}^{m} \frac{(I_{ni} - I_n)^2}{(m-1)} \right]^{1/2}, \qquad S_{If} = \left[\sum_{i=1}^{m} \frac{(I_{fi} - I_f)^2}{(m-1)} \right]^{1/2} \qquad \text{(AM1-5)}$$

$$S_{Rn} = \left[\sum_{i=1}^{m} \frac{(R_{ni} - R_n)^2}{(m-1)} \right]^{1/2},$$

$$S_{Rf} = \left[\sum_{i=1}^{m} \frac{(R_{fi} - R_f)^2}{(m-1)} \right]^{1/2}. \qquad \text{(AM1-6)}$$

The standard deviation, S_o, for each associated opacity value, O_p, shall be calculated using Equation (AM1–7).

$$S_o = \frac{(100\%)}{2} \left(\frac{I_f}{R_f} \frac{R_n}{I_n} \right)^{1/2} \left[\frac{S_{In}^2}{I_n^2} + \frac{S_{If}^2}{I_f^2} + \frac{S_{Rn}^2}{R_n^2} + \frac{S_{Rf}^2}{R_f^2} \right]^{1/2} \qquad \text{(AM1-7)}$$

The calculated values of I_n, I_f, R_n, R_f, S_{In}, S_{If}, S_{Rn}, S_{Rf}, O_p, and S_o should be recorded. Any plume signal with an S_o greater than 8% shall be discarded.

2.6.1 Azimuth Angle Correction. If the azimuth angle correction to opacity specified in this section is performed, then the elevation angle correction specified in section 2.6.2 shall not be performed. When opacity is measured in the residual region of an attached steam plume, and the lidar line-of-sight is not perpendicular to the plume, it may be necessary to correct the opacity measured by the lidar to obtain the opacity that would be measured on a path perpendicular to the plume. The following method, or any other method which produces equivalent results, shall be used to determine the need for a correction, to calculate the correction, and to document the point within the plume at which the opacity was measured.

Figure AM1–IV(b) shows the geometry of the opacity correction. L′ is the path through the plume along which the opacity measurement is made. P′ is the path perpendicular to the plume at the same point. The angle ε is the angle between L′ and the plume center line. The angle (π/2-ε), is the angle between the L′ and P′. The measured opacity, O_p, measured along the path L′ shall be corrected to obtain the corrected opacity, O_{pc}, for the path P′, using Equation (AM1–8).

$$\begin{aligned} O_{pc} &= (100\%) \left[1 - (1 - 0.01\, O_p)^{\cos(\pi/2 - \varepsilon)} \right] \\ &= (100\%) \left[1 - (1 - 0.01\, O_p)^{\sin \varepsilon} \right] \qquad \text{(AM1-8)} \end{aligned}$$

The correction in Equation (AM1–8) shall be performed if the inequality in Equation (AM1–9) is true.

$$\varepsilon \geq \mathrm{Sin}^{-1}\left[\frac{\ln(101 - O_p)}{\ln(100 - O_p)}\right] \qquad \text{(AM1-9)}$$

Figure AM1–IV(a) shows the geometry used to calculate ε and the position in the plume at which the lidar measurement is made. This analysis assumes that for a given lidar measurement, the range from the lidar to the plume, the elevation angle of the lidar from the horizontal plane, and the azimuth angle of the lidar from an arbitrary fixed reference in the horizontal plane can all be obtained directly.

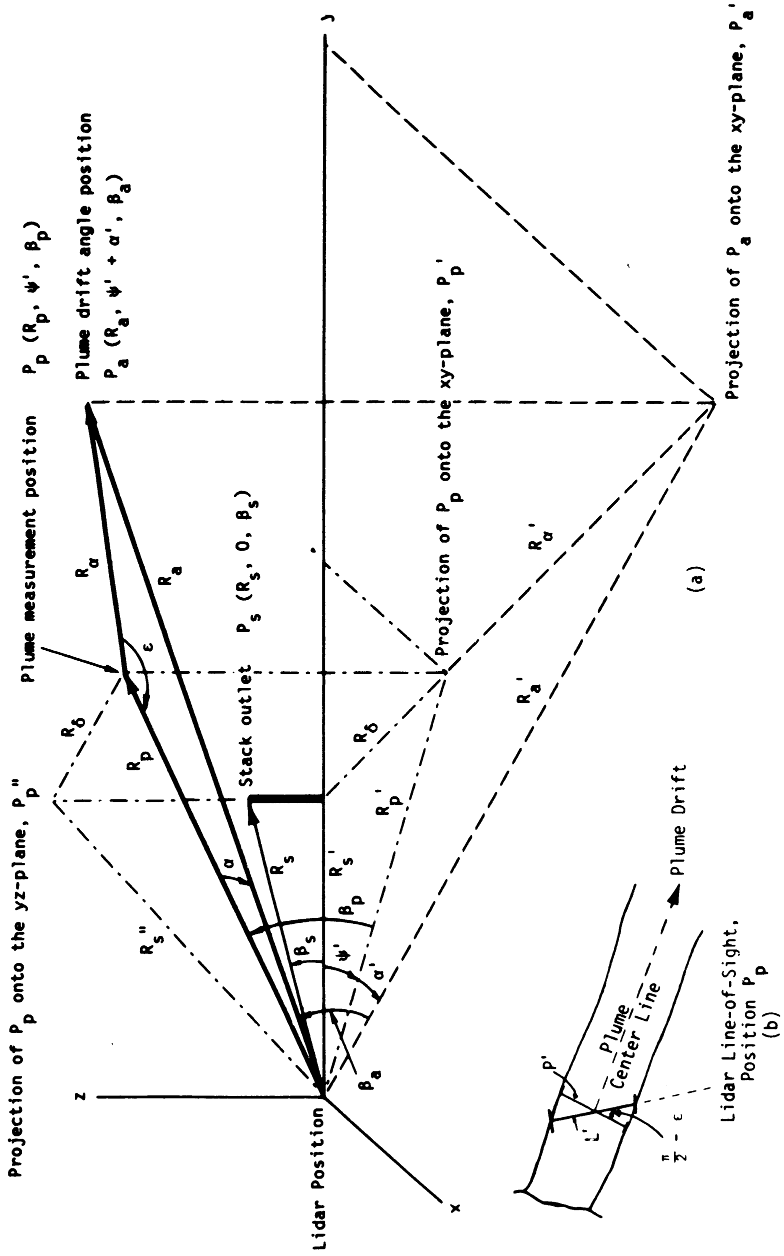


Figure AMI - IV. Correction in Opacity for Drift of the Residual Region of an Attached Steam Plume.

R_s = range from lidar to source*

β_s = elevation angle of R_s*

R_p = range from lidar to plume at the opacity measurement point*

β_p = elevation angle of R_p*

R_a = range from lidar to plume at some arbitrary point, P_a, so the drift angle of the plume can be determined*

β_a = elevation angle of R_a*
α = angle between R_p and R_a
R'_s = projection of R_s in the horizontal plane
R'_p = projection of R_p in the horizontal plane
R'_a = projection of R_a in the horizontal plane
ψ' = angle between R'_s and R'_p*
α' = angle between R'_p and R'_a*
R≤ = distance from the source to the opacity measurement point projected in the horizontal plane
$R\theta$ = distance from opacity measurement point P_p to the point in the plume P_a.

$$O_{pc} = 1 - (1 - O_p)^{\mathrm{Cos}\ (\pi/2-\varepsilon)} = 1 - (1 - O_p)^{\mathrm{Sin}\ \varepsilon} \qquad \text{(AMI-8)}$$

The correction angle ε shall be determined using Equation AM1–10.

Where:

$\alpha = \mathrm{Cos}^{-1}\ (\mathrm{Cos}\beta_p\ \mathrm{Cos}\beta_a\ \mathrm{Cos}\alpha' + \mathrm{Sin}\beta_p\ \mathrm{Sin}\beta_a)$, and

$R\theta = (R_p2 + R_a2 - 2\ R_p\ R_a\ \mathrm{Cos}\alpha)^{1/2}$

R≤, the distance from the source to the opacity measurement point projected in the horizontal plane, shall be determined using Equation AM1–11.

$$R_\delta = (R'^2_s + R'^2_p - 2R'_sR'_p\mathrm{Cos}\psi')^{1/2}\ , \qquad \text{(AM1-11)}$$

Where:

$R'_s = R_s\ \mathrm{Cos}\ \beta_s$, and
$R'_p = R_p\ \mathrm{Cos}\ \beta_p$.

In the special case where the plume centerline at the opacity measurement point is horizontal, parallel to the ground, Equation AM1–12 may be used to determine ε instead of Equation AM1–10.

$$\varepsilon = \mathrm{Cos}^{-1}\left[\frac{R_p^2 + R_\delta^2 - R''^2_s}{2\ R_p\ R_\delta}\right] \qquad \text{(AM1-12)}$$

Where:

$R''_s = (R'^2_s + R_p^2\mathrm{Sin}^2\beta_p)^{1/2}$.

If the angle ε is such that ε≤30° or ε ≥150°, the azimuth angle correction shall not be performed and the associated opacity value shall be discarded.

2.6.2 Elevation Angle Correction. An individual lidar-measured opacity, O_p, shall be corrected for elevation angle if the laser elevation or inclination angle, β_p [Figure AM1–V], is greater than or equal to the value calculated in Equation AM1–13.

$$\beta_p \geq \mathrm{Cos}^{-1}\left[\frac{\ln\ (101 - O_p)}{\ln\ (100 - O_p)}\right] \qquad \text{(AM1-13)}$$

The measured opacity, O_p, along the lidar path L, is adjusted to obtain the corrected opacity, O_{pc}, for the actual plume (horizontal) path, P, by using Equation (AM1–14).

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*Obtained directly from lidar. These values should be recorded.

$$O_{pc} = (100\%)\left[1 - \left(1 - 0.01\, O_p\right)^{\mathrm{Cos}\beta} p\right], \qquad (\mathrm{AM1\text{-}14})$$

Where:

β_p = lidar elevation or inclination angle,
O_p = measured opacity along path L, and
O_{pc} = corrected opacity for the actual plume thickness P.

The values for β_p, O_p and O_{pc} should be recorded.

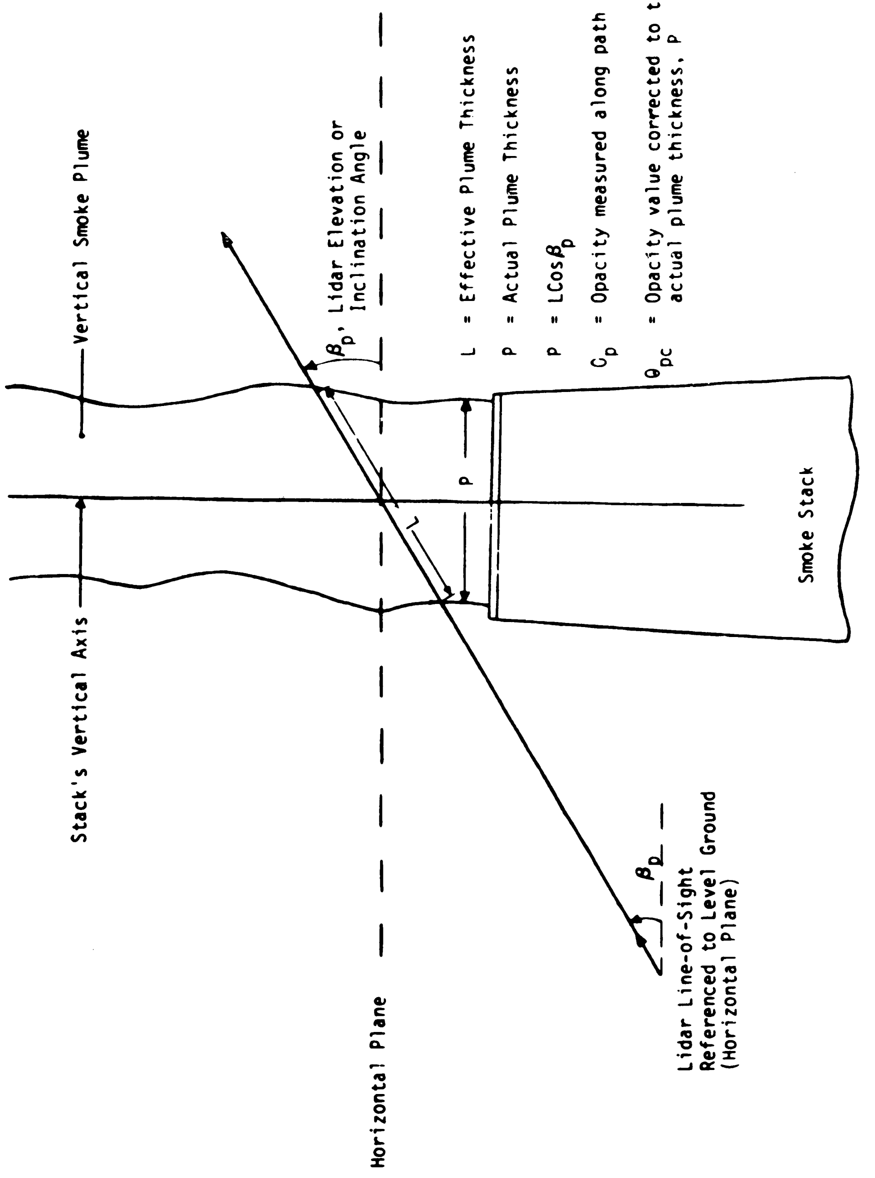


Figure AM1-V. Elevation Angle Correction for Vertical Plumes.

2.6.3 Determination of Actual Plume Opacity. Actual opacity of the plume shall be determined by Equation AM1-15.

$$O_{pa} = O_{pc} - [2 S_o + 5\%]. \qquad \text{(AM1-15)}$$

2.6.4 Calculation of Average Actual Plume Opacity. The average of the actual plume opacity, O_{pa}, shall be calculated as the average of the consecutive individual actual opacity values, O_{pa}, by Equation AM1-16.

$$\bar{O}_{pa} = \frac{1}{n} \sum_{k=1}^{n} (O_{pa})_k \quad , \qquad \text{(AM1-16)}$$

Where:

$(O_{pa})_k$ = the kth actual opacity value in an averaging interval containing n opacity values; k is a summing index.

Σ = the sum of the individual actual opacity values.

n = the number of individual actual opacity values contained in the averaging interval.

O_{pa} = average actual opacity calculated over the averaging interval.

3. Lidar Performance Verification

The lidar shall be subjected to two types of performance verifications that shall be performed in the field. The annual calibration, conducted at least once a year, shall be used to directly verify operation and performance of the entire lidar system. The routine verification, conducted for each emission source measured, shall be used to insure proper performance of the optical receiver and associated electronics.

3.1 Annual Calibration Procedures. Either a plume from a smoke generator or screen targets shall be used to conduct this calibration.

If the screen target method is selected, five screens shall be fabricated by placing an opaque mesh material over a narrow frame (wood, metal extrusion, etc.). The screen shall have a surface area of at least one square meter. The screen material should be chosen for precise optical opacities of about 10, 20, 40, 60, and 80%. Opacity of each target shall be optically determined and should be recorded. If a smoke generator plume is selected, it shall meet the requirements of section 3.3 of Reference Method 9. This calibration shall be performed in the field during calm (as practical) atmospheric conditions. The lidar shall be positioned in accordance with section 2.1.

The screen targets must be placed perpendicular to and coincident with the lidar line-of-sight at sufficient height above the ground (suggest about 30 ft) to avoid ground-level dust contamination. Reference signals shall be obtained just prior to conducting the calibration test.

The lidar shall be aimed through the center of the plume within 1 stack diameter of the exit, or through the geometric center of the screen target selected. The lidar shall be set in operation for a 6-minute data run at a nominal pulse rate of 1 pulse every 10 seconds. Each backscatter return signal and each respective opacity value obtained from the smoke generator transmissometer, shall be obtained in temporal coincidence. The data shall be analyzed and reduced in accordance with section 2.6 of this method. This calibration shall be performed for 0% (clean air), and at least five other opacities (nominally 10, 20, 40, 60, and 80%).

The average of the lidar opacity values obtained during a 6-minute calibration run shall be calculated and should be recorded. Also the average of the opacity values obtained from the smoke generator transmissometer for the same 6-minute run shall be calculated and should be recorded.

Alternate calibration procedures that do not meet the above requirements but produce equivalent results may be used.

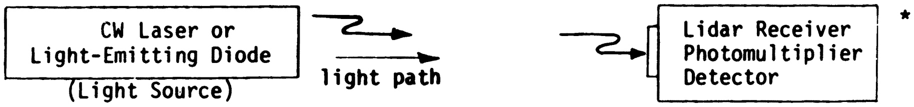
3.2 Routine Verification Procedures. Either one of two techniques shall be used to conduct this verification. It shall be performed at least once every 4 hours for each emission source measured. The following parameters shall be directly verified.

1) The opacity value of 0% plus a minimum of 5 (nominally 10, 20, 40, 60, and 80%) opacity values shall be verified through the PMT detector and data processing electronics.

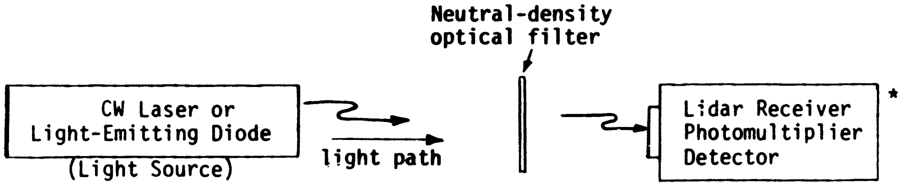
2) The zero-signal level (receiver signal with no optical signal from the source present) shall be inspected to insure that no spurious noise is present in the signal. With the entire lidar receiver and analog/digital electronics turned on and adjusted for normal operating performance, the following procedures shall be used for Techniques 1 and 2, respectively.

3.2.1 Procedure for Technique 1. This test shall be performed with no ambient or stray light reaching the PMT detector. The narrow band filter (694.3 nanometers peak) shall be removed from its position in front of the PMT detector. Neutral density filters of nominal opacities of 10, 20, 40, 60, and 80% shall be used. The recommended test configuration is depicted in Figure AM1–VI.

(a) Zero-Signal Level Test



(b) Clear-Air or 0% Opacity Test



(c) Optical Filter Test (simulated opacity values)

*Tests shall be performed with no ambient or stray light reaching the detector.

Figure AM1-VI. Test Configuration for Technique 1.

The zero-signal level shall be measured and should be recorded, as indicated in Figure AM1–VI(a). This simulated clear-air or 0% opacity value shall be tested in using the selected light source depicted in Figure AM1–VI(b).

The light source either shall be a continuous wave (CW) laser with the beam mechanically chopped or a light emitting diode controlled with a pulse generator (rectangular pulse). (A laser beam may have to be attenuated so as not to saturate the PMT detector). This signal level shall be measured and should be recorded. The opacity value is calculated by taking two pick intervals [Section 2.6] about 1 microsecond apart in time and using Equation (AM1–2) setting the ratio $R_n/R_f = 1$. This calculated value should be recorded.

The simulated clear-air signal level is also employed in the optical test using the neutral density filters. Using the test configuration in Figure AM1–VI(c), each neutral density filter shall be separately placed into the light path from the light source to the PMT detector. The signal level shall be measured and should be recorded. The opacity value for each filter is calculated by taking the signal level for that respective filter (I_f), dividing it by the 0% opacity signal level (I_n) and performing the remainder of the calculation by Equation (AM1–2) with $R_n/R_f = 1$. The calculated opacity value for each filter should be recorded.

The neutral density filters used for Technique 1 shall be calibrated for actual opacity with accuracy of ±2% or better. This calibration shall be done monthly while the filters are in use and the calibrated values should be recorded.

3.2.2 Procedure for Technique 2. An optical generator (built-in calibration mechanism) that contains a light-emitting diode (red light for a lidar containing a ruby laser) is used. By injecting an optical signal into the lidar receiver immediately ahead of the PMT detector, a backscatter signal is simulated. With the entire lidar receiver electronics turned on and adjusted for normal operating performance, the optical generator is turned on and the simulation signal (corrected for $1/R^2$) is selected with no plume spike signal and with the opacity value equal to 0%. This simulated clear-air atmospheric return signal is displayed on the system's video display. The lidar operator then makes any fine adjustments that may be necessary to maintain the system's normal operating range.

The opacity values of 0% and the other five values are selected one at a time in any order. The simulated return signal data should be recorded. The opacity value shall be calculated. This measurement/calculation shall be performed at least three times for each selected opacity value. While the order is not important, each of the opacity values from the optical generator shall be verified. The calibrated optical generator opacity value for each selection should be recorded.

The optical generator used for Technique 2 shall be calibrated for actual opacity with an accuracy of ±1% or better. This calibration shall be done monthly while the generator is in use and calibrated value should be recorded.

Alternate verification procedures that do not meet the above requirements but produce equivalent results may be used.

3.3 Deviation. The permissible error for the annual calibration and routine verification are:

3.3.1 Annual Calibration Deviation.

3.3.1.1 Smoke Generator. If the lidar-measured average opacity for each data run is not within ±5% (full scale) of the respective smoke generator's average opacity over the range of 0% through 80%, then the lidar shall be considered out of calibration.

3.3.1.2 Screens. If the lidar-measured average opacity for each data run is not within ±3% (full scale) of the laboratory-determined opacity for each respective simulation screen target over the range of 0% through 80%, then the lidar shall be considered out of calibration.

3.3.2 Routine Verification Error. If the lidar-measured average opacity for each neutral density filter (Technique 1) or optical generator selection (Technique 2) is not within ±3% (full scale) of the respective laboratory calibration value then the lidar shall be considered non-operational.

4. Performance/Design Specification for Basic Lidar System

4.1 Lidar Design Specification. The essential components of the basic lidar system are a pulsed laser (transmitter), optical receiver, detector, signal processor, recorder, and an aiming device that is used in aiming the lidar transmitter and receiver. Figure AM1–VII shows a functional block diagram of a basic lidar system.

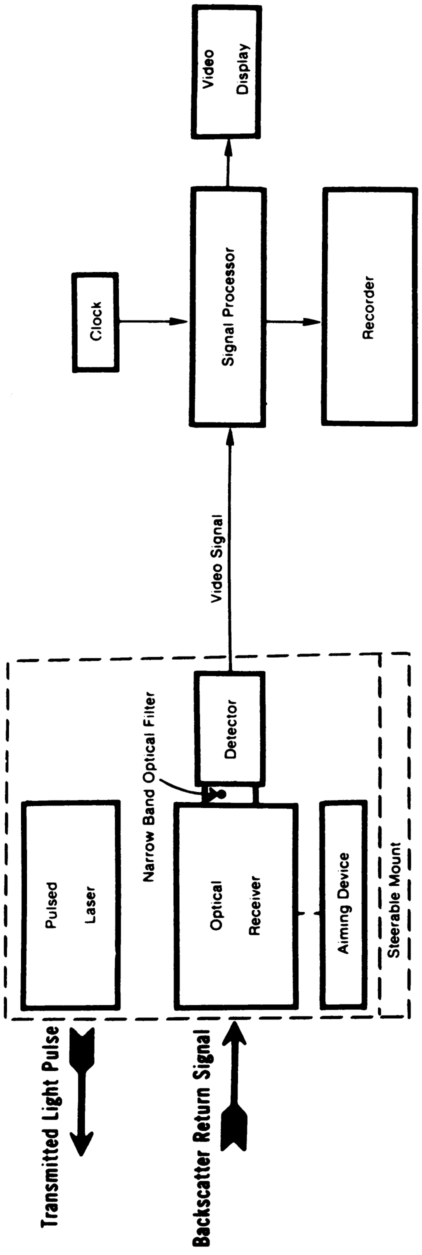


Figure AM1-VII. Functional Block Diagram of a Basic Lidar System

4.2 Performance Evaluation Tests. The owner of a lidar system shall subject such a lidar system to the performance verification tests described in section 3, prior to first use of this method. The annual calibration shall be performed for three separate, complete runs and the results of each should be recorded. The requirements of section 3.3.1 must be fulfilled for each of the three runs.

Once the conditions of the annual calibration are fulfilled the lidar shall be subjected to the routine verification for three separate complete runs. The requirements of section 3.3.2 must be fulfilled for each of the three runs and the results should be recorded. The Administrator may request that the results of the performance evaluation be submitted for review.

5. References

5.1 The Use of Lidar for Emissions Source Opacity Determination, U.S. Environmental Protection Agency, National Enforcement Investigations Center, Denver, CO. EPA–330/1–79–003–R, Arthur W. Dybdahl, current edition [NTIS No. PB81–246662].

5.2 Field Evaluation of Mobile Lidar for the Measurement of Smoke Plume Opacity, U.S. Environmental Protection Agency, National Enforcement Investigations Center, Denver, CO. EPA/NEIC-TS-128, February 1976.

5.3 Remote Measurement of Smoke Plume Transmittance Using Lidar, C. S. Cook, G. W. Bethke, W. D. Conner (EPA/RTP). Applied Optics 11, pg 1742. August 1972.

5.4 Lidar Studies of Stack Plumes in Rural and Urban Environments, EPA–650/4–73–002, October 1973.

5.5 American National Standard for the Safe Use of Lasers ANSI Z 136.1–176, March 8, 1976.

5.6 U.S. Army Technical Manual TB MED 279, Control of Hazards to Health from Laser Radiation, February 1969.

5.7 Laser Institute of America Laser Safety Manual, 4th Edition.

5.8 U.S. Department of Health, Education and Welfare, Regulations for the Administration and Enforcement of the Radiation Control for Health and Safety Act of 1968, January 1976.

5.9 Laser Safety Handbook, Alex Mallow, Leon Chabot, Van Nostrand Reinhold Co., 1978.

METHOD 10—DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES (INSTRUMENTAL ANALYZER PROCEDURE)

1.0 Scope and Application

What is Method 10?

Method 10 is a procedure for measuring carbon monoxide (CO) in stationary source emissions using a continuous instrumental analyzer. Quality assurance and quality control requirements are included to assure that you, the tester, collect data of known quality. You must document your adherence to these specific requirements for equipment, supplies, sample collection and analysis, calculations, and data analysis. This method does not completely describe all equipment, supplies, and sampling and analytical procedures you will need but refers to other methods for some of the details. Therefore, to obtain reliable results, you should also have a thorough knowledge of these additional test methods which are found in appendix A to this part:

(a) Method 1—Sample and Velocity Traverses for Stationary Sources.

(b) Method 4—Determination of Moisture Content in Stack Gases.

(c) Method 7E—Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure).

1.1 Analytes. What does this method determine? This method measures the concentration of carbon monoxide.

Analyte	CAS No.	Sensitivity
CO	630–08–0	Typically <2% of Calibration Span.

1.2 Applicability. When is this method required? The use of Method 10 may be required by specific New Source Performance Standards, State Implementation Plans, and permits where CO concentrations in stationary source emissions must be measured, either to determine compliance with an applicable emission standard or to conduct performance testing of a continuous emission monitoring system (CEMS). Other regulations may also require the use of Method 10.

1.3 Data Quality Objectives. Refer to section 1.3 of Method 7E.

2.0 Summary of Method

In this method, you continuously or intermittently sample the effluent gas and convey the sample to an analyzer that measures the concentration of CO. You must meet the performance requirements of this method to validate your data.

3.0 Definitions

Refer to section 3.0 of Method 7E for the applicable definitions.

4.0 Interferences

Substances having a strong absorption of infrared energy may interfere to some extent in some analyzers. Instrumental correction may be used to compensate for the interference. You may also use silica gel and ascarite traps to eliminate the interferences. If this option is used, correct the measured gas volume for the carbon dioxide (CO_2) removed in the trap.

5.0 Safety

Refer to section 5.0 of Method 7E.

6.0 Equipment and Supplies

What do I need for the measurement system?

6.1 Continuous Sampling. Figure 7E–1 of Method 7E is a schematic diagram of an acceptable measurement system. The components are the same as those in sections 6.1 and 6.2 of Method 7E, except that the CO analyzer described in section 6.2 of this method must be used instead of the analyzer described in section 6.2 of Method 7E. You must follow the noted specifications in section 6.1 of Method 7E except that the requirements to use stainless steel, Teflon, or non-reactive glass filters do not apply. Also, a heated sample line is not required to transport dry gases or for systems that measure the CO concentration on a dry basis.

6.2 Integrated Sampling.

6.2.1 Air-Cooled Condenser or Equivalent. To remove any excess moisture.

6.2.2 Valve. Needle valve, or equivalent, to adjust flow rate.

6.2.3 Pump. Leak-free diaphragm type, or equivalent, to transport gas.

6.2.4 Rate Meter. Rotameter, or equivalent, to measure a flow range from 0 to 1.0 liter per minute (0.035 cfm).

6.2.5 Flexible Bag. Tedlar, or equivalent, with a capacity of 60 to 90 liters (2 to 3 ft^3). (Verify through the manufacturer that the Tedlar alternative is suitable for CO and make this verified information available for inspection.) Leak-test the bag in the laboratory before using by evacuating with a pump followed by a dry gas meter. When the evacuation is complete, there should be no flow through the meter.

6.2.6 Sample Tank. Stainless steel or aluminum tank equipped with a pressure indicator with a minimum volume of 4 liters.

6.3 What analyzer must I use? You must use an instrument that continuously measures CO in the gas stream and meets the specifications in section 13.0. The dual-range analyzer provisions in section 6.2.8.1 of Method 7E apply.

7.0 Reagents and Standards

7.1 Calibration Gas. What calibration gases do I need? Refer to section 7.1 of Method 7E for the calibration gas requirements.

7.2 Interference Check. What additional reagents do I need for the interference check? Use the appropriate test gases listed in Table 7E–3 of Method 7E (i.e., potential interferents, as identified by the instrument manufacturer) to conduct the interference check.

8.0 Sample Collection, Preservation, Storage, and Transport

Emission Test Procedure

8.1 Sampling Site and Sampling Points. You must follow section 8.1 of Method 7E.

8.2 Initial Measurement System Performance Tests. You must follow the procedures in section 8.2 of Method 7E. If a dilution-type measurement system is used, the special considerations in section 8.3 of Method 7E also apply.

8.3 Interference Check. You must follow the procedures of section 8.2.7 of Method 7E.

8.4 Sample Collection.

8.4.1 Continuous Sampling. You must follow the procedures of section 8.4 of Method 7E.

8.4.2 Integrated Sampling. Evacuate the flexible bag or sample tank. Set up the equipment as shown in Figure 10–1 with the bag disconnected. Place the probe in the stack and purge the sampling line. Connect the bag, making sure that all connections are leak-free. Sample at a rate proportional to the stack velocity. If needed, the CO_2 content of the gas may be determined by using the Method 3 integrated sample procedures, or by weighing an ascarite CO_2 removal tube used and computing CO_2 concentration from the gas volume sampled and the weight gain of the tube. Data may be recorded on a form similar to Table 10–1. If a sample tank is used for sample collection, follow procedures similar to those in sections 8.1.2, 8.2.3, 8.3, and 12.4 of Method 25 as appropriate to prepare the tank, conduct the sampling, and correct the measured sample concentration.

8.5 Post-Run System Bias Check, Drift Assessment, and Alternative Dynamic Spike Procedure. You must follow the procedures in sections 8.5 and 8.6 of Method 7E.

9.0 Quality Control

Follow the quality control procedures in section 9.0 of Method 7E.

10.0 Calibration and Standardization

Follow the procedures for calibration and standardization in section 10.0 of Method 7E.

11.0 Analytical Procedures

Because sample collection and analysis are performed together (see section 8), additional discussion of the analytical procedure is not necessary.

12.0 Calculations and Data Analysis

You must follow the procedures for calculations and data analysis in section 12.0 of Method 7E, as applicable, substituting CO for NO_X as applicable.

12.1 Concentration Correction for CO_2 Removal. Correct the CO concentration for CO_2 removal (if applicable) using Eq. 10–1.

$$C_{Avg} = C_{CO\ stack}\left(1 - F_{CO2}\right)$$

Where:

C_{Avg} = Average gas concentration for the test run, ppm.

$C_{CO\ stack}$ = Average unadjusted stack gas CO concentration indicated by the data recorder for the test run, ppmv.

F_{CO2} = Volume fraction of CO_2 in the sample, i.e., percent CO_2 from Orsat analysis divided by 100.

13.0 Method Performance

The specifications for analyzer calibration error, system bias, drift, interference check, and alternative dynamic spike procedure are the same as in section 13.0 of Method 7E.

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 Alternative Procedures

The dynamic spike procedure and the manufacturer stability test are the same as in sections 16.1 and 16.3 of Method 7E

17.0 References

1. ‘‘EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards— September 1997 as amended, EPA–600/R–97/121

18.0 Tables, Diagrams, Flowcharts, and Validation Data

Figure 10-1. Integrated Gas Sampling Train.

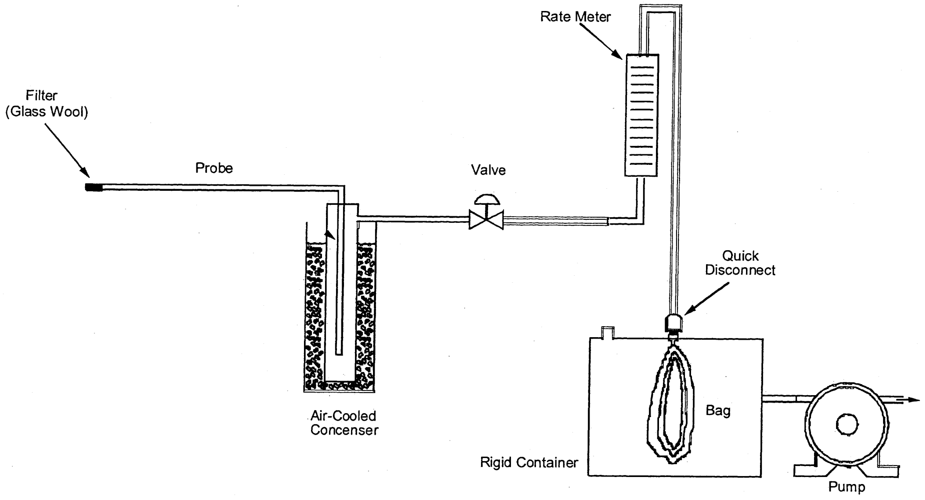


TABLE 10–1—FIELD DATA

[Integrated sampling]

Location: Date:

Test: Operator:

Clock Time	Rotameter Reading liters/min (cfm)	Comments

METHOD 10A—DETERMINATION OF CARBON MONOXIDE EMISSIONS IN CERTIFYING CONTINUOUS EMISSION MONITORING SYSTEMS AT PETROLEUM REFINERIES

NOTE: This method does not include all of the specifications (*e.g.*, equipment and supplies) and procedures (*e.g.*, sampling and analytical) essential to its performance. Some material is incorporated by reference from other methods in this part. Therefore, to obtain reliable results, persons using this method should have a thorough knowledge of at least the following additional test methods: Method 1, Method 4, and Method 5.

1.0 Scope and Application

1.1 Analytes.

Analyte	CAS No.	Sensitivity
Carbon monoxide (CO)	630–08–0	3 ppmv

1.2 Applicability. This method is applicable for the determination of CO emissions at petroleum refineries. This method serves as the reference method in the relative accuracy test for nondispersive infrared (NDIR) CO continuous emission monitoring systems (CEMS) that are required to be installed in petroleum refineries on fluid catalytic cracking unit catalyst regenerators (§ 60.105(a)(2) of this part).

1.3 Data Quality Objectives. Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods.

2.0 Summary of Method

An integrated gas sample is extracted from the stack, passed through an alkaline permanganate solution to remove sulfur oxides and nitrogen oxides, and collected in a Tedlar or equivalent bag. (Verify through the manufacturer that the Tedlar alternative is suitable for NO and make this verified information available for inspection.) The CO concentration in the sample is measured spectrophotometrically using the reaction of CO with *p*-sulfaminobenzoic acid.

3.0 Definitions [Reserved]

4.0 Interferences

Sulfur oxides, nitric oxide, and other acid gases interfere with the colorimetric reaction. They are removed by passing the sampled gas through an alkaline potassium permanganate scrubbing solution. Carbon dioxide (CO_2) does not interfere, but, because it is removed by the scrubbing solution, its concentration must be measured independently and an appropriate volume correction made to the sampled gas.

5.0 Safety

5.1 Disclaimer. This method may involve hazardous materials, operations, and equipment. This test method may not address all of the safety problems associated with its use. It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to performing this test method. The analyzer users manual should be consulted for specific precautions to be taken with regard to the analytical procedure.

5.2 Corrosive reagents. The following reagents are hazardous. Personal protective equipment and safe procedures are useful in preventing chemical splashes. If contact occurs, immediately flush with copious amounts of water for at least 15 minutes. Remove clothing under shower and decontaminate. Treat residual chemical burns as thermal burns.

5.2.1 Sodium Hydroxide (NaOH). Causes severe damage to eyes and skin. Inhalation causes irritation to nose, throat, and lungs.

Reacts exothermically with limited amounts of water.

6.0 Equipment and Supplies

6.1 Sample Collection. The sampling train shown in Figure 10A–1 is required for sample collection. Component parts are described below:

6.1.1 Probe. Stainless steel, sheathed Pyrex glass, or equivalent, equipped with a glass wool plug to remove particulate matter.

6.1.2 Sample Conditioning System. Three Greenburg-Smith impingers connected in series with leak-free connections.

6.1.3 Pump. Leak-free pump with stainless steel and Teflon parts to transport sample at a flow rate of 300 ml/min (0.01 ft^3/min) to the flexible bag.

6.1.4 Surge Tank. Installed between the pump and the rate meter to eliminate the pulsation effect of the pump on the rate meter.

6.1.5 Rate Meter. Rotameter, or equivalent, to measure flow rate at 300 ml/min (0.01 ft^3/min). Calibrate according to section 10.2.

6.1.6 Flexible Bag. Tedlar, or equivalent, with a capacity of 10 liters (0.35 ft^3) and equipped with a sealing quick-connect plug. The bag must be leak-free according to section 8.1. For protection, it is recommended that the bag be enclosed within a rigid container.

6.1.7 Sample Tank. Stainless steel or aluminum tank equipped with a pressure indicator with a minimum volume of 10 liters.

6.1.8 Valves. Stainless-steel needle valve to adjust flow rate, and stainless-steel 3-way valve, or equivalent.

6.1.9 CO_2 Analyzer. Fyrite, or equivalent, to measure CO_2 concentration to within 0.5 percent.

6.1.10 Volume Meter. Dry gas meter, capable of measuring the sample volume under calibration conditions of 300 ml/min (0.01 ft^3/min) for 10 minutes.

6.1.11 Pressure Gauge. A water filled U-tube manometer, or equivalent, of about 30 cm (12 in.) to leak-check the flexible bag.

6.2 Sample Analysis.

6.2.1 Spectrophotometer. Single- or double-beam to measure absorbance at 425 and 600 nm. Slit width should not exceed 20 nm.

6.2.2 Spectrophotometer Cells. 1-cm pathlength.

6.2.3 Vacuum Gauge. U-tube mercury manometer, 1 meter (39 in.), with 1-mm divisions, or other gauge capable of measuring pressure to within 1 mm Hg.

6.2.4 Pump. Capable of evacuating the gas reaction bulb to a pressure equal to or less than 40 mm Hg absolute, equipped with coarse and fine flow control valves.

6.2.5 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 1 mm Hg.

6.2.6 Reaction Bulbs. Pyrex glass, 100-ml with Teflon stopcock (Figure 10A–2), leak-free at 40 mm Hg, designed so that 10 ml of the colorimetric reagent can be added and removed easily and accurately. Commercially available gas sample bulbs such as Supelco Catalog No. 2–2161 may also be used.

6.2.7 Manifold. Stainless steel, with connections for three reaction bulbs and the appropriate connections for the manometer and sampling bag as shown in Figure 10A–3.

6.2.8 Pipets. Class A, 10–ml size.

6.2.9 Shaker Table. Reciprocating-stroke type such as Eberbach Corporation, Model 6015. A rocking arm or rotary-motion type shaker may also be used. The shaker must be large enough to accommodate at least six gas sample bulbs simultaneously. It may be necessary to construct a table top extension for most commercial shakers to provide sufficient space for the needed bulbs (Figure 10A–4).

6.2.10 Valve. Stainless steel shut-off valve.

6.2.11 Analytical Balance. Capable of weighing to 0.1 mg.

7.0 Reagents and Standards

Unless otherwise indicated, all reagents shall conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available; otherwise, the best available grade shall be used.

7.1 Sample Collection.

7.1.1 Water. Deionized distilled, to conform to ASTM D 1193–77 or 91, Type 3 (incorporated by reference—see §60.17). If high concentrations of organic matter are not expected to be present, the potassium permanganate test for oxidizable organic matter may be omitted.

7.1.2 Alkaline Permanganate Solution, 0.25 M $KMnO_4$/1.5 M Sodium Hydroxide (NaOH). Dissolve 40 g $KMnO_4$ and 60 g NaOH in approximately 900 ml water, cool, and dilute to 1 liter.

7.2 Sample Analysis.

7.2.1 Water. Same as in section 7.1.1.

7.2.2 1 M Sodium Hydroxide Solution. Dissolve 40 g NaOH in approximately 900 ml of water, cool, and dilute to 1 liter.

7.2.3 0.1 M NaOH Solution. Dilute 50 ml of the 1 M NaOH solution prepared in section 7.2.2 to 500 ml.

7.2.4 0.1 M Silver Nitrate ($AgNO_3$) Solution. Dissolve 8.5 g $AgNO_3$ in water, and dilute to 500 ml.

7.2.5 0.1 M Para-Sulfaminobenzoic Acid (p-SABA) Solution. Dissolve 10.0 g p-SABA in 0.1 M NaOH, and dilute to 500 ml with 0.1 M NaOH.

7.2.6 Colorimetric Solution. To a flask, add 100 ml of 0.1 M p-SABA solution and 100 ml of 0.1 M $AgNO_3$ solution. Mix, and add 50 ml of 1 M NaOH with shaking. The resultant solution should be clear and colorless. This solution is acceptable for use for a period of 2 days.

7.2.7 Standard Gas Mixtures. Traceable to National Institute of Standards and Technology (NIST) standards and containing between 50 and 1000 ppm CO in nitrogen. At least two concentrations are needed to span each calibration range used (Section 10.3). The calibration gases must be certified by the manufacturer to be within 2 percent of the specified concentrations.

8.0 Sample Collection, Preservation, Storage, and Transport

8.1 Sample Bag or Tank Leak-Checks. While a leak-check is required after bag or sample tank use, it should also be done before the bag or sample tank is used for sample collection. The tank should be leak-checked according to the procedure specified in section 8.1.2 of Method 25. The bag should be leak-checked in the inflated and deflated condition according to the following procedure:

8.1.1 Connect the bag to a water manometer, and pressurize the bag to 5 to 10 cm H_2O (2 to 4 in H_2O). Allow the bag to stand for 60 minutes. Any displacement in the water manometer indicates a leak.

8.1.2 Evacuate the bag with a leakless pump that is connected to the downstream side of a flow indicating device such as a 0- to 100-ml/min rotameter or an impinger containing water. When the bag is completely evacuated, no flow should be evident if the bag is leak-free.

8.2 Sample Collection.

8.2.1 Evacuate and leak check the sample bag or tank as specified in section 8.1. Assemble the apparatus as shown in Figure 10A–1. Loosely pack glass wool in the tip of the probe. Place 400 ml of alkaline permanganate solution in the first two impingers and 250 ml in the third. Connect the pump to the third impinger, and follow this with the surge tank, rate meter, and 3-way valve. Do not connect the bag or sample tank to the system at this time.

8.2.2 Leak-check the sampling system by plugging the probe inlet, opening the 3-way valve, and pulling a vacuum of approximately 250 mm Hg on the system while observing the rate meter for flow. If flow is indicated on the rate meter, do not proceed further until the leak is found and corrected.

8.2.3 Purge the system with sample gas by inserting the probe into the stack and drawing the sample gas through the system at 300 ml/min ±10 percent for 5 minutes. Connect the evacuated bag or sample tank to the system, record the starting time, and sample at a rate of 300 ml/min for 30 minutes, or until the bag is nearly full, or the sample tank reaches ambient pressure. Record the sampling time, the barometric pressure, and the ambient temperature. Purge the system as described above immediately before each sample.

8.2.4 The scrubbing solution is adequate for removing sulfur oxides and nitrogen oxides from 50 liters (1.8 ft^3) of stack gas when the concentration of each is less than 1,000 ppm and the CO_2 concentration is less than 15 percent. Replace the scrubber solution after every fifth sample.

8.3 Carbon Dioxide Measurement. Measure the CO_2 content in the stack to the nearest 0.5 percent each time a CO sample is collected. A simultaneous grab sample analyzed by the Fyrite analyzer is acceptable.

9.0 Quality Control

9.1 Miscellaneous Quality Control Measures.

Section	Quality control measure	Effect
8.1	Sampling equipment leak-checks and calibration.	Ensure accuracy and precision of sampling measurements.
10.3	Spectrophotometer calibration	Ensure linearity of spectrophotometer response to standards.

9.2 Volume Metering System Checks. Same as Method 5, section 9.2.

10.0 Calibration and Standardization

NOTE: Maintain a laboratory log of all calibrations.

10.1 Gas Bulb Calibration. Weigh the empty bulb to the nearest 0.1 g. Fill the bulb to the stopcock with water, and again weigh to the nearest 0.1 g. Subtract the tare weight, and calculate the volume in liters to three significant figures using the density of water at the measurement temperature. Record the volume on the bulb. Alternatively, mark an identification number on the bulb, and record the volume in a notebook.

10.2 Rate Meter Calibration. Assemble the system as shown in Figure 10A–1 (the impingers may be removed), and attach a volume meter to the probe inlet. Set the rotameter at 300 ml/min, record the volume meter reading, start the pump, and pull ambient air through the system for 10 minutes. Record the final volume meter reading. Repeat the procedure and average the results to determine the volume of gas that passed through the system.

10.3 Spectrophotometer Calibration Curve.

10.3.1 Collect the standards as described in section 8.2. Prepare at least two sets of three bulbs as standards to span the 0 to 400 or 400 to 1000 ppm range. If any samples span both concentration ranges, prepare a calibration curve for each range using separate reagent blanks. Prepare a set of three bulbs containing colorimetric reagent but no CO to serve as a reagent blank. Analyze each standard and blank according to the sample analysis procedure of section 11.0 Reject the standard set where any of the individual bulb absorbances differs from the set mean by more than 10 percent.

10.3.2 Calculate the average absorbance for each set (3 bulbs) of standards using Equation 10A–1 and Table 10A–1. Construct a graph of average absorbance for each standard against its corresponding concentration. Draw a smooth curve through the points. The curve should be linear over the two concentration ranges discussed in section 13.3.

11.0 Analytical Procedure

11.1 Assemble the system shown in Figure 10A–3, and record the information required in Table 10A–1 as it is obtained. Pipet 10.0 ml of the colorimetric reagent into each gas reaction bulb, and attach the bulbs to the system. Open the stopcocks to the reaction bulbs, but leave the valve to the bag closed. Turn on the pump, fully open the coarse-adjust flow valve, and slowly open the fine-adjust valve until the pressure is reduced to at least 40 mm Hg. Now close the coarse adjust valve, and observe the manometer to be certain that the system is leak-free. Wait a minimum of 2 minutes. If the pressure has increased less than 1 mm Hg, proceed as described below. If a leak is present, find and correct it before proceeding further.

11.2 Record the vacuum pressure (P_v) to the nearest 1 mm Hg, and close the reaction bulb stopcocks. Open the bag valve, and allow the system to come to atmospheric pressure. Close the bag valve, open the pump coarse adjust valve, and evacuate the system again. Repeat this fill/evacuation procedure at least twice to flush the manifold completely. Close the pump coarse adjust valve, open the bag valve, and let the system fill to atmospheric pressure. Open the stopcocks to the reaction bulbs, and let the entire system come to atmospheric pressure. Close the bulb stopcocks, remove the bulbs, record the room temperature and barometric pressure (P_{bar}, to nearest mm Hg), and place the bulbs on the shaker table with their main axis either parallel to or perpendicular to the plane of the table top. Purge the bulb-filling system with ambient air for several minutes between samples. Shake the samples for exactly 2 hours.

11.3 Immediately after shaking, measure the absorbance (A) of each bulb sample at 425 nm if the concentration is less than or equal to 400 ppm CO or at 600 nm if the concentration is above 400 ppm.

NOTE: This may be accomplished with multiple bulb sets by sequentially collecting sets and adding to the shaker at staggered intervals, followed by sequentially removing sets from the shaker for absorbance measurement after the two-hour designated intervals have elapsed.

11.4 Use a small portion of the sample to rinse a spectrophotometer cell several times before taking an aliquot for analysis. If one cell is used to analyze multiple samples, rinse the cell with deionized distilled water several times between samples. Prepare and analyze standards and a reagent blank as described in section 10.3. Use water as the reference. Reject the analysis if the blank absorbance is greater than 0.1. All conditions should be the same for analysis of samples and standards. Measure the absorbances as soon as possible after shaking is completed.

11.5 Determine the CO concentration of each bag sample using the calibration curve for the appropriate concentration range as discussed in section 10.3.

12.0 Calculations and Data Analysis

Carry out calculations retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

12.1 Nomenclature.

A = Sample absorbance, uncorrected for the reagent blank.
A_r = Absorbance of the reagent blank.
A_s = Average sample absorbance per liter, units/liter.
B_w = Moisture content in the bag sample.
C = CO concentration in the stack gas, dry basis, ppm.
C_b = CO concentration of the bag sample, dry basis, ppm.
C_g = CO concentration from the calibration curve, ppm.
F = Volume fraction of CO_2 in the stack.
n = Number of reaction bulbs used per bag sample.
P_b = Barometric pressure, mm Hg.
P_v = Residual pressure in the sample bulb after evacuation, mm Hg.
P_w = Vapor pressure of H_2O in the bag (from Table 10A–2), mm Hg.
V_b = Volume of the sample bulb, liters.
V_r = Volume of reagent added to the sample bulb, 0.0100 liter.

12.2 Average Sample Absorbance per Liter. Calculate A_s for each gas bulb using Equation 10A–1, and record the value in Table 10A–1. Calculate the average A_s for each bag sample, and compare the three values to the average. If any single value differs by more than 10 percent from the average, reject this value, and calculate a new average using the two remaining values.

$$A_s = \frac{(A - A_r)(P_b)}{(V_b - V_r)(P_b - P_v)} \qquad \text{Eq. 10A-1}$$

NOTE: A and A_r must be at the same wavelength.

12.3 CO Concentration in the Bag. Calculate C_b using Equations 10A–2 and 10A–3. If condensate is visible in the bag, calculate B_w using Table 10A–2 and the temperature and barometric pressure in the analysis room. If condensate is not visible, calculate B_w using the temperature and barometric pressure at the sampling site.

$$B_w = \frac{P_w}{P_b} \qquad \text{Eq. 10A-2}$$

$$C_b = \frac{C_g}{\left(1 - B_w\right)} \qquad \text{Eq. 10A-3}$$

12.4 CO Concentration in the Stack.

$$C = C_b\ (1 - F) \qquad \text{Eq. 10A-4}$$

13.0 Method Performance

13.1 Precision. The estimated intralaboratory standard deviation of the method is 3 percent of the mean for gas samples analyzed in duplicate in the concentration range of 39 to 412 ppm. The interlaboratory precision has not been established.

13.2 Accuracy. The method contains no significant biases when compared to an NDIR analyzer calibrated with NIST standards.

13.3 Range. Approximately 3 to 1800 ppm CO. Samples having concentrations below 400 ppm are analyzed at 425 nm, and samples having concentrations above 400 ppm are analyzed at 600 nm.

13.4 Sensitivity. The detection limit is 3 ppmv based on a change in concentration equal to three times the standard deviation of the reagent blank solution.

13.5 Stability. The individual components of the colorimetric reagent are stable for at least one month. The colorimetric reagent must be used within two days after preparation to avoid excessive blank correction. The samples in the bag should be stable for at least one week if the bags are leak-free.

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 References

1. Butler, F.E., J.E. Knoll, and M.R. Midgett. Development and Evaluation of Methods for Determining Carbon Monoxide Emissions. U.S. Environmental Protection Agency, Research Triangle Park, N.C. June 1985. 33 pp.

2. Ferguson, B.B., R.E. Lester, and W.J. Mitchell. Field Evaluation of Carbon Monoxide and Hydrogen Sulfide Continuous Emission Monitors at an Oil Refinery. U.S. Environmental Protection Agency, Research Triangle Park, N.C. Publication No. EPA–600/4–82–054. August 1982. 100 pp.

3. Lambert, J.L., and R.E. Weins. Induced Colorimetric Method for Carbon Monoxide. Analytical Chemistry. *46*(7):929–930. June 1974.

4. Levaggi, D.A., and M. Feldstein. The Colorimetric Determination of Low Concentrations of Carbon Monoxide. Industrial Hygiene Journal. *25*:64–66. January-February 1964.

5. Repp, M. Evaluation of Continuous Monitors For Carbon Monoxide in Stationary Sources. U.S. Environmental Protection Agency. Research Triangle Park, N.C. Publication No. EPA–600/2–77–063. March 1977. 155 pp.

6. Smith, F., D.E. Wagoner, and R.P. Donovan. Guidelines for Development of a Quality Assurance Program: Volume VIII—Determination of CO Emissions from Stationary Sources by NDIR Spectrometry. U.S. Environmental Protection Agency. Research Triangle Park, N.C. Publication No. EPA–650/4–74–005–h. February 1975. 96 pp.

17.0 Tables, Diagrams, Flowcharts, and Validation Data

TABLE 10A–1—DATA RECORDING SHEET FOR SAMPLES ANALYZED IN TRIPLICATE

Sample No./type	Room temp °C	Stack %CO_2	Bulb No.	Bulb vol. liters	Reagent vol. in bulb, liter	Partial pressure of gas in bulb, mm Hg	P_b, mm Hg	Shaking time, min	Abs versus water	$A\text{-}A_r$	A_s	Avg A_s
blank												
Std. 1												
Std. 2												
Sample 1												
Sample 2												
Sample 3												

TABLE 10A–2—MOISTURE CORRECTION

Temperature °C	Vapor pressure of H_2O, mm Hg	Temperature °C	Vapor pressure of H_2, mm Hg
4	6.1	18	15.5
6	7.0	20	17.5
8	8.0	22	19.8
10	9.2	24	22.4
12	10.5	26	25.2
14	12.0	28	28.3
16	13.6	30	31.8

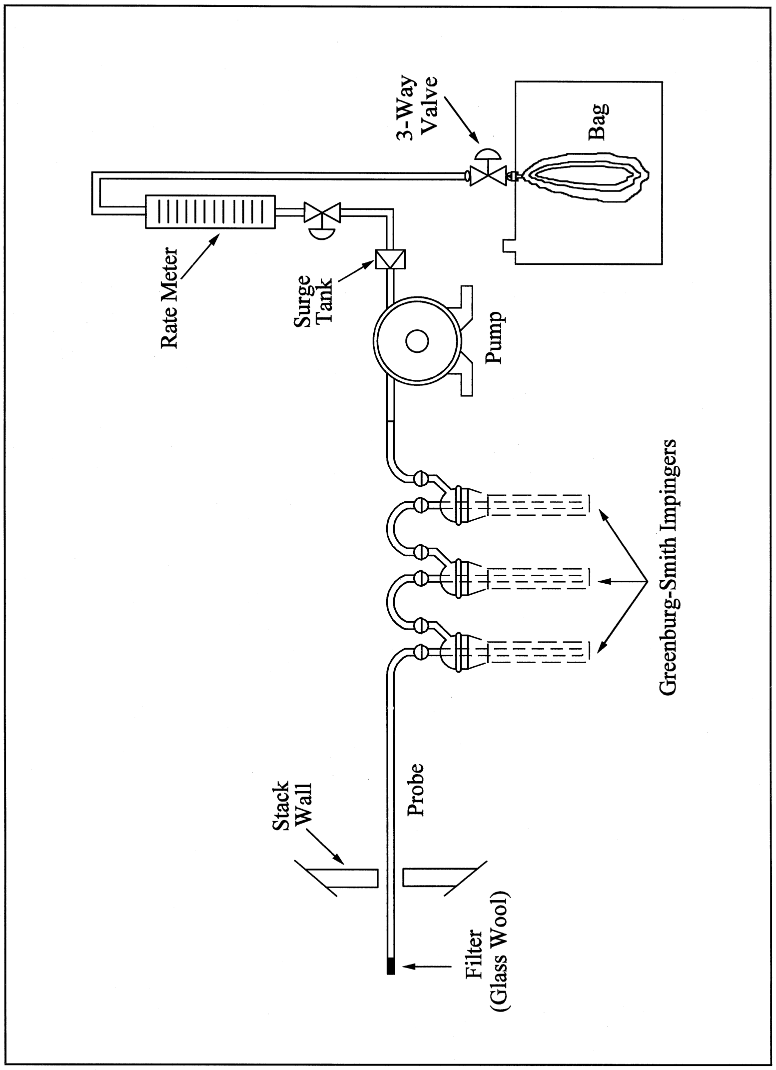


Figure 10A-1. Sampling Train.

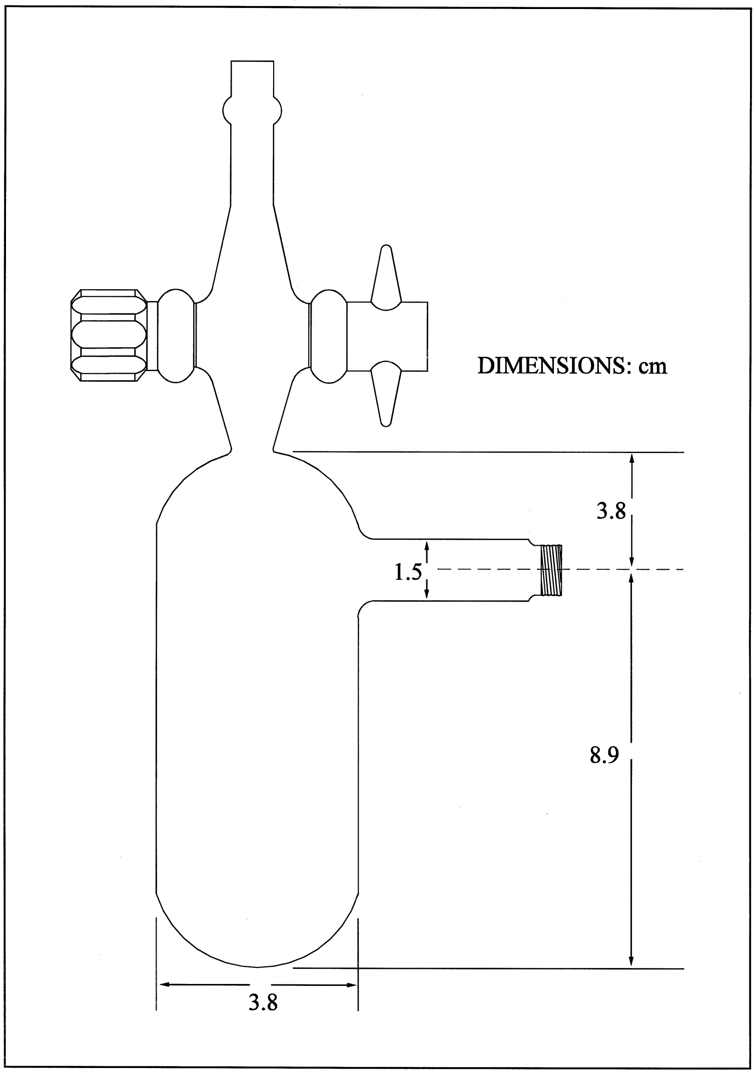


Figure 10A-2. Sample Reaction Bulbs.

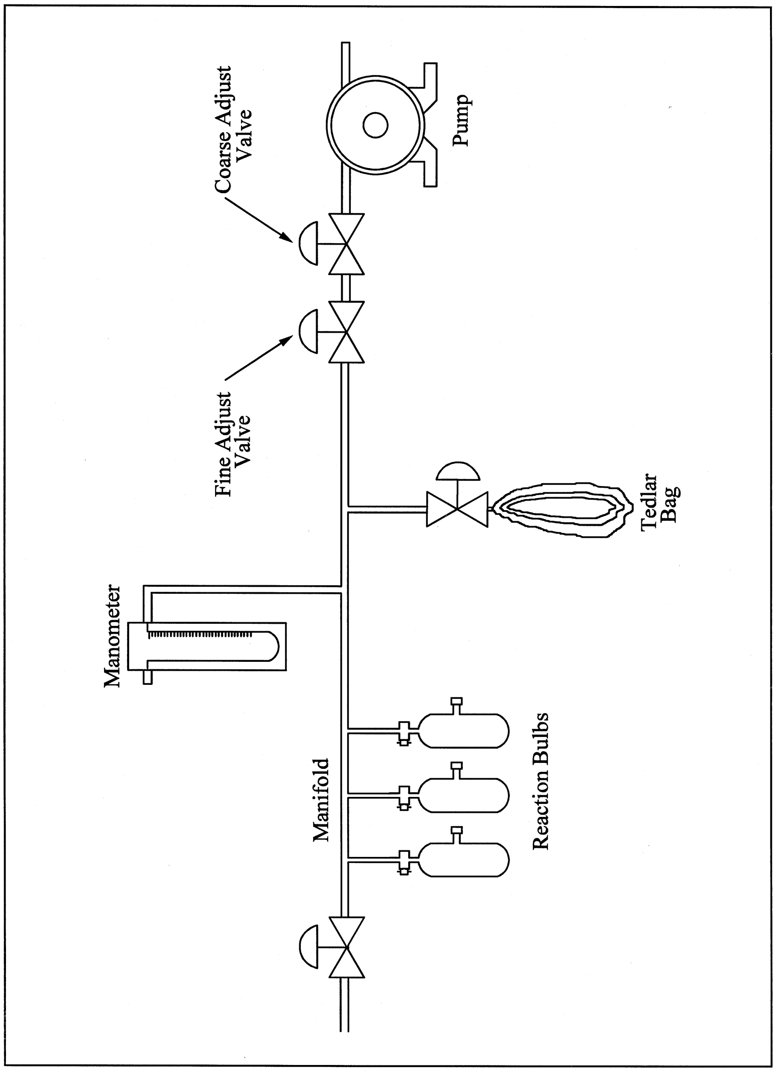


Figure 10A-3. Sample Bulb Filling System.

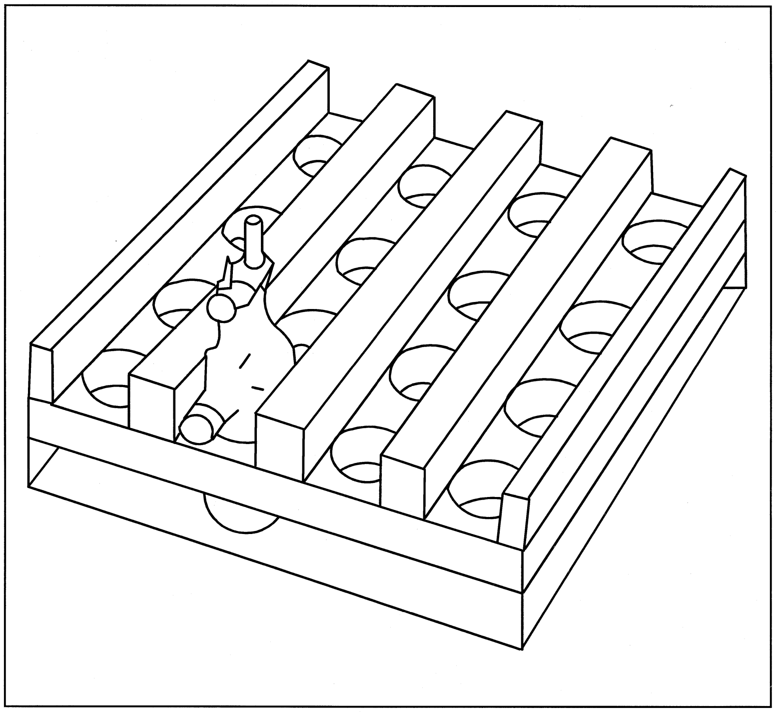


Figure 10A-4. Shaker Table Adapter.

METHOD 10B—DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES

NOTE: This method is not inclusive with respect to specifications (*e.g.*, equipment and supplies) and procedures (*e.g.*, sampling and analytical) essential to its performance. Some material is incorporated by reference from other methods in this part. Therefore, to obtain reliable results, persons using this method should have a thorough knowledge of at least the following additional test methods: Method 1, Method 4, Method 10A, and Method 25.

1.0 Scope and Application

1.1 Analytes.

Analyte	CAS No.	Sensitivity
Carbon monoxide (CO)	630–08–0	Not determined.

1.2 Applicability. This method applies to the measurement of CO emissions at petroleum refineries and from other sources when specified in an applicable subpart of the regulations.

1.3 Data Quality Objectives. Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods.

2.0 Summary of Method

2.1 An integrated gas sample is extracted from the sampling point, passed through a conditioning system to remove interferences, and collected in a Tedlar or equivalent bag. (Verify through the manufacturer that the Tedlar alternative is suitable for NO and make this verifying information available for inspection.) The CO is separated from the sample by gas chromatography (GC) and catalytically reduced to methane (CH_4) which is determined by flame ionization detection (FID). The analytical portion of this method is identical to applicable sections in Method 25 detailing CO measurement.

3.0 Definitions [Reserved]

4.0 Interferences

4.1 Carbon dioxide (CO_2) and organics potentially can interfere with the analysis. Most of the CO_2 is removed from the sample by the alkaline permanganate conditioning system; any residual CO_2 and organics are separated from the CO by GC.

5.0 Safety

5.1 Disclaimer. This method may involve hazardous materials, operations, and equipment. This test method may not address all of the safety problems associated with its use. It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to performing this test method. The analyzer users manual should be consulted for specific precautions concerning the analytical procedure.

6.0 Equipment and Supplies

6.1 Sample Collection. Same as in Method 10A, section 6.1 (paragraphs 6.1.1 through 6.1.11).

6.2 Sample Analysis. A GC/FID analyzer, capable of quantifying CO in the sample and consisting of at least the following major components, is required for sample analysis. [Alternatively, complete Method 25 analytical systems (Method 25, section 6.3) are acceptable alternatives when calibrated for CO and operated in accordance with the Method 25 analytical procedures (Method 25, section 11.0).]

6.2.1 Separation Column. A column capable of separating CO from CO_2 and organic compounds that may be present. A 3.2-mm (1/8-in.) OD stainless steel column packed with 1.7 m (5.5 ft.) of 60/80 mesh Carbosieve S-II (available from Supelco) has been used successfully for this purpose.

6.2.2 Reduction Catalyst. Same as in Method 25, section 6.3.1.2.

6.2.3 Sample Injection System. Same as in Method 25, Section 6.3.1.4, equipped to accept a sample line from the bag.

6.2.4 Flame Ionization Detector. Meeting the linearity specifications of section 10.3 and having a minimal instrument range of 10 to 1,000 ppm CO.

6.2.5 Data Recording System. Analog strip chart recorder or digital integration system, compatible with the FID, for permanently recording the analytical results.

7.0 Reagents and Standards

7.1 Sample Collection. Same as in Method 10A, section 7.1.

7.2 Sample Analysis.

7.2.1 Carrier, Fuel, and Combustion Gases. Same as in Method 25, sections 7.2.1, 7.2.2, and 7.2.3, respectively.

7.2.2 Calibration Gases. Three standard gases with nominal CO concentrations of 20, 200, and 1,000 ppm CO in nitrogen. The calibration gases shall be certified by the manufacturer to be ±2 percent of the specified concentrations.

7.2.3 Reduction Catalyst Efficiency Check Calibration Gas. Standard CH_4 gas with a nominal concentration of 1,000 ppm in air.

8.0 Sample Collection, Preservation, Storage, and Transport

Same as in Method 10A, section 8.0.

9.0 Quality Control

Section	Quality control measure	Effect
8.0	Sample bag/sampling system leak-checks	Ensures that negative bias introduced through leakage is minimized.
10.1	Carrier gas blank check	Ensures that positive bias introduced by contamination of carrier gas is less than 5 ppmv.
10.2	Reduction catalyst efficiency check	Ensures that negative bias introduced by inefficient reduction catalyst is less than 5 percent.
10.3	Analyzer calibration	Ensures linearity of analyzer response to standards.
11.2	Triplicate sample analyses	Ensures precision of analytical results.

10.0 Calibration and Standardization

10.1 Carrier Gas Blank Check. Analyze each new tank of carrier gas with the GC analyzer according to section 11.2 to check for contamination. The corresponding concentration must be less than 5 ppm for the tank to be acceptable for use.

10.2 Reduction Catalyst Efficiency Check. Prior to initial use, the reduction catalyst shall be tested for reduction efficiency. With the heated reduction catalyst bypassed, make triplicate injections of the 1,000 ppm CH_4 gas (Section 7.2.3) to calibrate the analyzer. Repeat the procedure using 1,000 ppm CO gas (Section 7.2.2) with the catalyst in operation. The reduction catalyst operation is acceptable if the CO response is within 5 percent of the certified gas value.

10.3 Analyzer Calibration. Perform this test before the system is first placed into operation. With the reduction catalyst in operation, conduct a linearity check of the analyzer using the standards specified in section 7.2.2. Make triplicate injections of each calibration gas, and then calculate the average response factor (area/ppm) for each gas, as well as the overall mean of the response factor values. The instrument linearity is acceptable if the average response factor of each calibration gas is within 2.5 percent of the overall mean value and if the relative standard deviation (calculated in section 12.8 of Method 25) for each set of triplicate injections is less than 2 percent. Record the overall mean of the response factor values as the calibration response factor (R).

11.0 Analytical Procedure

11.1 Preparation for Analysis. Before putting the GC analyzer into routine operation, conduct the calibration procedures listed in section 10.0. Establish an appropriate carrier flow rate and detector temperature for the specific instrument used.

11.2 Sample Analysis. Purge the sample loop with sample, and then inject the sample. Analyze each sample in triplicate, and calculate the average sample area (A). Determine the bag CO concentration according to section 12.2.

12.0 Calculations and Data Analysis

Carry out calculations retaining at least one extra significant figure beyond that of the acquired data. Round off results only after the final calculation.

12.1 Nomenclature.

A = Average sample area.
B_w = Moisture content in the bag sample, fraction.
C = CO concentration in the stack gas, dry basis, ppm.
C_b = CO concentration in the bag sample, dry basis, ppm.
F = Volume fraction of CO_2 in the stack, fraction.
P_{bar} = Barometric pressure, mm Hg.
P_w = Vapor pressure of the H_2O in the bag (from Table 10A–2, Method 10A), mm Hg.
R = Mean calibration response factor, area/ppm.

12.2 CO Concentration in the Bag. Calculate C_b using Equations 10B–1 and 10B–2. If condensate is visible in the bag, calculate B_w using Table 10A–2 of Method 10A and the temperature and barometric pressure in the analysis room. If condensate is not visible, calculate B_w using the temperature and barometric pressure at the sampling site.

$$B_w = \frac{P_w}{P_{bar}} \qquad \text{Eq. 10B-1}$$

$$C_b = \frac{A}{R\left(1 - B_w\right)} \qquad \text{Eq. 10B-2}$$

12.3 CO Concentration in the Stack

$$C = C_b\ (1 - F) \qquad \text{Eq. 10B-3}$$

13.0 Method Performance [Reserved]

14.0 Pollution Prevention [Reserved]

15.0 Waste Management [Reserved]

16.0 References

Same as in Method 25, section 16.0, with the addition of the following:

1. Butler, F.E, J.E. Knoll, and M.R. Midgett. Development and Evaluation of Methods for Determining Carbon Monoxide Emissions. Quality Assurance Division, Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, NC. June 1985. 33 pp.

17.0 Tables, Diagrams, Flowcharts, and Validation Data [Reserved]

[36 FR 24877, Dec. 23, 1971]

EDITORIAL NOTE: For FEDERAL REGISTER citations affecting appendix A–4 to part 60, see the List of CFR sections Affected, which appears in the Finding Aids section of the printed volume and at *www.fdsys.gov*.

APPENDIX A–5 TO PART 60—TEST METHODS 11 THROUGH 15A

Method 11—Determination of hydrogen sulfide content of fuel gas streams in petroleum refineries
Method 12—Determination of inorganic lead emissions from stationary sources
Method 13A—Determination of total fluoride emissions from stationary sources—SPADNS zirconium lake method
Method 13B—Determination of total fluoride emissions from stationary sources—Specific ion electrode method
Method 14—Determination of fluoride emissions from potroom roof monitors for primary aluminum plants
Method 14A—Determination of Total Fluoride Emissions from Selected Sources at Primary Aluminum Production Facilities
Method 15—Determination of hydrogen sulfide, carbonyl sulfide, and carbon disulfide emissions from stationary sources
Method 15A—Determination of total reduced sulfur emissions from sulfur recovery plants in petroleum refineries

The test methods in this appendix are referred to in §60.8 (Performance Tests) and §60.11 (Compliance With Standards and Maintenance Requirements) of 40 CFR part 60, subpart A (General Provisions). Specific uses of these test methods are described in the standards of performance contained in the subparts, beginning with Subpart D.

Within each standard of performance, a section title ‘‘Test Methods and Procedures’’ is provided to: (1) Identify the test methods

AMEND: 340-208-0510

RULE TITLE: Clackamas, Columbia, Multnomah, and Washington Counties: Exclusions

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding division 244 to applicable rules and removing reduction of animal matter exemption.

RULE TEXT:

(1) The requirements contained in OAR 340-208-0510 through 340-208-0610 apply to all activities conducted in Clackamas, Columbia, Multnomah, and Washington Counties, except for activities for which specific industrial standards have been adopted (under OAR chapter 340, divisions 230, 234, 236, 238, and 244).

(2) The requirements outlined in OAR 340-208-0510 through 340-208-0610 do not apply to activities related to a domestic residence of four or fewer family-living units.

STATUTORY/OTHER AUTHORITY: ORS 468, 468A

STATUTES/OTHER IMPLEMENTED: ORS 468A.025

AMEND: 340-208-0610

RULE TITLE: Clackamas, Columbia, Multnomah, and Washington Counties: Particulate Matter Weight Standards

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding language to specify exempt fuel burning equipment must have been installed prior to June 1, 1970.

RULE TEXT:

Except for equipment burning natural gas and liquefied petroleum gas, the maximum allowable emission of particulate matter from any fuel burning equipment:

(1) Is a function of maximum heat input as determined from Figure 1, except that from:

(a) Existing fuel burning equipment installed, constructed or last modified on or before June 1, 1970, utilizing wood residue, it is 0.20 grain per standard cubic foot of exhaust, corrected to 12 percent carbon dioxide; and

(b) New fuel burning equipment installed, constructed, or modified after June 1, 1970 utilizing wood residue, it is 0.10 grain per standard cubic foot of exhaust gas, corrected to 12 percent carbon dioxide; and

(2) Must not exceed Smoke Spot #2 for distillate fuel and #4 for residual fuel, measured by ASTM D2156-65, “Standard Method for Test for Smoke Density of the Flue Gases from Distillate Fuels.”

[NOTE: View a PDF of Figure by clicking on "Tables" link below.]

[NOTE: Publications referenced are available from the agency.]

STATUTORY/OTHER AUTHORITY: ORS 468, 468A

STATUTES/OTHER IMPLEMENTED: ORS 468.020, 468A.025

State of Oregon Department of Environmental Quality

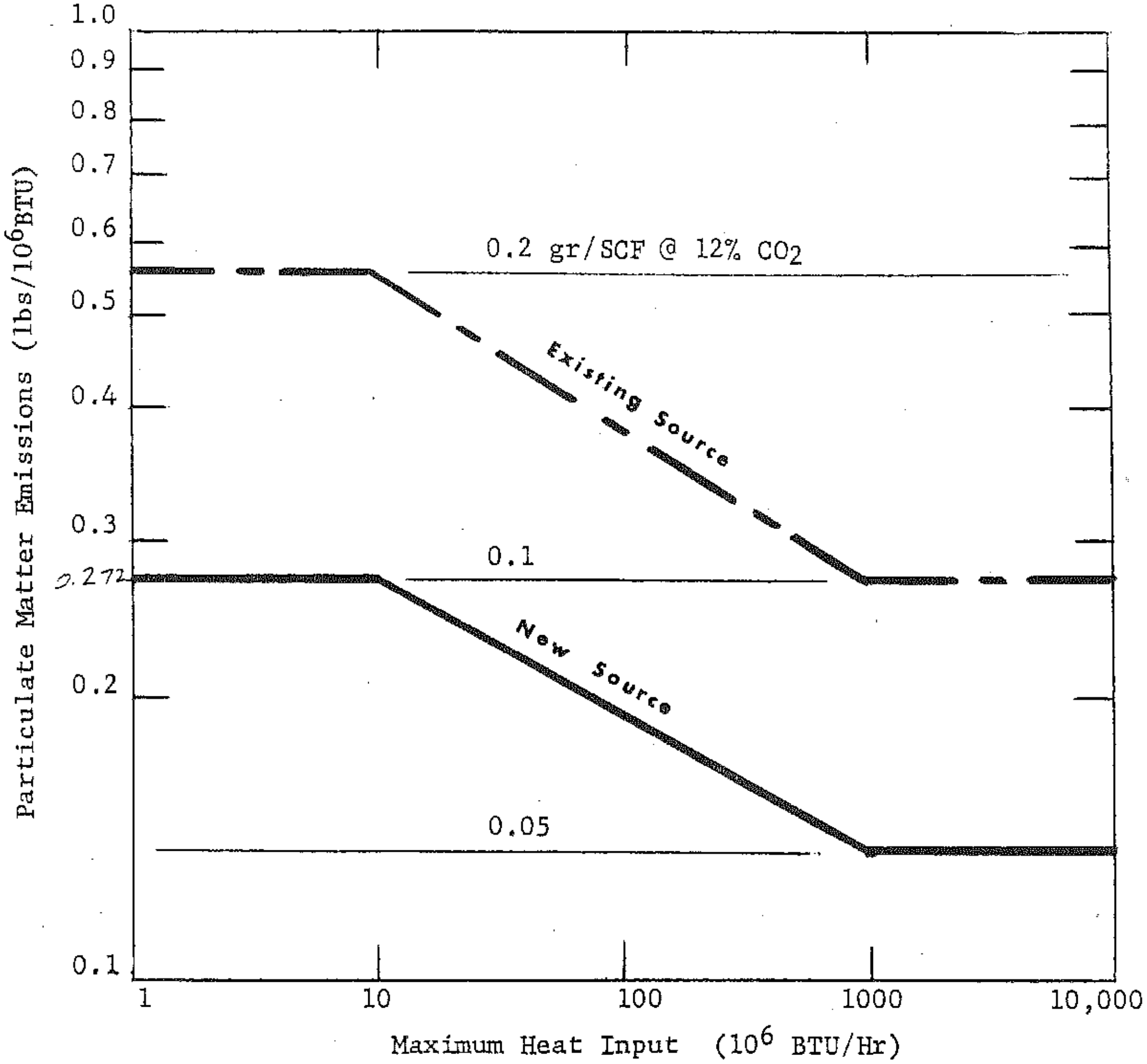
OAR 340-208-0610

Figure 1

Particulate Matter Emission Standards

OAR 340-208-0610

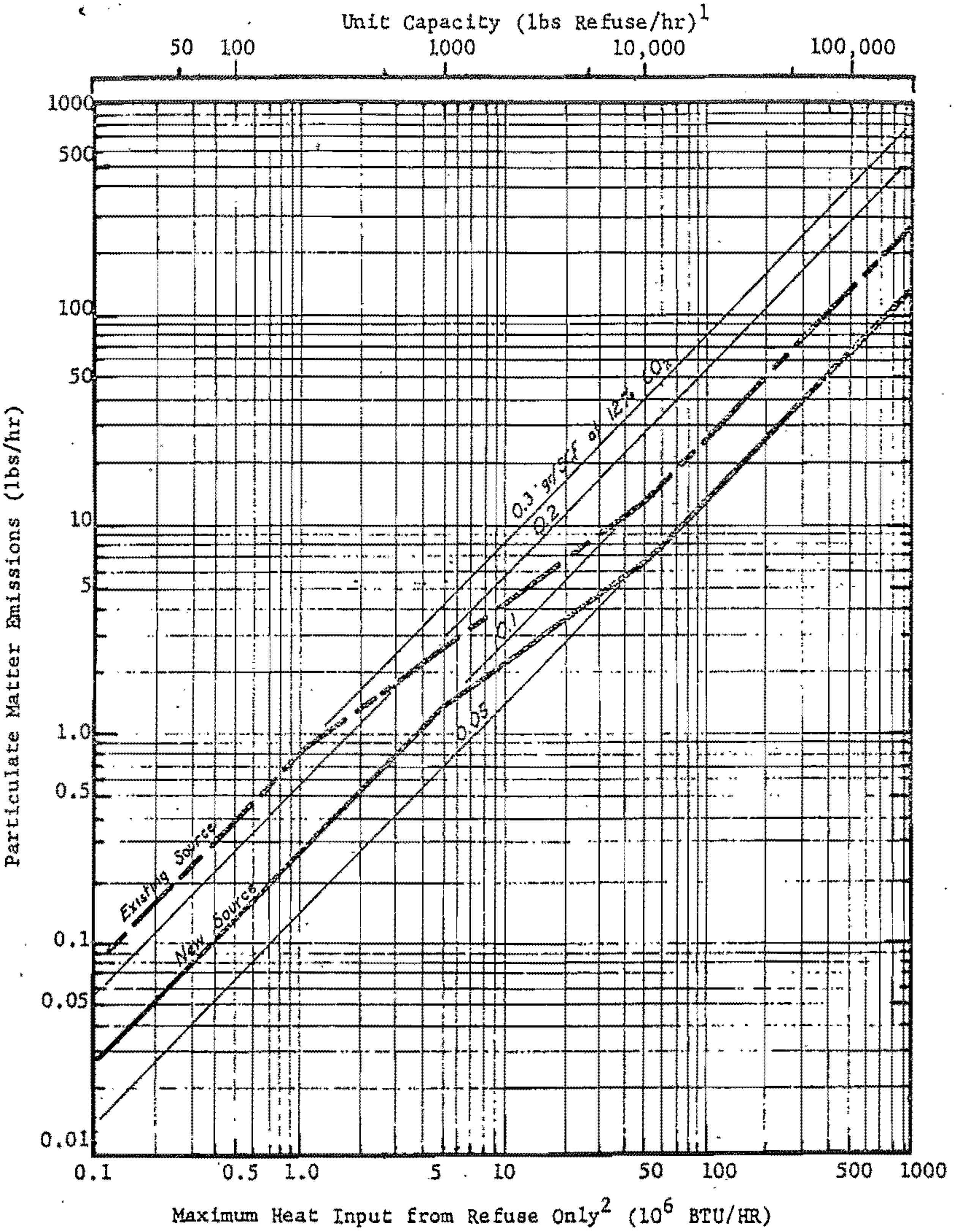
Figure 1



PARTICULATE MATTER EMISSION STANDARDS FOR FUEL BURNING EQUIPMENT

Figure 1

PARTICULATE MATTER EMISSION STANDARDS FOR REFUSE BURNING EQUIPMENT



[1] For refuse having heat content of 5000 BTU/lb as fired

[2] Excluding any auxiliary heat

OAR 340-208-0610
Figure 2

AMEND: 340-209-0080

RULE TITLE: Issuance or Denial of a Permit

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding language to clarify permit denial and challenge.

RULE TEXT:

(1) Following the public comment period and public hearing, if one is held, DEQ will take action upon the matter as expeditiously as possible. Before taking such action, DEQ will prepare a written response to address each relevant, distinct issue raised during the comment period and raised during the hearing on the record.

(2) DEQ will make a record of the public comments, including the names and affiliation of persons who commented, and the issues raised during the public participation process. The public comment records may be in summary form rather than a verbatim transcript. The public comment records are available to the public at the DEQ office processing the permit.

(3) The applicant may submit a written response to any comments submitted by the public within 10 working days after DEQ provides the applicant with a copy of the written comments received by DEQ. DEQ will consider the applicant's response in making a final decision.

(4) After considering the comments, DEQ may adopt or modify the provisions requested in the permit application.

(5) Issuance of permit: DEQ will promptly notify the applicant in writing of the final action as provided in OAR 340-011-0525 and will include a copy of the issued permit. If the permit conditions are different from those contained in the proposed permit, the notification will identify the affected conditions and include the reasons for the changes. The permit is effective on the date that it is signed unless the applicant requests a hearing to contest the permit within 20 days of the date of the notification of issuance of the permit.

(6) Denial of a permit application: If DEQ proposes to deny a permit application, DEQ will promptly notify the applicant in writing of the proposed final action as provided in OAR 340-011-0525.The notification will include the reasons for the denial. The denial of a permit application is effective 60 days from the date of notification of the proposed denial unless within that time, the applicant requests a hearing as provided in section (7).

(7) A request for a hearing to challenge a DEQ decision under section (5) or (6) must be in writing and state the grounds for the request. The hearing will be conducted as a contested case hearing in accordance with ORS 183.413 through 183.470 and OAR chapter 340, division 11.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468.065, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 183.413, 183.415, 468.065, 468A.035, 468A.040, 468A.310

AMEND: 340-210-0100

RULE TITLE: Registration in General

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Changing fees to refer to tables in 340-216-8020.

RULE TEXT:

(1) Any air contaminant source not subject to Air Contaminant Discharge Permits, OAR chapter 340, division 216, or Oregon Title V Operating Permits, OAR chapter 340, division 218, must register with DEQ upon request pursuant to OAR 340-210-0110 through 340-210-0120.

(2) The owner or operator of an air contaminant source listed in subsection (a) that is certified through a DEQ approved environmental certification program, as provided in subsection (b), and that is subject to an Area Source NESHAP may register the source with DEQ pursuant to OAR 340-210-0110 through 340-210-0120 in lieu of obtaining a permit otherwise required by OAR 340-216-0020, unless DEQ determines that the source has not complied with the requirements of the environmental certification program. A source registered under this section must pay fees as provided in subsection (c), is subject to termination of its registration for failure to pay fees as provided in subsection (d), and must keep records as provided in subsection (e).

(a) The following sources may be registered under this section:

(A) Motor vehicle surface coating operations.

(B) Dry cleaners using perchloroethylene.

(b) Approved environmental certification program. To be approved, the environmental certification program must, at a minimum, require certified sources to comply with all applicable state and federal rules and regulations and require additional measures to increase environmental protection.

(c) Fees. In order to obtain and maintain registration, owners and operators of sources registered pursuant to this section must pay the annual registration fees in OAR 340-216-8020 Table 2 by March 1 of each year.

(d) Failure to pay fees. Registration is automatically terminated upon failure to pay annual fees by March 1 of each year, unless prior arrangements for payment have been approved in writing by DEQ.

(e) Recordkeeping. In order to maintain registration, owners and operators of sources registered pursuant to this section must maintain records required by the approved environmental performance program under subsection (b). The records must be kept on site and in a form suitable and readily available for expeditious inspection and review.

(3) The owner or operator of an air contaminant source that is subject to a federal NSPS in 40 CFR part 60 or NESHAP in 40 CFR part 63 and that is not located at a source that is required to obtain a permit under OAR chapter 340, division 216 (Air Contaminant Discharge Permits) or OAR chapter 340, division 218 (Oregon Title V Operating Permits), must register and maintain registration with DEQ pursuant to OAR 340-210-0110 through 340-210-0120 if requested in writing by DEQ (or by EPA at DEQ's request).

(4) Revocation. DEQ may revoke a registration if a source fails to meet any requirement in OAR 340-210-0110.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the EQC under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.035, 468A.050, 468A.070, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.035, 468A.050, 468A.070, 468A.310

AMEND: 340-210-0205

RULE TITLE: Notice of Construction and Approval of Plans: Applicability and Requirements

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding clarification to what constitutes a permit modification.

RULE TEXT:

(1) Except as provided in section (2), OAR 340-210-0205 through 340-210-0250 apply to the following:

(a) New Sources. Owners or operators of proposed new sources, not otherwise required to obtain a permit under OAR chapter 340, division 216 or 218, must submit a notice of construction application before undertaking construction or operation of a new source that emits any regulated air pollutant.

(b) Existing Sources. Owners or operators of existing sources, including sources that have permits under OAR chapter 340, division 216 or 218, must submit the appropriate application before undertaking any of the following:

(A) Construction or modification that will cause an increase, on an hourly basis at full production, in any regulated air pollutant emissions;

(B) Replacement of a device or activity that emits any regulated air pollutants; or

(C) Construction, modification, or replacement of any air pollution control device.

(2) OAR 340-210-0205 through 340-210-0250 do not apply to the following sources:

(a) Sources for which the owners or operators are required to obtain a permit under OAR chapter 340, division 216 or 218 for the construction or modification;

(b) Agricultural operations or equipment that is exempted by OAR 340-200-0030;

(c) Heating equipment in or used in connection with residences used exclusively as dwellings for not more than four families;

(d) Other activities associated with residences used exclusively as dwellings for not more than four families, including, but not limited to barbecues, house painting, maintenance, and groundskeeping;

(e) Portable sources, except modifications of portable sources that have permits under OAR chapter 340, division 216 or 218 and are specified in section (1); and

(f) Categorically insignificant activities as defined in OAR 340-200-0020 unless they are subject to NESHAP or NSPS requirements. This exemption applies to all categorically insignificant activities whether or not they are located at major or non-major sources.

(3) OAR 340-210-0205 through 340-210-0250 apply to Title V sources under OAR 340-218-0190 but are called Notices of Approval.

[NOTE: This rule, with the exception of section (3), is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.055

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.035, 468A.055

REPEAL: 340-210-0215

RULE TITLE: Notice of Construction and Approval of Plans: Requirement

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Repealing rule.

RULE TEXT:

(1) New Sources. No person is allowed to construct, install, or establish a new source that will cause an increase in any regulated pollutant emissions without first notifying DEQ in writing.

(2) Modifications to existing sources. No person is allowed to make a physical change or change in operation of an existing source that will cause an increase, on an hourly basis at full production, in any regulated pollutant emissions without first notifying DEQ in writing.

(3) Air Pollution Control Devices. No person is allowed to construct or modify any air pollution control device without first notifying DEQ in writing.

NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.055

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.035, 468A.055

AMEND: 340-210-0225

RULE TITLE: Notice of Construction and Approval of Plans: Types of Construction/Modification Changes

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding details to what types of construction require DEQ to be notified.

RULE TEXT:

For the purpose of OAR 340-210-0205 through 340-210-0250, emission calculations for determining the type of change at a source must use the regulated air pollutant emission capacity, except for Type 1 changes under subsection (1)(b) and Type 4 changes. The notices of construction changes are divided into the following types:

(1) Type 1 changes include construction or modification for which the owner or operator is not required to obtain a permit or permit modification under OAR chapter 340, division 216, and where the changes meet the criteria in either subsection (a) or (b):

(a) The construction or modification would:

(A) Have emissions from any new, modified, or replaced device or activity, or any combination of devices or activities, of less than or equal to the de minimis levels defined in OAR 340-200-0020;

(B) Not result in an increase of emissions from the source above any PSEL;

(C) Not result in an increase of emissions from the source above the netting basis by more than or equal to the SER;

(D) Not be used to establish a federally enforceable limit on the potential to emit; and

(E) Not require a TACT determination under OAR 340-226-0130 or a MACT determination under OAR 340-244-0200; or

(b) The construction or modification is one of the following:

(A) Stationary internal combustion engines having a rated capacity <60 horsepower output;

(B) Emergency stationary internal combustion Tier 4 engines having a rated capacity <670 horsepower (500 kilowatts) output;

(C) Hand-held sanding equipment;

(D) Portable vacuum blasting equipment using steel shot and vented to a fabric filter;

(E) Shot peening operations, provided that no surface material is removed;

(F) Replacement of equipment that is used to control processes, such as temperature, air pressure, water pressure, electrical current, flow rate, etc.;

(G) Equipment and instrumentation used for quality control/assurance or inspection purposes;

(H) Vacuum pumps;

(I) Equipment used for extrusion, compression molding, and injection molding of plastics, provided that the VOC content of all mold release products or lubricants is <1% by weight;

(J) Injection or blow-molding equipment for rubber or plastics, provided that no blowing agent other than compressed air, water, or carbon dioxide is used;

(K) Presses or molds used for curing, post-curing, or forming composite products and plastic products, provided that the blowing agent contains no VOC or chlorinated compounds;

(L) Equipment used exclusively for the mixing and blending of materials at ambient temperature to make water-based adhesives;

(M) Dredging wet spoils handling and placement;

(N) Graphic label and/or box labeling operations where the inks are applied by hand stamping or hand rolling;

(O) Ultraviolet disinfection processes;

(P) The cleaning and/or deburring of metal products where all tumblers are used without abrasive blasting;

(Q) Ozone generators and ozonation equipment;

(R) Emissions from the storage and application of road salt (calcium chloride or sodium chloride);

(S) Process emissions from sources which are located at private, public, or vocational education institutions, where the emissions are primarily the result of teaching and training exercises, and the institution is not engaged in the

manufacture of products for commercial sale;
(T) Degreasing units which exclusively use caustics (e.g., potassium hydroxide and sodium hydroxide);
(U) Equipment used for hydraulic or hydrostatic testing with water-based hydraulic fluids;
(V) Storage tanks, reservoirs, pumping and handling equipment, and control equipment used to exclusively vent such equipment of any size, limited to soaps, lubricants, hydraulic fluid, vegetable oil, grease, animal fat, aqueous salt solutions or other materials and processes using appropriate lids and covers where there is no generation of objectionable odor or airborne particulate matter or toxic air pollutants listed in OAR chapter 340, division 247;
(W) Operation, loading and unloading storage of butane, propane, or liquefied petroleum gas with a vessel capacity less than 40,000 gallons where annual emissions are less than or equal to the de minimis levels;
(X) Tanks, vessels and pumping equipment, with lids or other appropriate closure for storage or dispensing of aqueous solutions of inorganic salts, bases and acids;
(Y) Ultraviolet curing processes, to the extent that toxic air contaminants as defined in OAR chapter 340, division 247 are not emitted;
(Z) Contaminant detectors, sampling devices and recorders;
(AA) Environmental chambers and humidity chambers using only gases that are not toxic air contaminants listed in OAR chapter 340, division 247;
(BB) Lithographic printing equipment which uses laser printing;
(CC) Equipment used exclusively for conveying and storage of plastic pellets that don’t break down or degrade and are only used for indoor manufacturing;
(DD) Gas cabinets using only gasses that are not regulated air pollutants;
(EE) Salt baths using nonvolatile salts and not used in operations which result in air emissions;
(FF) Paper shredding and carpet and paper shearing, fabric brushing and sueding as well as associated conveying systems, baling equipment, and control equipment venting such equipment. This exemption does not include carpet and fabric recycling operations;
(GG) Hammermills used exclusively to process aluminum and/or tin cans, and control equipment exclusively venting such equipment;
(HH) Drop hammers or hydraulic presses for forging or metal working; or
(II) Concrete application, and installation.
(2) Type 2 changes include construction or modification for which the owner or operator is not required to obtain a permit or permit modification under OAR chapter 340, division 216, and where the construction or modification would:
(a) Have emissions from any new, modified, or replaced device or activity, or any combination of devices or activities, of less than the SER defined in OAR 340-200-0020;
(b) Not result in an increase of emissions from the source above any PSEL;
(c) Not result in an increase of emissions from the source above the netting basis by more than or equal to the SER;
(d) Not be used to establish a federally enforceable limit on the potential to emit;
(e) Be used to establish a state-only enforceable limit on the potential to emit;
(f) Not require a TACT determination under OAR 340-226-0130 or a MACT determination under OAR 340-244-0200; and
(g) Not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202 for a new or replaced device or activity.
(3) Type 3 changes include construction or modification where the construction or modification would:
(a) Have emissions from any new, modified, or replaced device or activity, or any combination of devices or activities, of more than or equal to the SER defined in OAR 340-200-0020;
(b) Result in an increase of emissions from the source above any PSEL before applying unassigned emissions or emissions reduction credits available to the source but less than the SER after applying unassigned emissions or emissions reduction credits available to the source;
(c) Be used to establish a federally enforceable limit on the potential to emit;

(d) Require a TACT determination under OAR 340-226-0130 or a MACT determination under 340-244-0200; or
(e) Not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202 for a new or replaced device or activity.
(4) Type 4 changes include construction or modification subject to New Source Review under OAR chapter 340, division 224.
[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040 except for OAR 340-210-0225(2)(e).]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.050, ORS 468A.055, 468A.070, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.035, 468A.040, 468A.050, 468A.055, 468A.070, 468A.310

AMEND: 340-210-0230

RULE TITLE: Notice of Construction and Approval of Plans: Notice to Construct Application

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding requirements for what must be included in a land use compatibility statement.

RULE TEXT:

(1) An application for any type of change must meet the requirements of the rules that were in effect on the date the complete application was submitted.

(2) Any person proposing a Type 1 or 2 change must submit a notice of construction application using electronic forms provided by DEQ, unless otherwise approved in writing by DEQ and applicable fees in OAR 340-216-8020 to DEQ before undertaking such construction or modification. The notice of construction application must include the following information, as applicable, for present or anticipated operating conditions:

(a) Name, address, tax lot, and nature of business;

(b) Name of local person responsible for compliance with these rules;

(c) Name of person authorized to receive requests for data and information;

(d) The type of construction or modification as defined in OAR 340-210-0225;

(e) A description of the proposed construction or modification;

(f) A description of the production processes and a related flow chart for the proposed construction or modification;

(g) A plot plan showing the location and height of the proposed construction or modification, and the nearest residential and commercial properties;

(h) Production, throughput, or material usage;

(i) Type and quantity of fuels used;

(j) The amount, nature and duration of regulated pollutant emissions from the proposed construction or modification and any proposed change in emissions with supporting calculation, except for equipment listed in OAR 340-210-0225(1)(b);

(k) Plans and specifications for air pollution control devices and facilities and their relationship to the production process, including estimated efficiency of air pollution control devices;

(l) Any information on pollution prevention measures and cross-media impacts the owner or operator wants DEQ to consider in determining applicable control requirements and evaluating compliance methods;

(m) A list of any requirements applicable to the construction or modification;

(n) Where the operation or maintenance of air pollution control devices and emission reduction processes can be adjusted or varied from the highest reasonable efficiency and effectiveness, information necessary for DEQ to establish operational and maintenance requirements under OAR 340-226-0120(1) and (2);

(o) Amount and method of refuse disposal;

(p) Land Use Compatibility Statement(s) when required by OAR chapter 340, division 018:

(A) Signed by the applicable local planning jurisdictions(s), determining that construction or modification is compatible with the applicable local planning jurisdiction's acknowledged comprehensive plan. If DEQ receives a LUCS which states that the proposed action is incompatible with the acknowledged comprehensive plan, DEQ shall notify the applicant that the application cannot be processed; or

(B) If the local planning jurisdiction declines to provide a LUCS determination in response to a request for a LUCS, the owner or operator must provide DEQ with its own analysis to demonstrate that the proposed action complies with all applicable statewide planning goals;

(q) Anticipated date of the commencement of construction (i.e., breaking ground); and

(r) Anticipated date of construction or modification completion.

(3) In addition, any person proposing a Type 2 or Type 3 change for a new or replaced device or activity must also submit an air quality analysis for any pollutants that are emitted above the de minimis emission level demonstrating that the emissions, including reductions due to air pollution control devices or permitted limits on production capacity, from the

individual device or activity will not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202.

(4) Any person proposing a Type 3 change must:

(a) Submit an application for either a new or modified Basic ACDP, a Construction ACDP, a new or modified Simple ACDP, or a new or modified Standard ACDP, whichever is appropriate; or

(b) If the owner or operator of a source assigned to a General ACDP still qualifies for the General ACDP after the Type 3 change is approved, submit the information required in OAR 340-210-0230(2).

(5) Any person proposing a Type 4 change must comply with OAR chapter 340, division 224 and must submit an application for either a Construction ACDP, or a new or modified Standard ACDP, whichever is appropriate.

(6) Additional information. If DEQ determines that additional information or corrections are needed for consideration of any type of proposed construction or modification, DEQ will provide the applicant with a written request to provide such information by a reasonable date.

(7) If DEQ determines it is not able to approve the applicant's submittal, or if the applicant does not timely provide additional information or corrections requested by DEQ under section (6), then in addition to any other remedies available, DEQ may:

(a) Return the application;

(b) Retain any applicable fees; and

(c) Issue a proposed denial of the application.

(8) A person who has submitted an application under this rule must notify DEQ of any corrections and revisions to the plans and specifications that would impact emissions upon becoming aware of the changes. If the correction or revision changes the type of Notice of Construction, the person must submit the appropriate application.

(9) Where a permit issued in accordance with OAR chapter 340, divisions 216 or 218 includes construction approval for future changes for operational flexibility, the notice requirements in this rule are waived for the approved changes.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.050, 468A.055, 468A.070, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.035, 468A.040, 468A.050, 468A.055, 468A.070, 468A.310

AMEND: 340-210-0240

RULE TITLE: Notice of Construction and Approval of Plans: Construction Approval

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding requirements for what must be included in notices to construct.

RULE TEXT:

(1) Approval to Construct:

(a) For Type 1 changes:

(A) Under OAR 230-210-0225(1)(b), the owner or operator of a source may proceed with the construction or modification immediately after notifying DEQ.

(B) Under OAR 230-210-0225(1)(a), the owner or operator of a source may proceed with the construction or modification immediately after notifying DEQ unless they request confirmation that the proposed construction or modification qualifies as a Type 1 change. DEQ has 30 calendar days from receipt of the written request, with a complete notice application, to provide written approval of the proposed construction or modification, or notify the owner or operator in writing that the proposed construction or modification does not qualify as a Type 1 change.

(b) For Type 2 changes, the owner or operator of a source may proceed with the construction or modification 60 calendar days after DEQ receives the complete notice application and fees required in OAR 340-210-0230 or on the date that DEQ approves the proposed construction or modification in writing, whichever is sooner, unless DEQ notifies the owner or operator in writing that the proposed construction or modification does not qualify as a Type 2 change.

(c) For Type 3 changes, the owner or operator of a source must obtain either:

(A) A new or modified Basic ACDP, Construction ACDP, a new or modified Simple ACDP, or a new or modified Standard ACDP, whichever is appropriate, in accordance with OAR chapter 340, division 216 before proceeding with the construction or modification; or

(B) A new Simple or Standard ACDP, whichever is appropriate, in accordance with OAR chapter 340, division 216 before proceeding with the construction or modification if the source no longer qualifies for its assigned General ACDP(s).

(d) For Type 4 changes, the owner or operator of a source must obtain either a Construction ACDP or a new or modified Standard ACDP in accordance with OAR chapter 340, division 216 before proceeding with the construction or modification.

(2) Upon DEQ approval, the owner or operator of a source must construct or modify and operate the source in accordance with the approved plans and specifications, including any corrections or revisions approved by DEQ, previously submitted in the application required under OAR 340-210-0230.

(3) Approval to construct or modify does not relieve the owner or operator of a source of the obligation of complying with applicable requirements.

(4) The owner or operator of a source that receives approval to construct or modify must commence construction within 18 months of approval, or other date approved in writing by DEQ.

(a) Construction or modification approval terminates and is invalid for the following reasons:

(A) Construction or modification is not commenced within 18 months after DEQ issues such approval, by an alternative deadline established by DEQ under this section, or by the deadline approved by DEQ in an extension under subsection (b);

(B) Construction or modification is discontinued for a period of 18 months or more; or

(C) Construction or modification is not completed within 18 months of the anticipated date of construction completion included in the application.

(b) The owner or operator may submit a request to extend the construction or modification commencement deadline by submitting a written, detailed explanation of why the source could not commence construction or modification within the initial 18-month period. DEQ may grant, for good cause, one 18-month construction or modification approval extension.

(5) Notice of Completion. Unless otherwise specified in the Construction ACDP or approval, the owner or operator of a source must notify DEQ in writing that the construction or modification has been completed using a form furnished by DEQ. Unless otherwise specified, the notice is due 30 days after completing the construction or modification. The notice of completion must include the following:

(a) The date of completion of construction or modification;

(b) Whether the construction or modification was completed in accordance with approved plans, specifications and any corrections or revisions thereto under OAR 340-210-0230, such as but not limited to:

(A) Make, model, and identification name or number of the constructed device or activity, or any combination of devices or activities;

(B) Location of the constructed device or activity, or any combination of devices or activities;

(C) Exhaust parameters (e.g., stack height, diameter, temperature, flowrate, volume or area source dimensions); and

(c) The date the stationary source, device, activity, or air pollution control device was or will be put in operation.

(6) Order Prohibiting Construction or Modification. If at any time, DEQ determines that the proposed construction is not in accordance with applicable statutes, rules, regulations, and orders, DEQ will issue an order prohibiting the construction or modification. The order prohibiting construction or modification will be forwarded to the owner or operator of the source by certified mail.

(7) Hearing. An owner or operator of a source against whom an order prohibiting construction or modification is directed may request a contested case hearing within 20 days from the date of mailing the order. The request must be in writing, state the grounds for hearing, and be mailed to the Director of DEQ. The hearing will be conducted pursuant to the applicable provisions of ORS chapter 183 and OAR chapter 340, division 11.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.050, 468A.055, 468A.070, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A. 025, 468A.035, 468A.040, 468A.050, 468A.055, 468A.070, 468A.310

AMEND: 340-210-0250

RULE TITLE: Notice of Construction and Approval of Plans: Approval to Operate

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding Simple ACDP to Type 3 changes and adding (3)"(b) For new sources, Type 4 changes require a Standard ACDP before operation of the approved changes."

RULE TEXT:

(1) The approval to construct does not provide approval to operate the constructed, modified, or replaced stationary source or air pollution control device unless otherwise allowed by section (2) or (3) or under the applicable ACDP (OAR chapter 340, division 216) or Oregon Title V Operating Permit programs (OAR chapter 340, division and 218).

(2) Type 1 and 2 changes:

(a) For sources that are not required to obtain a permit in accordance with OAR 340-216-0020, Type 1 and 2 changes may be operated without further approval subject to the conditions of DEQ's approval to construct provided in accordance with OAR 340-210-0240.

(A) Approval to operate does not relieve the owner of the obligation of complying with applicable requirements that may include but are not limited to the general opacity standards in OAR 340-208-0110 and general particulate matter standards in OAR 340-226-0210 and OAR 340-228-0210.

(B) If required by DEQ as a condition of the approval to construct or at any other time in accordance with OAR 340-212-0120, the owner or operator must conduct testing or monitoring to verify compliance with applicable requirements. All required testing must be performed in accordance with OAR 340-212-0140.

(C) The owner or operator must register the air contaminant source with DEQ if required as a condition of the approval to construct or at any other time in accordance with OAR 340-210-0100.

(b) For sources currently operating under an ACDP, Type 1 and 2 changes may be operated without further approval unless the ACDP specifically prohibits the operation.

(c) For sources currently operating under an Oregon Title V Operating Permit, Type 1 and 2 changes may only be operated in accordance with OAR 340-218-0190(2).

(3) Type 3 and 4 changes:

(a) For new sources, or sources that have not been required to obtain a permit, Type 3 changes require the owner or operator to obtain a Construction, Basic, General, Simple, or Standard ACDP, whichever is appropriate, before operation of the approved changes.

(b) For sources currently operating under a General ACDP, a Type 3 change may be operated under the assigned General ACDP if the source still qualifies for the General ACDP. Otherwise, the owner or operator must obtain a new Simple or Standard ACDP before operation of the approved changes.

(c) For sources currently operating under a Basic, Simple or Standard ACDP, approval to operate a Type 3 change will require the owner or operator to obtain a new or modified Basic ACDP, a new or modified Simple ACDP, or a new or modified Standard ACDP, in accordance with OAR chapter 340, division 216 before operation of the approved changes. All current ACDP terms and conditions remain in effect until the new or modified ACDP is issued.

(d) Type 4 changes require the owner or operator to obtain a new or modified Standard ACDP in accordance with OAR chapter 340, division 216 before operation of the approved changes.

(e) For sources currently operating under an Oregon Title V Operating Permit, Type 3 or 4 changes may only be operated in accordance with OAR 340-218-0190(2) unless a permit modification is required.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.050, 468A.055, 468A.070, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A. 025, 468A.035, 468A.040, 468A.050, 468A.055, 468A.070, 468A.310

AMEND: 340-214-0110

RULE TITLE: Reporting: Request for Information

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "(4) Determine whether a source's emissions may cause or contribute to an exceedance or violation of an ambient air quality standard adopted under OAR chapter 340, division 202; "

RULE TEXT:

All owners or operators of stationary sources must provide any and all information and analysis, including an air quality analysis of the source, that DEQ reasonably requires for the purpose of regulating stationary sources. DEQ will provide the source with a written request to provide such information to DEQ by a reasonable date. Such information may be required on a one-time, periodic, or continuous basis and may include, but is not limited to, information necessary to:

(1) Issue a permit and ascertain compliance or noncompliance with the permit terms and conditions;

(2) Ascertain applicability of any requirement;

(3) Ascertain compliance or noncompliance with any applicable requirement;

(4) Determine whether a source's emissions may cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202; and

(5) Incorporate monitoring, recordkeeping, reporting, and compliance certification requirements into a permit.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.050

AMEND: 340-214-0114

RULE TITLE: Reporting: Records; Maintaining and Reporting

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Removing "under divisions 200 to 264" from (4) and ". For the owner or operator of a source permitted under OAR 340 division 216, this requirement takes effect on July 1, 2015." from (5).

RULE TEXT:

(1) When notified by DEQ, any person owning or operating a source within the state must keep and maintain written records of the nature, type, and amounts of emissions from such source and other information DEQ may require in order to determine whether the source is in compliance with applicable emission rules, limitations, or control measures.

(2) The records must be prepared in the form of a report and submitted to DEQ on an annual, semi-annual, or more frequent basis, as requested in writing by DEQ. Submittals must be filed at the end of the first full period after DEQ's notification to such persons owning or operating a stationary air contaminant source of these recordkeeping requirements. Unless otherwise required by rule or permit, semi-annual periods are Jan. 1 to June 30, and July 1 to Dec. 31. A more frequent basis for reporting may be required due to noncompliance or if necessary to protect human health or the environment.

(3) The required reports must be completed on forms approved by DEQ and submitted within 30 days after the end of the reporting period, unless otherwise authorized by permit.

(4) When a due date for submittal falls on a weekend or holiday, the submittal is not due until the next succeeding business day.

(5) All reports and certifications submitted to DEQ under OAR chapter 340, division 200 through division 271 must accurately reflect the monitoring, record keeping and other documentation held or performed by the owner or operator.

(6) The owner or operator of any source required to obtain a permit under OAR chapter 340, division 216 or 218 must retain records of all required monitoring data and supporting information for a period of at least five years from the date of the monitoring sample, measurement, report, or application.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.050, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.050, 468A.310

AMEND: 340-214-0130

RULE TITLE: Reporting: Information Exempt from Disclosure

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Updating the ORS references.

RULE TEXT:

(1) Pursuant to the provisions of ORS 192.311 to 192.478, all information submitted to DEQ is subject to inspection upon request by any person unless such information is determined to be exempt from disclosure pursuant to section (2) or (3).

(2) If an owner or operator claims that any writing, as that term is defined in ORS 192.311, is confidential or otherwise exempt from disclosure, in whole or in part, the owner or operator must comply with the following procedures:

(a) The writing must be clearly marked with a request for exemption from disclosure. For a multi-page writing, each page must be so marked.

(b) The owner or operator must state the specific statutory provision under which it claims exemption from disclosure and explain why the writing meets the requirements of that provision.

(c) For writings that contain both exempt and non-exempt material, the proposed exempt material must be clearly distinguishable from the non-exempt material. If possible, the exempt material must be arranged so that it is placed on separate pages from the non-exempt material.

(3) For a writing to be considered exempt from disclosure as a “trade secret,” it must meet all of the following criteria:

(a) The information cannot be patented;

(b) It must be known only to a limited number of individuals within a commercial concern who have made efforts to maintain the secrecy of the information;

(c) It must be information that derives actual or potential economic value from not being disclosed to other persons;

(d) It must give its users the chance to obtain a business advantage over competitors not having the information; and

(e) It must not be emissions data.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 192.430, 468.020, 468A.050

STATUTES/OTHER IMPLEMENTED: ORS 192.410 - 192.505, 468.020, 468A.025, 468A.050

AMEND: 340-214-0330

RULE TITLE: Excess Emissions and Emergency Provision: All Other Excess Emissions

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding requirements to what must be done during periods of excess emissions and what will be considered when considering minimization plans.

RULE TEXT:

(1) This rule applies to all excess emissions not addressed in OAR 340-214-0310, 340-214-0320, and 340-214-0360.
(a) The owner or operator of a large source, as defined by OAR 340-214-0010, must immediately notify DEQ of the first onset per calendar day of any excess emissions event, unless otherwise specified by a permit condition.
(b) The owner or operator of a small source, as defined by OAR 340-214-0010, need not immediately notify DEQ of excess emissions events unless otherwise required by a permit condition, written notice by DEQ, or if the excess emission is of a nature that could endanger public health.
(c) Additional reporting and recordkeeping requirements are specified in OAR 340-214-0340.
(2) During any period of excess emissions, the owner or operator of the source must immediately reduce emissions to the greatest extent practicable or cease operation of the equipment or facility until the condition causing the excess emissions has been corrected or brought under control. The owner or operator must cease operation of the equipment or facility within 8 hours of the beginning of the period of excess emissions unless:
(a) Ceasing operation could result in physical damage to the equipment or facility;
(b) Ceasing operation could cause injury to employees; or
(c) Emissions associated with shutdown and the subsequent startup will exceed those emissions resulting from continued operation.
(3) An owner or operator may request continued operations under the conditions in section (2) by submitting to DEQ a written request to continue operation along with the following information within 8 hours of the beginning of the period of excess emissions:
(a) A description or plan of how the owner or operator will minimize the excess emissions to the greatest extent practicable;
(b) A plan and timeline for returning the equipment or facility back to the applicable compliant emission limits as soon as possible; and either:
(A) Information verifying that reducing or ceasing operation could result in physical damage to the equipment or facility or injury to employees; or
(B) Calculations of emissions associated with shutdown and the subsequent startup and emissions resulting from continued operation.
(4)(a) If DEQ disapproves the request to continue operation, the owner or operator must cease operation of the equipment or facility within one hour of receiving DEQ's written disapproval (e.g., email or telephone conversation with email backup), until the condition causing the excess emissions has been corrected or brought under control.
(b) If DEQ approves the request to continue operation, the owner or operator must follow the approved plans and timeline to minimize excess emissions and return the equipment or facility back to the applicable compliant emission limits as required in DEQ's written approval (e.g., email or telephone conversation with email backup).
(c) The owner or operator must report excess emissions under OAR 340-214-0340 within 5 days of the date of the event.
(5) Notwithstanding section (2), at any time during the period of excess emissions, DEQ may require the owner or operator to cease operation of the equipment or facility.
[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.040, 468A.310

AMEND: 340-216-0020

RULE TITLE: Applicability and Jurisdiction

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Amending language for clarity

RULE TEXT:

(1) This division applies to all sources listed in OAR 340-216-8010. This division also applies to Oregon Title V Operating Permit program sources when an ACDP is required by 340-218-0020 or 340-224-0010. Sources referred to in 340-216-8010 are subject to fees in 340-216-8020.

(2) Owners or operators of sources in any one of the categories in OAR 340-216-8010 must obtain a permit. Source categories are not listed in alphabetical order. If a source meets the requirements of more than one of the source categories and the source is not eligible for a Basic ACDP or a General ACDP that has been authorized by DEQ, then the owner or operator of the source must obtain a Simple or Standard ACDP. DEQ may determine that a source is ineligible for a Basic ACDP or a General ACDP based upon the considerations in OAR 340-216-0025(7).

(a) Owners or operators of commercial and industrial sources listed in OAR 340-216-8010 Part A must obtain a Basic ACDP under 340-216-0056 unless the person chooses to obtain a General, Simple or Standard ACDP for the source. For purposes of Part A, production and emission parameters are based on the latest consecutive 12 month period, or future projected operation, whichever is higher. Part A eligibility cutoffs are based on actual production, throughput, or material usage of the source, as applicable.

(b) Owners or operators of sources in any one of the categories in OAR 340-216-8010 Part B must obtain one of the following unless otherwise allowed in Part B:

(A) A General ACDP, if one is available for the source classification and the source qualifies for a General ACDP under OAR 340-216-0060;

(B) A Simple ACDP under OAR 340-216-0064; or

(C) A Standard ACDP under OAR 340-216-0066 if the source fits one of the criteria of Part C or does not qualify for a Simple ACDP.

(c) Owners or operators of sources in any one of the categories in OAR 340-216-8010 Part C must obtain a Standard ACDP under the procedures set forth in OAR 340-216-0066.

(3) No person may construct, install, establish, develop or operate any air contaminant source listed in OAR 340-216-8010 without first obtaining an ACDP from DEQ or LRAPA and keeping a copy onsite at all times, unless otherwise deferred from the requirement to obtain an ACDP in subsection (3)(c) or DEQ has granted an exemption from the requirement to obtain an ACDP under subsection (3)(d). No person may continue to operate an air contaminant source if the ACDP expires, or is terminated, denied, or revoked; except as provided in OAR 340-216-0082.

(a) The owner or operator must construct and operate their facility in accordance with the approved plans and specifications, including any corrections or revisions approved by DEQ, previously submitted in the application required under OAR 340-216-0040.

(b) For portable sources, a permit may be issued or assigned by:

(A) DEQ for operation in any area of the state except Lane County; or

(B) LRAPA for operation in Lane County.

(c) The owner or operator of a source required to obtain an ACDP or ACDP Attachment in order to comply with a NESHAP under OAR chapter 340, division 244 or a NSPS under OAR chapter 340, division 238, is not required to submit an application for an ACDP or ACDP Attachment until four months after the effective date of the EQC's adoption of the NESHAP or NSPS, and is not required to obtain an ACDP or ACDP Attachment until six months after the EQC's adoption of the NESHAP or NSPS. In addition, DEQ may defer the requirement to submit an application for, or to obtain an ACDP or ACDP Attachment, or both, for up to an additional twelve months, subject to paragraphs (A) and (B).

(A) Deferrals of Oregon permitting requirements do not relieve an air contaminant source from the responsibility of complying with applicable federal NESHAP or NSPS requirements.

(B) OAR 340-216-0060(1)(b)(A), 340-216-0062(2)(b)(A), 340-216-0064(4)(a), and 340-216-0066(3)(a), do not relieve a permittee from the responsibility of complying with federal NESHAP or NSPS requirements that apply to the source even if DEQ has not incorporated such requirements into the permit.

(d) DEQ may exempt a source from the requirement to obtain an ACDP if it determines that the source is subject to only procedural requirements, such as notification that the source is affected by an NSPS or NESHAP.

(4) No person may construct, install, establish, or develop any source that will be subject to the Oregon Title V Operating Permit program without first obtaining an ACDP, unless the source may be placed onsite and operated without any other construction necessary and obtains an Oregon Title V Operating Permit prior to operation.

(5) The owner or operator of a source that has been issued an ACDP may not modify the source without first complying with the requirements of OAR 340-210-0205 through 340-210-0250.

(6) The owner or operator of a source required to have an ACDP may not make modifications to the source that would result in the source becoming subject to the Oregon Title V Operating Permit program without complying with the requirements of OAR 340-210-0205 through 340-210-0250.

(7) The owner or operator of a source required to have an ACDP may not increase emissions above the PSEL without first applying for and obtaining a modified ACDP.

(8) The owner or operator of a source that has been issued an ACDP may not violate any conditions included in the ACDP.

(9) Subject to the requirements in this division and OAR 340-200-0010(3), LRAPA is designated by the EQC to implement the rules in this division within its area of jurisdiction.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the EQC under OAR 340-200-0040 with the exception of all references to toxic air contaminants and OAR chapter 340, division 245.]

[NOTE: Tables referenced are in OAR 340-216-8010 and 340-216-8020.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.155, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.040, 468A.135 - 468A.155, 468A.310

AMEND: 340-216-0025

RULE TITLE: Types of Permits

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Cleaning up language and adding section (7).

RULE TEXT:

(1) Construction ACDP:

(a) A Construction ACDP may be used for approval of Type 3 changes specified in OAR 340-210-0225 at a source subject to the ACDP permit requirements in this division.

(b) A Construction ACDP is required for Type 3 changes specified in OAR 340-210-0225 at sources subject to the Oregon Title V Operating Permit requirements.

(2) General ACDP. A General ACDP is a permit for a category of sources for which individual permits are unnecessary in order to protect the environment, as determined by DEQ. An owner or operator of a source may be assigned to a General ACDP if DEQ has issued a General ACDP for the source category and:

(a) The source meets the qualifications specified in the General ACDP;

(b) DEQ determines that the source has not had ongoing, recurring, or serious compliance problems; and

(c) DEQ determines that a General ACDP would appropriately regulate the source.

(3) Short Term Activity ACDP. A Short Term Activity ACDP is a letter permit that authorizes the activity and includes any conditions placed upon the method or methods of operation of the activity. DEQ may issue a Short Term Activity ACDP for activities included in OAR 340-216-0054.

(4) Basic ACDP. A Basic ACDP is a permit that authorizes the regulated source to operate in conformance with the rules contained in OAR chapter 340, divisions 200 to 268.

(a) Owners and operators of sources and activities listed in Part A of OAR 340-216-8010 must at a minimum obtain a Basic ACDP.

(b) Any owner or operator of a source required to obtain a Basic ACDP may choose to obtain either a Simple or Standard ACDP.

(5) Simple ACDP.

(a) Owners and operators of sources and activities listed in OAR 340-216-8010 Part B that do not qualify for a General ACDP and are not required to obtain a Standard ACDP must, at a minimum, obtain a Simple ACDP. The owner or operator of a source required to obtain a Simple ACDP may choose to obtain a Standard ACDP.

(b) A Simple ACDP is a permit that contains:

(A) All relevant applicable requirements for source operation, including general ACDP conditions for incorporating generally applicable requirements;

(B) PSELs at less than the SER for all regulated pollutants emitted at more than the de minimis emission level according to OAR chapter 340, division 222; and

(C) Testing, monitoring, recordkeeping, and reporting requirements sufficient to determine compliance with the PSEL and other emission limits and standards, as necessary.

(6) Standard ACDP:

(a) Applicability.

(A) The owner or operator of a source listed in Part C of OAR 340-216-8010 must obtain a Standard ACDP;

(B) The owner or operator of a source listed in Part B of OAR 340-216-8010 that does not qualify for a General ACDP or Simple ACDP must obtain a Standard ACDP;

(C) The owner or operator of a source not required to obtain a Standard ACDP may choose to apply for a Standard ACDP.

(b) A Standard ACDP is a permit that contains:

(A) All applicable requirements, including general ACDP conditions for incorporating generally applicable requirements;

(B) PSELs for all regulated pollutants emitted at more than the de minimis emission level according to OAR chapter 340, division 222; and

(C) Testing, monitoring, recordkeeping, and reporting requirements sufficient to determine compliance with the PSEL and other emission limits and standards, as necessary.

(7)(a) Notwithstanding the other provisions of this division that establish the eligibility of a source for different types of ACDPs, DEQ may determine, pursuant to the standards described in subsection (b), that the owner or operator of a source is ineligible for certain types of ACDP and must be issued a different type of ACDP;

(b) DEQ will make a determination about which type of ACDP that the owner or operator of source must obtain based upon the following considerations:

(A) The nature, extent, toxicity and impact on human health and the environment of the source's emissions;

(B) The complexity of the source and the rules applicable to that source;

(C) The complexity of the emission controls, potential threat to human health and the environment if the emission controls fail, and the source's capacity;

(D) The location of the source and its proximity to places where people live and work; and

(E) The compliance history of the source, including by the source's:

(i) Current corporate officers, managers, members of the board of directors, general partners or similar persons, provided that the person exercises or will exercise substantial control on behalf of or over the facility that is the subject of the application or permit;

(ii) Parent corporations, or similar business entities, that exercise substantial control over the facility that is the subject of the application or permit; and

(iii) Subsidiary corporations, or similar business entities, over which the applicant or permittee exercises substantial control.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the EQC under OAR 340-211-0040.]

[NOTE: All tables are found in OAR 340-216-8010, -8020, -8030.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.040, 468A.310

AMEND: 340-216-0040

RULE TITLE: Application Requirements

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding requirements for what must be included in ACDP applications.

RULE TEXT:

(1) New Permits.

(a) Except for Short Term Activity ACDPs, any person required to obtain a new ACDP must provide a complete application with the following general information, as applicable, in addition to any other information required for a specific permit type. Complete applications must be submitted using electronic forms provided by DEQ, unless otherwise approved in writing by DEQ:

(A) Identifying information, including the name of the company, the mailing address, the facility address, and the nature of business, Standard Industrial Classification (SIC) code;

(B) The name and phone number of a local person responsible for compliance with the permit;

(C) The name of a person authorized to receive requests for data and information;

(D) A description of the production processes and related flow chart;

(E) A plot plan showing the location and height of all emissions units, devices and activities that emit to the atmosphere, including any air pollution control devices, and the nearest residential and commercial properties;

(F) Make, model, and identification name or number of each device, activity, and air pollution control device, if known;

(G) Exhaust parameters (e.g., stack height, diameter, temperature, flowrate, volume or area source dimensions) of each emissions unit, device, and air pollution control device that emits to the atmosphere;

(H) The type and quantity of fuels used;

(I) An estimate of the amount and type of each air contaminant emitted by the source in terms of hourly, daily, or monthly and yearly rates, showing calculation procedures;

(J) Any information on pollution prevention measures and cross-media impacts the applicant wants DEQ to consider in determining applicable control requirements and evaluating compliance methods;

(K) Estimated efficiency of air pollution control devices under present or anticipated operating conditions;

(L) Where the operation or maintenance of air pollution control devices and emission reduction processes can be adjusted or varied from the highest reasonable efficiency and effectiveness, information necessary for DEQ to establish operational and maintenance requirements in OAR 340-226-0120(1) and (2);

(M) Land Use Compatibility Statement(s), when required by OAR chapter 340, division 018:

(i) Signed by the applicable local planning jurisdiction(s), determining that construction or modification of the source is compatible with applicable local jurisdiction's acknowledged comprehensive plan. If DEQ receives a LUCS which states that the proposed action is incompatible with the acknowledged comprehensive plan, DEQ shall notify the applicant that the application cannot be processed;

(ii) If the local planning jurisdiction declines to provide a LUCS determination in response to a request for a LUCS, the owner or operator must provide DEQ with its own analysis to demonstrate that the proposed action complies with all applicable statewide planning goals;

(N) The most recent information reported through EPA's Toxics Release Inventory program at the time of application submittal, if the source is subject to the program;

(O) An air quality analysis, conducted in accordance with the procedures in OAR chapter 340, division 225, demonstrating that the emissions, including reductions due to air pollution control devices or permitted limits on production capacity, will not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202;

(P) Any information required by OAR chapter 340, divisions 222, 224, 225, and 245, including but not limited to control technology and analysis and air quality analysis, conducted in accordance with the procedures in OAR chapter 340, division 225; and information related to offsets and net air quality benefit, if applicable;

(Q) Anticipated date of the commencement of construction (i.e., breaking ground); and

(R) Anticipated date of construction completion; and

(S) Any other information requested by DEQ.

(b) Owners or operators must submit complete applications for new permits in accordance with the timelines provided in subsection (2)(b), as well as OAR 340-245-0030, Cleaner Air Oregon submittal and payment deadlines, and OAR 340-224-0030, permit applications subject to New Source Review, to allow DEQ adequate time to process the application and issue a permit before it is needed.

(2) Permit Renewals. Any person who wants to renew an existing permit must submit a complete application using forms provided by DEQ, unless otherwise allowed in writing by DEQ.

(a) The renewal application must include:

(A) All information identified in subsection (1)(a) that has changed since the last permit renewal or issuance;

(B) A complete list of all devices and activities, or any combination of devices and activities, including all air pollution control devices, and all categorically insignificant activities;

(C) An estimate of the amount and type of each air contaminant emitted by the source in terms of hourly, daily, or monthly and yearly rates, showing calculation procedures;

(D) All changes to the source since the last permit issuance and all requirements applicable to those changes; a(E) When required by DEQ, an air quality analysis, conducted in accordance with the procedures in OAR chapter 340, division 225, demonstrating that the source’s emissions, including reductions due to air pollution control devices or permitted limits on production capacity, will not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202.

(b) The owner or operator must submit an application for renewal of the existing permit by no later than:

(A) 30 days prior to the expiration date of a Basic ACDP;

(B) 120 days prior to the expiration date of a Simple ACDP; or

(C) 180 days prior to the expiration date of a Standard ACDP.

(c) DEQ must receive an application for reassignment to General ACDPs and General ACDP attachments within 30 days prior to expiration of the General ACDPs or General ACDP attachments.

(3) Permit Modifications.

(a) An owner or operator applying for a modification of a Basic, Simple or Standard ACDP must provide the information in subsection (1)(a) relevant to the requested changes to the permit and a list of any requirements applicable to those changes.

(b) DEQ recommends that applicants for permit modifications consider the timelines provided in subsection (2)(b), as well as OAR 340-245-0030, Cleaner Air Oregon submittal and payment deadlines, and OAR 340-224-0030, permit applications subject to New Source Review, to allow DEQ adequate time to process the application and issue a permit before it is needed.

(c) When required by DEQ, the owner or operator must submit an air quality analysis demonstrating that the emissions, including reductions due to air pollution control devices or permitted limits on production capacity, will not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202.

(4) Any person who fails to submit any relevant facts or who has submitted incorrect information in a permit application must, upon becoming aware of such failure or incorrect submittal, promptly submit such supplementary facts or corrected information.

(5) Permit applications must be completed in full and signed by the applicant or the applicant's legally authorized representative.

(6) When a permit application is subject to Major NSR under OAR chapter 340, division 224, a copy of the permit application, including all supplemental and supporting information, must also be submitted directly to the EPA.

(7) The name of the applicant on a permit application must be the legal name of the facility’s owner, the owner's agent or the lessee responsible for the operation and maintenance of the facility. The legal name must be registered with the

Oregon Secretary of State Corporations Division, unless the applicant is an individual person that is operating the facility or applying for the permit, and is not doing so under an assumed business name.
(8) All permit applications must include the appropriate fees as specified in OAR 340-216-8020 and OAR 340-216-8030.
(9) Permit applications that are obviously incomplete, unsigned, improperly signed, or lacking the required exhibits or fees will be rejected by DEQ and returned to the applicant for completion.
(10) Within 15 days after receiving the application, DEQ will preliminarily review the application to determine the adequacy of the information submitted, and:
(a) If DEQ determines that additional information is needed, DEQ will promptly ask the applicant for the needed information and provide the applicant with a written request to provide such information by a date, not to exceed a 60-day period;
(b) An applicant may request an extension of time from a deadline established in subsection (a) by providing DEQ with a written request 15 days prior to the submittal deadline. DEQ may grant an extension based on the following criteria:
(A) The applicant has demonstrated progress in completing the submittal; and
(B) A delay is necessary, for good cause shown by the applicant, related to obtaining more accurate or new data, performing additional analyses, or addressing changes in operations or other key parameters, any of which are likely to have a substantive impact on the outcomes of the submittal;
(c) If DEQ determines it is not able to approve the applicant's submittal, or if the applicant does not timely provide additional information or corrections requested by DEQ under subsection (a), then in addition to any other remedies available, DEQ may issue a proposed denial of the application under OAR 340-209-0080(6);
(d) If DEQ has determined that additional information or corrections are necessary under subsection (a), and except as provided in subsection (c), DEQ will not consider the application to be complete for processing until DEQ has received the requested information; and
(e) When DEQ has determined that the information in an application is adequate for processing, DEQ will so notify the applicant in writing.
(11) If at any time while processing the permit application, DEQ determines that additional information is needed, DEQ will follow the procedures in section (10) to request such information.
(12) If, upon review of an application, DEQ determines that a permit is not required, DEQ will so notify the applicant in writing. Such notification is a final action by DEQ on the application.
[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the EQC under OAR 340-200-0040 with the exception of all references to toxic air contaminants or OAR chapter 340, division 245.]
[NOTE: Tables referenced are in OAR 340-216-8010 and 340-216-8020.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468.065, 468A.025, 468A.040, 468A.310, 468A.315

STATUTES/OTHER IMPLEMENTED: ORS 468, 468A

AMEND: 340-216-0054

RULE TITLE: Short Term Activity ACDPs

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding detail for when DEQ may issue a Short Term Activity ACDP.

RULE TEXT:

(1) Applicability. DEQ may issue a Short Term Activity ACDP for the following types of activities:

(a) Activities that do not require a Title V permit under OAR chapter 340, division 218;

(b) Unexpected or emergency activities; or

(c) Operation of a pilot or an exploratory emissions unit.

(2) Application requirements. Any person requesting a Short Term Activity ACDP must apply in writing, fully describing the proposed activities, operations, and emissions. The application must include the following:

(a) Identifying information, including the name of the company, the mailing address, the facility address, and the nature of business, Standard Industrial Classification (SIC) code;

(b) The name and phone number of a local person responsible for compliance with the permit;

(c) The name of a person authorized to receive requests for data and information;

(d) A description of the production processes and related flow chart;

(e) Make, model, and identification name or number of each device, activity, and air pollution control device;

(f) The type and quantity of fuels used;

(g) An estimate of the amount and type of each air contaminant emitted by the source in terms of hourly, daily, or monthly rates, showing calculation procedures;

(h) Land use approval;

(i) Anticipated date of the commencement of construction (i.e., breaking ground);

(j) Anticipated date of construction completion; and

(k) When required by DEQ, an air quality analysis, conducted in accordance with the procedures in OAR chapter 340, division 225, demonstrating that the source’s emissions will not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202.

(3) Fees. Applicants for a Short Term Activity ACDP must pay the fees in OAR 340-216-8020.

(4) Permit content:

(a) A Short Term Activity ACDP must include conditions that ensure adequate protection of property and preservation of public health, welfare, and resources.

(b) A Short Term Activity ACDP may not include a PSEL for any air contaminants discharged as a result of the permitted activity.

(c) A Short Term Activity ACDP will automatically terminate 60 days from the date of issuance. The permittee may request that the Short Term Activity ACDP be renewed one time, for an additional 60-day period by notifying DEQ in writing at least 14 days before the expiration of the Short Term Activity ACDP. If DEQ approves the renewal, no additional permit fees are required.

(5) If a Short Term Activity ACDP is issued to a permitted source, the permittee must include emissions from the short term activity when determining compliance with PSELs under OAR chapter 340, division 222 and Source Risk Limits under OAR chapter 340, division 245.

(6) Permit issuance public notice procedures. A Short Term Activity ACDP requires public notice as a Category I permit action under OAR chapter 340, division 209.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468.065, 468A.025, 468A.040, 468A.310, 468A.315

STATUTES/OTHER IMPLEMENTED: ORS 468, 468A

AMEND: 340-216-0056

RULE TITLE: Basic ACDPs

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "(2) DEQ may determine that a source is ineligible for a Basic ACDP based upon the considerations in OAR 340-216-0025(7)."

RULE TEXT:

(1) Application requirements. Any person requesting a Basic ACDP must submit an application according to OAR 340-216-.
(2) DEQ may determine that a source is ineligible for a Basic ACDP based upon the considerations in OAR 340-216-0025(7).
(3) Fees. Applicants for a new Basic ACDP must pay the fees in OAR 340-216-8020.
(4) Permit content:
(a) A Basic ACDP will contain only the most significant and relevant rules applicable to the source;
(b) A Basic ACDP may not contain a PSEL;
(c) A Basic ACDP may contain any physical or operational limitation, including any combination of the use of control devices, restrictions on hours of operation, or restrictions on the type or amount of materials combusted, stored, or processed, as permit conditions to limit short term emissions for all devices and activities that require controls or limitations to ensure the source's emission will not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202;
(d) A Basic ACDP will require that a simplified annual report be submitted to DEQ; and
(e) A Basic ACDP may be issued for a period not to exceed ten years.
(5) Permit issuance public notice procedures. A Basic ACDP requires public notice as a Category I permit action according to OAR chapter 340, division 209.
[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the EQC under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468.065, 468A.025, 468A.040, 468A.310, 468A.315

STATUTES/OTHER IMPLEMENTED: ORS 468, 468A

AMEND: 340-216-0060

RULE TITLE: General Air Contaminant Discharge Permits

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Cleaning up language and adding "(2) Petition for General ACDP Categories" section.

RULE TEXT:

(1) Applicability.

(a) DEQ may issue a General ACDP under the following circumstances:

(A) There are multiple sources that involve the same or substantially similar types of operations;

(B) All requirements applicable to the covered operations can be contained in a General ACDP;

(C) The emission limitations, monitoring, recordkeeping, reporting and other enforceable conditions are the same for all operations covered by the General ACDP; and

(D) The regulated pollutants emitted are of the same type for all covered operations.

(E) DEQ may determine that a source is ineligible for a General ACDP based upon the considerations in OAR 340-216-0025(7).

(b) Permit content. Each General ACDP must include the following:

(A) All relevant requirements for the operations covered by the General ACDP, excluding any federal requirements not adopted by the EQC;

(B) PSELs set at the potential to emit for the largest emitting source in the source category in the state for all regulated pollutants emitted at more than the de minimis emission level according to OAR chapter 340, division 222;

(C) Testing, monitoring, recordkeeping, and reporting requirements necessary to ensure compliance with the PSEL and other applicable emissions limits and standards; and

(D) A permit expiration date not to exceed 10 years from the date of issuance.

(c) Permit issuance public notice procedures: A new General ACDP requires public notice as a Category III permit action according to OAR chapter 340, division 209. A reissued General ACDP or a modification to a General ACDP requires public notice as a Category II permit action according to OAR chapter 340, division 209.

(d) DEQ will retain all General ACDPs on file and make them available for public review at DEQ's headquarters.

(2) Petition for General ACDP Categories.

Any person may file a petition with DEQ to add a category for a General ACDP. DEQ may use its discretion to determine whether to issue any such new General ACDP. The petition must include at least the following information:

(a) Justification for why a new General ACDP category should be developed;

(b) The approximate number of businesses that would be eligible for the General ACDP;

(c) Criteria for qualification to the General ACDP; and

(d) A list of the requirements applicable to the activities or sources that would be eligible for the new General ACDP.

(3) Source assignment:

(a) Application requirements. Any person requesting that a source be assigned to a General ACDP must submit a written application according to OAR 340-216-0040 that includes the information in 340-216-0040(1), specifies the General ACDP source category, and shows that the source qualifies for the General ACDP.

(b) Fees. Applicants must pay the fees in OAR 340-216-8020. The fee class for each General ACDP is Fee Class One unless otherwise specified as follows:

(A) Hard chrome platers — Fee Class Three;

(B) Decorative chrome platers — Fee Class Two;

(C) Halogenated solvent degreasers — batch cold, batch vapor, and in-line — Fee Class Two;

(D) Perchloroethylene dry cleaners — Fee Class Six;

(E) Asphalt plants — Fee Class Three;

(F) Rock crushers — Fee Class Two;

(G) Ready-mix concrete — Fee Class One;

(H) Sawmills, planing mills, millwork, plywood manufacturing and veneer drying — Fee Class Three;
(I) Boilers — Fee Class Two;
(J) Crematories — Fee Class One;
(K) Grain elevators — Fee Class One;
(L) Prepared feeds, flour, and cereal — Fee Class One;
(M) Seed cleaning — Fee Class One;
(N) Coffee roasters — Fee Class One;
(O) Bulk gasoline plants — Fee Class One;
(P) Electric power generators — Fee Class Two;
(Q) Clay ceramics — Fee Class One;
(R) Hospital sterilizers — Fee Class Four;
(S) Gasoline dispensing facilities — stage I — Fee Class Five;
(T) Gasoline dispensing facilities — stage II — Fee Class Four;
(U) Wood preserving — Fee Class Four;
(V) Metal fabrication and finishing — with two or more of the following operations — Fee Class Two;
(i) Dry abrasive blasting performed in a vented enclosure or of objects greater than 8 feet (2.4 meters) in any one dimension that uses materials that contain MFHAP or has the potential to emit MFHAP;
(ii) Spray-applied painting operation using MFHAP containing paints;
(iii) Welding operation that uses materials that contain MFHAP or has the potential to emit MFHAP and uses 2,000 pounds or more per year of MFHAP containing welding wire and rod (calculated on a rolling 12-month basis);
(W) Metal fabrication and finishing — with only one of the operations listed in subparagraphs (2)(b)(W)(i) through (iii) — Fee Class One;
(X) Metal fabrication and finishing — with none of the operations listed in subparagraphs (2)(b)(W)(i) through (iii) — Fee Class Four;
(Y) Plating and polishing — Fee Class One;
(Z) Surface coating operations — Fee Class One;
(AA) Paints and allied products manufacturing — Fee Class Two; and
(BB) Emergency generators and firewater pumps, if a permit is required – Fee Class Two.
(c) Source assignment procedures:
(A) Assignment of a source to a General ACDP is a Category I permit action and is subject to the Category I public notice requirements according to OAR chapter 340, division 209.
(B) A person is not a permittee under the General ACDP until DEQ assigns the General ACDP to the person.
(C) Assignments to General ACDPs and attachments terminate when the General ACDP or attachment expires or is modified, terminated or revoked.
(D) Once a source has been assigned to a General ACDP, if the assigned General ACDP does not cover all applicable requirements, excluding any federal requirements not adopted by the EQC, the other applicable requirements must be covered by assignment to one or more General ACDP Attachments according to OAR 340-216-0062, otherwise the owner or operator of the source must obtain a Simple or Standard ACDP.
(E) An owner or operator of a source requesting to be assigned to a General ACDP Attachment, according to OAR 340-216-0062, for a source category in a higher annual fee class than the General ACDP to which the source is currently assigned, must be reassigned to the General ACDP for the source category in the higher annual fee class.
(4) DEQ Initiated Modification. If DEQ determines that the conditions have changed such that a General ACDP for a category needs to be modified, DEQ may issue a modified General ACDP for that category and assign all existing General ACDP permit holders to the modified General ACDP.
(5) Rescission. DEQ may rescind a permittee's assignment to a General ACDP if the permittee's source no longer meets the requirements or qualification conditions of the permit. In such case, the permittee must submit an application within 60 days for a Simple or Standard ACDP upon notification by DEQ of DEQ's intent to rescind the General ACDP. Upon

issuance of the Simple or Standard ACDP, or if the permittee fails to submit an application for a Simple or Standard ACDP, DEQ will rescind the permittee's assignment to the General ACDP.
[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the EQC under OAR 340-200-0040.]
[NOTE: All tables are found in OAR 340-216-8010, -8020, -8030.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468.065, 468A.025, 468A.040, 468A.310, 468A.315

STATUTES/OTHER IMPLEMENTED: ORS 468, 468A

AMEND: 340-216-0064

RULE TITLE: Simple ACDP

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "(2) DEQ may determine that a source is ineligible for a Simple ACDP based upon the considerations in OAR 340-216-0025(7)." and (4)(c): "(c) To ensure the source's emission will not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202:
(A) Any physical or operational limitation, including any combination of the use of control devices, restrictions on hours of operation, or restrictions on the type or amount of materials combusted, stored, or processed, will be included as permit conditions to limit short term emissions for all devices and activities that require controls or limitations; or
(B) A requirement to conduct ambient monitoring to confirm a new exceedance of a National Ambient Air Quality Standard. Ambient monitoring and meteorological monitoring must be conducted in accordance with a DEQ approved monitoring plan for a period of not less than 12 months. There must be at least 12 months of valid data with greater than 75 percent data completeness per quarter."

RULE TEXT:
(1) Application Requirements. Any person requesting a new, modified, or renewed Simple ACDP must submit an application according to OAR 340-216-0040.
(2) DEQ may determine that a source is ineligible for a Simple ACDP based upon the considerations in OAR 340-216-0025(7).
(3) Fees. Applicants for a new or modified Simple ACDP must pay the fees in OAR 340-216-8020. Applicants for a new Simple ACDP must initially pay the High Annual Fee. Once the initial permit is issued, annual fees for Simple ACDPs will be assessed based on the following:
(a) Low Fee — A source may qualify for the low fee if:
(A) The source is, or will be, permitted under only one of the following categories in OAR 340-216-8010 Part B:
(i) Category 7. Asphalt felt and coatings;
(ii) Category 13. Boilers and other fuel burning equipment (can be combined with category 27. Electric power generation);
(iii) Category 27. Electric power generation;
(iv) Category 33. Galvanizing & pipe coating;
(v) Category 39. Gray iron and steel foundries, malleable iron foundries, steel investment foundries, steel foundries 100 or more tons/yr. metal charged (not elsewhere identified);
(vi) Category 40. Gypsum products;
(vii) Category 45. Liquid storage tanks subject to OAR chapter 340, division 232;
(viii) Category 56. Non-ferrous metal foundries 100 or more tons/year of metal charged;
(ix) Category 57. Organic or inorganic industrial chemical manufacturing;
(x) Category 62. Perchloroethylene dry cleaning;
(xi) Category 73. Secondary smelting and/or refining of ferrous and non-ferrous metals; or
(xii) Category 85. All other sources not listed in OAR 340-216-8010 (can be combined with category 27. Electric Power Generation); and
(B) The actual emissions from the calendar year immediately preceding the invoice date are less than five tons/year of PM10 in a PM10 nonattainment or maintenance area or PM2.5 in a PM2.5 nonattainment or maintenance area, and less than 10 tons/year for each criteria pollutant; and
(C) The source is not creating a nuisance under OAR 340-208-0310 or 340-208-0450.
(b) High Fee — Any source required to have a Simple ACDP (OAR 340-216-8010 Part B) that does not qualify for the low fee under subsection (2)(a) will be assessed the high fee.
(c) If DEQ determines that a source was invoiced for the low annual fee but does not meet the low fee criteria outlined above, the source will be required to pay the difference between the low and high fees, plus applicable late fees in OAR

340-216-8020 Part 5. In the case of late fees, DEQ will issue a new invoice specifying applicable fees.

(4) Permit Content. Each Simple ACDP must include the following:

(a) All relevant applicable requirements for source operation, including general ACDP conditions for incorporating generally applicable requirements, but excluding any federal requirements not adopted by the EQC;

(b) PSELs at less than the SER for all regulated pollutants emitted at more than the de minimis emission level under OAR chapter 340, division 222;

(c) To ensure the source's emission will not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202:

(A) Any physical or operational limitation, including any combination of the use of control devices, restrictions on hours of operation, or restrictions on the type or amount of materials combusted, stored, or processed, will be included as permit conditions to limit short term emissions for all devices and activities that require controls or limitations; or

(B) A requirement to conduct ambient monitoring to confirm a new exceedance of a National Ambient Air Quality Standard. Ambient monitoring and meteorological monitoring must be conducted in accordance with a DEQ approved monitoring plan for a period of not less than 12 months. There must be at least 12 months of valid data with greater than 75 percent data completeness per quarter.

(d) Testing, monitoring, recordkeeping, and reporting requirements sufficient to determine compliance with the PSEL and other emission limits and standards, as necessary; and

(e) A permit duration not to exceed 10 years.

(5) Permit issuance public notice procedures:

(a) Issuance of a new or renewed Simple ACDP requires public notice as a Category III permit according to OAR chapter 340, division 209.

(b) Issuance of a modification to a Simple ACDP requires one of the following procedures, as applicable:

(A) Public notice as a Category I permit action for non-technical and basic and simple technical modifications according to OAR chapter 340, division 209; or

(B) Public notice as a Category III permit action for moderate and complex technical modifications according to OAR chapter 340, division 209.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the EQC under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468.065, 468A.025, 468A.040, 468A.310, 468A.315

STATUTES/OTHER IMPLEMENTED: ORS 468, 468A

AMEND: 340-216-0066

RULE TITLE: Standard ACDPs

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding requirements for what Standard ACDPs must include.

RULE TEXT:

(1) Application requirements. Any person requesting a new, modified, or renewed Standard ACDP must submit an application according to OAR 340-216-0040 and include the following additional information as applicable:

(a) New or modified Standard ACDPs that are not subject to Major NSR, but have emissions increases above the significant emissions rate are subject to the requirements of State NSR. The application must include an analysis of the air quality and, for federal major sources only, the visibility impacts of the source or modification, including meteorological and topographical data, specific details of models used, and other information necessary to estimate air quality impacts.

(b) For new or modified Standard ACDPs that are subject to Major NSR, the application must include the following information as applicable:

(A) A detailed description of the air pollution control devices and emission reductions processes that are planned for the major source or major modification, and any other information necessary to determine that BACT or LAER technology, whichever is applicable, would be applied;

(B) An analysis of the air quality and, for federal major sources only, the visibility impacts of the major source or major modification, including meteorological and topographical data, specific details of models used, and other information necessary to estimate air quality impacts; and

(C) An analysis of the air quality and, for federal major sources only, the visibility impacts, and the nature and extent of all commercial, residential, industrial, and other source emission growth, which has occurred since the baseline concentration year in the area the major source or major modification would affect.

(2) Fees. Applicants for a Standard ACDP must pay the fees in OAR 340-216-8020.

(3) Permit content. Each Standard ACDP must include the following:

(a) All applicable requirements, including general ACDP conditions for incorporating generally applicable requirements, but excluding any federal requirements not adopted by the EQC;

(b) PSELs for all regulated pollutants emitted at more than the de minimis emission level under OAR chapter 340, division 222;

(c) To ensure the source’s emission will not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202:

(A) Any physical or operational limitation, including any combination of the use of control devices, restrictions on hours of operation, or restrictions on the type or amount of materials combusted, stored, or processed, will be included as permit conditions to limit short term emissions for all devices and activities that require controls or limitations; or

(B) A requirement to conduct ambient monitoring to confirm a new exceedance of a National Ambient Air Quality Standard. Ambient monitoring and meteorological monitoring must be conducted in accordance with a DEQ approved monitoring plan for a period of not less than 12 months. There must be at least 12 months of valid data with greater than 75 percent data completeness per quarter.

(d) Testing, monitoring, recordkeeping, and reporting requirements sufficient to determine compliance with the PSEL and other emission limits and standards, as necessary; and

(e)(A) A permit duration not to exceed 5 years, for all permits except as allowed under paragraph (B); or

(B) For a Standard ACDP that is issued solely to implement the requirements of OAR chapter 340, division 224 for New Source Review for a Title V source, there is no expiration date. This permit is only required to be modified if any of the New Source Review permit conditions must be modified. The owner or operator does not have to pay annual fees for this permit but must pay the applicable specific activity fees for any permit modification.

(4) Permit issuance procedures.

(a) Issuance of a new or renewed Standard ACDP requires public notice under OAR chapter 340, division 209 as follows:

(A) Public notice as a Category III permit action for permit actions that will increase allowed emissions but that are not Major NSR or Type A State NSR permit actions under OAR chapter 340, division 224, or as a Category II permit action if the permit will not increase allowed emissions;

(B) Public notice as a Category IV permit action for permit actions that are Major NSR or Type A State NSR permit actions under OAR chapter 340, division 224;

(b) Issuance of a modified Standard ACDP requires public notice under OAR chapter 340, division 209 as follows:

(A) Public notice as a Category I permit action for non-technical modifications and basic and simple technical modifications according to OAR chapter 340, division 209;

(B) Public notice as a Category II permit action for moderate and complex technical modifications if there will be no increase in allowed emissions, or as a Category III permit action if there will be an increase in emissions; or

(C) Public notice as a Category IV permit action for major modifications subject to Major NSR or Type A State NSR under OAR chapter 340, division 224.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan as adopted by the EQC under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468.065, 468A.025, 468A.040, 468A.310, 468A.315

STATUTES/OTHER IMPLEMENTED: ORS 468, 468A

AMEND: 340-216-0068

RULE TITLE: Simple and Standard ACDP Attachments

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding SIP note to the end of the rule.

RULE TEXT:

(1) Purpose. This rule allows DEQ to add new requirements to existing Simple or Standard ACDPs by assigning the source to an ACDP Attachment issued under section (2). An ACDP Attachment would apply to an affected source until the new requirements are incorporated into the source's Simple or Standard ACDP at the next permit renewal or at the time of permit modification.

(2) ACDP Attachment issuance procedures:

(a) An ACDP Attachment issuance requires public notice as a Category II permit action under OAR chapter 340, division 209. Assigning ACDP Attachments to Simple or Standard ACDPs require notice as Category I permit actions.

(b) DEQ may issue an ACDP Attachment when there are multiple sources that are subject to the new requirements.

(c) Attachment content. Each ACDP Attachment must include the following:

(A) Testing, monitoring, recordkeeping, and reporting requirements necessary to ensure compliance with the applicable emissions limits and standards; and

(B) An attachment expiration date not to exceed 5 years from the date of issuance.

(3) Assignment to ACDP Attachment:

(a) A source is not a permittee under the ACDP Attachment until DEQ assigns the ACDP Attachment to the source.

(b) The ACDP Attachment is removed from the Simple or Standards ACDP when the requirements of the ACDP Attachment are incorporated into the source's Simple or Standard ACDP at the time of renewal or of a modification.

(c) If an EPA or DEQ action causes a source to be subject to the requirements in an ACDP Attachment, assignment to the ACDP Attachment is a DEQ initiated modification to the Simple or Standard ACDP and the permittee is not required to submit an application or pay fees for the permit action. In such case, DEQ would notify the permittee of the proposed permitting action and the permittee may object to the permit action if the permittee demonstrates that the source is not subject to the requirements of the ACDP Attachment.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-216-0082

RULE TITLE: Expiration, Termination, Reinstatement or Revocation of an ACDP

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding reasons why a permit may be terminated or reinstated.

RULE TEXT:

(1) Expiration.

(a) A source may not be operated after the expiration date of a permit, unless any of the following occur prior to the expiration date of the permit:

(A) A timely and complete application for renewal or reassignment has been submitted; or

(B) Another type of permit, ACDP or Oregon Title V Operating Permit, has been applied for or issued authorizing operation of the source.

(b) If a timely and complete renewal or reassignment application has been submitted, the existing permit will remain in effect until final action has been taken on the renewal application to issue or deny a permit.

(c) For a source operating under an ACDP or Oregon Title V Operating Permit, a requirement established in an earlier ACDP remains in effect notwithstanding expiration of the ACDP, unless the provision expires by its terms or unless the provision is modified or terminated according to the procedures used to establish the requirement initially.

(2) Termination. Except as provided in section (3), a source may not be operated after the termination of a permit. A permit terminates upon:

(a) Issuance of a renewal, reassigned ACDP or a new ACDP for the same activity or operation;

(b) Written request by the permittee to DEQ requesting termination. If DEQ determines that a permit is no longer needed, DEQ will confirm termination in writing to the permittee;

(c) Failure to submit a timely and complete application for permit renewal or reassignment as required in OAR 340-216-0040. Termination is effective on the permit expiration date;

(d) Failure to pay annual fees within 90 days of the invoice due date as issued by DEQ, unless prior arrangements for a payment plan have been approved in writing by DEQ.

(3) Termination of construction approval.

(a) Construction approval issued by DEQ under this division terminates and is invalid for the following reasons:

(A) Construction is not commenced within 18 months after DEQ issues such approval, by an alternative deadline established by DEQ under this section, or by the deadline approved by DEQ in an extension under subsection (b);

(B) Construction is discontinued for a period of 18 months or more; or

(C) Construction is not completed within 18 months of the anticipated date of construction completion included in the application.

(b) The owner or operator of a source for which construction approval has been terminated under subsection (a) may submit a request to extend the construction commencement deadline by submitting a written, detailed explanation of why the source could not commence construction within the initial 18-month period. DEQ may grant for good cause one 18-month construction approval extension.

(4) Reinstatement of Terminated Permit.

(a) A permit subject to termination under subsection (2)(c) may only be reinstated if, not later than 30 days after the permit expiration date, the permittee submits a complete renewal application and pays a late application fee equivalent to the initial new permitting application fee that would apply if the source was a new source, in which case the existing, expired permit will be reinstated effective as of the permit expiration date and will remain in effect until final action has been taken on the renewal application to issue or deny a permit;

(b) A permit terminated under subsection (2)(d) may only be reinstated if, not later than 90 days after termination, the permittee pays all unpaid annual fees and applicable late fees in which case the existing permit will be reinstated effective on the date of termination; and

(c) A terminated permit may only be reinstated as provided in subsections (a) and (b). If neither subsection (a) or (b) apply, the former permittee of a terminated permit who wishes to obtain an ACDP must submit a complete application for a new permit, including paying applicable new source permit application fees and any unpaid annual fees and late fees that were due under the terminated permit. Until DEQ issues or reassigns a new permit, the source may not operate.

(5) Revocation:

(a) If DEQ determines that a permittee is in noncompliance with the terms of the permit, submitted false information in the application or other required documentation, or is in violation of any applicable rule or statute, DEQ may revoke the permit. DEQ will provide notice of the intent to revoke the permit to the permittee under OAR 340-011-0525. The notice will include the reasons why the permit will be revoked, and include an opportunity for the permittee to request a contested case hearing prior to the revocation. A permittee’s written request for hearing must be received by DEQ within 60 days from service of the notice on the permittee, and must state the grounds of the request. The hearing will be conducted as a contested case hearing under ORS 183.413 through 183.470 and OAR chapter 340, division 011. The permit will continue in effect until the 60th day after service of the notice on the permittee, if the permittee does not timely request a hearing, or until a final order is issued if the permittee timely requests a hearing.

(b) If DEQ finds there is a serious danger to the public health, safety or the environment caused by a permittee's activities, DEQ may immediately revoke or refuse to renew the permit without prior notice or opportunity for a hearing. If no advance notice is provided, notification will be provided to the permittee as soon as possible under OAR 340-011-0525. The notification will set forth the specific reasons for the revocation or refusal to renew and will provide an opportunity for the permittee to request a contested case hearing for review of the revocation or refusal to renew. A permittee’s written request for hearing must be received by DEQ within 90 days of service of the notice on the permittee and must state the grounds for the request. The hearing will be conducted as a contested case hearing under ORS 183.413 through 183.470 and OAR chapter 340, division 011. The revocation or refusal to renew becomes final without further action by DEQ if a request for a hearing is not received within the 90 days. If a request for a hearing is timely received, the revocation or refusal to renew will remain in place until issuance of a final order.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468.065, 468A.025, 468A.040, 468A.310, 468A.315

STATUTES/OTHER IMPLEMENTED: ORS 183.468, 468A

AMEND: 340-216-0084

RULE TITLE: Department Initiated Modification

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Pointing to the procedures in 340-216-0056, 0064 and 0066 that DEQ will follow when notifying a permittee of a permit modification.

RULE TEXT:

(1) If DEQ determines it is appropriate to modify an ACDP, other than a General ACDP, DEQ will notify the permittee by regular, registered or certified mail of the modification and will include the proposed modification and the reasons for the modification, following the permit issuance procedures in OAR 340-216-0056(5) for Basic ACDPs, OAR 340-216-0064(5) for Simple ACDPs, and OAR 340-216-0066(4) for Standard ACDPs.

(2) The modification will become effective upon mailing unless the permittee requests a contested case hearing within 20 days. A request for hearing must be made in writing and must include the grounds for the request. The hearing will be conducted as a contested case hearing under ORS 183.413 through 183.470 and OAR 340 division 011. If a hearing is requested, the existing permit will remain in effect until after a final order is issued following the hearing.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 183, 468A

AMEND: 340-216-8010

RULE TITLE: Table 1 — Activities and Sources

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Amending attached table for clarity.

RULE TEXT:

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

[NOTE: For the history of these tables prior to 2014 see the history under OAR 340-216-0020]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

OAR 340-216-8010

Table 1

Activities and Sources

The following source categories must obtain a permit as required by OAR 340-216-0020 Applicability and Jurisdiction.

Part A: Basic ACDP

1 Autobody repair or painting shops painting more than 25 automobiles in a year and that are located inside the Portland AQMA.

2 Concrete manufacturing including redi-mix and CTB, both stationary and portable, more than 5,000 but less than 25,000 cubic yards per year output.

3 Crematory incinerators with less than 20 tons/year material input.

4 Individual natural gas or propane-fired boilers with heat input rating between 9.9 and 29.9 MMBTU/hour, constructed after June 9, 1989, that do not use more than 9,999 gallons per year of #2 diesel oil as a backup fuel.

5 Prepared feeds for animals and fowl and associated grain elevators more than 1,000 tons/year but less than 10,000 tons per year throughput.

6 Rock, concrete or asphalt crushing, both stationary and portable, more than 5,000 tons/year but less than 25,000 tons/year crushed.

7 Surface coating operations whose actual or expected usage of coating materials is greater than 250 gallons per month but does not exceed 3,500 gallons per year, excluding sources that exclusively use non-VOC and non-HAP containing coatings, e.g., powder coating operations.

8 Sources subject to permitting under Part B of this table, number 85 if all of the following criteria are met:

   a. The source is not subject to any category listed on this table other than Part B number 85;
   b. The source has requested an enforceable limit on their actual emissions, if the source were to operate uncontrolled, to below Part B number 85 of this table as applicable depending on the source's location through one or both

of the following:

  - i. A limit on hours of operation;
  - ii. A limit on production;

- c. Control devices are not required to be used or otherwise accounted for to maintain emissions levels compliant with 8.b above;
- d. The source is not subject to and does not have any affected emissions units subject to a 40 C.F.R. part 60, part 61, or part 63 standard (NSPS or NESHAP);
- e. The source is not subject to any specific industry or operation standard in OAR chapter 340, divisions 232, 234, or 236.
- f. DEQ has determined that the source is not required to conduct source testing and source testing for emission factor verification will not be required.

Part B: General, Simple or Standard ACDP

1 Aerospace or aerospace parts manufacturing subject to RACT under OAR chapter 340, division 232.

2 Aluminum, copper, and other nonferrous foundries subject to an area source NESHAP under OAR chapter 340, division 244.

3 Aluminum production – primary.

4 Ammonia manufacturing.

5 Animal rendering and animal reduction facilities.

6 Asphalt blowing plants.

7 Asphalt felts or coating manufacturing.

8 Asphaltic concrete paving plants, both stationary and portable.

9 Bakeries, commercial over 10 tons of VOC emissions per year.

10 Battery separator manufacturing.

11 Lead-acid battery manufacturing and re-manufacturing.

12 Beet sugar manufacturing.

13 Oil-fired boilers and other fuel burning equipment whose total heat input rating at the source is over 10 MMBTU/hour; or individual natural gas, propane, or butane-fired boilers and other fuel burning equipment 30 MMBTU/hour or greater heat input rating.

14 Building paper and building board mills.

15 Calcium carbide manufacturing.

16 Can or drum coating subject to RACT under OAR chapter 340, division 232.[2]

17 Cement manufacturing.

18 Cereal preparations and associated grain elevators 10,000 or more tons/year throughput.[1]

19 Charcoal manufacturing.

20 Chlorine and alkali manufacturing.

21 Chrome plating and anodizing subject to a NESHAP under OAR chapter 340, division

244.

22 Clay ceramics manufacturing subject to an area source NESHAP under OAR chapter 340, division 244.

23 Coffee roasting, roasting 30 or more green tons per year.

24 Concrete manufacturing including redi-mix and CTB, both stationary and portable, 25,000 or more cubic yards per year output.

25 Crematory incinerators 20 or more tons/year material input.

26 Degreasing operations, halogenated solvent cleanings subject to a NESHAP under OAR chapter 340, division 244.

27 Electrical power generation from combustion, excluding units used exclusively as emergency generators and units less than 500 kW.

28 Commercial ethylene oxide sterilization, excluding facilities using less than 1 ton of ethylene oxide within all consecutive 12-month periods after December 6, 1996.

29 Ferroalloy production facilities subject to an area source NESHAP under OAR chapter 340, division 244.

30 Flatwood coating subject to RACT under OAR chapter 340, division 232.[2]

31 Flexographic or rotogravure printing subject to RACT under OAR chapter 340, division 232.[2]

32 Flour, blended and/or prepared and associated grain elevators 10,000 or more tons/year throughput.[1]

33 Galvanizing and pipe coating, except galvanizing operations that use less than 100 tons of zinc/year.

34 Bulk gasoline plants, bulk gasoline terminals, and pipeline facilities.

35 Gasoline dispensing facilities, excluding gasoline dispensing facilities with monthly throughput of less than 10,000 gallons of gasoline per month[3].

36 Glass and glass container manufacturing subject to a NSPS under OAR chapter 340, division 238 or a NESHAP under OAR chapter 340, division 244.

37 Grain elevators used for intermediate storage 10,000 or more tons/year throughput.[1]

38 Reserved.

39 Gray iron and steel foundries, malleable iron foundries, steel investment foundries, steel foundries 100 or more tons/year metal charged, not elsewhere identified.

40 Gypsum products manufacturing.

41 Hardboard manufacturing, including fiberboard.

42 Hospital sterilization operations subject to an area source NESHAP under OAR chapter 340, division 244.

43 Incinerators with two or more tons per day capacity.

44 Lime manufacturing.

45 Liquid storage tanks subject to RACT under OAR chapter 340, division 232.[2]

46 Magnetic tape manufacturing.

47 Manufactured home, mobile home and recreational vehicle manufacturing.

48 Marine vessel petroleum loading and unloading subject to RACT under OAR chapter 340, division 232.

49 Metal fabrication and finishing operations subject to an area source NESHAP under OAR chapter 340, division 244, excluding facilities that meet all the following:

  a. Do not perform any of the operations listed in OAR 340-216-0060(3)(b)(V)(i) through (iii);

  b. Do not perform shielded metal arc welding (SMAW) using metal fabrication and finishing hazardous air pollutant (MFHAP) containing wire or rod; and

  c. Use less than 100 pounds of MFHAP containing welding wire and rod per year.

50 Millwork manufacturing, including kitchen cabinets and structural wood members, 25,000 or more board feet/maximum 8 hour input.

51 Molded plastic container manufacturing, using extrusion, molding, lamination, and foam processing and molded fiberglass container manufacturing, excluding injection molding.

52 Motor coach, travel trailer, and camper manufacturing.

53 Motor vehicle and mobile equipment surface coating operations subject to an area source NESHAP under OAR chapter 340, division 244, excluding motor vehicle surface coating operations painting less than 10 vehicles per year or using less than 20 gallons of coating and 20 gallons of methylene chloride containing paint stripper per year, mobile equipment surface coating operations using less than 20 gallons of coating and 20 gallons of methylene chloride containing paint stripper per year, and motor vehicle

surface coating operations registered pursuant to OAR 340-210-0100(2).

54 Natural gas and oil production and processing and associated fuel burning equipment.

55 Nitric acid manufacturing.

56 Nonferrous metal foundries 100 or more tons/year of metal charged.

57 Organic or inorganic chemical manufacturing and distribution with ½ or more tons per year emissions of any one criteria pollutant, sources in this category with less than ½ ton/year of each criteria pollutant are not required to have an ACDP.

58 Paint and allied products manufacturing subject to an area source NESHAP under OAR chapter 340, division 244.

59 Paint stripping and miscellaneous surface coating operations subject to an area source NESHAP under OAR chapter 340, division 244, excluding paint stripping and miscellaneous surface coating operations using less than 20 gallons of coating and also using less than 20 gallons of methylene chloride containing paint stripper per year.

60 Paper or other substrate coating subject to RACT under OAR chapter 340, division 232.[2]

61 Particleboard manufacturing, including strandboard, flakeboard, and waferboard.

62 Perchloroethylene dry cleaning operations subject to an area source NESHAP under OAR chapter 340, division 244, excluding perchloroethylene dry cleaning operations registered pursuant to OAR 340-210-0100(2).

63 Pesticide manufacturing 5,000 or more tons/year annual production.

64 Petroleum refining and re-refining of lubricating oils and greases including asphalt production by distillation and the reprocessing of oils and/or solvents for fuels.

65 Plating and polishing operations subject to an area source NESHAP under OAR chapter 340, division 244.

66 Plywood manufacturing and/or veneer drying.

67 Prepared feeds manufacturing for animals and fowl and associated grain elevators 10,000 or more tons per year throughput.

68 Primary smelting and/or refining of ferrous and non-ferrous metals.

69 Pulp, paper and paperboard mills.

70 Rock, concrete or asphalt crushing, both stationary and portable, 25,000 or more tons/year crushed.

71 Sawmills and/or planing mills 25,000 or more board feet/maximum 8 hour finished product.

72 Secondary nonferrous metals processing subject to an Area Source NESHAP under OAR chapter 340, division 244.

73 Secondary smelting and/or refining of ferrous and nonferrous metals.

74 Seed cleaning and associated grain elevators 5,000 or more tons/year throughput.[1]

75 Sewage treatment facilities employing internal combustion engines for digester gasses.

76 Soil remediation facilities, both stationary and portable.

77 Steel works, rolling and finishing mills.

78 Surface coating in manufacturing subject to RACT under OAR chapter 340, division 232.[2]

79 Surface coating operations with actual emissions of VOCs, if the source were to operate uncontrolled, of 10 or more tons/year.

80 Synthetic resin manufacturing.

81 Tire manufacturing.

82 Wood furniture and fixtures 25,000 or more board feet/maximum 8 hour input.

83 Wood preserving (excluding waterborne).

84 All other sources, both stationary and portable, not listed herein that DEQ determines an air quality concern exists or one which would emit significant malodorous emissions.

85 All other sources, both stationary and portable, not listed herein which would have the capacity of 5 or more tons per year of direct PM2.5 or PM10 if located in a PM2.5 or PM10 nonattainment or maintenance area, or 10 or more tons per year of any single criteria pollutant .[4]

86 Chemical manufacturing facilities subject to 40 C.F.R. part 63 subpart VVVVVV.

87 Stationary internal combustion engines if:

a. For emergency generators and firewater pumps, the aggregate engine horsepower rating is greater than 30,000 horsepower; or

b. For any individual non-emergency or non-fire pump engine, the engine is subject to 40 CFR part 63, subpart ZZZZ and is rated at 500 horsepower or more, excluding two stroke lean burn engines, engines burning exclusively landfill or digester gas, and four stroke engines located in remote areas; or

c. For any individual non-emergency engine, the engine is subject to 40 CFR part 60, subpart IIII and:

A. The engine has a displacement of 30 liters or more per cylinder; or

B. The engine has a displacement of less than 30 liters per cylinder and is rated at 500 horsepower or more and the engine and control device are either not certified by the manufacturer to meet the NSPS or not operated and maintained according to the manufacturer’s emission-related instructions; or

d. For any individual non-emergency engine, the engine is subject to 40 CFR part 60, subpart JJJJ and is rated at 500 horsepower or more and the engine and control device are either not certified by the manufacturer to meet the NSPS or not operated and maintained according to the manufacturer’s emission-related instructions.

88 All sources subject to RACT under OAR chapter 340, division 232, BACT or LAER under OAR chapter 340, division 224, a NESHAP under OAR chapter 340, division 244, a NSPS under OAR chapter 340, division 238, or State MACT under OAR 340-244-0200(2), except sources:

a. Exempted in any of the categories above;

b. For which a Basic ACDP is available; or

c. Registered pursuant to OAR 340-210-0100(2).

89 Pathological waste incinerators.

90 Landfills with more than 200,000 tons of waste in place and calculated methane generation rate is less than 664 metric tons per year which are subject to the requirements in OAR 340 division 239.

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[1] Applies only to Special Control Areas

[2] Portland AQMA, Medford-Ashland AQMA or Salem-Keizer in the SKATS only

[3] “monthly throughput” means the total volume of gasoline that is loaded into, or dispensed from, all gasoline storage tanks at the gasoline dispensing facility during a month. Monthly throughput is calculated by summing the volume of gasoline loaded into, or dispensed from, all gasoline storage tanks at the gasoline dispensing facility during the month, plus the total volume of gasoline loaded into, or dispensed from, all gasoline storage tanks at the gasoline dispensing facility during the previous 11 months, and then dividing that sum by 12

[4] A source subject to permitting from this category may be able to obtain a Basic ACDP under Part A number 8 of this table. For sources that meet the criteria of Part A number 8 of this table, the enforceable production or hours limitation in an issued ACDP may be used to demonstrate a permit is not required by Part B number 85 of this table irrespective of the term ‘uncontrolled’.

Part C: Standard ACDP

1 Incinerators for PCBs, other hazardous wastes, or both.

2 All sources that DEQ determines have emissions that constitute a nuisance.

3 All sources electing to maintain the source's netting basis.

4 All sources that request a PSEL equal to or greater than the SER for a regulated pollutant.

5 All sources having the potential to emit 100 tons or more of any regulated pollutant, except GHG, in a year.

6 All sources having the potential to emit 10 tons or more of a single hazardous air pollutant in a year.

7 All sources having the potential to emit 25 tons or more of all hazardous air pollutants combined in a year.

8 Landfills with more than 200,000 tons of waste in place and calculated methane generation rate is greater than or equal to 664 metric tons per year which are subject to the requirements in OAR 340 division 239.

NOTE: For the history of these tables prior to 2014 see the history under OAR 340-216-0020. This history is also shown below:

DEQ 9-2013(Temp), f. & cert. ef. 10-24-13 thru 4-22-14
DEQ 4-2013, f. & cert. ef. 3-27-13
DEQ 14-2011, f, & cert. ef. 7-21-11
DEQ 13-2011, f. & cert. ef. 7-21-11
DEQ 11-2011, f. & cert. ef. 7-21-11
DEQ 5-2011, f. 4-29-11, cert. ef. 5-1-11
DEQ 1-2011, f. & cert. ef. 2-24-11
DEQ 12-2010, f. & cert. ef. 10-27-10
DEQ 10-2010(Temp), f. 8-31-10, cert. ef. 9-1-10 thru 2-28-11
DEQ 9-2009(Temp), f. 12-24-09, cert. ef. 1-1-10 thru 6-30-10
DEQ 8-2009, f. & cert. ef. 12-16-09
DEQ 15-2008, f. & cert. ef 12-31-08
DEQ 8-2007, f. & cert. ef. 11-8-07
DEQ 7-2007, f. & cert. ef. 10-18-07
DEQ 4-2002, f. & cert. ef. 3-14-02
DEQ 6-2001, f. 6-18-01, cert. ef. 7-1-01
DEQ 14-1999, f. & cert. ef. 10-14-99, Renumbered from 340-028-1720
DEQ 22-1996, f. & cert. ef. 10-22-96

DEQ 19-1996, f. & cert. ef. 9-24-96
DEQ 22-1995, f. & cert. ef. 10-6-95
DEQ 22-1994, f. & cert. ef. 10-4-94
DEQ 19-1993, f. & cert. ef. 11-4-93
DEQ 12-1993, f. & cert. ef. 9-24-93, Renumbered from 340-020-0155
DEQ 4-1993, f. & cert. ef. 3-10-93
DEQ 27-1991, f. & cert. ef. 11-29-91
DEQ 12-1987, f. & cert. ef. 6-15-87
DEQ 3-1986, f. & cert. ef. 2-12-86
DEQ 11-1983, f. & cert. ef. 5-31-83
DEQ 23-1980, f. & cert. ef. 9-26-80
DEQ 20-1979, f. & cert. ef. 6-29-79
DEQ 125, f. & cert. ef. 12-16-76
DEQ 107, f. & cert. ef. 1-6-76, Renumbered from 340-020-0033
DEQ 63, f. 12-20-73, cert. ef. 1-11-74
DEQ 47, f. 8-31-72, cert. ef. 9-15-72

AMEND: 340-216-8020

RULE TITLE: Table 2 — Air Contaminant Discharge Permits

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "Title V sources may be subject to the Cleaner Air Oregon annual fees and the specific activity permit fees in Table 2, if applicable. " to (1), removing SIP note and amending attached table.

RULE TEXT:

(1) Sources referred to in Table 1 of OAR 340-216-8010 are subject to air contaminant discharge permit fees in Table 2. Title V sources may be subject to the Cleaner Air Oregon annual fees and the specific activity permit fees in Table 2, if applicable.

(2) Requests for waiver of fees must be made in writing to the Director, on a case-by-case basis, and be based upon financial hardship. Applicants for waivers must describe the reason for the request and certify financial hardship. The Director may waive part or all of a fee.

[NOTE: For the history of these tables prior to 2014 see the history under OAR 340-216-0020.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

OAR 340-216-8020
Table 2
Air Contaminant Discharge Permits

Part 1. Initial Permitting Application Fees: (in addition to first annual fee)

Short Term Activity ACDP	$4,500.00
Basic ACDP	$180.00
Assignment to General ACDP [1]	$1,800.00
Simple ACDP	$9,000.00
Construction ACDP	$14,400.00
Standard ACDP	$18,000.00
Standard ACDP (Major NSR or Type A State NSR)	$63,000.00

1. DEQ may waive the assignment fee for an existing source requesting to be assigned to a General ACDP because the source is subject to a newly adopted area source NESHAP as long as the existing source requests assignment within 90 days of notification by DEQ.

Part 2. Annual Fees: (Due date 12/1[1] for 1/1 to 12/31 of the following year) (applicable July 1, 2022)

Registration – Motor vehicle surface coating operations		$288.00
Registration - Dry cleaners using perchloroethylene		$216.00
Short Term Activity ACDP		$0
Basic ACDP	(A) #1-7 OAR 340-216-8010 Table 1 Part A	$648.00
	(B) #8 OAR 340-216-8010 Table 1 Part A	$1,469.00
General ACDP	(A) Fee Class One	$1,469.00
	(B) Fee Class Two	$2,644.00
	(C) Fee Class Three	$3,818.00
	(D) Fee Class Four	$734.00
	(E) Fee Class Five	$245.00
	(F) Fee Class Six	$490.00
Simple ACDP	(A) Low Fee	$3,917.00

OAR 340-216-8020
Table 2
Air Contaminant Discharge Permits

	(B) High Fee	$7,834.00
Standard ACDP		$15,759.00
Greenhouse Gas Reporting, as required by OAR chapter 340, Division 215		7.31% of the applicable ACDP annual fee in Part 2

Part 3. Cleaner Air Oregon Annual Fees: (Due date 12/1[1] for 1/1 to 12/31 of the following year)

Basic ACDP	(A) #1-7 OAR 340-216-8010 Table 1 Part A	$151.00
	(B) #8 OAR 340-216-8010 Table 1 Part A	$302.00
General ACDP	(A) Fee Class One	$302.00
	(B) Fee Class Two	$544.00
	(C) Fee Class Three	$786.00
	(D) Fee Class Four	$151.00
	(E) Fee Class Five	$50.00
	(F) Fee Class Six	$100.00
Simple ACDP	(A) Low Fee	$806.00
	(B) High Fee	$1,612.00
Standard ACDP		$3,225.00

1. DEQ may extend the payment due date for dry cleaners or gasoline dispensing facilities until March 1st.

Part 4. Specific Activity Fees:

Notice of Intent to Construct Type 2[1]		$720.00
Permit Modification	(A) Non-Technical	$432.00
	(B) Basic Technical	$540.00

OAR 340-216-8020
Table 2
Air Contaminant Discharge Permits

	(C) Simple Technical	$1,800.00
	(D) Moderate Technical	$9,000.00
	(E) Complex Technical	$18,000.00
Toxic Air Contaminant Permit Addendum Modification	(A) Non-Technical	$432.00
	(B) Basic Technical	$432.00
	(C) Simple Technical	$1,440.00
	(D) Moderate Technical	$7,200.00
	(E) Complex Technical	$14,440.00
Major NSR or Type A State NSR Permit Modification		$63,000.00
Modeling Review (outside Major NSR or Type A State NSR)		$9,000.00
Public Hearing at Source's Request		$3,600.00
State MACT Determination		$9,000.00
Compliance Order Monitoring [2]		$180.00/month
Part 5. Late Fees:		
8-30 days late		5%
31-60 days late		10%
61 or more days late		20%

1. The Type 2 Notice of Intent to Construct does not apply to existing Basic ACDP or General ACDP sources.

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2. This is a one-time fee payable when a compliance order is established in a permit or a DEQ order containing a compliance schedule becomes a final order of DEQ and is based on the number of months DEQ will have to oversee the order.

NOTE: See history of this table under OAR 340-216-0020.

AMEND: 340-218-0020

RULE TITLE: Applicability

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Amending the language in (4)(a) for clarity.

RULE TEXT:

(1) Except as provided in section (4), this division applies to the following sources:

(a) Any major source;

(b) Any source, including an area source, subject to a standard, limitation, or other requirement under section 111 of the FCAA;

(c) Any source, including an area source, subject to a standard or other requirement under section 112 of the FCAA, except that a source is not required to obtain a permit solely because it is subject to regulations or requirements under section 112(r) of the FCAA;

(d) Any affected source under Title IV; and

(e) Any source in a source category designated by the EQC under this rule.

(2) The owner or operator of a source with an Oregon Title V Operating Permit whose potential to emit later falls below the emission level that causes it to be a major source, and which is not otherwise required to have an Oregon Title V Operating Permit, may submit a request for revocation of the Oregon Title V Operating Permit. Granting of the request for revocation does not relieve the source from compliance with all applicable requirements or ACDP requirements.

(3) Synthetic minor sources.

(a) A source which would otherwise be a major source subject to this division may choose to become a synthetic minor source by limiting its emissions below the emission level that causes it to be a major source through limits contained in an ACDP issued by DEQ under 340 division 216.

(b) The reporting and monitoring requirements of the emission limiting conditions contained in the ACDPs of synthetic minor sources issued by DEQ under OAR 340-216 must meet the requirements of OAR 340-212-0010 through 340-212-0150 and division 214.

(c) Synthetic minor sources who request to increase their potential to emit above the major source emission rate thresholds will become subject to this division and must submit a permit application under OAR 340-218-0040 and obtain an Oregon Title V Operating Permit before increasing emissions above the major source emission rate thresholds.

(d) Synthetic minor sources that exceed the limitations on potential to emit are in violation of OAR 340-218-0020(1)(a).

(4) Source category exemptions.

(a) All sources listed in OAR 340-218-0020(1) that are not major sources, affected sources, or solid waste incineration units required to obtain a permit under section 129(e) of the FCAA are not required to obtain a Title V permit, unless the source is a non-major source subject to a standard under section 111 or section 112 of the FCAA that specifically requires the source to obtain a Title V permit.

(b) The following source categories are exempted from the obligation to obtain an Oregon Title V Operating Permit:

(A) All sources and source categories that would be required to obtain a permit solely because they are subject to 40 C.F.R. part 60, subpart AAA — Standards of Performance for New Residential Wood Heaters; and

(B) All sources and source categories that would be required to obtain a permit solely because they are subject to 40 C.F.R. part 61, subpart M — National Emission Standard for Hazardous Air Pollutants for Asbestos, section 61.145, Standard for Demolition and Renovation.

(c) Any source listed in OAR 340-218-0020(1) exempt from the requirement to obtain a permit under this rule may opt to apply for an Oregon Title V Operating Permit.

(5) Sources subject to this division may also be subject to OAR 340-245-0005 through 340-245-8010.

(6) Emissions units and Oregon Title V Operating Permit program sources.

DEQ will include in the permit all applicable requirements for all relevant emissions units in the Oregon Title V

Operating Permit source, including any equipment used to support the major industrial group at the site.

(7) Fugitive emissions. Fugitive emissions from an Oregon Title V Operating Permit program source must be included in the permit application and the permit in the same manner as stack emissions, regardless of whether the source category in question is included in the list of sources contained in the definition of major source.

(8) Insignificant activity emissions. All emissions from insignificant activities, including categorically insignificant activities and aggregate insignificant emissions, must be included in the determination of the applicability of any requirement.

(9) Oregon Title V Operating Permit program sources that are required to obtain an ACDP, OAR chapter 340, division 216, or a Notice of Approval, OAR 340-210-0205 through 340-210-0250, because of a Title I modification, must operate in compliance with the Oregon Title V Operating Permit until the Oregon Title V Operating Permit is revised to incorporate the ACDP or the Notice of Approval for the Title I modification.

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-218-0040

RULE TITLE: Permit Applications

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding requirements to (3) for what must be included in a standard application form.

RULE TEXT:

(1) Duty to apply. For each Oregon Title V Operating Permit program source, the owner or operator must submit a timely and complete permit application according to this rule:

(a) Timely application:

(A) A timely application for a source that is in operation as of the effective date of the Oregon Title V Operating Permit program is one that is submitted 12 months after the effective date of the Oregon Title V Operating Permit program in Oregon or on or before such earlier date as DEQ may establish. If an earlier date is established, DEQ will provide at least six (6) months for the owner or operator to prepare an application. A timely application for a source that is not in operation or that is not subject to the Oregon Title V Operating Permit program as of the effective date of the Oregon Title V Operating Permit program is one that is submitted within 12 months after the source becomes subject to the Oregon Title V Operating Permit program;

(B) Any Oregon Title V Operating Permit program source required to have obtained a permit prior to construction under the ACDP program, OAR chapter 340, division 216; New Source Review program, OAR chapter 340, division 224; or the Notice of Construction and Approval of Plans rules, 340-210-0205 through 340-210-0250, must file a complete application to obtain the Oregon Title V Operating Permit or permit revision within 12 months after commencing operation. Commencing operation will be considered initial startup of the construction or modification. Where an existing Oregon Title V Operating Permit would prohibit such construction or change in operation, the owner or operator must obtain a permit revision before commencing operation;

(C) Any Oregon Title V Operating Permit program source owner or operator must follow the appropriate procedures under this division prior to commencement of operation of a source permitted under the Notice of Construction and Approval of Plans rules, OAR 340-210-0205 through 340-0210-0250;

(D) For purposes of permit renewal, a timely application is one that is submitted at least 12 months prior to the date of permit expiration, or such other longer time as may be approved by DEQ that ensures that the term of the permit will not expire before the permit is renewed. If more than 12 months is required to process a permit renewal application, DEQ will provide no less than six (6) months for the owner or operator to prepare an application. In no event will this time be greater than 18 months; and

(E) Applications for Compliance Extensions for Early Reductions of HAP must be submitted before proposal of an applicable emissions standard issued under section 112(d) of the FCAA and must comply with OAR 340-244-0100.

(b) Complete application:

(A) To be deemed complete, an application must provide all information required pursuant to section (3). Complete applications must be submitted using electronic forms provided by DEQ, unless otherwise allowed in writing by DEQ, and all applicable fees. Information required under section (3) must be sufficient to evaluate the subject source and to determine all applicable requirements. A responsible official must certify the submitted information under section (6);

(B) Applications which are obviously incomplete, unsigned, or which do not contain the required exhibits, clearly identified, will not be accepted by DEQ for filing and will be returned to the applicant for completion;

(C) If DEQ determines that additional information is necessary before making a completeness determination, it may request such information in writing and set a reasonable deadline for a response. The application will not be considered complete for processing until the adequate information has been received, either before the expiration of the permit or by the reasonable deadline for response if after the expiration date of the permit. When the information in the application is deemed adequate, the applicant will be notified that the application is complete for processing;

(D) Unless DEQ determines that an application is not complete within 60 days of receipt of the application, such application will be deemed to be complete, except as otherwise provided in OAR 340-218-0120(1)(e). If, while processing an application that has been determined or deemed to be complete, DEQ determines that additional information is necessary to evaluate or take final action on that application, it may request such information in writing and set a reasonable deadline for a response. If the additional information is not provided by the deadline specified, the application will be determined to be incomplete, and the application shield will cease to apply;

(E) Applications determined or deemed to be complete will be submitted by DEQ to the EPA as required by OAR 340-218-0230(1)(a); and

(F) The source's ability to operate without a permit, as set forth in 340-218-0120(2), will be in effect from the date the application is determined or deemed to be complete until the final permit is issued, provided that the applicant submits any requested additional information by the deadline specified by DEQ.

(2) Duty to supplement or correct application. Any applicant who fails to submit any relevant facts or who has submitted incorrect information in a permit application must, upon becoming aware of such failure or incorrect submittal, promptly submit such supplementary facts or corrected information. In addition, an applicant must provide additional information as necessary to address any requirements that become applicable to the source after the date it filed a complete application but prior to release of a draft permit.

(3) Standard application form and required information. Applications must be submitted in electronic formats specified by DEQ, unless otherwise allowed in writing by DEQ. Information as described below for each emissions unit at an Oregon Title V Operating Permit program source must be included in the application. An application may not omit information needed to determine the applicability of, or to impose, any applicable requirement, including those requirements that apply to categorically insignificant activities, or to evaluate the fee amount required. The application must include the elements specified below, except for renewal applications as required in section (4):

(a) Identifying information, including company name and address, plant name and address if different from the company's name, owner's name and agent, and telephone number and names of plant site manager/contact;

(b) A description of the source's processes and products by Standard Industrial Classification Code including any associated with each alternative operating scenario identified by the owner or operator and related flow chart;

(c) The following emissions-related information for all requested alternative operating scenarios identified by the owner or operator:

(A) All emissions of regulated pollutants for which the source is major, all emissions of regulated pollutants and all emissions of regulated pollutants listed in OAR 340-244-0040. A permit application must describe all emissions of regulated pollutants emitted from any emissions unit, except where such units are exempted under this section. DEQ may require additional information related to the emissions of regulated pollutants sufficient to verify which requirements are applicable to the source, and other information necessary to collect any permit fees owed;

(B) Identification and description of all points of emissions described in paragraph (3)(c)(A) in sufficient detail to establish the basis for fees and applicability of requirements of the FCAA and state rules;

(C) Emissions rates in tons per year and in such terms as are necessary to establish compliance consistent with the applicable standard reference test method and to establish PSELs for all regulated pollutants except as restricted by OAR 340-222-0035 and 340-222-0060:

(i) If a short term PSEL is required, an applicant may request that a period longer than daily be used for the short term PSEL provided that the requested period is consistent with the means for demonstrating compliance with any other applicable requirement and the PSEL requirement, and:

(I) The requested period is no longer than the shortest period of the Ambient Air Quality Standards for the regulated pollutant or daily for VOC and NOx; or

(II) The applicant demonstrates that the requested period, if longer than the shortest period of the Ambient Air Quality Standards for the regulated pollutant, is the shortest period compatible with source operations but no longer than monthly.

(ii) The requirements of the applicable rules must be satisfied for any requested increase in PSELs, establishment of baseline emissions rates, requested emission reduction credit banking, or other PSEL changes.

(D) Additional information as determined to be necessary to establish any alternative emission limit under OAR 340-

226-0400, if the permit applicant requests one;
(E) The application must include a list of all categorically insignificant activities and an estimate of all emissions of regulated pollutants from those activities which are designated insignificant because of aggregate insignificant emissions. Owners or operators that use more than 100,000 pounds per year of a mixture that contains not greater than 1% by weight of any chemical or compound regulated under divisions 200 through 268 of this chapter, and not greater than 0.1% by weight of any carcinogen listed in the U.S. Department of Health and Human Service's Annual Report on Carcinogens must contact the supplier and manufacturer of the mixture to try and obtain information other than Material Safety Data Sheets in order to quantify emissions;
(F) The following information to the extent it is needed to determine or regulate emissions: fuels, fuel sulfur content, fuel use, raw materials, production rates, and operating schedules;
(G) Any information on pollution prevention measures and cross-media impacts the owner or operator wants DEQ to consider in determining applicable control requirements and evaluating compliance methods; and
(H) Where the operation or maintenance of air pollution control devices and emission reduction processes can be adjusted or varied from the highest reasonable efficiency and effectiveness, information necessary for DEQ to establish operational and maintenance requirements under OAR 340-226-0120(1) and (2);
(I) Identification and description of air pollution control devices, including estimated efficiency of the control devices, and compliance monitoring devices or activities;
(J) Limitations on source operation affecting emissions or any work practice standards, where applicable, for all regulated pollutants at the Oregon Title V Operating Permit program source;
(K) Other information required by any applicable requirement, including information related to stack height limitations developed pursuant to OAR 340-212-0130;
(L) Calculations on which the information in items (A) through (K) is based;
(M) The most recent information reported through EPA’s Toxics Release Inventory program at the time of application submittal, if the source is subject to the program; and
(N) When required by DEQ, an air quality analysis, conducted in accordance with the procedures in OAR chapter 340, division 225, demonstrating that the emissions, including reductions due to air pollution control devices or permitted limits on production capacity, will not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202.
(d) A plot plan showing the location of all emissions units identified by Universal Transverse Mercator or "UTM" as provided on United States Geological Survey maps and the nearest residential or commercial property;
(e) The following air pollution control requirements:
(A) Citation and description of all applicable requirements; and
(B) Description of or reference to any applicable test method for determining compliance with each applicable requirement.
(f) The following monitoring, recordkeeping, and reporting requirements:
(A) All emissions monitoring and analysis procedures or test methods required under the applicable requirements, including OAR 340-212-0200 through 340-212-0280;
(B) Proposed periodic monitoring to determine compliance where an applicable requirement does not require periodic testing or monitoring;
(C) The proposed use, maintenance, and installation of monitoring equipment or methods, as necessary;
(D) Documentation of the applicability of the proposed monitoring protocol, such as test data and engineering calculations;
(E) Proposed consolidation of reporting requirements, where possible;
(F) A proposed schedule of submittal of all reports; and
(G) Other similar information as determined by DEQ to be necessary to protect human health or the environment or to determine compliance with applicable requirements.
(g) Other specific information that may be necessary to implement and enforce other applicable requirements of the

FCAA or state rules or of this division or to determine the applicability of such requirements;
(h) An explanation of any proposed exemptions from otherwise applicable requirements.
(i) A copy of any existing permit attached as part of the permit application. Owners or operators may request that DEQ make a determination that an existing permit term or condition is no longer applicable by supplying adequate information to support such a request. The existing permit term or condition will remain in effect unless or until DEQ determines that the term or condition is no longer applicable by permit modification.
(j) Additional information as determined to be necessary by DEQ to define permit terms and conditions implementing off-permit changes for permit renewals;
(k) Additional information as determined to be necessary by DEQ to define permit terms and conditions implementing section 502(b)(10) changes for permit renewals;
(l) Additional information as determined to be necessary by DEQ to define permit terms and conditions implementing emissions trading under the PSEL including but not limited to proposed replicable procedures and permit terms that ensure the emissions trades are quantifiable and enforceable if the applicant requests such trading;
(m) Additional information as determined to be necessary by DEQ to define permit terms and conditions implementing emissions trading, to the extent that the applicable requirements provide for trading without a case-by-case approval of each emissions trade if the applicant requests such trading;
(n) A compliance plan that contains all the following:
(A) A description of the compliance status of the source with respect to all applicable requirements.
(B) A description as follows:
(i) For applicable requirements with which the source is in compliance, a statement that the source will continue to comply with such requirements.
(ii) For applicable requirements that will become effective during the permit term, a statement that the source will meet such requirements on a timely basis.
(iii) For requirements for which the source is not in compliance at the time of permit issuance, a narrative description of how the source will achieve compliance with such requirements.
(C) A compliance schedule as follows:
(i) For applicable requirements with which the source is in compliance, a statement that the source will continue to comply with such requirements;
(ii) For applicable requirements that will become effective during the permit term, a statement that the source will meet such requirements on a timely basis. A generic statement that the source will meet in a timely manner applicable requirements that become effective during the permit term will satisfy this provision, unless a more detailed schedule is expressly required by the applicable requirement;
(iii) A schedule of compliance for sources that are not in compliance with all applicable requirements at the time of permit issuance. Such a schedule will include a schedule of remedial measures, including an enforceable sequence of actions with milestones, leading to compliance with any applicable requirements for which the source will be in noncompliance at the time of permit issuance and interim measures to be taken by the source to minimize the amount of excess emissions during the scheduled period. This compliance schedule must resemble and be at least as stringent as that contained in any judicial consent decree or administrative order to which the source is subject. Any such schedule of compliance must be supplemental to, and must not sanction noncompliance with, the applicable requirements on which it is based.
(D) A schedule for submission of certified progress reports no less frequently than every 6 months for sources required to have a schedule of compliance to remedy a violation.
(E) The compliance plan content requirements specified in this section will apply and be included in the acid rain portion of a compliance plan for an affected source, except as specifically superseded by regulations promulgated under Title IV of the FCAA with regard to the schedule and method the source will use to achieve compliance with the acid rain emissions limitations.
(o) Requirements for compliance certification, including the following:

(A) A certification of compliance with all applicable requirements by a responsible official consistent with section (6) and section 114(a)(3) of the FCAA;

(B) A statement of methods used for determining compliance, including a description of monitoring, recordkeeping, and reporting requirements and test methods;

(C) A schedule for submission of compliance certifications during the permit term, to be submitted no less frequently than annually, or more frequently if specified by the underlying applicable requirement or by DEQ; and

(D) A statement indicating the source's compliance status with any applicable compliance assurance monitoring and compliance certification requirements of the FCAA or state rules.

(p) A Land Use Compatibility Statement (LUCS), when required by OAR chapter 340, division 018:

(A) Signed by the applicable local planning jurisdiction(s) to assure that the type of land use and activities in conjunction with that use have been reviewed and approved as compatible with the applicable local jurisdiction’s acknowledged comprehensive plan, before a permit is processed and issued. If DEQ receives a LUCS which states that the proposed action is incompatible with the acknowledged comprehensive plan, DEQ shall notify the applicant that the application cannot be processed; or

(B) If the local planning jurisdiction declines to provide a LUCS determination in response to a request for a LUCS, the owner or operator must provide DEQ with its own analysis to demonstrate that the proposed action complies with all applicable statewide planning goals.

(q) The use of nationally standardized forms for acid rain portions of permit applications and compliance plans, as required by regulations promulgated under Title IV of the FCAA.

(r) For purposes of permit renewal, the owner or operator must submit all information as required in section (3). The owner or operator may identify information in its previous permit or permit application for emissions units that should remain unchanged and for which no changes in applicable requirements have occurred and provide copies of the previous permit or permit application for those emissions units.

(4) Permit Renewal Applications. Any person required to renew an existing permit must submit a complete application using forms provided by DEQ, unless otherwise allowed in writing by DEQ. The renewal application must include:

(a) All information identified in section (3) that has changed since the last permit renewal or issuance;

(b) A complete list of all emissions units, including all air pollution control devices, and all categorically and aggregate insignificant activities;

(c) An estimate of the amount and type of each air contaminant emitted by the source in terms of hourly, daily, or monthly and yearly rates, showing calculation procedures;

(d) All changes to the source since the last permit issuance and all requirements applicable to those changes; and

(e) When required by DEQ, an air quality analysis, conducted in accordance with the procedures in OAR chapter 340, division 225, demonstrating that the source’s emissions, including reductions due to air pollution control devices or permitted limits on production capacity, will not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202.

(5) Quantifying Emissions:

(a) When quantifying emissions for purposes of a permit application, modification, or renewal an owner or operator must use the most representative data available or required in a permit condition. DEQ will consider the following data collection methods as acceptable for determining air emissions:

(A) Continuous emissions monitoring system data obtained using the DEQ Continuous Monitoring Manual [NOTE: DEQ Manuals are published with OAR 340-200-0035];

(B) Source testing data obtained using the DEQ Source Sampling Manual except where material balance calculations are more accurate and more indicative of an emissions unit's continuous operation than limited source test results (e.g. a volatile organic compound coating operation) [NOTE: DEQ Manuals are published with OAR 340-200-0035];

(C) Material balance calculations;

(D) Emission factors subject to Department review and approval; and

(E) Other methods and calculations subject to Department review and approval.

(b) When continuous monitoring or source test data has previously been submitted to and approved by DEQ for a particular emissions unit, that information must be used for quantifying emissions. Material balance calculations may be used as the basis for quantifying emissions when continuous monitoring or source test data exists if it can be demonstrated that the results of material balance calculations are more indicative of actual emissions under normal continuous operating conditions. Emission factors or other methods may be used for calculating emissions when continuous monitoring data, source test data, or material balance data exists if the owner or operator can demonstrate that the existing data is not representative of actual operating conditions. When an owner or operator uses emission factors or other methods as the basis of calculating emissions, a brief justification for the validity of the emission factor or method must be submitted with the calculations. DEQ will review the validity of the emission factor or method during the permit application review period. When an owner or operator collects emissions data that is more representative of actual operating conditions, either as required under a specific permit condition or for any other requirement imposed by DEQ, the owner or operator must use that data for calculating emissions when applying for a permit modification or renewal. Nothing in this provision requires owners or operators to conduct monitoring or testing solely for the purpose of quantifying emissions for permit applications, modifications, or renewals.

(6) Any application form, report, or compliance certification submitted pursuant to this division must contain certification by a responsible official of truth, accuracy, and completeness. This certification and any other certification required under this division must state that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

[NOTE: Publications referenced are available from the agency.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.050 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-218-0050

RULE TITLE: Standard Permit Requirements

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding (1)(b): "(b) To ensure the source's emission will not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202:

(A) Any physical or operational limitation, including any combination of the use of control devices, restrictions on hours of operation, or restrictions on the type or amount of materials combusted, stored, or processed, will be included as permit conditions to limit short term emissions for all emissions units that require controls or limitations; or

(B) A requirement to conduct ambient monitoring to confirm a new exceedance of a National Ambient Air Quality Standard. Ambient monitoring and meteorological monitoring must be conducted in accordance with a DEQ approved monitoring plan for a period of not less than 12 months. There must be at least 12 months of valid data with greater than 75 percent data completeness per quarter;"

RULE TEXT:

Each permit issued under this division must include the following elements:

(1) Emission limitations and standards, including those operational requirements and limitations that assure compliance with all applicable requirements at the time of permit issuance:

(a) The permit must specify and reference the origin of and authority for each term or condition, and identify any difference in form as compared to the applicable requirement upon which the term or condition is based;

(b) To ensure the source's emission will not cause or contribute to a new exceedance of a National Ambient Air Quality Standard adopted under OAR chapter 340, division 202:

(A) Any physical or operational limitation, including any combination of the use of control devices, restrictions on hours of operation, or restrictions on the type or amount of materials combusted, stored, or processed, will be included as permit conditions to limit short term emissions for all emissions units that require controls or limitations; or

(B) A requirement to conduct ambient monitoring to confirm a new exceedance of a National Ambient Air Quality Standard. Ambient monitoring and meteorological monitoring must be conducted in accordance with a DEQ approved monitoring plan for a period of not less than 12 months. There must be at least 12 months of valid data with greater than 75 percent data completeness per quarter;

(c) For sources regulated under the national acid rain program, the permit must state that, where an applicable requirement of the FCAA or state rules is more stringent than an applicable requirement of regulations promulgated under Title IV of the FCAA, both provisions must be incorporated into the permit and will be enforceable by the EPA;

(d) For any alternative emission limit established using OAR 340-226-0400, the permit must contain an equivalency determination and provisions to ensure that any resulting emissions limit has been demonstrated to be quantifiable, accountable, enforceable, and based on replicable procedures.

(2) Permit duration. DEQ will issue permits for a fixed term of 5 years in the case of affected sources, and for a term not to exceed 5 years in the case of all other sources.

(3) Monitoring and related recordkeeping and reporting requirements:

(a) Each permit must contain the following requirements with respect to monitoring:

(A) A monitoring protocol to provide accurate and reliable data that:

(i) Is representative of actual source operation;

(ii) Is consistent with the averaging time in the permit emission limits;

(iii) Is consistent with monitoring requirements of other applicable requirements; and

(iv) Can be used for compliance certification and enforcement.

(B) All emissions monitoring and analysis procedures or test methods required under applicable monitoring and testing requirements, including OAR 340-212-0200 through 340-212-0280 and any other procedures and methods that may be promulgated pursuant to sections 504(b) or 114(a)(3) of the FCAA. If more than one monitoring or testing requirement applies, the permit may specify a streamlined set of monitoring or testing provisions provided the specified monitoring or testing is adequate to assure compliance at least to the same extent as the monitoring or testing applicable requirements that are not included in the permit as a result of such streamlining;

(C) Where the applicable requirement does not require periodic testing or instrumental or noninstrumental monitoring (which may consist of recordkeeping designed to serve as monitoring), periodic monitoring sufficient to yield reliable data from the relevant time period that are representative of the source's compliance with the permit, as reported pursuant to OAR 340-218-0050(3)(c). Such monitoring requirements must assure use of terms, test methods, units, averaging periods, and other statistical conventions consistent with the applicable requirement. Continuous monitoring and source testing must be conducted using the DEQ Continuous Monitoring Manual and the Source Sampling Manual, respectively. [NOTE: DEQ manuals are published with OAR 340-200-0035.] Other monitoring must be conducted using DEQ approved procedures. The monitoring requirements may include but are not limited to any combination of the following:

(i) Continuous emissions monitoring systems (CEMS);

(ii) Continuous opacity monitoring systems (COMS);

(iii) Continuous parameter monitoring systems (CPMS);

(iv) Continuous flow rate monitoring systems (CFRMS);

(v) Source testing;

(vi) Material balance;

(vii) Engineering calculations;

(viii) Recordkeeping; or

(ix) Fuel analysis; and

(D) As necessary, requirements concerning the use, maintenance, and, where appropriate, installation of monitoring equipment or methods;

(E) A condition that prohibits any person from knowingly rendering inaccurate any required monitoring device or method;

(F) Methods used in OAR chapter 340, division 220 to determine actual emissions for fee purposes must also be used for compliance determination and can be no less rigorous than the requirements of OAR 340-218-0080. The compliance monitoring protocol must include the method used to determine the amount of actual emissions;

(G) Monitoring requirements must commence on the date of permit issuance unless otherwise specified in the permit.

(b) With respect to recordkeeping, the permit must incorporate all applicable recordkeeping requirements and require, where applicable, the following:

(A) Records of required monitoring information that include the following:

(i) The date, place as defined in the permit, and time of sampling or measurements;

(ii) The date analyses were performed;

(iii) The company or entity that performed the analyses;

(iv) The analytical techniques or methods used;

(v) The results of such analyses;

(vi) The operating conditions as existing at the time of sampling or measurement; and

(vii) The records of quality assurance for continuous monitoring systems (including but not limited to quality control activities, audits, calibrations drifts).

(B) Retention of records of all required monitoring data and support information for a period of at least 5 years from the date of the monitoring sample, measurement, report, or application. Support information includes all calibration and maintenance records and all original strip-chart recordings for continuous monitoring instrumentation, and copies of all reports required by the permit;

(C) Recordkeeping requirements must commence on the date of permit issuance unless otherwise specified in the permit.

(c) With respect to reporting, the permit must incorporate all applicable reporting requirements and require the following:

(A) Submittal of one (1) electronic copy of reports of any required monitoring at least every 6 months, unless otherwise required by permit, completed on forms approved by DEQ. Unless otherwise approved in writing by DEQ, six-month periods are January 1 to June 30, and July 1 to December 31. The reports required by this rule must be submitted within 30 days after the end of each reporting period, unless otherwise approved in writing by DEQ. One copy of the report must be submitted to the EPA, and two copies to DEQ's regional office identified in the permit. All instances of deviations from permit requirements must be clearly identified in such reports:

(i) The semi-annual report will be due on July 30, unless otherwise approved in writing by DEQ, and must include the semi-annual compliance certification, OAR 340-218-0080;

(ii) The annual report will be due on February 15, unless otherwise approved in writing by DEQ, but may not be due later than March 15, and must consist of the annual reporting requirements as specified in the permit; the emission fee report; the emission statement, if applicable, OAR 340-214-0220; the annual certification that the risk management plan is being properly implemented, 340-218-0050; and the semi-annual compliance certification, 340-218-0080.

(B) Prompt reporting of deviations from permit requirements that do not cause excess emissions, including those attributable to upset conditions, as defined in the permit, the probable cause of such deviations, and any corrective actions or preventive measures taken. "Prompt" means within fifteen (15) days of the deviation. Deviations that cause excess emissions, as specified in OAR 340-214-0300 through 340-214-0360 must be reported under 340-214-0340;

(C) Submittal of any required source test report within 30 days after the source test unless otherwise approved in writing by DEQ or specified in a permit;

(D) All required reports must be certified by a responsible official consistent with OAR 340-218-0040(6);

(E) Reporting requirements must commence on the date of permit issuance unless otherwise specified in the permit.

(d) DEQ may incorporate more rigorous monitoring, recordkeeping, or reporting methods than required by applicable requirements in an Oregon Title V Operating Permit if they are contained in the permit application, are determined by DEQ to be necessary to determine compliance with applicable requirements, or are needed to protect human health or the environment.

(4) A permit condition prohibiting emissions exceeding any allowances that the source lawfully holds under Title IV of the FCAA or the regulations promulgated there under:

(a) No permit revision will be required for increases in emissions that are authorized by allowances acquired pursuant to the acid rain program, provided that such increases do not require a permit revision under any other applicable requirement;

(b) No limit may be placed on the number of allowances held by the source. The source may not, however, use allowances as a defense to noncompliance with any other applicable requirement;

(c) Any such allowance must be accounted for according to the procedures established in regulations promulgated under Title IV of the FCAA.

(5) A severability clause to ensure the continued validity of the various permit requirements in the event of a challenge to any portions of the permit.

(6) Provisions stating the following:

(a) The permittee must comply with all conditions of the Oregon Title V Operating Permit, including keeping a copy of the permit onsite at the source. Any permit condition noncompliance constitutes a violation of the FCAA and state rules and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application;

(b) The need to halt or reduce activity will not be a defense. It will not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit;

(c) The permit may be modified, revoked, reopened and reissued, or terminated for cause as determined by DEQ. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or of a

notification of planned changes or anticipated noncompliance does not stay any permit condition;
(d) The permit does not convey any property rights of any sort, or any exclusive privilege;
(e) The permittee must furnish to DEQ, within a reasonable time, any information that DEQ may request in writing to determine whether cause exists for modifying, revoking and reissuing, or terminating the permit or to determine compliance with the permit. Upon request, the permittee must also furnish to DEQ copies of records required to be kept by the permit or, for information claimed to be confidential, the permittee may furnish such records directly to the EPA along with a claim of confidentiality.
(7) A provision to ensure that an Oregon Title V Operating Permit program source pays fees to DEQ consistent with the fee schedule in OAR chapter 340, division 220.
(8) Terms and conditions for reasonably anticipated alternative operating scenarios identified by the owner or operator in its application as approved by DEQ. Such terms and conditions:
(a) Must require the owner or operator, contemporaneously with making a change from one operating scenario to another, to record in a log at the permitted facility a record of the scenario under which it is operating;
(b) Must extend the permit shield described in OAR 340-218-0110 to all terms and conditions under each such alternative operating scenario; and
(c) Must ensure that the terms and conditions of each such alternative operating scenario meet all applicable requirements and the requirements of this division.
(9) Terms and conditions, if the permit applicant requests them, for the trading of emissions increases and decreases in the permitted facility solely for the purpose of complying with the PSELs. Such terms and conditions:
(a) Must include all terms required under OAR 340-218-0050 and 340-218-0080 to determine compliance;
(b) Must extend the permit shield described in OAR 340-218-0110 to all terms and conditions that allow such increases and decreases in emissions;
(c) Must ensure that the trades are quantifiable and enforceable;
(d) Must ensure that the trades are not Title I modifications;
(e) Must require a minimum 7-day advance, written notification to DEQ and the EPA of the trade that must be attached to DEQ's and the source's copy of the permit. The written notification must state when the change will occur and must describe the changes in emissions that will result and how these increases and decreases in emissions will comply with the terms and conditions of the permit; and
(f) Must meet all applicable requirements and requirements of this division.
(10) Terms and conditions, if the permit applicant requests them, for the trading of emissions increases and decreases in the permitted facility, to the extent that the applicable requirements provide for trading such increases and decreases without a case-by-case approval of each emission trade. Such terms and conditions:
(a) Must include all terms required under OAR 340-218-0050 and 340-218-0080 to determine compliance;
(b) Must extend the permit shield described in OAR 340-218-0110 to all terms and conditions that allow such increases and decreases in emissions; and
(c) Must meet all applicable requirements and requirements of this division.
(11) Terms and conditions allowing for off-permit changes, OAR 340-218-0140(2).
(12) Terms and conditions allowing for section 502(b)(10) changes, OAR 340-218-0140(3).
[NOTE: Publications referenced are available from the agency.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468.065, 468A.025, 468A.040, 468A.050, 468A.310, 468A.315

STATUTES/OTHER IMPLEMENTED: ORS 468, 468A

AMEND: 340-218-0080

RULE TITLE: Compliance Requirements

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Updating (7) to reference C.F.R. instead of OAR.

RULE TEXT:

All Oregon Title V Operating Permits must contain the following elements with respect to compliance:

(1) Consistent with OAR 340-218-0050(3), compliance certification, testing, monitoring, reporting, and recordkeeping requirements sufficient to assure compliance with the terms and conditions of the permit.

(2) A requirement that any document (including but not limited to reports) required by an Oregon Title V Operating Permit must contain a certification by a responsible official or the designated representation for the acid rain portion of the permit that meets the requirements of OAR 340-218-0040(6).

(3) Inspection and entry requirements that require that, upon presentation of credentials and other documents as may be required by law, the permittee must allow DEQ or an authorized representative to perform the following:

(a) Enter upon the permittee's premises where an Oregon Title V Operating Permit program source is located or emissions-related activity is conducted, or where records must be kept under the conditions of the permit;

(b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit;

(c) Inspect at reasonable times any facilities, equipment (including monitoring and air pollution control devices), practices, or operations regulated or required under the permit; and

(d) As authorized by the FCAA or state rules, sample or monitor at reasonable times substances or parameters for the purpose of assuring compliance with the permit or applicable requirements.

(4) A schedule of compliance consistent with OAR 340-218-0040(3)(n)(C).

(5) Progress reports consistent with an applicable schedule of compliance and OAR 340-218-0040(3)(n)(C) to be submitted at least semi-annually, or at a more frequent period if specified in the applicable requirement or by DEQ. Such progress reports must contain the following:

(a) Dates for achieving the activities, milestones, or compliance required in the schedule of compliance, and dates when such activities, milestones or compliance were achieved; and

(b) An explanation of why any dates in the schedule of compliance were not or will not be met, and any preventive or corrective measures adopted.

(6) Requirements for compliance certification with terms and conditions contained in the permit, including emission limitations, standards, or work practices. Permits must include each of the following:

(a) The frequency (not less than annually or such more frequent periods as specified in the applicable requirement or by DEQ) of submissions of compliance certifications;

(b) Under OAR 340-218-0050(3), a means for monitoring the compliance of the source with its emissions limitations, standards, and work practices;

(c) A requirement that the compliance certification include all of the following (provided that the identification of applicable information may cross-reference the permit or previous reports, as applicable):

(A) The identification of each term or condition of the permit that is the basis of the certification;

(B) The identification of the method or other means used by the owner or operator for determining the compliance status with each term and condition during the certification period. Such methods and other means must include, at a minimum, the methods and means required under OAR 340-218-0050(3). If necessary, the owner or operator also must identify any other material information that must be included in the certification to comply with section 113(c)(2) of the FCAA, which prohibits knowingly making a false certification or omitting material information;

(C) The status of compliance with the terms and conditions of the permit for the period covered by the certification, including whether compliance during the period was continuous or intermittent. The certification must be based on the method or means designated in paragraph (6)(c)(B). The certification must identify each deviation and take it into account in the compliance certification. The certification must also identify as possible exceptions to compliance any

periods during which compliance is required and in which an excursion or exceedance as defined under OAR 340-200-0020 and 40 CFR part 64 occurred; and
(D) Such other facts as DEQ may require to determine the compliance status of the source.
(d) A requirement that all compliance certifications be submitted to the EPA as well as to DEQ; and
(e) Notwithstanding any other provision contained in any applicable requirement, the owner or operator may use monitoring as required under OAR 340-218-0050(3) and incorporated into the permit, in addition to any specified compliance methods, for the purpose of submitting compliance certifications.
(7) Annual certification that the risk management plan is being properly implemented under 40 CFR Part 68.
(8) Such other provisions as DEQ may require in order to protect human health or the environment.

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.050, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468, 468A

AMEND: 340-218-0150

RULE TITLE: Administrative Permit Amendments

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Cleaning up language and adding the requirements of division 11 to hearing procedures.

RULE TEXT:

(1) An "administrative permit amendment" is a permit revision that:

(a) Corrects typographical errors;

(b) Identifies a change in the name, address, or phone number of the responsible official identified in the permit, or provides a similar minor administrative change at the source;

(c) Allows for a change in the name of the permittee;

(d) Allows for a change in ownership or operational control of a source where DEQ determines that no other change in the permit is necessary, provided that a written agreement containing a specific date for transfer of permit responsibility, coverage, and liability between the current and new permittee has been submitted to DEQ;

(e) Requires more frequent monitoring or reporting by the permittee;

(f) Allows for a change in the date for reporting or source testing requirements for a source or emissions unit that is temporarily shut down or would otherwise have to be operated solely for the purposes of conducting the source test, except when required by a compliance schedule;

(g) Relaxes monitoring, reporting or recordkeeping due to a permanent source shutdown for only the emissions unit being shut down; or

(h) Incorporates into the Oregon Title V Operating Permit the requirements from preconstruction review permits authorized under OAR chapter 340, division 224 or OAR 340-210-0205 through 340-210-0250, provided that the procedural requirements followed in the preconstruction review are substantially equivalent to the requirements of 340-218-0120 through 340-218-0210 and 340-218-0230 that would be applicable to the change if it were subject to review as a permit modification, compliance requirements are substantially equivalent to those contained in 340-218-0050 through 340-218-0110, and no changes in the construction or operation of the facility that would require a permit modification under 340-218-0160 through 340-218-0180 have taken place.

(2) Administrative permit amendments for purposes of the national acid rain portion of the permit will be governed by regulations promulgated under Title IV of the FCAA.

(3) Administrative permit amendment procedures. An administrative permit amendment will be made by DEQ consistent with the following:

(a) The owner or operator must promptly submit an application for an administrative permit amendment, along with the applicable fees, upon becoming aware of the need for one on forms provided by DEQ along with a copy of the draft amendment;

(b) DEQ will take no more than 60 days from receipt of a request for an administrative permit amendment to take final action on such request, and may incorporate such changes without providing notice to the public or affected States provided that it designates any such permit revisions as having been made pursuant to this rule;

(c) DEQ will issue the administrative permit amendment in the form of a permit addendum for only those conditions that will change;

(d) DEQ will submit a copy of the permit addendum to the EPA;

(e) The source may implement the changes addressed in the request for an administrative amendment immediately upon submittal of the request;

(f) If the source fails to comply with its draft permit terms and conditions upon submittal of the application and until DEQ takes final action, the existing permit terms and conditions it seeks to modify may be enforced against it.

(4) DEQ must, upon taking final action granting a request for an administrative permit amendment, allow coverage by the permit shield in OAR 340-218-0110 only for administrative permit amendments made pursuant to OAR 340-218-0150(1)(h) which meet the relevant requirements of OAR 340-218-0050 through 340-218-0240 for significant permit

modifications.
(5) If it becomes necessary for DEQ to initiate an administrative amendment to the permit, DEQ will notify the permittee of the intended action by certified or registered mail. The action will become effective 20 days after the date of mailing unless within that time the permittee makes a written request for a hearing. The request must state the grounds for the hearing. Any hearing held will be conducted pursuant to the applicable provisions of ORS 183 and OAR chapter 340, division 11.

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-218-0170

RULE TITLE: Minor Permit Modifications

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding ", along with the applicable fees" to (2)(a).

RULE TEXT:

(1) Criteria:

(a) Minor permit modification procedures may be used only for those permit modifications that:

(A) Do not violate any applicable requirement;

(B) Do not involve significant changes to existing monitoring, reporting, or recordkeeping requirements in the permit;

(C) Do not require or change a case-by-case determination of an emission limitation or other standard, or a source-specific determination for temporary sources of ambient impacts, or a visibility or increment analysis;

(D) Do not seek to establish or change a permit term or condition for which there is no corresponding underlying applicable requirement and that the source has assumed to avoid an applicable requirement to which the source would otherwise be subject. Such terms and conditions include:

(i) A federally enforceable emissions cap assumed to avoid classification as a Title I modification; and

(ii) An alternative emissions limit approved pursuant to OAR 340-244-0100 through 340-244-0180.

(E) Do not increase emissions over the PSEL;

(F) Are not Title I modifications; and

(G) Are not required by OAR 340-218-0180 to be processed as a significant modification.

(b) Notwithstanding subsection (1)(a), minor permit modification procedures may be used for permit modifications involving the use of emissions trading and other similar approaches, to the extent that such minor permit modification procedures are explicitly provided for in the Oregon SIP or in applicable requirements promulgated by the EPA.

(2) Minor permit modification procedures. A minor permit modification will be made by DEQ consistent with the following:

(a) Application. An application requesting the use of minor permit modification procedures must meet the requirements of OAR 340-218-0040(3), must be submitted on forms and electronic formats provided by DEQ, along with the applicable fees, and must include the following additional information:

(A) A description of the change, the change in emissions resulting from the change, and any new applicable requirements that will apply if the change occurs;

(B) The source's suggested draft permit;

(C) Certification by a responsible official, consistent with OAR 340-218-0040(6), that the proposed modification meets the criteria for use of minor permit modification procedures and a request that such procedures be used; and

(D) Completed forms for DEQ to use to notify the EPA and affected states as required under OAR 340-218-0230.

(b) EPA and affected state notification. Within five working days of receipt of a complete minor permit modification application, DEQ will meet its obligation under OAR 340-218-0230(1)(a) and (2)(a) to notify the EPA and affected states of the requested permit modification. DEQ promptly will send any notice required under OAR 340-218-0230(2)(b) to the EPA;

(c) Timetable for issuance. DEQ will not issue a final permit modification until after the EPA's 45-day review period or until the EPA has notified DEQ that the EPA will not object to issuance of the permit modification, whichever is first, although DEQ can approve the permit modification prior to that time. Within 90 days of DEQ's receipt of an application under minor permit modification procedures or 15 days after the end of the EPA's 45-day review period under OAR 340-218-0230(3), whichever is later, DEQ will:

(A) Issue the permit modification as proposed for only those conditions that will change;

(B) Deny the permit modification application;

(C) Determine that the requested modification does not meet the minor permit modification criteria and must be reviewed under the significant modification procedures; or

(D) Revise the draft permit modification and transmit to the EPA the new proposed permit modifications as required by OAR 340-218-0230(1).

(d) Source's ability to make change. The source may make the change proposed in its minor permit modification application immediately after it files an application. After the source makes the change, and until the permitting authority takes any of the actions specified in paragraphs (2)(c)(A) through (C), the source must comply with both the applicable requirements governing the change and the draft permit terms and conditions. During this time period, the source need not comply with the existing permit terms and conditions it seeks to modify. However, if the source fails to comply with its draft permit terms and conditions during this time period, the existing permit terms and conditions it seeks to modify may be enforced against it;

(e) DEQ may initiate enforcement if the modification has been initiated and does not meet the minor permit modification criteria;

(f) Permit shield. The permit shield under OAR 340-218-0110 does not extend to minor permit modifications.

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-218-0180

RULE TITLE: Significant Permit Modifications

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Making language changes for clarity.

RULE TEXT:

(1) Criteria. Significant modification procedures must be used for applications requesting permit modifications that do not qualify as minor permit modifications or as administrative amendments. Significant modifications include:

(a) Increases in PSELs except those increases subject to OAR 340-210-0205 through 340-210-0250; or OAR chapter 340, division 224;

(b) Every significant change in existing monitoring permit terms or conditions;

(c) Every relaxation of reporting or recordkeeping permit terms or conditions;

(d) Incorporation into the Oregon Title V Operating Permit the requirements from pre-construction review permits authorized under OAR chapter 340, division 224 unless the incorporation qualifies as an administrative amendment;

(e) Incorporation into the Oregon Title V Operating Permit the requirements from preconstruction review permits authorized under OAR 340-210-205 through 340-210-0250 unless otherwise specified in 340-218-0190(2); and

(f) Nothing herein may be construed to preclude the permittee from making changes consistent with this division that would render existing permit compliance terms and conditions irrelevant.

(2) Significant permit modifications will be subject to all requirements of this division, including those for applications, applicable fees, public participation, review by affected States, and review by the EPA, as they apply to permit issuance and permit renewal.

(3) Major modifications, as defined in OAR 340-200-0020, require an ACDP under OAR chapter 340, division 224.

(4) Constructed and reconstructed major hazardous air pollutant sources are subject to OAR 340-210-0205 through 340-210-0250 and OAR 340-244-0200.

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-218-0240

RULE TITLE: Enforcement

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "(1) No person may violate the conditions of any Oregon Title V Operating Permit issued under this division."

RULE TEXT:

(1) No person may violate the conditions of any Oregon Title V Operating Permit issued to the person under this division.

(2) Whenever it appears to DEQ that any activity in violation of a permit that results in air pollution or air contamination is presenting an imminent and substantial endangerment to the public health, DEQ may enter a cease and desist order pursuant to ORS 468.115 or seek injunction relief pursuant to 468.100.

(3)(a) Whenever DEQ has good cause to believe that any person is engaged in or about to engage in acts or practices that constitute a violation of any part of the stationary source air permitting rules or any provision of a permit issued pursuant to these rules, DEQ may seek injunctive relief in court to enforce compliance thereto or to restrain further violations;

(b) The proceedings authorized by subsection (a) may be instituted without the necessity of prior agency revocation of the permit or during a permit revocation proceeding if one has been commenced.

(4) In addition to the enforcement authorities contained in sections (2) and (3) and any other penalty provided by law, any person who violates any of the following will incur a civil penalty as authorized under ORS 468.140 and established pursuant to OAR chapter 340, division 12:

(a) Any applicable requirement;

(b) Any permit condition;

(c) Any fee or filing requirements;

(d) Any duty to allow or carry out inspection, entry or monitoring activities; or

(e) Any rules or orders issued by DEQ.

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468, 468A

AMEND: 340-220-0180

RULE TITLE: Late and Underpayment of Fees

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Changing "postmarked" to "received".

RULE TEXT:

(1) Notwithstanding any enforcement action, the owner or operator will be subject to a late payment fee of:

(a) Two hundred dollars for payments received more than seven and less than 30 days late; and

(b) Four hundred dollars for payments received on or after 30 days late.

(2) Notwithstanding any enforcement action, DEQ may assess an additional fee of the greater of $400 or 20 percent of the amount underpaid for substantial underpayment.

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468.065, 468A.310, 468A.315

STATUTES/OTHER IMPLEMENTED: ORS 468, 468A

AMEND: 340-222-0020

RULE TITLE: Applicability and Jurisdiction

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding (3)(d) "(d) General ACDPs or General Oregon Title V Operating Permits where federally enforceable limits on potential to emit, such as a physical or operational limit, are used rather than a PSEL." and deleting (4).

RULE TEXT:

(1) Plant Site Emission Limits (PSELs) will be included in all Air Contaminant Discharge Permits (ACDP) and Oregon Title V Operating Permits, except as provided in section (3), as a means of managing airshed capacity by regulating increases and decreases in air emissions. Except as provided in OAR 340-222-0035(5) and 340-222-0060, all ACDP and Oregon Title V Operating Permit sources are subject to PSELs for all regulated pollutants listed in the definition of SER in 340-200-0020. DEQ will incorporate PSELs into permits when issuing a new permit or renewing or modifying an existing permit.

(2) The emissions limits established by PSELs provide the basis for:

(a) Assuring reasonable further progress toward attaining compliance with ambient air quality standards;

(b) Assuring compliance with ambient air quality standards and PSD increments;

(c) Administering offset and banking programs; and

(d) Establishing the baseline for tracking the consumption of PSD increments.

(3) PSELs are not required for:

(a) Regulated pollutants that will be emitted at less than the de minimis emission level listed in OAR 340-200-0020 from the entire source;

(b) Short Term Activity and Basic ACDPs;

(c) Hazardous air pollutants as listed in OAR 340-244-0040 Table 1; high-risk pollutants listed in 40 CFR 63.74; accidental release substances listed in 40 CFR 68.130; toxic air contaminants listed in OAR chapter 340, division 246; or toxic air contaminants listed in OAR chapter 340, division 247; except that PSELs are required for pollutants identified in this subsection that are also listed in the definition of SER, 340-200-0020; or

(d) General ACDPs or General Oregon Title V Operating Permits where federally enforceable limits on potential to emit, such as a physical or operational limit, are used rather than a PSEL.

(4) Subject to the requirements in this division and OAR 340-200-0010(3), LRAPA is designated by the EQC to implement the rules in this division within its area of jurisdiction.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

[ED. NOTE: Tables referenced are available from the agency.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-222-0035

RULE TITLE: General Requirements for Establishing All PSELs

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "Emissions from aggregate insignificant activities must be considered when determining Major NSR or State NSR applicability under OAR chapter 340, division 224." to (6).

RULE TEXT:

(1) PSELs may not exceed limits established by any applicable federal or state regulation or by any specific permit conditions unless the source meets the specific provisions of OAR 340-226-0400 (Alternative Emission Controls).
(2) DEQ may change PSELs at the time of a permit renewal, or if DEQ modifies a permit pursuant to OAR 340-216-0084, Department Initiated Modifications, or 340-218-0200, Reopenings, if:
(a) DEQ determines errors were made in calculating the PSELs or more accurate and reliable data is available for calculating PSELs; or
(b) More stringent control is required by a rule adopted by the EQC.
(3) PSEL reductions required by rule, order or permit condition will be effective on the compliance date of the rule, order, or permit condition.
(4) Annual PSELs apply on a rolling 12-consecutive month basis and limit the source's potential to emit.
(5) PSELs do not include emissions from categorically insignificant activities. Emissions from categorically insignificant activities must be considered when determining Major NSR or Type A State NSR applicability under OAR chapter 340, division 224.
(6) PSELs must include aggregate insignificant emissions, if applicable. Emissions from aggregate insignificant activities must be considered when determining Major NSR or State NSR applicability under OAR chapter 340, division 224.
[NOTE: This rule was moved verbatim from OAR 340-222-0043 and 340-222-0070 and amended on 04-16-15. Previous rule history for OAR 340-222-0043: DEQ 6-2001, f. 6-18-01, cert. ef. 7-1-01. Previous rule history for OAR 340-222-0070: DEQ 12-1993, f. & cert. ef. 9-24-93; DEQ 19-1993, f. & cert. ef. 11-4-93; DEQ 2-1996, f. & cert. ef. 1-29-96; DEQ 14-1999, f. & cert. ef. 10-14-99, Renumbered from 340-028-1060; DEQ 6-2001, f. 6-18-01, cert. ef. 7-1-01]
[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

REPEAL: 340-222-0040

RULE TITLE: Generic Annual PSEL

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Repealing rule.

RULE TEXT:

(1) Sources with capacity less than the SER will receive a generic PSEL unless they have a netting basis and request a source specific PSEL under OAR 340-222-0041.

(2) A generic PSEL may be used for any regulated pollutant that will be emitted at less than the SER.

(3) The netting basis for a source with a generic PSEL is zero for that regulated pollutant.

NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-222-0041

RULE TITLE: Annual PSEL

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Changing which sources PSELs apply to.

RULE TEXT:

(1) For sources subject to a General ACDP or a General Oregon Title V Operating Permit, a PSEL may be set based on the potential to emit of the largest emitting source in that source category for all sources on that permit type in the state. PSELs will be set for all regulated pollutants emitted at more than the de minimis emission level.

(2) For sources subject to a Simple ACDP, a PSEL will be set equal to the source's potential to emit.

(3) For sources subject to a Standard ACDP or an Oregon Title V Operating Permit, a PSEL will be set equal to the source's potential to emit, netting basis or a level requested by the applicant, whichever is less, except as provided in section (4) or (5).

(4) The initial PSEL for PM2.5 for a source that was permitted on or before May 1, 2011 with potential to emit greater than or equal to the SER will be set equal to the PM2.5 fraction of the PM10 PSEL in effect on May 1, 2011.

(a) Any source with a permit in effect on May 1, 2011 is eligible for an initial PM2.5 PSEL without being otherwise subject to section (5).

(b) For a source that had a permit in effect on May 1, 2011 but later needs to correct its PM10 PSEL that was in effect on May 1, 2011 due to more accurate or reliable information, the corrected PM10 PSEL will be used to correct the initial PM2.5 PSEL.

(A) Correction of a PM10 PSEL will not by itself trigger section (5) for PM2.5.

(B) Correction of a PM10 PSEL could result in further requirements for PM10 in accordance with all applicable regulations.

(c) If after establishing the initial PSEL for PM2.5 in accordance with this rule and establishing the initial PM2.5 netting basis in accordance with OAR 340-222-0046, the PSEL is more than nine tons above the netting basis, any future increase in the PSEL for any reason would be subject to section (5).

(5) If an applicant wants an annual PSEL at a rate greater than the netting basis, the applicant must, consistent with OAR 340-222-0035:

(a) Demonstrate that the requested increase over the netting basis is less than the SER; or

(b) For increases equal to or greater than the SER over the netting basis, demonstrate that the applicable Major NSR or State NSR requirements in OAR chapter 340, division 224 have been satisfied, except that:

(A) An increase in the PSEL for GHGs is subject to the requirements of NSR specified in OAR 340-224-0010(1)(c) only if the criteria in OAR 340-224-0010(1)(c) are met; and

(B) An increase in the PSEL for particulate matter (PM) is not subject to the air quality analysis but an air quality analysis is required for PM10 or PM2.5 increases, if applicable.

(6) If the netting basis is adjusted in accordance with OAR 340-222-0051(3), then the PSEL is not required to be adjusted.

(7) For sources that meet the criteria in subsections (a), (b) and (c), the requirements of section (5) do not immediately apply, but any future increase in the PSEL greater than or equal to the de minimis level for any reason is subject to section (5).

(a) A PSEL is established or revised to include emissions from activities that both existed at a source and were defined as categorically insignificant activities prior to April 16, 2015;

(b) The PSEL exceeds the netting basis by more than or equal to the SER solely as a result of a revision described in subsection (a); and

(c) The source would not have been subject to Major NSR or Type A State NSR under the applicable requirements of division 224 prior to April 16, 2015 if categorically insignificant activities had been considered.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR

340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-222-0042

RULE TITLE: Short Term PSEL

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Amending (1)(a) to read: "For new and existing sources with potential to emit less than the short term SER, the short term PSEL will be set equal to the short term potential to emit."

RULE TEXT:

(1) For sources located in areas with an established short term SER that is measured over an averaging period less than a full year, PSELs are required on a short term basis for those regulated pollutants that have a short term SER. The short term averaging period is daily, unless emissions cannot be monitored on a daily basis. The averaging period for short term PSELs can never be greater than monthly.

(a) For new and existing sources with potential to emit less than the short term SER, the short term PSEL will be set equal to the short term potential to emit.

(b) For existing sources with potential to emit greater than or equal to the short term SER, a short term PSEL will be set equal to the source's short term potential to emit or to the current permit’s short term PSEL, whichever is less.

(c) For new sources with potential to emit greater than or equal to the short term SER, the initial short term PSEL will be set at the level requested by the applicant provided the applicant meets the requirements of (2)(b).

(2) If a permittee requests an increase in a short term PSEL that will exceed the short term netting basis by an amount equal to or greater than the short term SER, the permittee must satisfy the requirements of subsections (a) or (b). In order to satisfy the requirements of subsection (a) or (b), the short term PSEL increase must first be converted to an annual increase by multiplying the short term increase by 8,760 hours, 365 days, or 12 months, depending on the term of the short term PSEL.

(a) Obtain offsets in accordance with the offset provisions for the designated area as specified in OAR 340-224-0510 through 340-224-0530, as applicable; or

(b) Obtain an allocation from an available growth allowance in accordance with the applicable maintenance plan.

(3) Once the short term PSEL is increased pursuant to section (2), the increased level becomes the basis for evaluating future increases in the short term PSEL.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-222-0046

RULE TITLE: Netting Basis

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Amending (2)(c)(B) to read: "Any regulated pollutant for which the PSEL was set based on a generic PSEL under previously applicable rules"

RULE TEXT:

(1) A netting basis will only be established for those regulated pollutants that could subject a source to NSR under OAR chapter 340, division 224.

(a) The initial PM2.5 netting basis for a source that was permitted prior to May 1, 2011 will be established with the first permitting action issued after July 1, 2011, provided the permitting action involved a public notice period that began after July 1, 2011.

(b) The initial greenhouse gas netting basis for a source will be established with the first permitting action issued after July 1, 2011, provided the permitting action involved a public notice period that began after July 1, 2011.

(2) A source's netting basis is established as specified in subsection (a), (b), or (c) and will be adjusted according to section (3):

(a) For all regulated pollutants except for PM2.5, a source's initial netting basis is equal to the baseline emission rate.

(b) For PM2.5, a source's initial netting basis is equal to the overall PM2.5 fraction of the PM10 PSEL in effect on May 1, 2011 multiplied by the PM10 netting basis in effect on May 1, 2011. DEQ may increase the initial PM2.5 netting basis by not more than 5 tons to ensure that the PM2.5 PSEL does not exceed the PM2.5 netting basis by more than the PM2.5 SER.

(A) Any source with a permit in effect on May 1, 2011 is eligible for a PM2.5 netting basis without being otherwise subject to OAR 340-222-0041(5).

(B) For a source that had a permit in effect on May 1, 2011 but later needs to correct its PM10 netting basis that was in effect on May 1, 2011, due to more accurate or reliable information, the corrected PM10 netting basis will be used to correct the initial PM2.5 netting basis.

(i) Correction of a PM10 netting basis will not by itself trigger OAR 340-222-0041(5) for PM2.5.

(ii) Correction of a PM10 netting basis could result in further requirements for PM10 in accordance with all applicable regulations.

(c) A source's netting basis is zero for:

(A) Any regulated pollutant emitted from a source that first obtained permits to construct and operate after the applicable baseline period for that regulated pollutant, and has not undergone NSR for that regulated pollutant, except as provided in subsection (b) for PM2.5;

(B) Any regulated pollutant for which the PSEL was set based on a generic PSEL under previously applicable rules; or

(C) Any source permitted as portable.

(3) A source's netting basis will be adjusted as follows:

(a) The netting basis will be reduced by any emission reductions required under a rule, order, or permit condition issued by the EQC or DEQ and required by the SIP or used to avoid any state (e.g., NSR) or federal requirements (e.g., NSPS, NESHAP), as of the effective date of the rule, order or permit condition;

(A) Netting basis reductions are effective on the effective date of the rule, order or permit condition that requires the reductions;

(B) Netting basis reductions may only apply to sources that are permitted, on the effective date of the applicable rule, order or permit condition, to operate the affected devices or emissions units that are subject to the rule, order, or permit condition requiring emission reductions;

(C) Netting basis reductions will include reductions for unassigned emissions for devices or emissions units that are affected by the rule, order or permit condition, if the shutdown or over control that created the unassigned emissions occurred within five years prior to the adoption of the rule, order or permit condition that required an emission reduction unless the unassigned emissions have been used for internal netting actions. This provision applies to emission reductions that have been placed in unassigned emissions or that are eligible to be placed in unassigned emissions but the permit that would place them in unassigned emissions has not been issued.

(D) Netting basis reductions will not affect emission reduction credits established under division 268.

(E) Netting basis reductions for the affected devices or emissions units will be determined consistent with the approach used to determine the netting basis prior to the regulatory action reducing the emissions. The netting basis reduction is the difference between the emissions calculated using the previous emission rate and the emission rate established by rule, order, or permit using appropriate conversion factors when necessary.

(F) The netting basis reductions will not include emission reductions achieved under OAR 340-226-0110, 340-226-0120, or OAR chapter 340, division 244;

(b) The netting basis will be reduced by any unassigned emissions that are reduced under OAR 340-222-0055(3)(a);

(c) The netting basis will be reduced by the amount of emission reduction credits transferred off site in accordance with OAR chapter 340, division 268;

(d) The netting basis will be reduced when actual emissions are reduced according to OAR 340-222-0051(3);

(e) The netting basis will be increased by any of the following:

(A) For sources that obtained a permit on or after April 16, 2015, any emission increases approved through Major NSR or Type A State NSR action under OAR chapter 340, division 224;

(B) For sources that obtained a permit prior to April 16, 2015, any emission increases approved through the NSR regulations in OAR chapter 340, division 224 in effect at the time; or

(C) For sources where the netting basis was increased in accordance with the DEQ PSD rules that were in effect prior to July 1, 2001, the netting basis may include emissions from emissions units that were not subject to both an air quality analysis and control technology requirements if the netting basis had been increased following the rules in effect at the time.

(f) The netting basis will be increased by any emissions from activities previously classified as categorically insignificant prior to April 16, 2015, provided the activities existed during the baseline period or at the time of the last NSR permitting action that changed the netting basis under subsection (e).

(4) In order to maintain the netting basis, permittees must maintain either a Standard ACDP or an Oregon Title V Operating Permit. A request to be assigned any other type of ACDP sets the netting basis at zero upon issuance of the other type of permit and remains at zero unless an increase is approved under subsection (3)(e).

(5) If a source relocates to a different site that DEQ determines is within or affects the same airshed, and the time between operation at the old and new sites is less than six months, the source may retain the netting basis from the old site.

(6) A source's netting basis for a regulated pollutant with a revised definition will be corrected if the source is emitting the regulated pollutant at the time the definition is revised, and the regulated pollutant is included in the source's netting basis.

(7) Where EPA requires an attainment demonstration based on dispersion modeling, the netting basis must not be more than the level used in the dispersion modeling to demonstrate attainment with the ambient air quality standard (i.e., the attainment demonstration is an emission reduction required by rule).

[NOTE: This rule was moved verbatim from OAR 340-200-0020(76) and amended on 04-16-15. Previous rule history for OAR 340-200-0020: [DEQ 15-1978, f. & ef. 10-13-78; DEQ 4-1993, f. & cert. ef. 3-10-93; DEQ 47, f. 8-31-72, ef. 9-15-72; DEQ 63, f. 12-20-73, ef. 1-11-74; DEQ 107, f. & ef. 1-6-76; Renumbered from 340-020-0033.04; DEQ 25-1981, f. & ef. 9-8-81; DEQ 5-1983, f. & ef. 4-18-83; DEQ 18-1984, f. & ef. 10-16-84; DEQ 8-1988, f. & cert. ef. 5-19-88 (and corrected 5-31-88); DEQ 14-1989, f. & cert. ef. 6-26-89; DEQ 42-1990, f. 12-13-90, cert. ef. 1-2-91; DEQ 2-1992, f. & cert. ef. 1-30-92; DEQ 7-1992, f. & cert. ef. 3-30-92; DEQ 27-1992, f. & cert. ef. 11-12-92; DEQ 4-1993, f. & cert. ef. 3-10-93; DEQ 12-1993, f. & cert. ef. 9-24-93, Renumbered from 340-020-0145, 340-020-0225, 340-020-0305, 340-020-0355, 340-020-0460 & 340-020-0520; DEQ 19-1993, f. & cert. ef. 11-4-93; DEQ 20-1993(Temp), f. & cert. ef. 11-4-93; DEQ 13-1994, f. & cert. ef. 5-19-94; DEQ 21-1994, f. & cert. ef. 10-14-94; DEQ 24-1994, f. & cert. ef. 10-28-94; DEQ

10-1995, f. & cert. ef. 5-1-95; DEQ 12-1995, f. & cert. ef. 5-23-95; DEQ 22-1995, f. & cert. ef. 10-6-95; DEQ 19-1996, f. & cert. ef. 9-24-96; DEQ 22-1996, f. & cert. ef. 10-22-96; DEQ 9-1997, f. & cert. ef. 5-9-97; DEQ 14-1998, f. & cert. ef. 9-14-98; DEQ 16-1998, f. & cert. ef. 9-23-98; DEQ 21-1998, f. & cert. ef. 10-14-98; DEQ 1-1999, f. & cert. ef. 1-25-99; DEQ 6-1999, f. & cert. ef. 5-21-99]; DEQ 14-1999, f. & cert. ef. 10-14-99, Renumbered from 340-020-0205, 340-028-0110; DEQ 6-2001, f. 6-18-01, cert. ef. 7-1-01; DEQ 2-2005, f. & cert. ef. 2-10-05; DEQ 2-2006, f. & cert. ef. 3-14-06; DEQ 6-2007(Temp), f. & cert. ef. 8-17-07 thru 2-12-08; DEQ 8-2007, f. & cert. ef. 11-8-07; DEQ 10-2008, f. & cert. ef. 8-25-08; DEQ 5-2010, f. & cert. ef. 5-21-10; DEQ 10-2010(Temp), f. 8-31-10, cert. ef. 9-1-10 thru 2-28-11; Administrative correction 3-29-11; DEQ 5-2011, f. 4-29-11, cert. ef. 5-1-11; DEQ 7-2011(Temp), f. & cert. ef. 6-24-11 thru 12-19-11; Administrative correction, 2-6-12; DEQ 1-2012, f. & cert. ef. 5-17-12; DEQ 4-2013, f. & cert. ef. 3-27-13; DEQ 11-2013, f. & cert. ef. 11-7-13]
[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-222-0060

RULE TITLE: Plant Site Emission Limits for Sources of Hazardous Air Pollutants

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Deleting (1)(a) which references division 220.

RULE TEXT:

(1) DEQ may establish PSELs for hazardous air pollutants (HAPs) if an owner or operator requests that DEQ create an enforceable PTE limit.

(2) PSELs will be set only for individual or combined HAPs and will not list HAPs by name. The PSEL will be set on a rolling 12 month basis and will be set based on the potential to emit if more than the de minimis emission level and to also comply with OAR chapter 340, division 245.

(3) The alternative emissions controls (bubble) provisions of OAR 340-226-0400 do not apply to emissions of HAPs.

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040, 468A.310

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-224-0030

RULE TITLE: New Source Review Procedural Requirements

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Amending language for clarity.

RULE TEXT:

(1) Information Required. The owner or operator of a source subject to Major NSR or State NSR must submit an application and all information DEQ needs to perform any analysis or make any determination required under this division and OAR chapter 340, division 225. The information must be in writing on forms supplied or approved by DEQ and include the information required to apply for a permit or permit modification under:

(a) OAR chapter 340, division 216 for Major NSR or Type A State NSR action; or

(b) OAR chapter 340, division 216 or 218, whichever is applicable, for Type B State NSR actions.

(2) Application Processing:

(a) For Type B State NSR, DEQ will review applications and issue permits using the procedures in OAR chapter 340, division 216 or 218, whichever is applicable.

(b) For Major NSR and Type A State NSR:

(A) Notwithstanding the requirements of OAR 340-216-0040(10), within 30 days after receiving an ACDP permit application to construct, or any additional information or amendment to such application, DEQ will advise the applicant whether the application is complete or if there is any deficiency in the application or in the information submitted. For purposes of this section, an application is complete as of the date on which DEQ received all required information;

(B) Upon determining that an application is complete, DEQ will undertake the public participation procedures in OAR chapter 340, division 209 for a Category IV permit action; and

(C) DEQ will make a final determination on the application within twelve months after receiving a complete application.

(3) An owner or operator that obtained approval of a project under this division must obtain approval for a revision to the project according to the permit application requirements in this division and OAR chapter 340, division 216 or 218, whichever is applicable, prior to initiating the revision. If construction has commenced, the owner or operator must temporarily halt construction until a revised permit is issued. The following are considered revisions to the project that would require approval:

(a) A change that would increase permitted emissions;

(b) A change that would require a re-evaluation of the approved control technology; or

(c) A change that would increase air quality impacts.

(4) For Major NSR and State NSR permit actions, an ACDP that approves construction must require construction to commence within 18 months of issuance. Construction approval terminates and is invalid if construction is not commenced within 18 months after DEQ issues such approval, or by the deadline approved by DEQ in an extension under section (5). Construction approval also terminates and is invalid if construction is discontinued for a period of 18 months or more or if construction is not completed within 18 months of the scheduled time. An ACDP may approve a phased construction project with separate construction approval dates for each subsequent phase and, for purposes of applying this section, the construction approval date for the second and subsequent phases will be treated as the construction approval issuance date.

(5) For Major NSR and State NSR permit actions, DEQ may grant for good cause one or two 18-month construction approval extensions as follows:

(a) Except as provided in subsection (i), for the first extension, the owner or operator must submit an application to modify the permit that includes the following:

(A) A detailed explanation of why the source could not commence construction within the initial 18-month period; and

(B) Payment of the simple technical permit modification fee in OAR 340-216-8020 Part 3.

(b) Except as provided in subsection (i), for the second extension, the owner or operator must submit an application to modify the permit that includes the following for the original regulated pollutants subject to Major NSR or Type A State

NSR:
(A) A detailed explanation of why the source could not commence construction within the second 18-month period;
(B) A review of the original LAER or BACT analysis for potentially lower limits and a review of any new control technologies that may have become commercially available since the original LAER or BACT analysis;
(C) A review of the air quality analysis to address any of the following:
(i) All ambient air quality standards and PSD increments that were subject to review under the original application;
(ii) Any new competing sources or changes in ambient air quality since the original application was submitted;
(iii) Any new ambient air quality standards or PSD increments for the regulated pollutants that were subject to review under the original application; and
(iv) Any changes to EPA approved models that would affect modeling results since the original application was submitted, and
(D) Payment of the moderate technical permit modification fee plus the modeling review fee in OAR 340-216-8020 Part 4.
(c) Except as provided in subsection (i), the permit will be terminated 54 months after it was initially issued if construction does not commence during that 54 month period. If the owner or operator wants approval to construct beyond the termination of the permit, the owner or operator must submit an application for a new Major NSR or State NSR permit.
(d) If construction is commenced prior to the date that construction approval terminates, the permit can be renewed or the owner or operator may apply for a Title V permit as required in OAR 340-218-0190;
(e) To request a construction approval extension under subsection (a) or (b), the owner or operator must submit an application to modify the permit at least 30 days but not more than 90 days prior to the end of the current construction approval period.
(f) Construction may not commence during the period from the end of the preceding construction approval to the time DEQ approves the next extension.
(g) DEQ will make a proposed permit modification available using the following public participation procedures in OAR chapter 340, division 209:
(A) Category II for an extension that does not require an air quality analysis; or
(B) Category III for an extension that requires an air quality analysis.
(h) DEQ will grant a permit modification extending the construction approval for 18 months from the end of the first or second 18-month construction approval period, whichever is applicable, if:
(A) Based on the information required to be submitted under subsection (a) or (b), DEQ determines that the proposed source will continue to meet NSR requirements; and
(B) For any extension, the area impacted by the source has not been redesignated to sustainment or nonattainment prior to the granting of the extension.
(i) If the area where the source is located is redesignated to sustainment or nonattainment before any extension is approved, the owner or operator must demonstrate compliance with the redesignated area requirements if the source is subject to Major or Type A State NSR for the redesignated pollutant, and must obtain the appropriate permit or permit revision before construction may commence. The new permit or permit revision under this subsection will be considered to start a new initial 18-month construction approval period.
(6) Approval to construct does not relieve any owner or operator of the responsibility to comply fully with applicable provisions of the SIP and any other requirements under local, state or federal law;
(7) Sources that are subject to OAR chapter 340, division 218, Oregon Title V Operating Permits, are subject to the following:
(a) Except as prohibited in subsection (b), approval to construct a source under an ACDP issued under OAR chapter 340, division 216 authorizes construction and operation of the source, until the later of:
(A) One year from the date of initial startup of operation of the source subject to Major NSR or State NSR; or
(B) If a timely and complete application for an Oregon Title V Operating Permit is submitted, the date of final action by

DEQ on the Oregon Title V Operating Permit application.
(b) Where an existing Oregon Title V Operating Permit prohibits construction or a change in operation, the owner or operator must obtain a Title V permit revision before commencing the construction, continuing the construction or making the change in operation.
[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.035, 468A.040, 468A.050, 468A.055, 468A.070

STATUTES/OTHER IMPLEMENTED: ORS 468A

REPEAL: 340-224-0100

RULE TITLE: Fugitive and Secondary Emissions

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Repealing rule.

RULE TEXT:

Fugitive emissions are included in the calculation of emission rates of all air contaminants. Fugitive emissions are subject to the same control requirements and analyses required for emissions from identifiable stacks or vents. Secondary emissions are not included in calculations of potential emissions that are made to determine if a proposed source or modification is major. Once a source or modification is identified as being major, secondary emissions are added to the primary emissions and become subject to the air quality impact analysis requirements in this division and OAR 340 division 225.

STATUTORY/OTHER AUTHORITY: ORS 468, 468A

STATUTES/OTHER IMPLEMENTED: ORS 468, 468

AMEND: 340-224-0520

RULE TITLE: Net Air Quality Benefit Emission Offsets: Requirements for Demonstrating Net Air Quality Benefit for Ozone Areas

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "OAR 340-226-0400" to applicability.

RULE TEXT:

When directed by the Major or State NSR rules, OAR 340-222-0042, or OAR 340-226-0400, the owner or operator must comply with this rule.

(1) Offsets for VOC and NOx are required if the source will be located within an ozone designated area or closer to the nearest boundary of an ozone designated area than the ozone impact distance as defined in section (2).

(2) Ozone impact distance is the distance in kilometers from the nearest boundary of an ozone designated area within which a source of VOC or NOx is considered to significantly affect that designated area. The determination of significance is made by either the formula method or the demonstration method.

(a) The Formula Method.

(A) For sources with complete permit applications submitted before Jan. 1, 2003: D = 30 km.

(B) For sources with complete permit applications submitted on or after Jan. 1, 2003: D = (Q/40) x 30 km.

(C) D is the ozone impact distance in kilometers. The value for D is 100 kilometers when D is calculated to exceed 100 kilometers. Q is the larger of the NOx or VOC emissions increase above the netting basis from the source being evaluated in tons per year.

(D) If a source is located closer than D from the nearest ozone designated area boundary, the source must obtain offsets under sections (3) and (4). If the source is located at a distance equal to or greater than D from the nearest ozone designated area boundary then the source is not required to obtain offsets.

(b) The Demonstration Method. An applicant may demonstrate to DEQ that the source or proposed source would not have a material effect on an ozone designated area other than attainment or unclassified areas. This demonstration may be based on an analysis of major topographic features, dispersion modeling, meteorological conditions, or other factors. If DEQ determines that the source or proposed source would not have a material effect on the designated area under high ozone conditions, the ozone impact distance is zero kilometers.

(3) The required ratio of offsetting emissions reductions from other sources (offsets) to the emissions increase from the proposed source or modification (emissions) and the location of sources that may provide offsets is as follows:

(a) For new or modified sources locating within an ozone nonattainment area, the offset ratio is 1.1:1 (offsets:emissions). These offsets must come from sources within either the same designated area as the new or modified source or from sources in another ozone nonattainment area with equal or higher nonattainment classification that contributes to a violation of the ozone ambient air quality standards in the same ozone designated area as the new or modified source.

(b) For new or modified sources locating within an ozone maintenance area, the offset ratio is 1.1:1 (offsets:emissions). These offsets may come from sources within either the maintenance area or from a source that is closer to the nearest maintenance area boundary than that source’s ozone impact distance.

(c) For new or modified sources locating outside the designated area not including attainment or unclassified areas, but closer than the ozone impact distance of the nearest boundary of the designated area, the offset ratio is 1:1 (offsets:emissions). These offsets may come from within either the designated area or from a source that is closer to the nearest maintenance area boundary than that source’s ozone impact distance.

(4) The amount of required offsets and the amount of provided offsets from contributing sources varies based on whether the proposed source or modification and the sources contributing offsets are located outside the ozone designated area other than attainment or unclassified areas. The required offsets and the provided offsets are calculated using either the formula method or the demonstration method, as follows, except that sources located inside an ozone nonattainment area must use the formula method.

(a) The Formula Method.

(A) Required offsets (RO) for new or modified sources are determined as follows:

(i) For sources with complete permit applications submitted before January 1, 2003: RO = SQ; and

(ii) For sources with complete permit applications submitted on or after January 1, 2003: RO = (SQ minus (SD multiplied by 40/30)).

(B) Contributing sources may provide offsets (PO) calculated as follows: PO = CQ minus (CD multiplied by 40/30).

(C) Multiple sources may contribute to the required offsets of a new source. For the formula method to be satisfied, total provided offsets (PO) must equal or exceed required offsets (RO) by the ratio described in section (3).

(D) Definitions of factors used in paragraphs (A) (B) and (C):

(i) RO is the required offset of NOx or VOC in tons per year as a result of the source emissions increase. If RO is calculated to be negative, RO is set to zero.

(ii) SQ (source quantity) is the source's emissions increase of NOx or VOC in tons per year above the netting basis.

(iii) SD is the source distance in kilometers to the nearest boundary of the designated area except attainment or unclassified areas. SD is zero for sources located within the designated area except attainment or unclassified areas.

(iv) PO is the provided offset from a contributing source and must be equal to or greater than zero;

(v) CQ (contributing quantity) is the contributing source's emissions reduction in tons per year calculated as the contemporaneous pre-reduction actual emissions less the post-reduction allowable emissions from the contributing source (as provided in OAR 340-268-0030(1)(b)).

(vi) CD is the contributing source's distance in kilometers from the nearest boundary of the designated area except attainment or unclassified areas. For a contributing source located within the designated area except attainment or unclassified areas, CD equals zero.

(b) The Demonstration Method. An applicant may demonstrate to DEQ using dispersion modeling or other analyses the level and location of offsets that would be sufficient to provide actual reductions in concentrations of VOC or NOx in the designated area during high ozone conditions as the ratio described in section (3). The modeled reductions of ambient VOC or NOx concentrations resulting from the emissions offset must be demonstrated over a greater area and over a greater period of time within the designated area as compared to the modeled ambient VOC or NOx concentrations resulting from the emissions increase from the source subject to this rule. If DEQ determines that the demonstration is acceptable, then DEQ will approve the offsets proposed by the applicant.

(c) Offsets obtained for a previous PSEL increase that did not involve resetting the netting basis can be credited toward offsets currently required for a PSEL increase.

(5) In lieu of obtaining offsets, the owner or operator may obtain an allocation at the rate of 1:1 from a growth allowance, if available, in an applicable maintenance plan.

[NOTE: This rule was moved verbatim from OAR 340-225-0020(10) and (11) and OAR 340-225-0090(1) and amended on 04-16-15. Previous rule history for OAR 340-225-0020: DEQ 6-2001, f. 6-18-01, cert. ef. 7-1-01; DEQ 11-2002, f. & cert. ef. 10-8-02; DEQ 12-2002(Temp), f. & cert. ef. 10-8-02 thru 4-6-03; Administrative correction 11-10-03; DEQ 1-2004, f. & cert. ef. 4-14-04; DEQ 1-2005, f. & cert. ef. 1-4-05; DEQ 9-2005, f. & cert. ef. 9-9-05; DEQ 10-2010(Temp), f. 8-31-10, cert. ef. 9-1-10 thru 2-28-11; Administrative correction, 3-29-11; DEQ 5-2011, f. 4-29-11, cert. ef. 5-1-11. Previous rule history for OAR 340-225-0090: DEQ 25-1981, f. & ef. 9-8-81; DEQ 5-1983, f. & ef. 4-18-83; DEQ 8-1988, f. & cert. ef. 5-19-88 (and corrected 5-31-88); DEQ 22-1989, f. & cert. ef. 9-26-89; DEQ 27-1992, f. & cert. ef. 11-12-92; DEQ 4-1993, f. & cert. ef. 3-10-93; DEQ 12-1993, f. & cert. ef. 9-24-93, Renumbered from 340-020-0260; DEQ 19-1993, f. & cert. ef. 11-4-93; DEQ 4-1995, f. & cert. ef. 2-17-95; DEQ 26-1996, f. & cert. ef. 11-26-96; DEQ 14-1999, f. & cert. ef. 10-14-99, Renumbered from 340-028-1970; DEQ 14-1999, f. & cert. ef. 10-14-99, Renumbered from 340-030-0111; DEQ 6-2001, f. 6-18-01, cert. ef. 7-1-01, Renumbered from 340-224-0090 & 340-240-0260; DEQ 11-2002, f. & cert. ef. 10-8-02; DEQ 12-2002(Temp), f. & cert. ef. 10-8-02 thru 4-6-03; Administrative correction 11-10-03; DEQ 1-2004, f. & cert. ef. 4-14-04; DEQ 1-2005, f. & cert. ef. 1-4-05; DEQ 3-2007, f. & cert. ef. 4-12-07; DEQ 10-2010(Temp), f. 8-31-10, cert. ef. 9-1-10 thru 2-28-11; Administrative correction, 3-29-11; DEQ 5-2011, f. 4-29-11, cert. ef. 5-1-11; DEQ 10-2012, f. & cert. ef. 12-11-12]

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-020-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.035, 468A.040, 468A.050, 468A.055, 468A.070

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-224-0530

RULE TITLE: Net Air Quality Benefit Emission Offsets: Requirements for Demonstrating Net Air Quality Benefit for Non-Ozone Areas

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "or OAR 340-226-0400" to (1).

RULE TEXT:

(1) When directed by the Major or State NSR rules, OAR 340-222-0042, or OAR 340-226-0400, the owner or operator of the source must comply with sections (2) through (6), as applicable. For purposes of this rule, priority sources are sources identified under OAR 340-204-0320 for the designated area.

(2) The ratio of offsets compared to the source's potential emissions increase is 1.2:1 (offsets:emissions). If the offsets include offsets from priority sources, the ratio will be decreased by the offsets obtained from priority sources as a percentage of the source's potential emissions increase. For example, if the owner or operator obtains offsets from priority sources equal to 10% of its potential emissions increase, then the offset ratio is reduced by 0.10, to 1.1:1. In no event, however, will the offset ratio be less than 1.0:1, even if more than 20% of offsets are from priority sources.

(3) The ratio of offsets compared to the source's potential emissions increase is 1.0:1 (offsets:emissions), except as allowed by subsection (a) or required by subsection (b).

(a) For State NSR only, if the offsets include offsets from priority sources, the ratio will be decreased by the offsets obtained from priority sources as a percentage of the source's potential emissions increase. For example, if the owner or operator obtains offsets from priority sources equal to 20% of its potential emissions increase, then the offset ratio is reduced by 0.2, to 0.8:1. In no event, however, will the offset ratio be less than 0.5:1, even if more than 50% of offsets are from priority sources.

(b) In the Medford-Ashland AQMA, proposed new PM10 major sources or PM10 major modifications locating within the AQMA that are required to provide emission offsets under OAR 340-224-0060(2)(a) must provide reductions in PM10 emissions equal to 1.2 times the emissions increase over the netting basis from the new or modified source.

(4) Except as provided in sections (5) and (6), the owner or operator must conduct an air quality analysis of the impacts from the proposed new emissions and comply with subsections (a) and (b) using the procedures specified in subsections (c) through (e):

(a) Demonstrate that the offsets obtained result in a reduction in concentrations at a majority of modeled receptors within the entire designated area; and

(b) Comply with paragraph (A) or paragraphs (B):

(A) Demonstrate that the impacts from the emission increases above the source's netting basis are less than the Class II SIL at all receptors within the entire designated area; or

(B) Demonstrate that the impacts from the emission increases above the source's netting basis:

(i) Are less than the Class II SIL at an average of receptors within an area designated by DEQ as representing a neighborhood scale, as specified in 40 CFR part 58, Appendix D, a reasonably homogeneous urban area with dimensions of a few kilometers that represent air quality where people commonly live and work in a representative neighborhood, centered on the DEQ approved ambient monitoring sites; and

(ii) The impacts of emission increases or decreases since the date of the current area designation of all other sources within the designated area or having a significant impact on the designated area, are less than 10 percent of the AAQS at all receptors within the designated area;

(c) The air quality analysis must comply with OAR 340-225-0030 and 340-225-0040;

(d) The air quality analysis must use a uniform receptor grid over the entire modeled area for the analyses required in subsections (a) and (b). The spacing of the receptor grids will be determined by DEQ for each analysis;

(e) For the purpose of subsection (a) and paragraph (b)(B):

(A) Subtract the priority source offsets from the new or modified source's emission increase if the priority sources identified are area sources. Area source emissions are spatially distributed emissions that can be generated from activities such as, but not limited to, residential wood heating, unpaved road dust, and non-road mobile sources;

(B) If the source's emissions are not offset 100 percent by priority sources that are area sources, conduct dispersion modeling of the source's remaining emission increases after subtracting any priority source offsets allowed in subparagraph (A); and in addition, model all other sources with emission increases or decreases in or impacting the designated area since the date the area was designated, including offsets used for the proposed project, but excluding offsets from priority sources that are area sources; and

(C) If the source's emissions are offset 100 percent by priority sources that are area sources, no further analysis is required.

(5) Small scale local energy projects and any infrastructure related to that project located in the same area are not subject to the requirements in section (4) provided that the proposed source or modification would not cause or contribute to a violation of an ambient air quality standard or otherwise pose a material threat to compliance with air quality standards in a nonattainment area.

(6) Offsets obtained in accordance with OAR 340-240-0550 and 340-240-0560 for sources locating within or causing significant air quality impact on the Klamath Falls PM2.5 nonattainment or PM10 maintenance areas are exempt from the requirements of OAR 340-224-0510 and section (4) provided that the proposed major source or major modification would not cause or contribute to a new violation of the national ambient air quality standard. This exemption only applies to the direct PM2.5 or PM10 offsets obtained from residential wood-fired devices in accordance with 340-240-0550 and 340-240-0560. Any remaining emissions from the source that are offset by emission reductions from other sources are subject to the requirements of OAR 340-224-0510 or section (4), as applicable.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-020-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.035, 468A.040, 468A.050, 468A.055, 468A.070

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-225-0030

RULE TITLE: Procedural Requirements

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "(3) An analysis of the air quality impacts for comparison to significant impact levels, PSD increments, and ambient air quality standards is not required for PM increases equal to or greater than the PM SER. If applicable, DEQ may require the owner or operator of a source to conduct speciation of PM and perform an analysis for PM10 and PM2.5."

RULE TEXT:

When required to conduct an air quality analysis under this division:

(1) The owner or operator of a source must submit a modeling protocol to DEQ and have it approved before submitting a permit application.

(2) In addition to the requirements defined in OAR 340-216-0040 for permit applications, the owner or operator of a source must submit all information necessary to perform any analysis or make any determination required under this division. Such information may include, but is not limited to:

(a) Emissions data for all existing and proposed emission points from the source or modification. This data must represent maximum emissions for the averaging times by regulated pollutant consistent with the ambient air quality standards in OAR chapter 340, division 202.

(b) Stack parameter data, height above ground, exit diameter, exit velocity, and exit temperature, for all existing and proposed emission points from the source or modification;

(c) An analysis of the air quality and visibility impact of the source or modification, including meteorological and topographical data, specific details of models used, and other information necessary to estimate air quality impacts; and

(d) An analysis of the air quality and visibility impacts, and the nature and extent of all commercial, residential, industrial, and other source emission growth, that has occurred since the baseline concentration year in the area the source or modification would significantly affect; and

(3) An analysis of the air quality impacts for comparison to significant impact levels, PSD increments, and ambient air quality standards is not required for PM increases equal to or greater than the PM SER. If applicable, DEQ may require the owner or operator of a source to conduct speciation of PM and perform an analysis for PM10 and PM2.5.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-020-0040]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.070

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-225-0050

RULE TITLE: Requirements for Analysis in PSD Class II and Class III Areas

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "or modification " to (2).

RULE TEXT:

Modeling: For determining compliance with the AAQS, PSD increments, and other requirements in PSD Class II and Class III areas, the following methods must be used:

(1) For each regulated pollutant, a single source impact analysis is sufficient to show compliance with the AAQS and PSD increments if:

(a) The modeled impacts from emission increases equal to or greater than a SER above the netting basis due to the proposed source or modification being evaluated are less than the Class II significant impact levels specified in OAR 340-200-0020; and

(b) The owner or operator provides an assessment of factors that may impact the air quality conditions in the area to show that the SIL by itself ensures that the proposed source or modification will not cause or contribute to a new violation of an AAQS and PSD increment. The assessment must take into consideration but is not limited to the following factors:

(A) The background ambient concentration relative to the AAQS;

(B) The emission increases and decreases since the baseline concentration year from other sources that are expected to cause a significant concentration gradient in the vicinity of the source. Determination of significant concentration gradient may take into account factors including but not limited to ROI formula, spatial distribution of existing emission sources, topography, and meteorology.

(2) If the requirement in section (1) is not satisfied, the owner or operator of a proposed source or modification being evaluated must complete a competing source analysis as follows:

(a) For demonstrating compliance with the PSD Class II and III increments (as defined in OAR 340-202-0210), the owner or operator of the proposed source or modification must show that modeled impacts from the proposed increased emissions, above the modeled baseline concentration, plus competing PSD increment consuming source impacts above the modeled baseline concentration are less than the PSD increments for all averaging times; and

(b) For demonstrating compliance with the AAQS, the owner or operator of the source must show that the total modeled impacts plus total competing source impacts plus general background concentrations are less than the AAQS for all averaging times.

(3) The owner or operator of a source or modification must also provide an analysis of:

(a) The impairment to visibility, soils and vegetation that would occur as a result of the proposed source or modification, and general commercial, residential, industrial and other growth associated with the source or modification. As a part of this analysis, deposition modeling analysis is required for sources emitting heavy metals above the SERs as defined in OAR 340-200-0020. Concentration and deposition modeling may also be required for sources emitting other compounds on a case-by-case basis; and

(b) The air quality concentration projected for the area as a result of general commercial, residential, industrial and other growth associated with the source or modification.

(4) Any analyses performed under this section must be done in compliance with OAR 340-225-0030 and 340-225-0040, as applicable.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-020-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.070

STATUTES/OTHER IMPLEMENTED: ORS 468A

AMEND: 340-225-0070

RULE TITLE: Requirements for Demonstrating Compliance with Air Quality Related Values Protection

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "or modification" to applicability.

RULE TEXT:

(1) Sources that are not federal major sources are exempt from the requirements of this rule.

(2) When directed by OAR chapter 340, division 224, the requirements of this rule apply to each emissions unit that increases the actual emissions of a regulated pollutant above the portion of the netting basis attributable to that emissions unit.

(3) DEQ must provide notice of permit applications involving AQRV analysis to EPA and Federal Land Managers as follows:

(a) If a proposed source or modification could impact air quality related values, including visibility, deposition, and ozone impacts within a Class I area, DEQ will provide written notice to the EPA and to the appropriate Federal Land Manager within 30 days of receiving such permit application. The notice will include a copy of all information relevant to the permit application, including analysis of anticipated impacts on Class I area air quality related values. DEQ will also provide at least 30 days' notice to EPA and the appropriate Federal Land Manager of any scheduled public hearings and preliminary and final actions taken on the application;

(b) If DEQ receives advance notice of a permit application for a source that may affect Class I area visibility, DEQ will notify all affected Federal Land Managers within 30 days of receiving the advance notice;

(c) During its review of source impacts on Class I area air quality related values, pursuant to this rule, DEQ will consider any analysis performed by the Federal Land Manager that is received by DEQ within 30 days of the date that DEQ sent the notice required by subsection (a). If DEQ disagrees with the Federal Land Manager's demonstration, DEQ will include a discussion of the disagreement in the Notice of Public Hearing;

(d) As a part of the notification required in OAR 340-209-0060, DEQ will provide the Federal Land Manager an opportunity to demonstrate that the emissions from the proposed source or modification would have an adverse impact on air quality related values, of any federal mandatory Class I area. This adverse impact determination may be made even if there is no demonstration that a Class I PSD increment has been exceeded. If DEQ agrees with the demonstration, it will not issue the permit.

(4) Visibility impact analysis requirements:

(a) If division 224 requires a visibility impact analysis, the owner or operator must demonstrate that the potential to emit any regulated pollutant at a SER in conjunction with all other applicable emission increases or decreases, including secondary emissions, permitted since January 1, 1984 and other increases or decreases in emissions, will not cause or contribute to significant impairment of visibility on any Class I area.

(b) The owner or operator must conduct a visibility analysis on the Columbia River Gorge National Scenic Area if it is affected by the source;

(c) The owner or operator must submit all information necessary to perform any analysis or demonstration required by these rules.

(d) Determination of significant impairment: The results of the modeling must be sent to the affected Federal Land Managers and DEQ. The land managers may, within 30 days following receipt of the source's visibility impact analysis, determine whether or not significant impairment of visibility in a Class I area would result. DEQ will consider the comments of the Federal Land Manager in its consideration of whether significant impairment of visibility in a Class I area will result. If DEQ determines that significant impairment of visibility in a Class I area would result, it will not issue a permit for the proposed source or modification.

(5) In consultation with the Federal Land Managers under FLAG, DEQ may require a plume blight analysis or regional haze analysis, or both.

(6) Criteria for visibility impacts:

(a) The owner or operator of a source, where required by division 224, is encouraged to demonstrate that its impacts on visibility satisfy the guidance criteria as referenced in the FLAG.
(b) If visibility impacts are a concern, DEQ will consider comments from the Federal Land Manager when deciding whether significant impairment will result. Emission offsets may also be considered. If DEQ determines that significant impairment of visibility in a Class I area would result, it will not issue a permit for the proposed source or modification.
(7) Deposition modeling is required for receptors in PSD Class I areas and the Columbia River Gorge National Scenic Area where visibility modeling is required. This may include, but is not limited to an analysis of nitrogen deposition and sulfur deposition.
(8) Visibility monitoring:
(a) If division 224 requires visibility monitoring data, the owner or operator must use existing data to establish existing visibility conditions within Class I areas as summarized in the FLAG Report.
(b) After construction has been completed the owner or operator must conduct such visibility monitoring if DEQ requires visibility monitoring as a permit condition to establish the effect of the regulated pollutant on visibility conditions within the impacted Class I area.
(9) Additional impact analysis: The owner or operator subject to OAR 340-224-0060(2) or 340-224-0070(3) must provide an analysis of the impact to visibility that would occur as a result of the proposed source or modification and general commercial, residential, industrial, and other growth associated with the source.
(10) If the Federal Land Manager recommends and DEQ agrees, DEQ may require the owner or operator to analyze the potential impacts on other Air Quality Related Values and how to protect them. Procedures from the FLAG report must be used in this recommendation. Emission offsets may also be used. If the Federal Land Manager finds that significant impairment of visibility in a Class I area would result from the proposed activities and DEQ agrees, DEQ will not issue a permit for the proposed source or modification.
(11) Any analyses performed under this section must be done in compliance with OAR 340-225-0030 and 340-225-0040, as applicable.
[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]
[NOTE: View a PDF of FLAG Phase I report by clicking on "Tables" link below.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.070

STATUTES/OTHER IMPLEMENTED: ORS 468A

State of Oregon Department of Environmental Quality

OAR 340-225-0070

Federal Land Managers' Air Quality Related Values Work Group Phase I Report - Revised

National Park Service
U.S. Department of the Interior

Natural Resource Program Center

Federal Land Managers' Air Quality Related Values Work Group (FLAG)

Phase I Report—Revised (2010)

Natural Resource Report NPS/NRPC/NRR—2010/232

ON THE COVER

Courthouse Towers, Arches National Park, Utah.
Photo by Debbie Miller.

THIS PAGE:

Jumping Cholla, Superstition Wilderness, Arizona.
Photo by Steve Boutcher

Federal Land Managers' Air Quality Related Values Work Group (FLAG)

Phase I Report—Revised (2010)

Natural Resource Report NPS/NRPC/NRR—2010/232

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October 2010

The National Park Service, Natural Resource Program Center publishes a range of reports that address natural resource topics of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate high-priority, current natural resource management information with managerial application. The series targets a general, diverse audience, and may contain NPS policy considerations or address sensitive issues of management applicability.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This guidance document was jointly prepared by the National Park Service, U.S. Forest Service, and the U.S. Fish and Wildlife Service, in collaboration with the Environmental Protection Agency. Guidance contained herein has been reviewed by subject matter experts and the general public through formal public review and comment period. This guidance document provides information for Federal Land Managers, permitting authorities, and permit applicants to use when assessing air quality impacts to air quality related values. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available from the Air Resources Division of the NPS (http://www.nature.nps.gov/air) and the Natural Resource Publications Management Web site (http://www.nature.nps.gov/publications/NRPM) on the Internet.

Please cite this publication as:

U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service. 2010. Federal land managers' air quality related values work group (FLAG): phase I report—revised (2010). Natural Resource Report NPS/NRPC/NRR—2010/232. National Park Service, Denver, Colorado.

NPS 999/105412, October 2010

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

OCT - 7 2010

Dear FLAG User:

We are pleased to provide the final revised FLAG report (FLAG 2010). FLAG was formed at the request of permit applicants and State permit review authorities to develop a more consistent and objective approach for the Federal Land Managers (FLMs), *i.e.*, National Park Service, U.S. Fish and Wildlife Service, and U.S. Department of Agriculture Forest Service, to evaluate air pollution effects on their Air Quality Related Values (AQRVs). The FLAG effort focused on how air pollutants – primarily particulate matter, nitrogen dioxide, sulfur dioxide, nitrates, sulfates, ozone – affect the health and status of resources in areas managed by the three agencies. FLAG subgroups concentrated on four key issues: (1) visibility; (2) aquatic and terrestrial effects of wet and dry pollutant deposition; (3) terrestrial effects of ozone; and (4) process and policy issues. In December 2000, the FLMs published a final Phase I report (FLAG 2000). Based on knowledge gained and regulatory developments since FLAG 2000, the FLMs believe certain revisions to FLAG 2000 are now appropriate. The final revised FLAG 2010 report reflects those changes.

The FLAG 2010 report contains a wealth of information and should continue to be a very useful tool; we support its recommendations. The FLAG report is guidance and reflects agency direction, but it is not a rule. Nevertheless, we encourage all FLMs, permitting authorities, permit applicants, and other interested parties to take advantage of the helpful information contained in the FLAG report when assessing air pollution impacts on AQRVs.

We want to thank the many people who contributed to this important and worthwhile project.

Sincerely,

Thomas L. Strickland
Assistant Secretary for Fish and Wildlife and Parks
Department of the Interior

Sincerely,

Harris Sherman, Under Secretary
Natural Resources and the Environment
Department of Agriculture

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Preface to this Edition of the FLAG Phase I Report (New)

Under the Clean Air Act, the Federal Land Manager (FLM) and the Federal official with direct responsibility for management of Federal Class I parks and wilderness areas (i.e., Park Superintendent, Refuge Manager, Forest Supervisor) have an affirmative responsibility to protect the air quality related values (AQRVs) (including visibility) of such lands, and to consider whether a proposed major emitting facility will have an adverse impact on such values. The FLM's decision regarding whether there is an adverse impact is then conveyed to the permitting authority – usually a State agency – for consideration in its determinations regarding the permit. The permitting authority's determinations generally consider a wide range of factors, including the potential impact of the new source or major modification on the AQRVs of Class I areas, if applicable.

Both State permitting agencies and permit applicants requested that the FLMs provide better consistency pertaining to their role in the review of new source permit applications near Federal Class I areas. To address this concern, the FLMs formed the Federal Land Managers' Air Quality Related Values Work Group (FLAG). The official "FLM" is the Secretary of the department with authority over the Federal Class I areas (or the Secretary's designee). For the Department of the Interior, the Secretary has designated the Assistant Secretary for Fish and Wildlife and Parks as the FLM, whereas the Secretary of Agriculture has delegated the FLM responsibilities to the Regional Forester, and in some cases, the Forest Supervisor.

The purpose of FLAG is twofold: (1) to develop a more consistent and objective approach for the FLMs to evaluate air pollution effects on public AQRVs in Class I areas, including a process to identify those resources and any potential adverse impacts, and (2) to provide State permitting authorities and potential permit applicants consistency on how to assess the impacts of new and existing sources on AQRVs in Class I areas, especially in the review of Prevention of Significant Deterioration (PSD) of air quality permit applications. Under the Clean Air Act, the FLM formal "affirmative responsibility" role in the permitting process is limited to the extent a proposed new or modified source may affect AQRVs in a Class I area.[1]

Adult Brown Pelicans on Breton Island National Wildlife Refuge, Louisiana.
Credit: USFWS

FLAG members include representatives from three of the federal land management agencies that administer Federal Class I areas: the U.S. Forest Service (USFS), under the Department of Agriculture, and the National Park Service (NPS) and U.S. Fish and Wildlife Service (FWS) under the Department of the Interior, hereafter referred to as "the Agencies" or the "FLMs." In addition, five Tribal governments each administer their redesignated Class I areas, and the Bureau of Land Management (BLM) jointly administers four mandatory Federal Class I areas with the USFS. BLM is not a member of FLAG. However, because BLM does manage federal PSD Class I lands, as well as large amounts of acres in the vicinity of many FLAG Agencies' Class I areas, they may apply, when appropriate, the assessment methodologies outlined in the FLAG report. Applicants with the potential to adversely impact visibility or other AQRVs at PSD Class I areas administered by the BLM should contact that agency directly to discuss their considerations. The Agencies review permit applications for projects that may impact their areas, and make recommendations to their respective FLM as to whether or not those impacts might be considered adverse. The FLM will then make the final decision regarding the nature of the potential impacts to AQRVs, which is then conveyed to the permitting authority for its consideration.

In December 2000, after undergoing a public review and comment process that included a 90 day public comment period announced in the *Federal Register* and a public meeting, the FLMs published a *FLAG Phase I Report* (FLAG 2000), along with an accompanying "Response to Public Comments" document. The FLAG 2000 report described the work accomplished in Phase I of the FLAG effort. FLAG 2000 provided State permitting authorities and potential permit applicants a consistent methodology for conducting Class I area impact analyses. At that time, the Agencies envisioned a FLAG Phase II to address unresolved issues

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[1] Nevertheless, the FLMs are also concerned about resources in Class II parks and wilderness areas because they have other mandates to protect those areas as well. The information and procedures outlined in this document are generally applicable to evaluating the effect of new or modified sources on the AQRVs in both Class I and Class II areas, including the evaluation of effects as part of Environmental Assessments and/or Environmental Impact Statements under the National Environmental Policy Act (NEPA). However, FLAG does not preclude more refined or regional analyses being performed under NEPA or other programs.

including those that will require research and the collection of new data. However, resource constraints have prevented the Agencies from embarking on a formal FLAG Phase II process, but the Agencies have made significant progress in obtaining effects-based information as part of their resource-protection responsibilities. This information is included in this revised report.

The Agencies formed three separate subgroups to deal with area specific technical and policy issues associated with visibility impairment, ozone effects on vegetation, and effects of pollutant deposition on soils and surface waters. FLAG 2000 consolidated the results of those three subgroups.

FLAG 2000 included recommendations for completing and evaluating New Source Review (NSR) projects that may affect federally protected areas. It was intended to be a screening tool to help the Agencies and permit applicants determine whether impacts would be negligible. It was not intended to provide a bright-line test that would allow one to determine whether or not a proposed source of air pollution would cause or contribute to an adverse impact on AQRVs. That determination remains a project-specific management decision of the FLM. Among other factors, the FLMs' assessment of whether or not an adverse impact would occur is based on the sensitivity of the AQRVs at the particular federally protected area under consideration, and the magnitude, frequency, duration, timing, and geographic extent of the estimated new source impacts. This report (FLAG 2010) reaffirms these intentions.

FLAG 2000 has been a useful tool to the Agencies, State permitting authorities, and permit applicants. It was intended to be a working document that would be revised as necessary as the Agencies learn more about how to better assess the health and status of AQRVs. Based on knowledge gained and regulatory developments since FLAG 2000, the Agencies believe certain revisions to FLAG 2000 are now appropriate. This revised report (FLAG 2010) reflects those changes. However, it is important to emphasize that in this revision the Agencies have made certain changes to update specific information and data, but retain intact much of the background and general information contained in FLAG 2000 (e.g., Appendices A through H). Therefore, while this version replaces FLAG 2000, FLAG 2010 does not constitute a comprehensive update of all the information and material contained in FLAG 2000. Instead, the Agencies have focused their efforts on those areas of FLAG 2000 that have received the most attention and concern from permit applicants and permitting authorities. In that regard, the Agencies have included substantial changes to the visibility analysis sections, as well as included a more detailed discussion of the factors that the FLMs will use in the decision making process for an adverse impact determination. The Agencies have also taken this opportunity to discuss some key regulatory developments since FLAG 2000, as well as update some information in the FLAG 2000 deposition and ozone sections. To aid the FLAG user wanting to focus on the most recent changes, the Agencies have identified those new and revised sections throughout the FLAG 2010 report.

The most significant changes in this FLAG 2010 revision are summarized as follows:

- Adopts similar criteria derived from EPA's 2005 Best Available Retrofit Technology (BART) guidelines for the Regional Haze Rule to screen out from AQRV review those sources with relatively small amounts of emissions located a large distance from a Class I area (i.e., $Q/D \leq 10$, for sources located greater than 50 km away).
- Utilizes the most recent EPA estimates to determine annual average or 20% best natural visibility conditions for Class I areas, using the new EPA-approved visibility algorithm.
- Adopts criteria derived from the 2005 BART guidelines that utilizes monthly average relative humidity adjustment factors to minimize the effects of weather events (i.e., short-term meteorological phenomena) on modeled visibility impacts.
- Adopts criteria derived from the 2005 BART guidelines that sets a 98th percentile value to screen out roughly seven days of haze-type visibility impairment per year.
- Includes deposition analysis thresholds and concern thresholds for nitrogen and sulfur deposition impacts on vegetation, soils, and water.
- Increases transparency and consistency of factors considered for adverse impact determinations.

A comparison of these FLAG 2010 changes to information contained in FLAG 2000 is provided in Table 1:

Other changes of note included in FLAG 2010 are:

- Clarifies the near field visibility analysis techniques for analyzing plumes or layers viewed against a background;
- Expands discussion of "Critical Loads" to reflect some significant developments in this area since FLAG 2000;
- Updates ozone sensitive species lists contained in Appendix 3.A of the FLAG 2000 report, but now includes that information on individual agency web sites rather than in the FLAG 2010 report;
- Replaces Appendix 3.B of FLAG 2000 (W126 and N100 ozone values) with current information on the individual agency web sites;
- Updates the information contained in Table D-2 of FLAG 2000 to reflect current information, but now includes that information on individual agency web sites rather than in the FLAG 2010 report;
- Replaces the dated sulfate, nitrate, and ammonium ion concentration maps (Figures D-2, D-3, and D-4 of FLAG 2000), with a reference to the NADP site for current trends data.

Table 1. FLAG 2000 vs. FLAG 2010 Analyses

	FLAG 2000	FLAG 2010
Annual emissions/Distance (Q/D) screening criteria. (Not applicable for Class I increment analyses).	None	≤10 (sum of certain pollutant emissions (TPY) divided by distance (km) from Class I area; applies to all AQRVs, not just visibility. See section 3.2.
Background Visibility Conditions.	Based on annual average natural, using NAPAP estimates.	Based on annual average natural, or 20% best natural, using EPA data from Regional Haze Rule development. See section 3.3.3.
Relative Humidity Adjustment Factor (f(RH)).	Hour-by-hour (with RH capped at 98%).	Monthly average (with RH capped at 95%). See section 3.3.3.
First Level Screening Model.	CALPUFF or CALPUFF-lite.	CALPUFF only. See section 3.3.3.
Visibility Assessment Criteria.	Maximum modeled value.	98th percentile modeled value at any receptor. See section 3.3.3.
Deposition Analysis Thresholds/ Concern Thresholds	None	Provided for nitrogen and sulfur deposition. See section 3.5.6.
Adverse Impact Determination Criteria.	"Likely to Object" if 10% threshold exceeded; regulatory factors implicitly considered.	Adverse impact determination process more explicit; considers regulatory and other factors. See sections 4.2-4.4

Executive Summary (Revised)

The Federal Land Managers' Air Quality Related Values Work Group (FLAG) formed to develop a more consistent approach for the Federal Land Managers (FLMs) to evaluate air pollution effects on resources. As discussed in the Preface, the *FLAG Phase I Report* (FLAG 2000) is being revised in part at this time. The primary—but not sole—focus of FLAG is the New Source Review (NSR) program, especially in the review of Prevention of Significant Deterioration (PSD) of air quality permit applications. The goals of FLAG have been to provide consistent policies and processes both for identifying air quality related values (AQRVs) and for evaluating the effects of air pollution on AQRVs, primarily in Federal Class I air quality areas, but also in some instances, in other national parks, national forests, national wildlife refuges, wilderness areas, and national monuments. Federal Class I areas are defined in the Clean Air Act as national parks over 6,000 acres and wilderness areas and memorial parks over 5,000 acres, established as of 1977. All other FLM areas are designated Class II. Maps of the Agencies' Federal Class I areas are provided in Appendix E.

FLMs have an "affirmative responsibility" to protect AQRVs. In this respect, the FLM role consists of considering whether emissions from a new or modified source may have an adverse impact on AQRVs and providing comments to permitting authorities (States or EPA). FLMs have no permitting authority under the Clean Air Act, and they have no authority under the Clean Air Act to establish air quality-related rules or standards. It is important to emphasize that the FLAG report only explains factors and information the FLMs expect to use when carrying out their consultative role. It is separate from Federal regulatory programs.

FLAG members include representatives from the three primary agencies that administer the nation's Federal Class I areas: the U.S. Forest Service (USFS), the National Park Service (NPS), and the U.S. Fish and Wildlife Service (FWS). (Subsequently in this report, these three agencies collectively will be referred to as "the Agencies" or the "FLMs." Class I and Class II air quality areas are called "FLM areas" in this report.) Appendix F contains a list of participants that worked on the original FLAG 2000 report.

This report describes the work accomplished in Phase I of the FLAG effort as revised to reflect current developments. That work includes identifying policies and processes common to the FLMs (herein called "commonalities") and developing new policies and processes using readily available information. This report provides State permitting authorities and potential permit applicants a consistent and predictable process for assessing the impacts of new and existing sources on AQRVs, including a process to identify those AQRVs and potential adverse impacts. The report also discusses considerations unrelated to new source review and managing emissions in Federal areas. If and when the Agencies embark on Phase II, FLAG will address unresolved issues including those that will require research and the collection of new data.

Marble Mountain Wilderness, California.
Credit: Steve Boutcher

This revised *FLAG Phase I Report* consolidates the results of the FLAG Visibility, Ozone, and Deposition subgroups. The chapters prepared by these subgroups contain issue-specific technical and policy analyses, recommendations for evaluating AQRVs, and information for completing and evaluating NSR permit applications. This information and the associated recommendations are intended for use by the FLMs, permitting authorities, NSR permit applicants, and other interested parties. The report includes background information on the roles and responsibilities of the FLMs under the NSR program.

This document includes recommendations for completing and evaluating NSR applications that may affect Class I FLM areas. This information can also be used to evaluate impacts on Class II parks and wilderness areas. It does not provide a universal formula that would, in all situations, allow one to determine whether or not a source of air pollution causes or contributes to an adverse impact. That determination remains a project-specific management decision, the responsibility for which remains with the FLM, as delegated by Congress. The FLM's assessment of whether or not an adverse impact would occur is based on the sensitivity of the AQRVs at the particular FLM area under consideration, as well as the consideration of several other factors, including the magnitude, frequency, duration, timing, and geographic extent of the new source's impacts.

To provide information for the FLM's assessment of adverse impacts on AQRVs, the permit applicant should identify the potential impacts of the source on all applicable AQRVs of that area. An FLM may ask that an applicant address any or all of the areas of concern. The primary areas of concern to the FLMs with respect to air pollution emissions are visibility impairment, ozone effects on vegetation, and effects of pollutant deposition on soils and surface waters.

The *FLAG Phase I Report* also describes the FLAG effort, including the FLAG approach, organization, and plans for future FLAG work. Appendix A of the report contains a glossary of technical terms, abbreviations, and acronyms used in the report along with associated definitions. Appendix G provides a list of all references cited in the FLAG report.

The key recommendations developed by the Visibility, Ozone, and Deposition subgroups are summarized below, and updated in part in this FLAG 2010 revision. However, for all three subject matter areas, FLAG recommends that the permit applicant consult with the appropriate permitting authority and with the FLM for the affected area(s) for confirmation of preferred procedures. This consultation should take place in the early stages of the permit application process.

Recommendations for Evaluating Visibility Impacts (Revised)

FLAG provides recommendations, specific procedures, and interpretation of results for assessing visibility impacts of new or modified sources on Class I area resources.[2]

FLAG addresses assessments for sources proposed for locations near (generally within 50 km) and at large distances (greater than 50 km) from these areas. The key components of the recommendations are highlighted below.

In general, FLAG recommends that an applicant:

- Apply the Q/D test (see "INITIAL SCREENING TEST" below) for proposed sources greater than 50 km from a Class I area to determine whether or not any further visibility analysis is necessary.
- Consult with the appropriate regulatory agency and with the FLM for the affected Class I area(s) or other affected area for confirmation of preferred visibility analysis procedures.
- Obtain FLM recommendation for the specified reference levels (estimate of natural conditions) and, if applicable, FLM recommended plume/observer geometries and model receptor locations.
- Apply the applicable EPA Guideline, steady-state models for regions within the Class I area that are affected by plumes or layers that are viewed against a background (generally within 50 km of the source).
    - Calculate hourly estimates of changes in visibility, as characterized by the change in the color difference index (ΔE) and plume contrast (C), with respect to natural conditions, and compare these estimates with the thresholds given in section 3.3.3.
- For regions of the Class I area where visibility impairment from the source would cause a general alteration of the appearance of the scene (generally 50 km or more away from the source or from the interaction of the emissions from multiple sources), apply a non-steady-state air quality model with chemical transformation capabilities (refer to EPA's *Guideline on Air Quality Models*), which yields ambient concentrations of visibility-impairing pollutants. At each Class I receptor:
    - Calculate the change in extinction due to the source being analyzed, compare these changes with the reference conditions, and then compare these results with the thresholds given in section 3.3.3.
    - Utilize estimates of annual average natural visibility conditions for each Class I area as presented in Table 6, unless otherwise recommended by the FLM or permitting authority. Alternative estimates of visibility conditions are provided in Table 5 for consistency with State agencies that elected to use 20% best visibility for regional haze or BART implementations, or when FLMs recommend using the 20% best visibility as natural background.
- If first-level modeling results are above levels of concern, continue to consult with the Agencies to discuss other considerations (e.g., possible impact mitigation, more refined analyses).

This review process for distant/multi-source applications is portrayed schematically in Figure 1.

Recommendations for Evaluating Ozone Impacts (Revised)

- FLM actions or specific requests on a permit application will be based on the existing air pollution situation at the area they manage. These conditions include (1) whether or not actual ozone damage has occurred in the area, and (2) whether or not ozone exposure levels occurring in the area are high enough to cause damage to vegetation (i.e., phytotoxic O_3 exposures). Figure 2 shows the FLM review process to assess ozone impacts for a project that exceeds the initial annual emissions over distance (Q/D) screening criteria. As noted in Figure 2, ambient ozone concentrations are considered along with data from exposure response studies (EPA 2007b) to determine whether a source will cause or contribute to phytotoxic

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[2] Nevertheless, the FLMs are also concerned about resources in Class II parks and wilderness areas because they have other mandates to protect those areas as well. The information and procedures outlined in this document are generally applicable to evaluating the effect of new or modified sources on the AQRVs in both Class I and Class II areas, including the evaluation of effects as part of Environmental Assessments and/or Environmental Impact Statements under the National Environmental Policy Act (NEPA). However, FLAG does not preclude more refined or regional analyses being performed under NEPA or other programs.

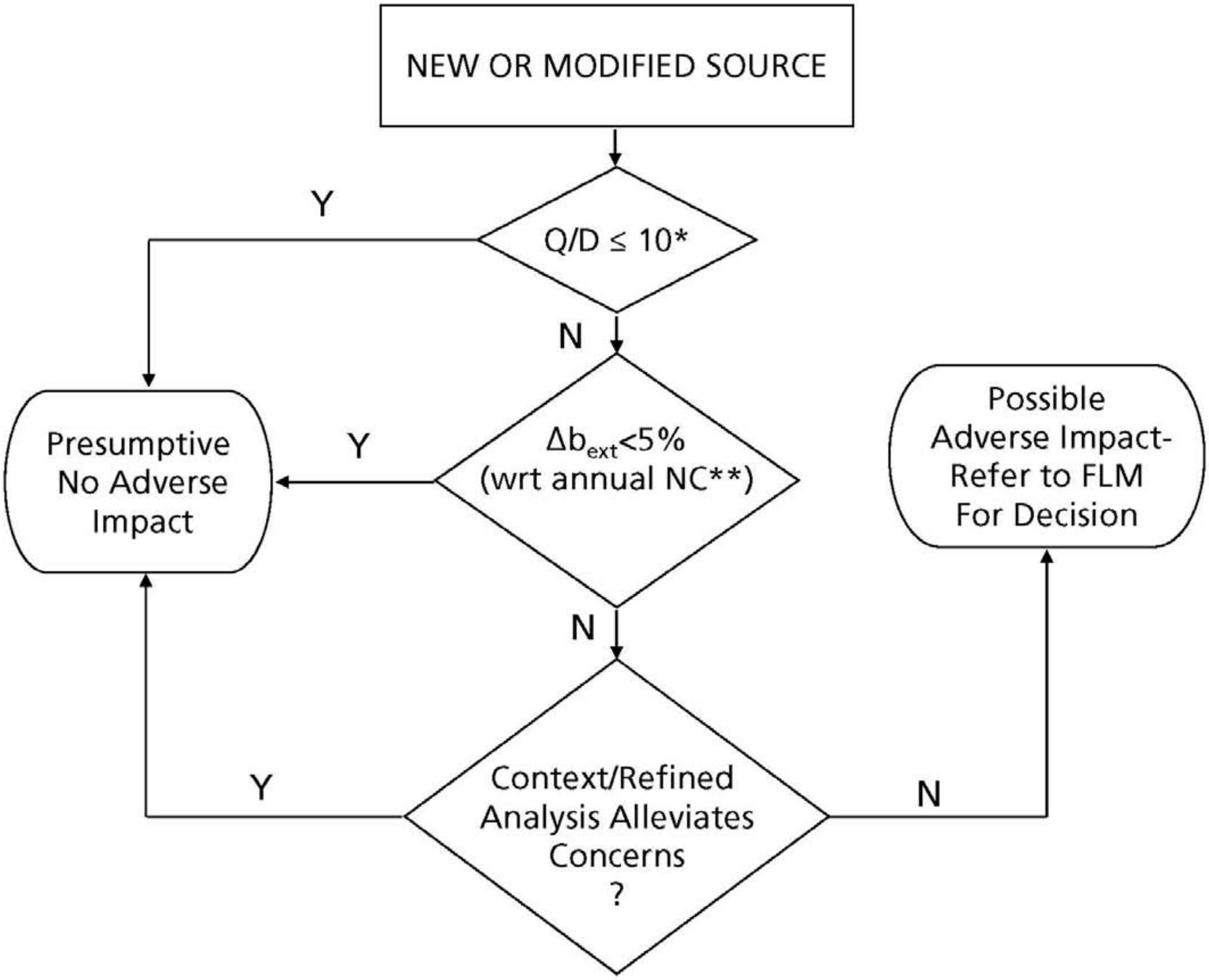

Figure 1. Procedure for Visibility Assessment for Distant/Multi-Source Applications (Revised)
*Q/D test only applies to sources located greater that 50 km from a Class I area.
**Difference Change in the 98th percentile with respect to (wrt) the annual average Natural Condition (NC). Applicant should use the 20th percentile best natural condition background if recommended by the FLM or permitting authority.

ozone levels (i.e., levels toxic to plants) at the affected site. The FLM may ask the applicant to calculate the ozone exposure values if these data are not already available. Ozone damage to vegetation is determined from field observations at the impacted site.

- Oxidant stipple necrosis on plant foliage and ozone-induced senescence infer adverse physiological or ecological effects, and are considered to be damage if they are determined to have a negative impact on aesthetic value.
- Established ozone metrics to describe ozone exposure are referenced.
- NO_x and VOC emissions are of concern because they are precursors of ozone. Current information indicates most FLM areas are NO_x limited. Until we determine the VOC or NO_x status of each area, we will focus on NO_x emission sources.

Recommendations for Evaluating Deposition Impacts (Revised)

For a project that exceeds the initial annual emissions over distance (Q/D) screening criteria, the permit applicant should consult with the appropriate regulatory agency and FLM for the affected area(s) to determine if a deposition impact analysis should be done (i.e., expected sulfur and/

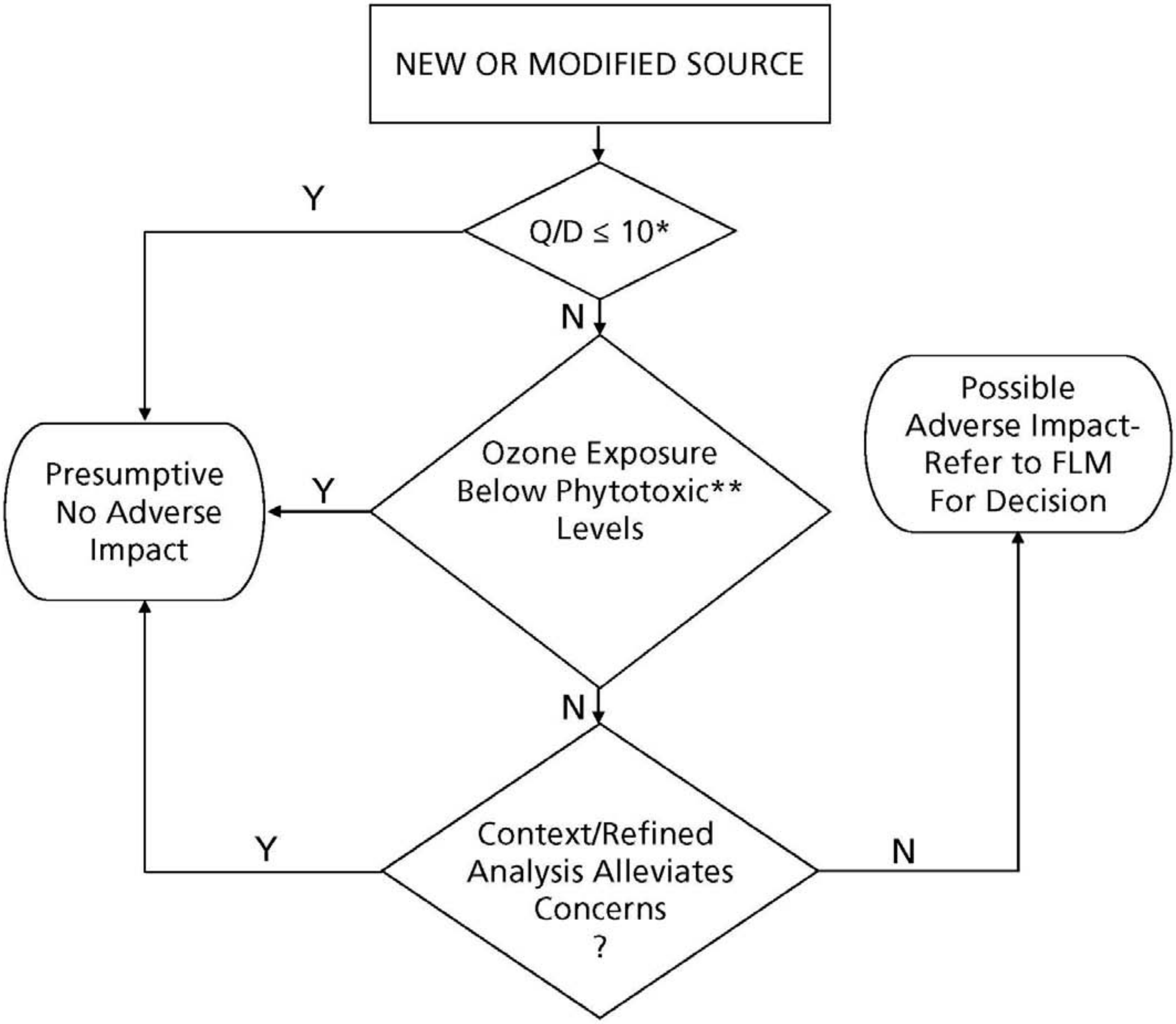

Figure 2. FLM Assessment of Potential Ozone Effects from New Emissions Source (Revised)
*Q/D test only applies to sources located greater that 50 km from a Class I area.
**Note: Ambient ozone concentrations are considered along with data from exposure response studies (EPA 2007b) to determine whether a source will cause or contribute to phytotoxic ozone levels (i.e., levels toxic to plants) at the affected site.

or nitrogen deposition impacts are above the Deposition Analysis Threshold (DAT) or concern threshold (see section 3.5.6). Please note that although mercury and other toxic emissions are of interest to the FLM, the deposition impact analyses discussed here applies only to nitrogen and sulfur emissions. If an analysis is advised, the permit applicant should obtain available information on Class I AQRVs, critical loads, and concern thresholds from the FLM. In addition, the applicant should refer to section 3.5.6 'Recommendations for Evaluating Potential Effects from Proposed Increases in Deposition to an FLM Area' section of the Deposition Chapter. The following steps summarize that process.

- From the respective Agency web sites, identify available on-site or representative wet and dry deposition data for the FLM area.
- Estimate the future deposition rate by adding the existing rate, the new emissions' contribution to deposition, and the contribution of sources permitted but not yet operating, while subtracting emission reductions that will occur before the proposed source begins operation. Modeling of new, reduced, and permitted but not yet operating emissions' contribution to deposition should be conducted following EPA recommendations.
- Compare the future deposition rate with the recommended screening criteria (e.g., critical load,

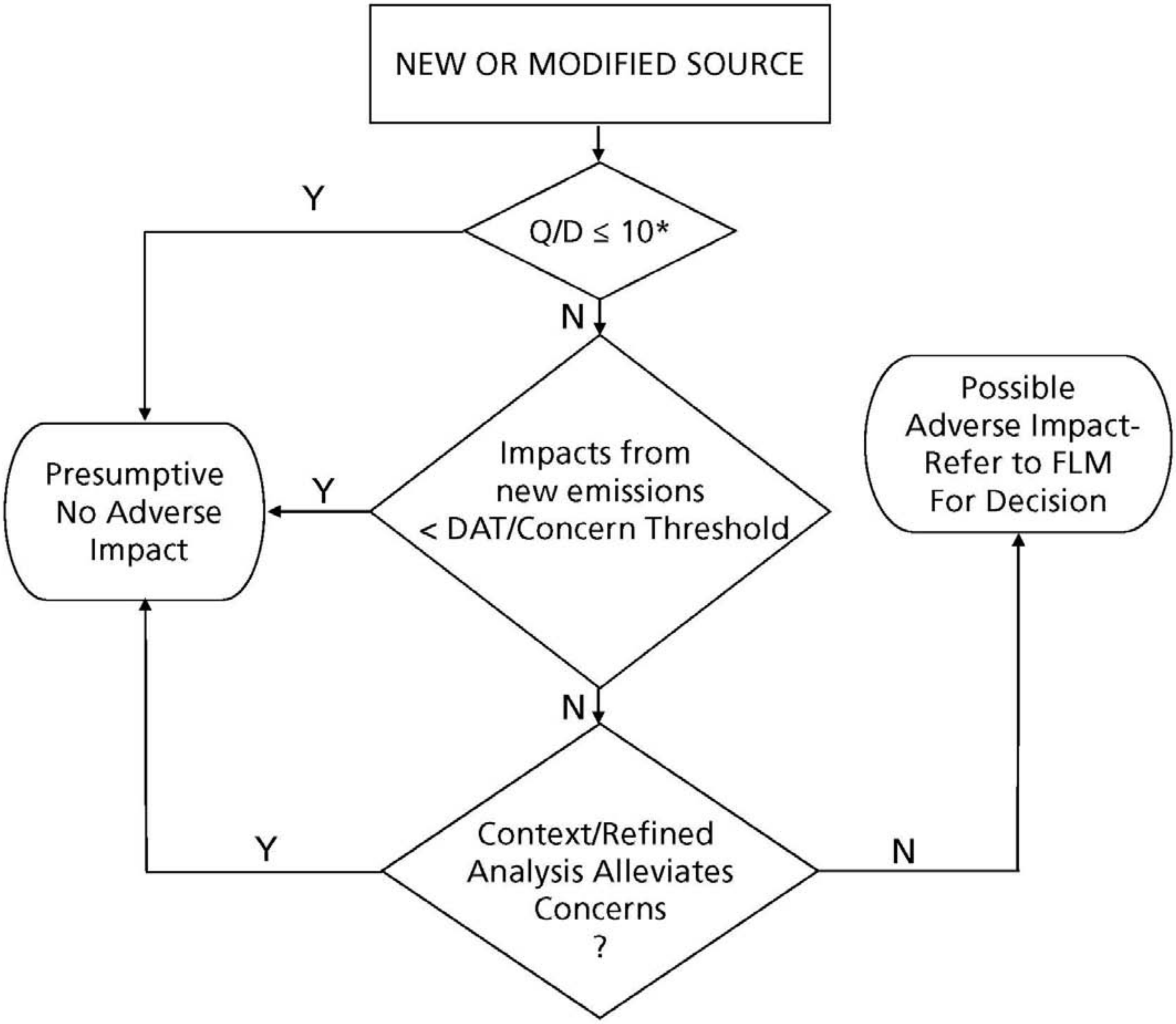

Figure 3. FLM Assessment of Potential Deposition Effects from New Emissions Sources (Revised)
*Q/D test only applies to sources located greater that 50 km from a Class I area.

concern threshold, or screening level value) for the affected FLM area. A list of documents summarizing these screening criteria, where available, can be found in Appendix G.

- Information for USFS Class I areas is also available at: http://www.fs.fed.us/air
- NPS and FWS Class I area information is available at: http://www.nature.nps.gov/air

- Figure 3 shows the FLM review process to assess deposition impacts from new emission sources.

1. Background

1.1. History (Revised)

The Clean Air Act Amendments of 1977 give Federal Land Managers (FLMs) an "affirmative responsibility" to protect the natural and cultural resources of Class I areas from the adverse impacts of air pollution (see Appendix B: 'Legal Framework for Managing Air Quality and Air Quality Effects on Federal Lands'). FLM responsibilities include the review of air quality permit applications from proposed new or modified major pollution sources near these Class I areas. If, in its permit review, an FLM demonstrates that emissions from a proposed source will cause or contribute to adverse impacts on the air quality related values (AQRVs) of a Class I area, the permitting authority, typically the State, can deny the permit.

The FLMs' role in the reviewing of permit applications focuses on impacts to Class I areas.[3] Individually, FLMs have developed different approaches to identifying AQRVs and defining adverse impacts on AQRVs in Class I areas. For example, in 1988, the U.S. Department of Agriculture Forest Service (USFS) conducted a national screening process to identify the AQRVs for each of its Class I areas. Using this national process as a starting point, each USFS Region refined the screening parameters and identified sensitive AQRVs for many Class I areas. However, this resulted in differences in the approaches and levels used by USFS Regions. The U.S. Department of the Interior National Park Service (NPS) and the U.S. Fish and Wildlife Service (FWS) have adopted a case-by-case approach to permit review, considering the most recent information available for each area. NPS and FWS have included lists of sensitive AQRVs for their Class I areas in their Air Resources Information System (ARIS) database.

1.1.1. FLAG Approach (Revised)

Air resource managers from the USFS, NPS, and FWS recognized the need for a more consistent approach among their agencies with respect to their efforts to protect AQRVs. In April 1997, an interagency Work Group was formed whose objective was "to achieve greater consistency in the procedures each agency uses in identifying and evaluating AQRVs." The Work Group named itself the Federal Land Managers' Air Quality Related Values Work Group, or FLAG. Although FLAG membership comprises air resource managers and subject matter experts from the three agencies, representatives from the Bureau of Land Management, the U.S. Environmental Protection Agency (EPA), U.S. Geological Survey, and State air agencies have also participated in FLAG efforts.

UL Bend National Wildlife Refuge, Montana.
Credit: Maribeth Oaks/The Wilderness Society

FLAG participants have collaborated to:

- define sensitive AQRVs,
- identify the critical loads (or pollutant levels) that would protect an area and identify the criteria that define adverse impacts, and
- standardize the methods and procedures for conducting AQRV analyses.

To accomplish its objective, FLAG started with (and will continue to build on) the procedures, terms, definitions, and screening levels common to the three agencies. Many such "commonalities" were identified early in the FLAG planning sessions (see section 1.4, 'Commonalities Among Federal Land Managers').

FLAG's "Action Plan" stipulates a phased approach. Phase I addressed issues that could be resolved without research or the collection of new data. When the Agencies embark on FLAG Phase II, they will address the more complex and unresolved issues from Phase I that may require additional data collection (see section 5, 'Future FLAG Work').

The FLAG effort focuses on the effects of the air pollutants that could affect the health of resources in Class I areas, primarily pollutants such as ozone, particulate matter, nitrogen dioxide, sulfur dioxide, nitrates, and sulfates. In Phase I, FLAG concentrated on four issues: (1) terrestrial effects of ozone; (2) aquatic and terrestrial effects of wet and dry pollutant deposition; (3) visibility impairment; and (4) process and policy issues. Four subgroups, one for each of

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[3] Nevertheless, the FLMs are also concerned about resources in Class II parks and wilderness areas because they have other mandates to protect those areas as well. The information and procedures outlined in this document are generally applicable to evaluating the effect of new or modified sources on the AQRVs in both Class I and Class II areas, including the evaluation of effects as part of Environmental Assessments and/or Environmental Impact Statements under the National Environmental Policy Act (NEPA). However, FLAG does not preclude more refined or regional analyses being performed under NEPA or other programs.

these issues, were formed and charged with developing a set of recommendations for consistent policies and processes.

FLAG 2000's findings and technical recommendations underwent scientific peer review, as well as review by agency decision-makers such as Class I area Park Superintendents, Refuge Managers, and Forest Supervisors; Regional Foresters; and the Assistant Secretary for Fish and Wildlife and Parks. (Note: USFS has designated the FLM as the Regional Foresters and, in some cases, Forest Supervisors.) FLAG products have also undergone public review and comment. A "notice of availability" of the draft FLAG 2000 report was published in the *Federal Register*, and the FLMs conducted a public meeting to discuss the draft FLAG report and provided a 90 day public comment period. For the FLAG 2010 revisions, the FLMs announced the availability of the draft report in the *Federal Register* and provided a 60 day public comment period. There was not sufficient public interest to conduct a public meeting to discuss the proposed revisions to the FLAG report.

1.1.2. FLAG Organization

In addition to the four subgroups (policy, deposition, ozone, and visibility), the FLAG organization included Leadership and Coordinating Committees and a Project Manager. The Leadership Committee, which includes the air quality program chiefs from the three FLM agencies, was responsible for providing direction to the Work Group and the resources necessary for FLAG to accomplish its objective. The Coordinating Committee, which also includes representatives from each agency, was responsible for communications within the Work Group, including coordination among the agencies and subgroups. The FLAG Project Manager coordinated FLAG activities, served as a single point-of-contact for the subgroups, and performed other administrative functions.

1.2. Overview of Resource Issues (Revised)

Research conducted on Federal lands by FLMs and others has characterized natural resource effects associated with air pollution, and has helped identify those particular resources that are vulnerable to pollution in different areas. This effort does not address the impacts from air pollution on cultural resources. Documented effects include impairment of visibility, injury and reduced growth of vegetation, and acidification and fertilization of soils and surface waters. Air pollution effects on resources have been identified in a number of FLM areas; a few examples are provided below. It is important to note that similar, or even more serious, air pollution effects may be occurring on all Federal lands, but FLMs have not had the financial resources to perform the inventorying, monitoring, and/or research necessary to document such effects. Furthermore, the sensitivity of resources may vary from area to area because the nature of the resource, as well as geological, meteorological, biological, and other factors, vary from place to place.

1.2.1. Visibility

Visitors to national parks and wildernesses list the ability to view unobscured scenic vistas as a significant part of a satisfying experience. Unfortunately, visibility impairment has been documented in all Class I areas with visibility monitoring. Most visibility impairment is in the form of regional haze. The greatest visibility impairment due to regional haze occurs in the eastern United States and in southern California, while the least impairment occurs in the Colorado Plateau and Nevada Great Basin areas, and in Alaska. Ammonium sulfate contributes at least 50% to visibility impairment at most Class I areas in the eastern United States. The contribution to visibility impairment from ammonium nitrate is highest in central and southern California and in the Midwest. The largest region of high rural organic carbon visibility impairment is in the southeastern United States; impairment in this range is also present in the Sierra Nevada region of California and in the northern Rockies of Montana. The highest contribution to visibility impairment from fine soil is found in the arid Southwest. The highest coarse particle contribution to impairment is also in the arid Southwest and southern California. (DeBell et al. 2006) Visibility impairment on Federal lands can also result from plume intrusion and has been documented in Mount Zirkel Wilderness, Moosehorn National Wildlife Refuge, and Grand Canyon National Park.

1.2.2. Vegetation

While several components of air pollution (e.g., sulfur dioxide, nitrogen dioxide, and peroxyacyl nitrates) can affect vegetation, ozone is generally acknowledged as the air pollutant causing the greatest amount of injury and damage to vegetation. The most common visible effects are stipple (dark colored lesions on leaves resulting from pigmentation of injured cells), fleck (collapse of a few cells in isolated areas of the upper layers of the leaf, resulting in tiny light-colored lesions), mottle (degeneration of the chlorophyll in certain areas of the leaf giving the leaf a blotchy appearance), necrosis (death of tissue), and in extreme cases, mortality. Aside from visible injury, ozone exposure can result in less obvious physiological impairment such as decreased growth or altered carbon allocation.

Ozone fumigation experiments have identified a number of plant species that are sensitive to ozone. For example, fumigations were conducted in Great Smoky Mountains National Park (Tennessee and North Carolina) from 1987 to 1992. On the basis of foliar injury, thirty species were rated as sensitive to ozone levels that occurred in the park. The species with foliar injury included black cherry (*Prunus serotina*) and American sycamore (*Platanus occidentalis*). Additional observations and physiological measurements indicated elevated ozone concentrations reduced leaf, root, and total dry weights, and increased the severity of leaf stipple and premature leaf abscission in these two species (Neufeld and Renfro 1993a,b). Field observations have documented foliar injury of these species in other eastern United States areas such as Brigantine Wilderness (New Jersey) and Cape Romain Wilderness (South Carolina).

Ponderosa pine (*Pinus ponderosa*) and Jeffrey pine (*Pinus jeffreyi*) are recognized as good candidates for ozone-injury surveys in the western United States, based on their documented sensitivity. For example, these species were examined for ozone injury in national parks and national forests in the California Sierra Nevada from 1991 to 1995. The sites surveyed included Lassen Volcanic, Yosemite, and Sequoia/Kings Canyon National Parks and the Tahoe, Eldorado, Stanislaus, Sierra, and Sequoia National Forests. Foliar injury attributable to ozone was found at all areas, and the extent of injury generally increased in a southward direction along the Sierra Nevada (Miller 1995).

1.2.3. Soils and Surface Waters

Acidity in rain, snow, cloud water, and dry deposition can affect soil fertility and nutrient cycling processes in watersheds and can result in acidification of lakes and streams with low buffering capacity. Deposition of sulfate to sensitive watersheds results in leaching of base cations, soil acidification, and surface-water acidification. In some soils, sulfate adsorption results in "delayed" acidification of surface waters. Deposition of excess nitrogen species (nitrate and ammonium) to both terrestrial and aquatic systems can result in acidifying streams, lakes, and soils. There is also evidence that nitrogen deposition can cause shifts in phytoplankton composition in lakes in which biological activity is limited by nitrogen availability, i.e., increased nitrogen deposition can cause phytoplankton species that use nitrogen more efficiently to eventually dominate the lake.

Water chemistry surveys and on-going monitoring show that many high elevation lakes on Federal lands in the Sierra Nevada, Cascades, and Rocky Mountains are sensitive to acid deposition. In general, these lakes are on bedrock that provides them with very little buffering capacity. Some of these lakes, for example, Loch Vale in Rocky Mountain National Park (Colorado) experience episodic acidification during Spring snow melt (Baron and Campbell 1997).

Through funding provided by the Southern Appalachian Mountains Initiative, Herlihy et al. (1996) compiled information on surface water sensitivity of streams in nine of the eleven Class I areas in the Southern Appalachians. The nine Class I areas were grouped according to geology, physiography, and stream chemistry, then the groupings were ranked in terms of effects. Class I areas in the West Virginia Plateau (Otter Creek and Dolly Sods Wildernesses) had the highest percentage of acidic stream length and lowest pH values. Class I areas in the Northern and Southern Blue Ridge (e.g., Shenandoah National Park in Virginia and Joyce Kilmer/Slickrock Wilderness in North Carolina) had a lower percentage of acidic stream length, however, streams with low buffering capacity were common. The Alabama Plateau Class I area (Sipsey Wilderness) had streams with the highest buffering capacity. (Note that the authors based their report on surveys conducted by others and did not account for potential differences in methods of data collection.)

A number of Federal areas contain estuarine and coastal areas that may experience eutrophication as a result of excess nitrogen deposition resulting from air pollution and other sources of nitrogen. For example, symptoms of eutrophication, including nutrient enrichment and algal blooms, have been observed in Everglades National Park and Chassahowitzka Wilderness (Florida).

1.3. Legal Responsibilities (Revised)

The specific legal responsibilities that Congress has given FLMs to protect natural, cultural, and scenic resources on the public lands from air pollution are identified in Appendix B. Statutes described in Appendix B include agency organic acts, the Wilderness Act, and the Clean Air Act (CAA).

The fundamental Congressional direction for managing public lands arises out of respective organic acts. Each of these laws is essentially a charter from Congress to the Executive Branch providing a purpose for parks, wildernesses, and refuges, respectively, and establishing broad management objectives for these areas. The Wilderness Act sets aside a subset of these public lands where natural processes are allowed to dominate. The agency stewards develop specific management objectives building on the organic acts using public involvement, regulations, best available science, and additional direction provided by Congress.

Among this additional Congressional direction is the Clean Air Act (CAA). It further characterizes some of the public lands as "Class I" areas and bestows on the land managers an affirmative responsibility to protect these areas from air pollution. The CAA directs that the FLMs identify and protect air quality related values, including visibility. This direction is consistent with the underlying charters provided by the organic acts and the Wilderness Act. The similarities of management objectives, and of the policies and procedures necessary for protecting Class I areas, are at the core of the FLAG process. Please note that although all wilderness is not Class I, and the FLMs have not proposed that non-Class I wilderness be classified as Class I, management actions (e.g., limiting human activities) that satisfy wilderness management objectives for Class II areas, are often substantially the same as those used in Class I area management.

In implementing laws, it is essential to understand the intent of Congress. In the case of the CAA, the FLM gleans additional insight from a passage in Senate Report No. 95-127, 95th Congress, 1st Session, 1977 which states:

> The Federal Land Manager holds a powerful tool. He is required to protect Federal lands from deterioration of an established value, even when Class I [increments] are not exceeded. … While the general scope of the Federal Government's activities in preventing significant deterioration has been carefully limited, the FLM should assume an aggressive role in protecting the air quality values of land areas under their jurisdiction. In cases of doubt the land manager should err on the side of protecting the air quality-related values for future generations.

Although the FLMs have an "affirmative responsibility" to protect AQRVs, they have no permitting authority under the CAA, and they have no authority under the CAA to establish air quality-related rules or standards. The FLM role within the regulatory context consists of considering whether emissions from a new source, or emission increases from a modified source, may have an adverse impact on AQRVs and providing comments to permitting authorities (States or EPA). It is important to emphasize that the FLAG report only explains factors and information the FLMs expect to use when carrying out their consultative role. It is not a rule or standard.

The FLAG report describes the steps and process that the FLMs intend to go through in order to perform their statutory duties. Consequently, the scope of the FLAG report is to provide a more consistent approach for the three FLM agencies to evaluate air pollution effects on resources, and to provide guidance to permitting authorities and permit applicants regarding necessary AQRV analyses. Although FLAG strives to be consistent with regulatory programs and initiatives such as the Regional Haze Rule and New Source Review Reform, no direct ties exist between FLAG and these regulatory requirements.

1.4. Commonalities Among Federal Land Managers

If a new source is proposed near two or more areas managed by different FLMs, the FLMs generally try to coordinate in their interactions with the permitting authority and with the applicant. For example, two or more FLMs involved in pre-application meetings typically try to minimize the workload for the applicant by reaching agreement on the types of analyses the application should contain. Beyond coordinating during permit review, FLMs currently base requests and decisions on similar principles regarding resource protection and FLM responsibilities. Listed below are the common principles in five areas of air resource management. In addition, Appendix C provides the FLM's 'General Policy for Managing Air Quality Related Values in Class I Areas.'

1.4.1. Identifying AQRVs (Revised)

FLMs agree on the following definition of an AQRV:

> A resource, as identified by the FLM for one or more Federal areas that may be adversely affected by a change in air quality. The resource may include visibility or a specific scenic, cultural, physical, biological, ecological, or recreational resource identified by the FLM for a particular area.

This definition is compatible with the general definition of AQRV that appears in the *Federal Register* (45 FR 43003, June 25, 1980). That definition includes visibility, flora, fauna, odor, water, soils, geologic features, and cultural resources. FLMs have the responsibility to identify specific AQRVs of areas they manage. To this end, FLMs further refine AQRVs beyond the above definition to be more site-specific (i.e., area specific) by using on-site information. To the extent possible, the FLMs have identified specific AQRVs for many Class I areas. Site-specific AQRV lists are available on the respective Agency web sites, or by contacting the Agencies directly. The FLMs also recognize that, ideally, inventories should be developed for all Class I areas. The FLMs may identify additional AQRVs in the future as more is learned through science about the sensitivity of resources to air pollution. A public process involving the regulated community and other interested members of the public is necessary and will be accomplished through participation in the land management planning process or reply to an announcement in the *Federal Register*. Finally, FLMs agree on the need for continued inventory, research, and monitoring to improve their ability to determine which AQRVs are most sensitive to air pollution and the sensitivity of these AQRVs.

1.4.2. Determining the Levels of Pollution that Trigger Concern for the Well-Being of AQRVs (Revised)

FLMs acknowledge the importance of being able to agree among themselves on the levels of pollution that trigger concerns for AQRVs. FLMs recognize the need to assess cumulative impacts and the difficulties associated with this process. Difficulties arise when a large number of minor source impacts eventually lead to an unacceptable cumulative impact or when a new source applies for a PSD permit in an area that has a high background concentration of pollution from existing sources. The agencies will evaluate a proposed new source within the context of the total impacts that are occurring or that potentially could occur from permitted/existing sources on the AQRVs of the area and should consider the effects of both emission increases and decreases.

1.4.3. Visibility

FLMs use EPA-approved models [Appendix W of Part 51 (EPA's *Guideline on Air Quality Models*, revised November 2005), as required under the PSD regulations at 40 CFR 51.166(1) and 52.21(1)] and the recommendations of the Interagency Work Group on Air Quality Modeling (IWAQM) to evaluate visibility impacts. The models use thresholds of visibility degradation measured in light extinction to evaluate source impacts to haze (far-field/multi-source impacts), and EPA established criteria for coherent plume impacts (near-field impacts). Currently all FLMs use Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring data to determine current conditions for visibility in FLM areas.

1.4.4. Biological and Physical Effects

All FLMs rely on research, monitoring, models, and effects experts to identify and understand physical, biological, and chemical changes resulting from air pollution and relating them to changes in AQRVs. Further, they focus on sensitive AQRVs (defined as either species or processes) to assess this biological/physical/chemical change.

1.4.5. Determining Pollution Levels of Concern (Revised)

FLMs rely on the best scientific information available in the published literature and best available data to make informed decisions regarding levels of pollution likely to cause adverse impacts. FLMs re-evaluate, update, and assess this information as appropriate. They consider specific Agency and Class I area legislative mandates in their decisions and, in cases of doubt, "err on the side of protecting the AQRVs for future generations." (Senate Report No. 95-127, 95th Congress, 1st Session, 1977)

For air quality dispersion modeling analyses, FLMs follow Appendix W of Part 51 (EPA's *Guideline on Air Quality Models*, revised November 2005), as required under the PSD regulations at 40 CFR 51.166(1) and 52.21(1), and the recommendations of the Interagency Work Group on Air Quality Modeling (IWAQM). FLMs recommend protocols for modeling analyses to permit applicants on a case-by-case basis considering types and amount of emissions, location of source, and meteorology. When reviewing modeling and impact analysis results, all FLMs consider frequency, magnitude, duration, location of impacts, and other factors, in determining whether impacts are adverse.

1.4.6. FLM Databases (Revised)

Air Resources Information System (ARIS) (Formerly Air Synthesis) (Revised)

ARIS provides information on air quality related values in NPS and FWS Class I areas, as well as in many NPS Class II areas. ARIS identifies specific AQRVs, and provides information on air quality and its effects in parks and wildernesses.

Natural Resource Information System – Air Module (NRIS-AIR) (Revised)

Publicly available USDA Forest Service Class I and II area information and related resource data can be linked to or found at http://www.fs.fed.us/air. If desired information and data cannot be found, contact any air program manager or specialist at national or regional offices for assistance.

1.5. Regulatory Developments Since FLAG 2000 (New)

Several regulatory developments have occurred since the FLMs published the FLAG report in December 2000. Some of these regulatory developments may have a significant effect on air resource management in mandatory Class I areas, or how these effects are assessed. First, on April 15, 2003, the Environmental Protection Agency (EPA) promulgated revisions to Appendix W of 40 C.F.R. §51 (*Guideline on Air Quality Models*). EPA revised the Guideline to adopt the CALPUFF model as a preferred long-range transport model for inclusion in Appendix A of that document. Prior to that date, FLAG 2000 relied on CALPUFF as the suggested model of choice for long-range transport assessments in accordance with recommendations of the Interagency Work Group on Air Quality Models (IWAQM). EPA's adoption of CALPUFF substantiates the Agencies' model choice. In addition, EPA's action, combined with improved computer technology, has resulted in the availability of more meteorological data. These improvements have enhanced the ability of permitting authorities and applicants to perform the types of modeling analyses suggested in FLAG. However, the FLMs will continue to work with the EPA on recommendations for future long-range transport model development.

On May 12, 2005, the EPA published the Clean Air Interstate Rule (CAIR) to reduce interstate transport of fine particulate matter and ozone. The CAIR applied to 28 eastern states and the District of Columbia, and required those areas to significantly reduce emissions of sulfur dioxide (SO_2) and/or nitrogen oxides (NO_x) from utilities. Although EPA developed the CAIR to address violations of the National Ambient Air Quality Standards (NAAQS) for fine particulates ($PM_{2.5}$) and ozone, the associated SO_2 and NO_x emission reductions would also benefit visibility and other AQRVs at many eastern Class I areas. The Agencies supported the CAIR, however, because it did not apply to western states, the majority of the Class I areas would not have directly benefited from the rule. Please note that at the time of this writing CAIR has been remanded to the EPA for revision to address various court challenges, and EPA has proposed a new transport rule as a replacement (EPA 2010a).

On July 6, 2005, the EPA published a final rule and associated guidelines that detail the Best Available Retrofit Technology (BART) requirements of the Regional Haze Rule. Among other things, the BART guidelines advise States to rely on the CALPUFF model for long-range visibility impairment assessments, provide thresholds for what constitutes causing or contributing to regional haze visibility impairment, and includes screening level values that exempt certain sources from further analysis. As discussed in more detail below, the Agencies believe the assumptions and methodology included in the BART guidelines also have merit with respect to evaluating haze-like visibility impairment for New Source Review under the PSD and other programs. Consequently, the Agencies are paralleling some of those BART guidelines in this FLAG revision.

Please note that FLAG 2000 acknowledges the EPA's July 1999 Regional Haze Rule, and discusses possible changes to FLAG that may be necessary as States implement the Regional Haze Rule. Although the EPA promulgated the Regional Haze Rule before the FLMs published FLAG 2000, there were several improvements and differences in the associated EPA guidance documents (e.g., those related to Natural Conditions and Tracking Progress) that were not finalized until December 2003. Therefore, these documents were not reflected in FLAG 2000, but have been considered in this revision. Currently, State Implementation Plans (SIPs) under the Regional Haze Rule are being developed, and submitted to the EPA for approval. If the new visibility SIPs adequately account for new source growth, the Agencies may need to make further revisions to the FLAG recommendations to reflect progress made through the SIP process that could minimize the focus the FLMs place on individual sources.

EPA has also developed other regulations, standards, and policies that will help reduce air pollution and resulting impacts at FLM areas (e.g., revised ozone, sulfur dioxide, nitrogen dioxide, and particulate matter standards; mobile source controls).

2. Federal Land Managers' Approach to AQRV Protection

FLM responsibilities for resource protection on Federal lands are clear and there should be no misunderstanding regarding the tools the FLM uses to fulfill these responsibilities. Opportunities to influence decisions regarding pollution sources external to the park or wilderness are limited. However, FLMs strive to minimize emissions from internal sources and their effects. Approaches for minimizing air pollution from external and internal sources are discussed in detail below.

2.1. AQRV Protection and Identification (Revised)

Congress assigned the FLMs an affirmative responsibility to protect AQRVs in Federal Class I areas. The FLMs interpret this assignment as a responsibility to:

- Identify AQRVs in each of the Class I areas.
- Establish inventorying and monitoring protocols for AQRVs.
- Prioritize AQRV inventorying and monitoring.
- Specify a process for evaluating air pollution effects on AQRVs, including the use of sensitive indicators.
- Specify adverse effects for each AQRV.

To the extent possible, AQRVs have been identified for each Class I area. As noted above, the FLMs may identify additional AQRVs in the future as more is learned about the sensitivity of resources to air pollution. The FLMs will provide a public process involving the regulated community and other interested members of the public in order to seek public input regarding AQRV-identification issues. This desired public involvement will be accomplished through participation in the land management planning process or reply to an announcement in the *Federal Register*.

While the sensitivity of an AQRV to air pollution may be known, long-term monitoring of the health or status of the AQRV may not have been accomplished. The expense of monitoring all AQRVs simultaneously is prohibitive. Consequently, FLMs seek opportunities through the permitting process and through partnerships to gather more information about condition of AQRVs.

Because AQRVs themselves are often difficult to measure, surrogates are used as indicators, or sensitive indicators, of the health or status of the AQRV. A working process for Class I area management and AQRV protection is outlined ahead in this document.

Sipsey Wilderness, Alabama.
Credit: Steve Boutcher

An adverse impact is determined for each AQRV. An adverse impact from air pollution results in a diminishment of the Class I area's national significance, that is, the reason the Class I area was created. Adverse impacts can also be an impairment of the structure or functioning of the ecosystem, as well as an impairment of the quality of the visitor experience. The FLMs make an adverse impact determination on a case-by-case basis, based on technical and other information, which is then conveyed to the permitting authority.[4] The permitting authority then considers this, along with other factors, in its determination regarding the permit application.

2.2. New Source Review (Revised)

Section 165 of the CAA spells out the roles and responsibilities for FLMs in New Source Review, including the Prevention of Significant Deterioration (PSD) permitting program. Other laws, such as the respective agency organic acts and the Wilderness Act, provide the fundamental underpinning of land management direction to land managers. The following discussion merges this complex labyrinth of legal responsibilities as it relates to air resource management.

2.2.1. Roles and Responsibilities of FLMs (Revised)

The federal officials directly responsible for the national parks, national wildlife refuges, and national forests (e.g., park superintendents, refuge managers, and forest supervisors, respectively) derive their responsibility from the respective agency organic acts. Furthermore, these officials, and the FLM for the respective agencies, have an affirmative responsibility under Section 165 of the CAA to protect and

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[4] As discussed elsewhere in this report, if a proposed source's impacts on AQRVs exceed established significance criteria, the FLMs will consider the magnitude, frequency, geographic extent, etc. of the impacts, and other relevant factors, in determining whether or not the impacts are adverse.

enhance the AQRVs of Class I areas from the adverse effects of air pollution. The FLM for the USFS is the Regional Forester or the Forest Supervisor depending on the specific location. The FLM for the NPS and FWS is the Department of the Interior's Assistant Secretary for Fish and Wildlife and Parks.

The FLMs have visibility protection responsibility under 40 CFR §51.307 (New source review), which spells out the requirements for State Implementation Plan (SIP) visibility protection programs, as well as 40 CFR §52.27 (Protection of visibility from sources in attainment areas) and 40 CFR §52.28 (Protection of visibility from sources in non-attainment areas). These three provisions, taken together along with the SIP-approved rules, establish the visibility protection program for new and modified sources throughout the country.

Notification

Section 165 (42 USC 7475) of the CAA requires the EPA, or the State/local permitting authority, to notify the FLM if emissions from a proposed project may impact a Class I area. The permitting authority should forward PSD applications to the FLM for review and analysis as soon as possible after receipt, giving the FLM an opportunity to review the application concurrently with the permitting authority.

Generally, the permitting authority should notify the FLM of all new or modified major facilities proposing to locate within 100 km (62 miles) of a Class I area. In addition, the permitting authority should notify the FLM of "very large sources" with the potential to affect Class I areas proposing to locate at distances greater than 100 km. (Reference March 19, 1979, memorandum from EPA Assistant Administrator for Air, Noise, and Radiation to Regional Administrators, Regions I - X). Given the multitude of possible size/distance combinations, the FLMs can not precisely define in advance what constitutes a "very large source" located more than 100 km away that may impact a particular Class I area. However, as discussed elsewhere in this report, the Agencies have adopted a size (Q)/distance (D) criteria to screen out from AQRV review those sources with relatively small amounts of emissions located a large distance from a Class I area. Consequently, as a minimum, the permitting authority should notify the FLM of all sources that exceed this Q/D criteria. Nevertheless, the FLM and permitting authority should still work together to determine which other PSD applications the FLM is to be made aware of in excess of 100 km. In making this determination, the FLM and permitting authority should consider, on a case-by-case basis, such factors as:

- Current conditions of sensitive AQRVs;
- Magnitude of emissions;
- Distance from the Class I area;
- Potential for source growth in an area/region;
- Existing/prevailing meteorological conditions;
- Cumulative effects of several sources to AQRVs, as well as changes in their emissions.

Additionally, such dialogue facilitates coordination between permitting authorities and the FLMs. The significance of the impact to AQRVs is more important than the distance of the source. Not all PSD permit applications that the FLM is notified of will be analyzed in-depth by the FLM. FLM notification of a PSD permit application for a project located greater than 100 km does not mean that the permit application will be reviewed by the FLM in detail. Notification of PSD permit applications in excess of 100 km by the permitting authority allows the FLM to gauge the level of potential cumulative effects. As indicated above, the FLM decides which PSD permit applications to review on a case-by-case basis depending on the potential impacts to AQRVs.

Pre-Application Meetings

To expedite the PSD permit review process, the FLM encourages pre-application meetings with permitting authorities and permit applicants to discuss air quality concerns for a specific Class I area in question. Given preliminary information, such as the source's location and the types and quantity of projected air emissions, the FLM can discuss specific AQRVs for an area and advise the applicant of the analyses needed to assess potential impacts on these resources.

Completeness Determination

To further minimize delays, the FLMs encourage the permitting authority to use comments provided by the FLM concerning the completeness of the application, and to not deem the application complete until the applicant performs all necessary air quality impact analyses, including all relevant AQRV impact information. The permitting authority should then notify the FLM when they deem the application to be complete.

Visibility Protection Procedures

Additional procedural requirements apply when a proposed source has the potential to impair visibility in a Class I area (40 CFR §52.27(d)(2007); 40 CFR §51.307(a)(2007)). Specifically, the permitting authority must, upon receiving a permit application for a source that may affect visibility in any Class I area, notify the FLM in writing. Such notification shall include a copy of all information relevant to the permit application, including the proposed source's anticipated impacts on visibility in a Class I area. The permitting authority shall notify the FLM within 30 days of receipt and at least 60 days prior to the close of the comment period.

If the FLM notifies the permitting authority that the proposed source may adversely impact visibility in a Class I area, or may adversely impact visibility in a previously identified integral (scenic) vista, then the permitting authority is to work with the FLM to address their concerns. If the permitting authority agrees with the FLM's finding that visibility in a Class I area may be adversely affected, the permit may not be issued. Even though the permitting authority may agree with the FLM's adverse impact finding regarding integral vistas, the permitting authority may still issue a permit if the emissions from the source are consistent with reasonable progress toward the national goal of preventing or remedying visibility impairment. In making this decision, the permitting authority may take into account the costs of compliance, the time needed for compliance, the energy and non-air quality environmental impacts of compliance, and the useful life of the source.

The FLM will make a preliminary determination regarding possible adverse visibility impacts upon receipt of all relevant information, including the draft permit and any associated staff analysis.

2.2.2. Elements of Permit Review

The FLM review of a PSD application for a proposed project that may impact a Class I area generally consists of three main analyses:

1. Air quality impact analysis to ensure that predicted pollutant levels in Class I areas do not exceed National Ambient Air Quality Standards (NAAQS) and PSD increments, and to provide sufficient information for the FLM to conduct an AQRV impact analysis. Ensuring that permit applicants meet these requirements is the direct responsibility of the permitting authority (see discussion below);
2. AQRV impact analysis to ensure that the Class I area resources (i.e., visibility, flora, fauna, etc.) are not adversely affected by the proposed emissions. The AQRV impact analysis includes interpreting the significance of the results from the applicant's air quality impact analysis and is the responsibility of the FLM (see discussion below); and
3. Best Available Control Technology (BACT) analysis to help ensure that the source installs the best control technology to minimize emission increases from the proposed project (See Appendix D for a summary of this analysis). The final BACT determination is a direct responsibility of the permitting authority.

Air Quality Impact Analysis

The permit applicant must perform an air quality impact analysis for each pollutant subject to PSD review (40 CFR §51.166). This analysis must show the contribution of the proposed emissions to increment consumption and to the existing ambient pollution levels in a Class I park or wilderness area. The applicant must perform a cumulative increment analysis for each pollutant and averaging time for which the proposed source will have a significant impact. Because proposed sources are not yet operating, the air quality analysis should rely on mathematical dispersion models to estimate the air quality impact of the proposed emissions. The FLMs provide the applicants with guidance on where to place model receptors within the Class I area. The applicant is responsible to provide sufficient information for the FLM to make a decision about the acceptability of potential AQRV impacts as a consequence of the new source.

The applicant must perform the air quality impact analysis using approved models and procedures as specified in Appendix W of Part 51 (EPA's *Guideline on Air Quality Models*, revised November 2005), as required under the PSD regulations at 40 CFR 51.166(1) and 52.21(1). The applicant should explicitly state all assumptions for the analysis, and furnish sufficient information on modeling input so that the FLM can validate and duplicate the model results. FLMs encourage the permit applicant to submit a modeling protocol for review before performing the Class I modeling analyses. This protocol should include the proposed air quality analysis methodology and model input (i.e., emissions, stack data, meteorological data, etc.), and the proposed location of the receptors in the FLM area.

AQRV Impact Analysis

According to the CAA's legislative history and current EPA regulations and guidance, the air quality impact analysis that provides sufficient information to enable the FLM to conduct the AQRV impact analysis is one part of a permit application just as are the BACT analysis and the air quality impact analysis relative to the increments and NAAQS. The applicant bears the entire cost of preparing the permit application including the complete air quality impact analysis.

It is important to highlight the distinction between the air quality impact analyses that the applicant performs and the AQRV impact analyses that FLMs perform. Whereas the permit applicant calculates changes in pollutant concentrations, deposition rates, or visibility extinction, the FLM assesses the extent to which these impacts affect sensitive visual, aquatic, or terrestrial resources. Given the FLM's statutory responsibilities and expertise, the FLM must have responsibility to consider whether the amount of pollution dispersed into the air or deposited on the ground (or in water) would have an adverse impact on any AQRV, and if so, to demonstrate that claim to the permitting authority. In making an adverse impact finding, FLMs consider such factors as magnitude, frequency, duration, location, geographic extent, and timing of impacts, as well as current and projected conditions of AQRVs based on cumulative impacts.

The FLM uses the results from the applicant's air quality impact analysis and other information to conduct the

AQRV impact analysis and make an informed decision about whether or not AQRVs will be adversely affected. If the FLM concludes that AQRVs will be adversely affected, the FLM will so demonstrate to the permitting authority. The following sections of this document give guidance to applicants on how to conduct an air quality impact analysis and how the FLM uses this information to make an AQRV impact decision.

Cumulative Impact Analysis

The FLM will evaluate on a case-by-case basis both the permit applicant's contribution to the AQRV impacts, as well as the cumulative source impacts on AQRVs, taking into account expected emission reductions. A cumulative air quality analysis in which the proposed source and any recently permitted (but not yet operating) sources in the area are modeled is an important part of any AQRV impact analysis. This cumulative modeled impact is then added to measured ambient levels (to the extent that such monitoring data are available) so that the FLM can assess the total effect of the anticipated ambient concentrations on AQRVs. If no representative monitoring data are available, the total pollutant concentrations should be estimated by modeling emissions from all contributing sources in the area.

Information Provided by the FLM to the Applicant

To assist the permit applicant in performing air quality impact analyses, the FLMs will provide all available information about AQRVs for a particular Class I area that may be adversely affected by emissions from the proposed source. FLMs will recommend available methods the applicant should use to analyze the potential effects (i.e., pollutant concentration, deposition rates, and visibility extinction) in the Class I area. In addition to identifying AQRVs, FLMs will, to the extent possible:

- identify inventories, surveys, monitoring data, scientific studies, or other published reports that are the basis for identification of AQRVs;
- identify specific receptors known to be most sensitive to air pollution and the pollutant or pollutants that individually or in combination can cause or contribute to an adverse effect on each receptor;
- identify the critical pollutant concentrations above which adverse effects are known or suspected to occur;
- recommend methods the applicant should use for predicting ambient pollutant concentrations and other related impacts (e.g., deposition, visibility) which may cause or contribute to an adverse effect on each receptor; and
- suggest screening level values or criteria that would be used to assess whether a proposed emissions increase would have a *de minimis* impact on AQRVs.

2.2.3. FLM Permit Review Process

The FLM's current permit review process for any application that may impact a FLM area is described below.

1. **Pre-application.** If possible, participate in any pre-application meeting to learn specifics of the proposed project (size, emissions, location, etc.) and to provide information regarding recommended Class I analyses.
2. **Modeling Protocol.** The FLMs encourage the permit applicant to submit a modeling protocol for review before performing the Class I modeling analyses. This protocol should include the proposed air quality analysis methodology and model input (i.e., emissions, stack data, meteorological data, etc.), and the proposed location of the receptors in the FLM area.
3. **Completeness Determination.** Upon receipt, the FLM will review the application and provide comments to the permitting authority regarding the completeness of the application and the need for additional information regarding the BACT, Air Quality Impacts, and AQRV Impacts analyses. The FLM will coordinate with the permitting authority and the permit applicant to ensure that all the necessary information to enable the FLM to make an impact determination is included.
4. **Public Comment Period.** After review of all relevant information, the FLM will provide pertinent comments to the permitting authority, before or during the official public comment period, and/or at scheduled public hearings.
5. **No Class I Increment Violated and No Adverse Impacts.** If no Class I increment is violated and no adverse impacts to AQRVs are expected, the FLM will inform the permitting authority of this determination and no further FLM action is necessary. The FLM may still provide BACT comments.
6. **No Class I Increment Violated but AQRV Impacts Uncertain.** If no Class I increment is violated but uncertainty exists regarding potential adverse impacts to AQRVs, the FLM may request that the permitting authority include a permit condition that requires the permittee to conduct relevant post-construction AQRV or air quality monitoring. The FLM may also request certain control technologies or methods to reduce impacts.
7. **Class I Increment Violated, but No Adverse AQRV Impacts.** If the Class I increment is violated, but no adverse AQRV impacts are anticipated, the applicant requests the FLM to "certify" no adverse impact under Section 165(d)(2)C)(iii) of the Clean Air Act [42 USC 7475(d)(2)(C)(iii)(1998)]. If the FLM concurs, (s)he makes a preliminary determination that no adverse impacts will occur.

- The FLM will inform the applicant, the State/local permitting authority, and EPA of the preliminary no adverse impact determination.
- The FLM will notify the public of its preliminary no adverse impact determination either through the permitting authority's notice procedures, or through separate notice in the *Federal Register*. Such notice should include a statement as to the availability of supporting documentation for inspection and copying, and an announcement of at least a 30 day public comment period on issues directly relevant to the determination in question.
- The FLM will review and prepare response to public comments.
- The FLM will make a final determination regarding no adverse impacts, with a clear and concise statement of reasons supporting that determination.
- The FLM will inform the permit applicant, the permitting authority, and EPA of its final determination and if the final determination is "no adverse impact," the FLM shall so "certify" in a letter to the affected parties.
- Simultaneous with above, the FLM will publish a final determination in the 'Notice' section of the *Federal Register*, including a clear and concise statement of reasons supporting that determination, statement as to availability of supporting documentation for inspection and copying, and statement as to immediate effective date (date signed) of final determination.
- The FLM will contact the permitting authority and request a revision to the State Implementation Plan (SIP) to eliminate the Class I increment violations.

8. **Adverse Impact Determination**. Regardless of increment status, the FLM may make a preliminary determination that the proposed project will cause, or contribute to, an adverse impact on AQRVs. Before officially declaring an adverse impact, the FLM will inform the proposed new source and the permitting authority that an adverse impact determination is imminent and suggest that the draft permit be modified. If the draft permit is modified to satisfy the concerns of the FLM, then an adverse determination is avoided.
    - The FLM will inform the applicant, the permitting authority, and EPA of a preliminary adverse impact determination.
    - The FLM will notify the public of the preliminary adverse impact determination either through the permitting authority's notice procedures, or through separate notice in the *Federal Register*. Such notice should include a statement as to the availability of supporting documentation for inspection and copying, and an announcement of at least a 30 day public comment period on issues directly relevant to the determination in question.
    - The FLM will review and prepare response to public comments.
    - The FLM will make a final determination regarding adverse impacts, with a clear and concise statement of reasons supporting that determination.
    - The FLM will inform the permit applicant, the permitting authority, and EPA of its final determination.
    - Simultaneous with above, the FLM will publish a final determination in the 'Notice' section of the *Federal Register*, including a clear and concise statement of reasons supporting that determination, statement as to availability of supporting documentation for inspection and copying, and statement as to immediate effective date (date signed) of final determination.
    - If the FLM makes a final determination that a source will have an adverse impact, the FLM will oppose the permit. However, the permit applicant may propose to mitigate any adverse impacts (via reducing emissions, obtaining emission offsets, etc.). If the applicant adequately mitigates the adverse impacts to the satisfaction of the FLM, the FLM will withdraw his objection to the permit. If the adverse impacts are not adequately mitigated and the permitting authority nevertheless issues the permit, the FLM may appeal the permit.

Note: If the permitting authority's SIP makes execution of the above listed steps impossible (e.g., inadequate time allotments for the FLM's determination or lack of timely FLM notice) the procedures shall be adjusted as appropriate. In addition, the above procedures (6 and 7) could also be modified to accommodate those situations when the FLM chooses to certify that existing impacts are adverse, absent a proposed new source. Such an action would alert potential permit applicants that adverse impacts exist and any new source would need to mitigate its potential impacts. Although each FLM may implement the above procedures somewhat differently, the FLAG goal is to reduce the differences in implementing the above steps.

Furthermore, FLMs intend to coordinate on air permit modeling requirements for new or modified sources that are geographically near more than one FLM area. For example, a proposed source in eastern Tennessee that lies equidistant from NPS-administered Great Smoky Mountains National Park and the FS-administered Joyce Kilmer/Slickrock Wilderness would receive coordinated guidance on modeling requirements from the FLMs. The FLMs may or may not have common AQRVs at different Class I areas, making coordination beneficial. The FLMs may also coordinate on potential permit conditions and mitigation strategies.

2.2.4. Criteria for Decision Making (Adverse Impact Considerations) (Revised)

As previously mentioned, the legislative history of the CAA provides direction to the FLM on how to comply with the affirmative responsibility to protect AQRVs in Class I areas, and in cases of doubt, the land manager should err on the side of protecting air quality-related values for future generations.

The FLMs define adverse impact on AQRVs as:

> An unacceptable effect, as identified by an FLM that results from current, or would result from predicted, deterioration of air quality in a Federal Class I or Class II area. A determination of unacceptable effect shall be made on a case-by-case basis for each area taking into account existing air quality conditions. It should be based on a demonstration that the current or predicted deterioration of air quality will cause or contribute to a diminishment of the area's national significance, impairment of the structure and functioning of the area's ecosystem, or impairment of the quality of the visitor experience in the area.

Also, the Federal visibility protection regulations (40 CFR §51.300, et seq., §52.27) define adverse impact on visibility as:

> [V]isibility impairment which interferes with the management, protection, preservation or enjoyment of the visitor's visual experience of the Federal class I area. This determination must be made on a case-by-case basis taking into account the geographic extent, intensity, duration, frequency, and time of visibility impairment, and how these factors correlate with: (1) times of visitor use of the Federal class I area, and (2) the frequency and timing of natural conditions that reduce visibility. (Id. §51.301(a))

FLMs typically address adverse impacts on a case-by-case basis in response to PSD permit applications. The factors the FLMs will consider in making an adverse impact determination are discussed in more detail below (see section 4.3). When an adverse impact is predicted, FLMs recommend that permits either be modified to protect AQRVs or be denied. FLMs can also address adverse conditions outside of the PSD process. They do so through a variety of mechanisms: certify visibility impairment; participate in regional assessments; informally collaborate with States and EPA; review lease permits, SIP revisions, National Environmental Policy Act (NEPA) analyses, Park/Refuge/Forest management plans, CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) reviews, and other documents.

In some States, FLMs use screening procedures or thresholds that indicate when the condition of an AQRV is acceptable or unacceptable. The pollutant concentration or loading rate that will adversely impact an AQRV can vary among Class I areas, and depends on current conditions. After a threshold is reached, an increase in pollutant concentrations is likely to be unacceptable. A concern threshold can be an adverse impact threshold or other quantifiable level in resource condition or pollutant exposure identified by the FLM.

2.2.5. Air Pollution Permit Conditions that Benefit Class I Areas

The FLM does not determine what permit conditions will be required or administer permit conditions; that is the responsibility of the permitting authority. However, the FLMs may request permit conditions or agree to withdraw objections to permit issuance if requested conditions are included. The FLMs view the inclusion of certain PSD permit conditions by the permitting authority as a means to help protect or enhance the condition of AQRVs when:

1. Air pollution source(s) may cause impacts that exceed protection thresholds for AQRVs;
2. Terrestrial resources, aquatic resources, and/or visibility are currently adversely impacted by air pollution and proposed emissions will exacerbate these adverse conditions;
3. FLM policies require improvement or restoration of AQRVs in parks and wildernesses; and
4. There is uncertainty on the extent and magnitude of air pollution effects on AQRVs.

Recommended permit conditions may include requiring emission offsets, AQRV and/or air quality monitoring, inventories, post-construction reassessment, LAER (or other improved control technologies), or other measures to protect, enhance, or restore resources and values of parks and wildernesses. Permit conditions may:

1. Result in net air quality benefits at a protected area or within a region;
2. Contribute to a reduction of air pollution within a region;
3. Promote ecosystem inventories and/or monitoring to evaluate physical and biological resource damage caused by air pollution emissions; and
4. Promote ecosystem restoration or improve the condition of resources that have been damaged by air pollution emissions.

The basis of an air permit condition should be identified in the public notice for the draft permit. To be effective, permit conditions must be federally enforceable and guaranteed. Air permit provisions may be temporary or permanent depending on the nature of the permit requirements.

Procedures to implement an air permit condition must be acceptable to the FLM (e.g., an agreement between parties [memorandum of understanding, interagency agreement] is an option to accomplish inventory, monitoring, or other requirements).

2.2.6. Reducing Pollution in Nonattainment Areas (Nonattainment Permit Process)

The PSD program does not apply with respect to a particular pollutant when the source locates in an area designated non-attainment for that pollutant. Instead, pollution sources are regulated by Non-attainment Area New Source Review (NNSR). NNSR includes air quality planning and regulation of stationary sources. Air quality planning addresses issues such as lowest achievable emission rate (LAER), offsets, reasonably available control technology (RACT), and mobile and stationary source control strategies. New major stationary sources and major modifications of sources in designated non-attainment areas must satisfy NNSR before construction begins. For visibility protection, SIPs must include either EPA-approved provisions to comply with 40 CFR §51.307 for the non-attainment pollutant, otherwise, the federally promulgated visibility provisions at 40 CFR §52.28 would apply to all sources located in non-attainment areas. Therefore, FLMs can provide suggestions to the permitting authority regarding these conditions during the permitting and planning processes.

SIPs provide a mechanism to address AQRV impacts when the source or the Class I area is located in a non-attainment area. FLMs may recommend that States adopt policies, rules, or regulations in their SIPs requiring a demonstration that offsets will result in a net air quality benefit within any Class I area likely to be impacted by emissions from the source to be permitted. FLMs may also request emissions reductions greater than 1:1, perhaps offset rates of 1.5 or 2.0 to 1, or higher, depending on the nature and magnitude of impacts to be offset. Such recommendations can be developed jointly in a meeting with the regulatory authority or in a letter from the FLM.

Mitigation measures recommended by FLMs may include stringent control technologies to minimize the increase in emissions and the impact on AQRVs. Monitoring can determine whether predicted resource conditions are observed. Offsets ensure that net emissions reductions from all sources will occur within a geographic area and their resulting air quality impacts at the Class I area will be mitigated.

2.3. Other Air Quality Review Considerations (Revised)

At all Class I areas where visibility has been monitored, visibility conditions have been found to be impaired by human-caused pollution. The impairment comes primarily from older sources, not new sources. From a regional perspective, new or modified sources (using new/cleaner technologies) contribute far less to impaired AQRV conditions than old sources. EPA has implemented a call for reducing NO_x emissions from older sources in the eastern U.S. to meet existing ozone standards. In addition to complying with national ambient standards, States are now developing plans to implement EPA's Regional Haze Regulations. If these requirements are implemented, then progress toward remedying impaired AQRVs is likely. However, given the sensitivity of some AQRVs to low levels of pollution, programs focused on reaching national goals, such as the NAAQS or visibility, may not fully remedy impacts on AQRVs in all locations. It is for this reason that the FLM does pursue other strategies to protect AQRVs. The following sections discuss FLM issues that go beyond NSR.

2.3.1. Remedying Existing Adverse Impacts

Allowing the existence of adverse impacts would be inconsistent with the mandates of the FLM agencies. Consequently, FLMs may request or participate in regional assessments to protect AQRVs, and remedy any existing adverse impacts on AQRVs, as appropriate. Regional assessments often use a multi-faceted approach to remedy impairment. For example, categories addressed by the Grand Canyon Visibility Transport Commission (GCVTC) include air pollution prevention; clean air corridors; stationary sources; sources in and near Class I areas; mobile sources; road dust; fire; and future regional coordination.

Clean Air Act requirements for remedying existing visibility impairment provide a mechanism for addressing impacts from specific sources or groups of sources [42 USC 7491). Negotiations at the Centralia Power Plant in the state of Washington provide an example of how to build partnerships and work collaboratively to obtain retrofit controls or more stringent control technologies for sources that affect a FLM area. Through a collaborative decision making process, owners of the Centralia plant agreed to reduce sulfur dioxide emissions at the plant by 90%. In another case, the FWS identified plume impacts from a pulp and paper mill located seven miles upwind of the Moosehorn Wilderness Area. Using cameras provided by the IMPROVE monitoring network, plumes from the mill were documented entering the Moosehorn Wilderness Area. In collaboration with the State of Maine, additional controls for nitrogen oxides and updated particulate controls were incorporated into the mill's PSD permit to address the plume impacts.

FLMs may also coordinate with others to ensure that emission reductions in nonattainment areas will improve air quality in FLM areas. Recommendations on urban planning were developed with FLM involvement to address nonattainment areas in California. Data documenting ozone effects on vegetation were provided to the planning authority.

2.3.2. Requesting State Implementation Plan (SIP) Revisions to Address AQRV Adverse Impacts (Revised)

A SIP is the mechanism that states use to develop the pollution control programs that will be used to achieve and maintain the NAAQS, as well as prevent significant deterioration of air quality. It is important for FLMs to be involved in SIP development, as participation provides an opportunity to influence planning of pollution control programs that can benefit air quality in FLM areas. Once a SIP is fully approved by EPA, it is legally enforceable under both State and Federal law. FLMs assist in the development of SIPs by providing analysis and comment to address existing impacts of concern. This approach is particularly useful for addressing impacts on AQRVs other than visibility, since the Clean Air Act does not provide specific requirements for other AQRVs.

SIP revisions could be used to address multiple sources and regional pollution that adversely affect AQRVs in all Class I areas. For example, in South Coast and San Diego, California, SIP revisions included FLM recommendations to reduce the impact of minor sources on AQRVs. South Coast recommendations addressed visibility while the San Diego recommendations addressed all AQRVs. EPA's NO_x SIP Call in the east is another example of obtaining emission reductions through the SIP revision process. The NO_x SIP Call was directed at 20 eastern States and the District of Columbia to address NO_x emissions from existing large sources. Significant reductions in ozone formation and nitrogen deposition have occurred as a result of these efforts.

2.3.3. Periodic Increment Consumption Review (Revised)

EPA has indicated its intention to establish a SIP revision requirement to address existing adverse impacts on AQRVs. The FLMs strongly support EPA exercising its authority in this way. In the interim, however, there are existing SIP revision requirements that are not being fully utilized. EPA's current regulations require States to conduct a periodic review of the adequacy of their PSD plan and program. [40 CFR §51.166(a)(4)] This would include an assessment of increment consumption in Class I and Class II areas. Few States have ever conducted a comprehensive, cumulative increment consumption analysis for one or more Class I areas. In addition, many PSD sources have not exceeded the significant impact levels for increment consumption; thus, few PSD permit applicants have had to perform a cumulative increment consumption analysis for Class I areas. Such a periodic increment consumption review would be beneficial given that the burden of proof for AQRV adverse impact determinations shifts from the FLM to the applicant when the increment has been consumed.

In its 1990 report, *Air Pollution: Protecting Parks and Wilderness From Nearby Pollution Sources,* the U.S. General Accounting Office (GAO) found that only 1 percent of the sources within 100 kilometers of five Class I areas it investigated were required to have permits under the PSD program, with 99 percent of the sources being minor or grandfathered sources. It also found that "non-PSD sources contribute from 53 to 90 percent of five of the six criteria pollutants emitted within a 100-kilometer radius of each of the five Class I areas." As part of its investigation, GAO noted that "a significant portion of total emissions of volatile organic compounds generally comes from small sources...and suggested that as part of the overall control strategy, States may want to consider lowering thresholds for regulating new sources to 25 tons of volatile organic compounds a year." According to the investigation, 55 percent of anthropogenic VOC emissions come from new sources or modifications totaling five tons per year or less. In a review of PSD permit applications near Mesa Verde National Park (a Class I area in Colorado), a cumulative modeling analysis of increment-consuming sources found that approximately 80 percent of the NO_2 Class I increment at the park had been consumed, but much of it by minor sources.

The FLMs have encouraged EPA to provide clearer direction on how often these periodic reviews should occur as the lack of a prescribed time-frame for conducting such analyses has clearly led to noncompliance with this requirement over the past twenty years by States.

2.4. Managing Emissions Generated in and Near FLM Areas (Revised)

Specific strategies need to be developed and implemented for reducing and preventing pollution from the many diverse sources and activities in communities surrounding FLM areas, including "gateway" communities (i.e., those adjacent to FLM areas). Accountability mechanisms are needed to ensure that appropriate actions are taken, reported and incorporated into SIPs, visibility protection plans, and Federal land management plans. Various forums (e.g., the Western Regional Air Partnership, and the Southern Appalachian Mountains Initiative) addressed some of the emissions sources of concern and developed regional strategies. In addition, EPA has formed other "regional planning organizations" for implementing its regional haze rule. FLMs participate in these forums, consistent with Federal law (e.g., Federal Advisory Committee Act), to the maximum extent possible and coordinate their activities within those forums to ensure that comprehensive strategies are developed and implemented to address all the key emissions sources near FLM areas.

A systematic assessment of emission sources in and near FLM areas would be extremely helpful for formulating strategies aimed at mitigating or eliminating adverse impacts on area resources, and the NPS has performed micro-emission inventories for several of its Class I areas. However, without this assessment for all areas it is not possible to accurately quantify the extent to which these emissions contribute to the overall problem. Nevertheless, FLMs can, and should, take steps to minimize emissions generated on FLM lands even without an accurate inventory of emissions sources.

2.4.1. Prescribed Fire

Prescribed fire is a land management tool used for multiple landscape objectives. Prescribed fire allows the FLM to mimic natural fire return intervals under controlled conditions where smoke management can minimize air quality impacts. The alternative is wildfires, which can be very difficult to control and may cause much more severe air quality impacts. A modeling assessment suggests that using prescribed fire to minimize wildfires can result in a net reduction in fine particle ($PM_{2.5}$) emissions in the long-term. In the Pacific Northwest wildfire emissions were found to be greater than prescribed fire emissions in the same airshed (Ottmar 1996).

Since the early 1900s, wildfire has been aggressively suppressed on most of the nation's public lands to protect public safety, property, and to prevent what was thought to be the destruction of our natural and cultural resources. Fire-exclusion practices have resulted in forests, shrub lands, and grasslands plagued with a variety of problems, including overcrowding, resulting from the encroachment of species normally suppressed by fire; vulnerability of trees to insects and disease; and inadequate reproduction of certain species. In addition, heavy accumulation of fuels (such as dead vegetation on the forest floor) can cause fires to be catastrophic, which threatens firefighter and public safety, impairs forest and ecosystem health, destroys property and natural and cultural resources, and degrades air quality. The intense or extended periods of smoke associated with wildfires can also cause serious health effects and significantly decrease visibility.

FLMs recognize prescribed fire as a valuable tool; they also recognize that emissions from prescribed fire can be a significant source of air pollution. Smoke particles are also in the size range ($< 2.5\ \mu m$) that they play a significant role in visibility impairment. Particulate matter is the main pollutant of concern from smoke because it can cause serious health problems, especially for people with respiratory illness.

The FLMs are committed to minimizing the impacts from smoke by following sound smoke management practices, and if practical, using non-burning alternatives (i.e., mechanical clearing, chipping, mulching) to achieve land management objectives. Each prescribed burn site will have unique characteristics, but in general, smoke impacts can be minimized by burning during weather conditions that provide optimal humidity levels and dispersion conditions for the type of materials being burned, in addition to limiting the amount of materials and acreage burned at one time.

EPA has worked in partnership with land management agencies in the U.S. Departments of Agriculture, Defense, and the Interior; State Foresters; State air regulators; Tribes; and others to obtain recommendations and develop a national policy that addresses how best to improve the quality of wildland ecosystems (including forests and grasslands) and reduce threats of catastrophic wildfires through the increased use of managed fire, while achieving national clean air goals (EPA 1998b). EPA's interim air quality policy on fire describes criteria for wildland managers (federal, state, tribal, and private), and state and tribal air pollution agencies, to use in planning for and implementing prescribed fires, and recommends a variety of smoke management techniques that land managers can use to help reduce smoke impacts from prescribed fires. The policy is available at EPA's web site: http://www.epa.gov/ttn/faca/fa08.html. In addition, on March 22, 2007, EPA promulgated its Exceptional Events Rule that clarifies how ambient air quality standard exceedances from wildland fire will be treated in determining attainment and nonattainment status. In that rule, EPA committed to revising its 1998 wildland fire policy (72 FR 13560, March 22, 2007).

2.4.2. Strategies to Minimize Emissions from Sources In and Near FLM Areas (Revised)

Aside from prescribed fire, other activities in and near FLM areas that generate air pollution include vehicle emissions, road building, operation of generators, oil and gas development, etc. Developing strategies for addressing natural resource impacts in or near an FLM area should not only take into consideration the type of activities generating the emissions and their amount, but also the existing condition of the resources of that area. More stringent measures should be recommended for sources in and near FLM areas that are already experiencing adverse effects from air pollution.

Examples of potential air pollution prevention practices that FLM agencies may encourage or develop and use are categorized under the following three strategies:

Pollution Prevention Strategies

- Review land management plans for affected FLM areas to assess whether they include strategies to limit and reduce air pollution emissions and incorporate protective measures into planning and decision documents.
- Place priority on pollution prevention.
- Encourage zero and near-zero emitting technologies.
- Promote energy conservation and the use of renewable energy sources.
- Promote use of clean fuels.

Mobile Source Strategies

- Promote the adoption of Low Emission Vehicle standards or the conversion of Federal fleets to alternative fuels.
- Improve control of evaporative emissions.
- Promote more stringent emission standards for the tour bus industry and other high-emitting vehicles used in federal areas (e.g., park shuttle vehicles).
- Considering restricting access of high emitting vehicles to sensitive areas.
- Retire high-emitting vehicles from Federal fleets as quickly as practicable and/or relocate high-emitting vehicles to less sensitive areas until they can be retired.
- Establish emission budgets from the transportation sector for selected FLM areas.
- Develop mass transit systems in some NPS units (e.g., light rail in Grand Canyon NP and a bus system in Zion NP).

Minor Source Strategies (Revised)

- Apply RACT, BACT, LAER, best and reasonably available control measures, etc., to existing federal sources, as appropriate.
- Recommend going beyond conformity requirements to include the protection of AQRVs in FLM areas, and ensure all actions FLMs can practicably control in and near FLM areas will not cause, or contribute to, an adverse impact on any AQRV.

Improved involvement with interested parties in gateway communities will likely be required to ensure growth in these communities occurs in a manner that mitigates the impact on natural resources. These communities may need to enhance their participation in the planning processes of FLMs. Similarly, FLMs should participate in planning activities for public lands located in the FLM area and communities adjacent to FLM areas to ensure air quality concerns are adequately addressed. Mechanisms should be identified and developed for community involvement in developing, implementing, and enforcing emission management strategies for sources near and in FLM areas.

Implementing strategies to achieve emission reductions in and near FLM areas will require efforts in at least three specific areas:

1. FLMs should ensure that sufficient emphasis is placed in agency planning documents requiring the minimization of air pollution emissions from new activities or practices.
2. FLMs should inventory air pollution emissions within FLM areas. After emissions have been quantified, FLMs, States, and adjacent communities will be able to assess the impact of these emissions through the use of appropriate models. Knowledge of Class I area emissions will also improve FLM ability to consult with States during the development and review of their SIPs (especially visibility SIPs). The NPS has developed an emissions inventory tool, the Climate Leadership in Parks (CLIP) Tool, that can be utilized by FLMs to inventory both greenhouse gases and all criteria air pollutants.
3. FLMs should cooperate with States and local communities in assessing the need for, and the development of, appropriate emission reduction strategies in and near FLM areas that address non-PSD sources. For Class I areas, the Regional Planning Organizations have completed analyses of emissions from nearby communities and activities that will serve as the basis for identifying strategies to reduce emissions. Without an acknowledgment from States and local communities that these sources may pose a threat to FLM areas and a systematic assessment of these potential impacts, current efforts to protect FLM area resources may be insufficient.

2.4.3. Conformity Requirements in Nonattainment Areas

Conformity criteria and procedures ensure that actions on lands administered by Federal agencies do not cause a violation of the NAAQS, increase the frequency of any standards violations, or delay attainment of a standard. Conformity to SIPs is only required for activities within nonattainment areas for non-transportation related sources if emissions are above de minimis levels and regionally significant. Any activity that represents 10 percent, or more, of the emission inventory for that pollutant in the non-attainment or maintenance area is regionally significant. Examples of actions that may require a conformity determination include road paving projects, ski area development, or mining. Activities such as prescribed fire, that are included in a conforming land management plan, are exempt from conformity requirements. Please note that conformity determinations must be made in accordance with applicable EPA regulations, are typically done before a project is approved, and are part of the NEPA process.

The FLM should define the process to be used in conformity determinations and perform the conformity analysis before a project is implemented. A conformity analysis typically includes emission calculations, public participation, mitigation measures/implementation schedules, and reporting methods. The Pacific Southwest Region of the USFS has published a *Conformity Handbook for FLMs* to assist in conformity compliance. In an approved Plan of Operation, FLMs can require monitoring. For example, in the case of Carlota Mine, located on National Forest land in Arizona, the USFS requested additional mitigation measures to protect AQRVs in the Superstition Wilderness.

Transportation projects in FLM areas classified as nonattainment are subject to a more complicated transportation conformity process. Consultation with State and local air quality and transportation agencies will be required to comply with applicable regulations.

3. Subgroup Reports: Technical Analyses and Recommendations

3.1. Subgroup Objectives and Tasks

Subgroups were formed to address the four key issues relevant to AQRV identification and evaluation issues: policy (and procedures), visibility, ozone, and deposition. Each of these subgroups reviewed the commonalities among the FLMs then addressed the tasks assigned to them by FLAG. One of their first tasks was to differentiate between Phase I tasks, those which could be resolved in the short term without significant additional resources, and Phase II issues, those that would require a longer period or greater effort.

Subgroups were asked to reach common ground among the FLMs on the issues. The intent was to develop, to the extent possible, consistent policies, processes, and terminology that could be used when identifying AQRVs and evaluating impacts on AQRVs. This involves recommending consistent approaches for identifying air pollution effects on AQRVs, for determining adverse impacts, and for attributing adverse impacts to specific pollution sources. In addition, the FLMs consider that AQRV protection from visibility, ozone, and deposition impacts are equally important. However, we also recognize that given the current state of the science, attributing adverse impacts to specific sources are easier to document for visibility than for deposition and ozone, and easier for deposition than ozone.

The individual subgroup reports document the common policies, procedures, and definitions identified or developed during Phase I activities. The Visibility, Ozone, and Deposition subgroup reports are included below. The FLAG Policy Subgroup Report was used as the basis for much of the rest of this *FLAG Phase I Report*, including much of section 1 'Background' and section 2 'Federal Land Managers' Approach to AQRV Protection'.

3.2. Initial Screening Criteria (New)

Experience with the FLAG 2000 recommendations in dealing with many new source review applications led the Agencies to believe that an initial screen that would exempt a source from AQRV impact review based on its annual emissions and distance from a Class I area may be appropriate in most situations. As part of its Regional Haze Regulation, the EPA has introduced a screening criteria in its BART guidelines based on a source's annual emission strength and distance from a Class I area. The EPA stated that it would be reasonable to conclude that the following sources would not be considered to cause or contribute to visibility impairment:

Acadia National Park, Maine.
Credit: National Park Service

- those located more than 50 km from any Class I area that emit less than 500 tons per year of NO_x or SO_2 (or combined NO_x and SO_2), and
- those located more than 100 km from any Class I area that emit less than 1,000 tons per year of NO_x or SO_2 (or combined NO_x and SO_2).

In both cases, the annual emissions over distance factor equates to 10.

The Agencies have concluded that a similar approach has merit with respect to new source impacts at Class I areas, for air pollution sources with relatively steady emissions throughout each year. However, the Agencies are modifying the size criteria to also include Particulate Matter less than 10 microns in size (PM_{10}) and sulfuric acid mist (H_2SO_4) emissions because those pollutants also impair visibility and contribute to other resource impacts. In addition, rather than the two-step BART test, the Agencies are using a fixed Q/D factor of 10 as a screening criteria for sources locating/located greater than 50 km from a Class I area. Furthermore, the Agencies are expanding the screening criteria to include all AQRVs, not just visibility. Therefore, the Agencies will consider a source locating greater than 50 km from a Class I area to have negligible impacts with respect to Class I AQRVs if its total SO_2, NO_x, PM_{10}, and H_2SO_4 annual emissions (in tons per year, based on 24-hour maximum allowable emissions), divided by the distance (in km) from the Class I area (Q/D) is 10 or less. The Agencies would not request any further Class I AQRV impact analyses from such sources.

In cases where a source's operations which generate visibility-affecting emissions are limited to time periods shorter than a year, the short-term potential to impact visibility may not be adequately expressed by the Q/D concept. For example, a source that is operated either seasonally or intermittently, and has zero emissions for substantial portions of a year, would have a total annual emission rate that under-represents its potential emission strength over a shorter time frame, such as a day or week. Because visibility is an air quality related value that is sensitive to immediate and short-term conditions, in order to apply the Q/D≤10 screening tool, these types of sources need to first adjust the tons-per-year emissions to reflect what the emissions would be if the source operated year-round. For instance, if operations are restricted to 3,000 hours per year, then the annual steady-state-equivalent emission rate (Q) is found by multiplying the permitted total tons per year for SO_2, NO_x, PM_{10} , and H_2SO_4 by the ratio of hours: 8,760 hours per year/3,000 hours operation.[5] Then, using this annual equivalent Q in the Q/D test, the Agencies will consider a source locating greater than 50 km and showing that its ratio of annual equivalent Q (tons per year) divided by distance from the Class I area (km) of 10 or less, as having negligible impacts with respect to Class I visibility impacts, and would not request any further Class I visibility impact analyses from such sources.

3.3. Visibility

3.3.1. Introduction (Revised)

This chapter describes methods for analyzing the impacts on visibility from new or modified air pollution sources. This includes sources that fall under the purview of the Prevention of Significant Deterioration (PSD) regulations and sources that are being analyzed for Environmental Assessments and/or Environmental Impact Statements under the National Environmental Policy Act (NEPA). The basis for some of the decisions outlined in this chapter is Section 169A of the Clean Air Act. The opening statement of this section states: "Congress hereby declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory class I Federal areas which impairment results from man made air pollution." Under the regulations promulgated for visibility protection (40 CFR §51.301 (x)) visibility impairment is defined as "…any humanly perceptible change in visibility (visual range, contrast, coloration) from that which would have existed under natural conditions." The remainder of this chapter describes methods that allow for new source growth to be analyzed against the constraint of preventing visibility impairment as defined in 40 CFR §51.301 (x), that is, new source growth should not allow any humanly perceptible change in visibility as compared against natural conditions.

Visibility Impairment

Before proceeding with the discussion, it is useful to identify the ways that visibility impairment can manifest itself. First, the pollutant loading of a section of the atmosphere can become visible, by the contrast or color difference between a layer or plume and a viewed background, such as a landscape feature or the sky. The second way that visibility is impaired is a general alteration in the appearance of landscape features or the sky, changing the color or the contrast between landscape features or causing features of a view to disappear. The first phenomenon is commonly referred to as plume impairment, whereas the second phenomenon is sometimes referred to as uniform haze impairment. As plumes are transported within a stable atmospheric layer, they may become a layered haze. As plumes and other more diffuse emission sources are transported and become well mixed in the atmosphere, they may develop into a uniform haze.

Visibility Parameters (Revised)

The analysis methods for new source growth, described in this chapter, deal with the visibility effects of discrete plumes and the aggregation of discrete plumes into a uniform haze. The difference in these phenomena, as treated in this chapter, is whether the visibility effect is primarily seen as a section of the atmosphere which exhibits a change in contrast or color as compared with a viewed background, or whether the effect is due to an alteration of the appearance of the background features themselves. For the first situation, the contrast (C) and color difference index (ΔE) of the plume and the viewing background are calculated. For the second situation, the change in atmospheric light extinction (Δb_{ext}), relative to natural conditions, is calculated. The light extinction is inversely proportional to "visual range." An approximation for which situation applies is the distance from the point of emission. (Distance serves as an indicator of where steady state conditions may apply.) The visibility impairment from sources within 50 kilometers of a view is usually calculated using contrast and color difference, whereas visibility impairment from sources greater than 50 kilometers from a view, or the aggregation of a number of plumes, regardless of distance, is usually calculated using the change in light extinction. The distance approximation is useful for distinguishing these two phenomena; the terms "near field" and "distant/multi-source" are sometimes used in the remainder of this document to make this distinction.

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[5] Or, an intermittent hourly emission limit could be annualized by multiplying by 8,760 hours per year/2,000 lb/ton (= 4.38).

3.3.2. Recommendations for Evaluating Visibility Impacts (Revised)

There are two fundamentally different approaches one could adopt to determine visibility impairment. One is a technically rigorous, complex, and situation-specific method, while the other is a more generalized approach. The more rigorous approach requires determination of particle concentrations and size distributions, calculation of particle growth dynamics, and application of elaborate physics (e.g., Mie Theory) to determine the optical characteristics of the aerosol distribution. Sophisticated radiative transfer models are then applied, using aerosol optical characteristics, lighting and scene characteristics, and spatial distribution of the pollutants to calculate the path and wavelength of image-forming and non-image-forming light that reaches a specific observer from all points in the scene being viewed.

While such a detailed analysis may be useful for assessing specific cases, it is usually impractical for situations in which visibility could be experienced in a nearly infinite variety of circumstances. Practical limitations frequently dictate that it is more reasonable to use a generalized approach to determine the change in extinction by using bulk-averaged aerosol-specific extinction efficiencies rather than trying to reproduce the complex optical phenomena that may occur in the atmosphere.

Consequently, as a first-level analysis, FLAG recommends the generalized approach for determining the effects on visibility from a proposed new source's emissions. The procedure is to estimate the atmospheric concentrations of visibility impairing pollutants, apply representative visibility parameters, calculate the change from specified reference levels, and compare this change with prescribed threshold values. The more detailed analysis described above may be appropriate as a refined analysis in the event the source fails the first-level analysis.

FLAG is using EPA's estimates of natural visibility conditions under its Regional Haze Rule as reference levels for Class I visibility analyses. Comparison with natural conditions will help ensure that those conditions will not be impaired in keeping with Section 169A of the CAA. Because of the different requirements of the two modeling approaches discussed below, natural conditions should be expressed using two different metrics:

- Standard visual range (visual range adjusted to a Rayleigh condition of 10 Mm^{-1}), for near field modeling. Present EPA guideline visibility models traditionally accept visibility conditions expressed in these terms.
- Extinction, for distant/multi-source modeling. Visibility conditions should be expressed in terms of the averaged extinction efficiencies of the individual atmospheric constituents that comprise the total extinction. The relative humidity effects of the hygroscopic particles should be accounted for when the change in extinction is calculated.

Information needed to calculate the above indices for all 156 Class I areas for which visibility is an important attribute is provided in Tables 5 through 10 at the end of this chapter. If estimates are needed for Class II areas, the FLM can provide them.

3.3.3. Air Quality Models and Visibility Assessment Procedures (Revised)

The modeling discussion will be divided into two parts to address the very different requirements for 1) near field modeling where plumes or layers are compared against a viewing background, and 2) distant/multi-source modeling for plumes and aggregations of plumes that affect the general appearance of a scene. Note that both of the above analyses might apply depending on the source's proximity to all portions of the Class I area or multiple Class I areas.

FLAG 2000 provided information in the form of recommendations, specific processes, and interpretations of results for assessing visibility impacts of sources affecting Class I areas (although some of this information is generally applicable to Class II areas, as well). The information separately addressed assessments for sources proposing to locate relatively near (within 50 km) and at farther distances (greater than 50 km) from these areas. It also recommended impairment thresholds and identified the conditions for which cumulative analyses could be warranted. This revision (FLAG 2010) updates the Distant/Multi-source analysis discussed in FLAG 2000, and clarifies the recommendations regarding the near-field (within 50 km)/steady-state analysis.

Near Field Analysis Technique for Analyzing Plumes or Layers Viewed Against a Background (Revised)

The Model (Near Field – Steady State Conditions Applicable) (Revised)

EPA has recommended a methodology to assess impacts due to coherent plumes. A guideline for when these steady state conditions apply is the distance from the source to the view of concern. This technique is usually applied for sources locating within 50 km of a Class I area. Applicants should first model their potential plume impacts using the screening model, VISCREEN (EPA 1992a), or, if the next level of analysis is called for, PLUVUE II (EPA 1992b and 1996a). Both of these models use steady-state, gaussian-based plume dispersion techniques to calculate one-hour concentrations within an elevated plume. These two models calculate the change in the color difference index (ΔE) and contrast between the plume and the viewing background. Values of ΔE and plume contrast are based on the concentrations of fine primary particulates (including sulfates), nitrogen dioxide (NO_2), and the geometry of the observer, target, plume, and the position of the sun. PLUVUE II also allows consideration of the effects of secondarily formed sulfates. Plume contrast results from an increase or decrease in light transmitted from the viewing background through the plume to the observer. The specifics of the emission scenarios and plume/observer geometries for modeling should be selected in consultation with the appropriate Agency representatives. At the present time there is no recommended procedure for conducting analyses of multiple sources with these modeling tools, so multiple coherent plumes should be treated individually, or combined into a representative single source if appropriate. Alternatively, the techniques outlined in the Distant/Multi-Source section below may be used on a case-by-case basis.

The Recommended Procedures (Near Field – Steady State Conditions) (Revised)

Until better modeling tools are available, FLAG recommends using the present EPA techniques for plume visual impact screening analyses (EPA 1992c). However, unlike those procedures, which suggest the use of current average annual visibility conditions, FLAG recommends that for Class I areas the visual range corresponding to natural conditions be used to generate the hourly estimates of ΔE and plume contrast. FLAG recommends this change in order for the analysis technique to be consistent with the national visibility goal. For plume analyses, FLAG recommends using the monthly average natural visual range conditions provided for each area in Table 10.

If a screening analysis of a new or modified source can demonstrate that its emissions will not cause a plume with any hourly estimates of ΔE greater than or equal to 2.0, or the absolute value of the contrast values (|C|) greater than or equal to 0.05, the FLM is likely not to object to the issuance of the PSD permit based on near field visibility impacts and no further near field visibility analyses will be requested. More refined analyses (i.e., PLUVUE II) would be undertaken if the above conditions are not met and would be compared against lower levels of concern. For PLUVUE II analyses, the FLM would likely not object if ΔE < 1.0 and |C| < 0.02.

All analysis for Class I visibility impacts should include all visibility impairing emissions. This means that even if a facility is only considered a significant emitter of one pollutant, all pollutants that may contribute to impairment should be modeled together. Furthermore, since visibility is an instantaneous value, short-term (24-hour) maximum allowable emissions should be used.

- Level-1 Near Field Screening. Conducting a complete refined plume blight analysis can become rather complex, so three levels of evaluation are available to an applicant. The first, Level-1 screening, is the simplest and most conservative method. As described in the EPA's Workbook for Estimating Visibility Impairment (EPA-450/4-80-031):

  > Level-1 Screening: Level-1 screening is designed to provide a conservative estimate of plume visual impacts (i.e., impacts that would be larger than those calculated with more realistic input and modeling assumptions). This conservatism is achieved by the use within the screening model VISCREEN of worst-case meteorological conditions: extremely stable (F) atmospheric condition, coupled with a very low wind speed (1 m/s) persisting for 12 hours, with a wind that would transport the plume directly adjacent to the observer (as shown schematically in Figure 7).

  Since little project specific information is used for a Level-1 screening analysis, documentation requirements are minimal. Basic information of emissions, meteorological parameters, and model results should be provided. Applicants are encouraged to supply electronic copies of all files necessary to reproduce the results. If an application shows estimated impact values within the thresholds, it is unlikely that additional evaluation will be necessary.

- Level-2 Near Field Screening. If Level-2 screening is necessary, more project specific information is now incorporated. Actual meteorology from the area and emission characteristics of the facility are used. Again, as described in the EPA's Workbook for Estimating Visibility Impairment:

  > Level-2 Screening: As shown in Figure 1, Level-2 plume visual impact screening is done if the Level-1 results exceed the screening criteria. The objective of Level-2 screening is identical to that of Level-1—the estimation of worst-day plume visual impacts—but in Level-2 screening more realistic (less conservative) input, representative of the given source and the Class I area, is provided. This situation-specific input may include particle size distributions for plume and background that are different from those used in the default Level-1 analysis. Median background visual range based on on-site measurements rather than the map shown in Figure 9 might be used. However, the most important potential difference in input between Level-1 and Level-2 analysis centers on meteorology and plume transport and dispersion patterns. While the Level-1 analysis assumes F stability, a 1 m/s wind speed, and a wind direction that would carry plume material very close to the observer, in the Level-2 analysis, meteorological data and topography representative of the source area and Class I area may suggest that worst-case plume dispersion conditions are different.

  It is important to note that the Agencies have maintained the recommendation that all applicants compare estimated modeled impacts from a facility against natural conditions. This is true for all analysis levels. The use of five years of site-representative meteorology and facility-specific emission characteristics is what makes this analysis different.

As a result of the increased project-specific information, documentation also should include summaries and/or tables describing the additional data sets and evaluation steps taken to conduct the analysis.

Once again, meeting screening thresholds means that it is likely that the Agencies' Class I air quality modeling procedures will have been satisfied.

- Level-3 Near Field Refined Analysis. A Level-3 analysis is the final assessment. An applicant can conduct a full refined analysis demonstrating estimates of frequency, magnitude, and spatial extent of a proposed project's visibility impacts. The EPA's Workbook for Estimating Visibility Impairment says:

> Level-3 Analysis: In Level-3 analysis, the objective is broadened from conservative analysis of worst-case conditions to a realistic analysis of all conditions that would be expected to occur in a typical year in the region that includes both the emission source and the observer. Level-3 analysis is no longer considered screening because it is a comprehensive analysis of the magnitude and frequency of occurrence of plume visual impacts as observed at a sensitive Class I area vista.
>
> It is important to determine the frequency of occurrence of visual impact because the adversity or significance of impact is dependent on how frequently an impact of a given magnitude occurs. For example, if a plume is perceptible from a Class I area a third of the time, the impact would be considered much more significant than if it were perceptible only one day per year. The assessment of frequency of occurrence of impact should be an integral part of Level-3 visual impact analysis.

As mentioned above, the threshold values for this analysis step changed. For this step, EPA's PLUVUE II model is currently recommended. One main difference with PLUVUE II is its inability to evaluate more than one hour of impact per run. Because it is customary to evaluate five years of site-specific meteorology, it can become an extensive process. Applicants may want to develop and utilize tools to group hourly meteorological and post processing scenarios. The analysis identifies specific locations for plume/observer relationships. These observation points should be established within each potentially impacted Class I area. With each observer, potential impacts are calculated for all possible views. As with the meteorology, PLUVUE II is only able to assess one observer location per model run. Specific information on setup methods can be found in EPA's Workbook for Estimating Visibility Impairment and PLUVUE II manual.

Substantial documentation is needed for this more refined analysis. The discussion should summarize data sources, processing methods, and modeling utilities used, and information regarding all assumptions or consolidation criteria. In short, sufficient information and electronic files should be provided to the Agencies that will allow reviewers to reproduce the results. Due to the complexity of this refined analysis, the Agencies suggest that consultation occur between the applicant and the Agencies before working on the impact analysis begins. Furthermore, selection of model parameters and input data should be documented in a written protocol and agreed upon by the affected Agencies in advance of any modeling being conducted.

If the estimated plume parameters exceed the aforementioned values, the FLM would rely on a case-by-case effects-based test (NPS 1993), taking into account magnitude, frequency, duration, and other factors, to decide whether to make an adverse impact determination.

Distant/Multi-Source Techniques for Analyzing Whether a Plume or an Aggregation of Plumes Alters the General Appearance of a Scene (Revised)

This analysis is generally more complex than the near field, coherent plume modeling analyses and the guidance from EPA is less definitive, though it is evolving. The modeling system should include the capability to assess single and multiple sources in a temporally and spatially varying meteorological domain, accommodate modeling domains measuring hundreds of kilometers, include rough and complex terrain, provide pollutant concentration estimates for averaging times from one-hour to annual, and address inert and secondarily formed pollutants and dry and wet deposition. In the early 1990s the FLMs and the EPA recognized the need for a consistent, technically credible technique to estimate contributions to air quality of multiple new sources locating more than 50 km from Class I areas. Towards that end, on April 15, 2003, the EPA promulgated revisions to Appendix W of 40 C.F.R. §51 (*Guideline on Air Quality Models*). The EPA revised the Guideline to adopt the CALPUFF model as the preferred long-range transport model for inclusion in Appendix A of that document. This technique is usually applied when sources are located more than 50 kilometers from portions of a Class I area, when an aggregation of plumes may impact an area, or when the assumptions inherent in steady state visibility models do not apply.

The first-level analysis procedures discussed in this revision differ from FLAG 2000 in several discrete areas, but generally remain the same. The primary differences are in the areas of the reference natural conditions that are used in the comparisons for thresholds of concern and using the average monthly relative humidity adjustment factors rather than the hour-by-hour factors identified in FLAG 2000. CALPUFF is still the preferred first-level air quality model for calculating pollutant concentrations, however, using "CALPUFF Lite" with single station meteorology is no longer recommended. We wish to emphasize that the first-level procedures defined herein are to be taken as a whole; any deviations from these procedures or ostensible refinements compromise the integrity of the analysis, and may warrant an hourly analysis for all hours in the analysis. Furthermore, the metric used for the first-level analysis (relative change in light extinction) is not necessarily the appropriate metric for a refined analysis. The procedures and metrics for refined analyses will need to be agreed upon by the affected Agencies.

The initial step in conducting the first-level analysis is to run CALPUFF using a minimum of three years of mesoscale meteorological model output, and preferably five years, consistent with current EPA guidance. Selection of model parameters and input data should be documented in a written protocol and agreed upon by the affected Agencies in advance of any modeling being conducted. Please note emissions input considerations and model receptor grid data are discussed below. The indices for comparison with the Agencies' levels of concern are calculated in CALPOST. The remainder of this discussion is focused on CALPOST.

After CALPUFF is run, CALPOST is used to evaluate whether the proposed source or modification will be below the Agencies' threshold for concern (i.e., 5% change in light extinction). The CALPOST parameter MVISBK is set to eight (8), sub-mode five (M8_MODE = 5), and the background hygroscopic and non-hygroscopic aerosol levels are derived from the annual average natural conditions provided in Table 6. The monthly relative humidity adjustment factors for the Class I area are input to the RHFAC array (Tables 7-9) in CALPOST. The 98th percentile test applies to the number of days that any model receptor in the Class I area exceeds the threshold. The visibility threshold for concern is not exceeded if the 98th percentile change in light extinction is less than 5% for each year modeled, when compared to the annual average natural condition value for that Class I area.

If this analysis indicates that the 98th percentile values for change in light extinction are equal to or greater than 5% for any year, then the Agencies will further scrutinize the applicant's proposal. The Agencies will consider the full range of factors discussed below (in the "Expansion of Discussion of Process for Adverse Impact Determination" chapter) and any refined analyses provided by the applicant before making a recommendation to the FLM regarding potential adverse impacts. As noted above, these refined analyses should account for the relevant physicochemical processes that produce visibility impairing pollutants and accurately treat the relevant radiative transfer properties affecting visibility. This will likely entail using different meteorological and air quality models capable of producing hourly concentrations, or less, and using a three dimensional radiative transfer model (see refined analysis discussion below).

For consistency with implementation of BART or the regional haze rule to specific Class I areas, the FLM or permitting authority may recommend use of the 20% best natural background values provided in Table 5 in lieu of annual averages on a case-by-case basis.

Background Information on Thresholds

In its BART guidelines, EPA indicated that for regional haze, a source whose 98th percentile value of the haze index is greater than 0.5 deciview (dv) (approximately a 5% change in light extinction) is considered to contribute to regional haze visibility impairment. Similarly, a source that exceeds 1.0 dv (approximately a 10% change in light extinction) causes visibility impairment. The 0.5 dv and 1.0 dv thresholds are similar to what the Agencies used in FLAG 2000. Therefore, for consistency between visibility protection programs and to address similar concerns, the Agencies will also use the 98th percentile value as a threshold in the first-level visibility analyses for new source impacts.

In its 2005 BART guidelines, the EPA also concluded that by using the 98th percentile of CALPUFF modeled impacts the sources that contribute 0.5 deciview to regional haze visibility impairment in a Class I area would effectively be captured, while minimizing the likelihood that the highest modeled visibility impacts might be caused by conservative assumptions in the model. Similarly, using the monthly average relative humidity adjustment factors, rather than the hour-by-hour factors, reduces some of the higher (e.g., weather –related) values seen in FLAG 2000.

Using the 98th percentile of modeled visibility values to compare to the 5% change in extinction threshold would exclude roughly seven days per year from consideration for each Class I area. However, consistent with the BART guidelines, the 98th percentile test applies to the number of days that any model receptor in the Class I area exceeds the threshold. Also, this test is limited to haze-like, first-level analyses. Therefore, all applicable sources locating within 50 km of a Class I area would still need to assess coherent plume impacts in accordance with the procedure described above. Furthermore, applicable sources would need to assess sulfur and nitrogen deposition impacts at the Class I area.

Natural Conditions

FLAG 2000 discussed assessing the change in visibility due to a proposed new source relative to annual average natural conditions. Therefore, it is important to define natural conditions for each Class I area. At the time of FLAG 2000, the Agencies acknowledged that the EPA was working on defining natural conditions in support of their visibility regulations. In the absence of more specific data, the FLMs at that time adopted the appropriate aerosol concentrations developed by the National Acid Precipitation Assessment Program (NAPAP) as estimates of natural conditions for each Class I area. The EPA has since published natural condition estimates for each Class I area. The natural condition values provided in FLAG 2000 and those developed by the EPA are based on similar underlying assumptions; consequently, the estimates are similar. Regardless, the EPA estimates should be used by applicants in future visibility impact assessments. Please note that Tables 5 and 6 contain estimates for the 20% best natural visibility and annual average natural visibility conditions for each Class I area, respectively.

Relative Humidity Adjustment Factor

FLAG 2000 discussed the importance of the relative humidity adjustment factor (f(RH)) when calculating the sulfate and nitrate components of the visibility extinction coefficient. These aerosols are hygroscopic and the addition of water enhances their scattering efficiencies. FLAG 2000 recommended using hour-by-hour f(RH) for the analysis. The EPA, in its 2005 BART guidelines, concluded that by using a monthly average f(RH) the likelihood that the highest modeled visibility impacts were caused by short-term and geographically different meteorological phenomena (e.g., weather events) would be minimized. The Agencies agree with the EPA that using the monthly f(RH) effectively neutralizes short-term weather events and are adopting a similar approach for Class I visibility impact analyses for new sources. Therefore, new sources performing Class I visibility analyses should use monthly average f(RH) values developed by EPA for large hygroscopic particles (Table 7), small hygroscopic particles (Table 8), and sea salt (Table 9), rather than the hourly values discussed in FLAG 2000.

Emissions Input

There are two other aspects of the visibility impact analysis that the Agencies would like to clarify at this time: (1) emissions input, and (2) the model receptor grid. Regarding the emission inputs, because applicants are assessing a 24-hour average regional haze visibility impact, it is important that they model a corresponding maximum allowable 24-hour mass emission rate, as opposed to monthly or annual average emissions. Using a 30 day average emission rate as input to the visibility modeling analyses does not restrict the facility from emitting pollution at a higher rate for shorter time periods (e.g., 24-hour average). A 30 day average emission rate smooths out days with high emissions, and therefore, would underestimate the predicted 24-hour visibility impacts. Because the emission rates and the corresponding averaging times influence the outcome of the analyses, it is critical that appropriate emissions are matched to the averaging time being assessed, and that these emission rates ultimately are included as enforceable permit conditions. This approach is consistent with the *Guideline on Air Quality Models* (Appendix W of 40 C.F.R. §51) and the EPA BART guidelines. Furthermore, if an applicant chooses to conduct any refined analyses, where visibility impairment is assessed at no more than an hourly basis, maximum hourly emissions should be analyzed.

Please note that all visibility impairing pollutants should be modeled from all modified or affected emission unit(s), regardless of which pollutants actually triggered NSR. Particulate Matter (PM) should also be speciated into filterable PM (coarse, fine, elemental carbon) and Condensable PM (organic carbon and sulfates) based on the best available information. Particulate speciation data for several source types can be found on the NPS Air Resources Division's web site at:

- http://www.nature.nps.gov/air/permits/ect/index.cfm

Applicants should calculate the 24-hour average net emission increase for each pollutant from modified facilities as the maximum allowable 24-hour average minus the actual hourly rate averaged over the past two years (annual emissions over past two years/hours of operation over last two years).[6]

Model Receptor Grid

Since FLAG 2000 was published, the NPS Air Resources Division has developed a database of modeling receptors for all of the Class I areas in the contiguous United States. A file conversion program to convert the data from latitude/longitude to other common mapping coordinates (currently Lambert Conformal and Universal Transverse Mercator (UTM)) has also been developed. Alaska and Hawaii are not yet complete, but will be included in the data sets when they are available.

Permit applicants can download the Class I Receptor Data files, as well as the Conversion program, from the link below. For modeling consistency, the Agencies ask that permit applicants use the uniform receptor grids provided. Also available are the Class I boundary shape files that were used to create the receptor data files.

- http://www.nature.nps.gov/air/Maps/Receptors/index.cfm

Receptor grids for FLM Class II areas should be dense enough to determine Class II increment consumption and

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[6] Note that this is different from the emission change calculation used for short-term increment, which is calculated as the maximum allowable 24-hour average minus the highest occurrence over the past two years.

to perform any required "secondary impacts" (i.e., soils, vegetation and visibility) analyses.

Refined Analysis

It is important to reiterate that the FLAG distant/multi-source visibility analysis is only a first-level screening technique, primarily designed to identify those sources that are unlikely to significantly affect visibility and warrant no further analysis, and those that may adversely impact visibility and warrant further scrutiny. Visibility is experienced instantaneously, not on a 24-hour average basis. The 24-hour average visibility calculation in FLAG is acceptable because of a number of simplifying assumptions in the prescribed technique. Accepting certain EPA BART guideline procedures as an update to the FLAG techniques does not alter the first-level nature of the procedure. Modifying those simplifying assumptions negates the acceptability of using a 24-hour average. Consequently, any applicant whose visibility analysis deviates from the recommended FLAG screening procedures warrants performing an hour-by-hour analysis.

Deviations from the first-level screening procedure should lead to refinements in the modeling and visibility analyses, not arbitrary adjustments to the prescribed first-level technique. This is especially important in dealing with weather-related events. The Agencies believe that by paralleling the BART guideline procedures they have adequately taken into account the effects of meteorological extremes, and model uncertainty. Therefore, given the Agencies' desire to balance the positive and negative biases of the FLAG screening methodology, any modifications to the screening technique invalidate the Level 1 model results. Consequently, the Agencies do not expect permit applicants that exceed the visibility effects thresholds to scrutinize the data and attempt to disregard specific impact days due to weather. Under those circumstances, the permit applicant can accept the modeling results at face value, and then the FLM will decide whether or not those impacts are adverse. Alternatively, the applicant could conduct an hour-by-hour analysis (as opposed to using a 24-hour average) by performing a refined analysis using a more sophisticated approach that requires determining particle concentrations and size distributions, calculation of particle growth dynamics, and application of Mie Theory to determine the optical characteristics of the aerosol distribution. Sophisticated radiative transfer models can then be applied, using aerosol optical characteristics, lighting and scene characteristics, and spatial distribution of the pollutants to calculate the path and wavelength of image-forming and non-image-forming light that reaches a specific observer from all points in the scene being viewed. The concept of this more refined approach is discussed in FLAG 2000, and one possible approach is included in "*Proposed FLAG Level II and III Visibility Assessment*" (Schichtel et al. 2006). However, if this situation arises, permit applicants are encouraged to consult with the Agencies and discuss the specifics of this refined analysis.

3.3.4. Summary (Revised)

FLAG provides recommendations, specific procedures, and interpretation of results for assessing visibility impacts of new or modified sources on Class I area resources. Although FLMs only have a formal role in the permitting process for applications that affect Class I areas, this information can be used for Class II areas as well. FLAG addresses assessments for sources proposed for locations near (generally within 50 km) and at large distances (greater than 50 km) from these areas. The key components of the recommendations are highlighted below.

In general, FLAG recommends that an applicant:

- Apply the Q/D test (see section 3.2, 'Initial Screening Criteria') for proposed sources greater than 50 km from a Class I area to determine whether or not any further visibility analysis is necessary.
- Consult with the appropriate regulatory agency and with the FLM for the affected Class I area(s) or other affected area for confirmation of preferred visibility analysis procedures.
- Obtain FLM recommendation for the specified reference levels (estimate of natural conditions) and, if applicable, FLM recommended plume/observer geometries and model receptor locations.
- Apply the applicable EPA Guideline, steady-state models for regions within the Class I area that are affected by plumes or layers that are viewed against a background (generally within 50 km of the source).
    - Calculate hourly estimates of changes in visibility, as characterized by the change in the color difference index (ΔE) and plume contrast (C), with respect to natural conditions, and compare these estimates with the thresholds given in section 3.3.3.
- For regions of the Class I area where visibility impairment from the source would cause a general alteration of the appearance of the scene (generally 50 km or more away from the source or from the interaction of the emissions from multiple sources), apply a non-steady-state air quality model with chemical transformation capabilities (refer to EPA guidance documents), which yields ambient concentrations of visibility-impairing pollutants. At each Class I receptor:
    - Calculate the change in extinction due to the source being analyzed, compare these changes with the reference conditions, and then compare these results with the thresholds given in section 3.3.3.
    - Utilize estimates of annual average natural visibility conditions for each Class I area as presented in Table 6, unless otherwise recommended by the

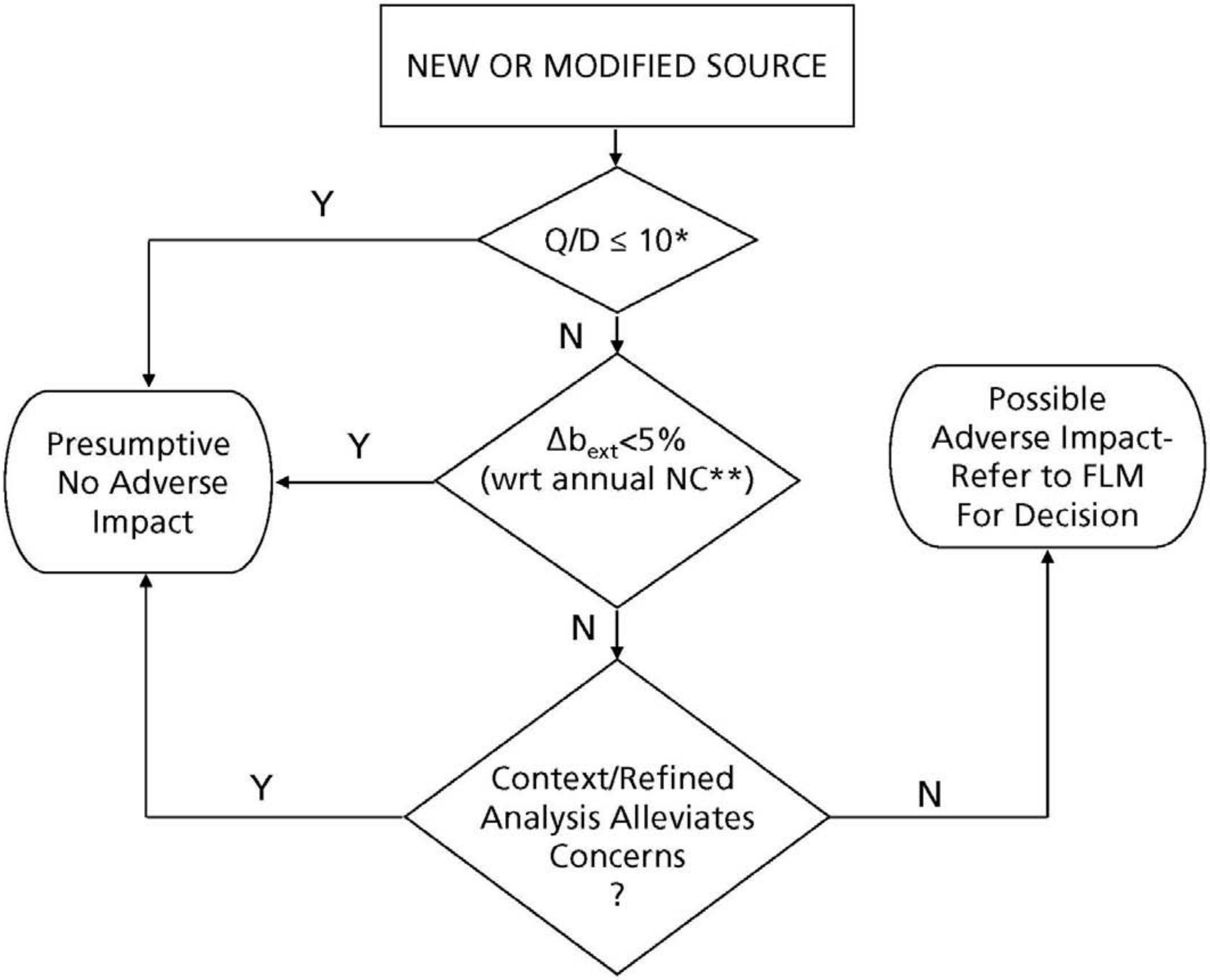

Figure 4. Procedure for Visibility Assessment for Distant/Multi-Source Applications (Revised)
*Q/D test only applies to sources located greater that 50 km from a Class I area.
**Difference Change in the 98th percentile with respect to (wrt) the annual average Natural Condition (NC). Applicant should use the 20th percentile best natural condition background if recommended by the FLM or permitting authority.

FLM or permitting authority. Alternative estimates of visibility conditions are provided in Table 5 for consistency with State agencies that elected to use 20% best visibility for regional haze or BART implementations.

- If first-level modeling results are above levels of concern, continue to consult with the Agencies to discuss other considerations (e.g., possible impact mitigation, more refined analyses).

This review process for distant/multi-source applications is portrayed schematically in Figure 4.

3.3.5. Natural Visibility Conditions and Analysis Methods (New)

Both distant/multi-source applications and near-field analyses require an estimate of natural visibility conditions. The effects of visibility impairing emissions from a source are compared to the natural visibility conditions to determine the potential for unacceptable visibility impacts. The methods and data for calculating natural visibility conditions in FLAG are presented in this section. The calculation of visibility metrics under the distant/multi-source application is also described. For the distant/multi-source application, aerosol species components are provided for input to the CALPUFF modeling system, which is the suggested model for most of these applications. For near-field analyses, visual ranges under natural conditions are provided for input to the VISCREEN and PLUVUE-II models.

Natural visibility conditions

Distant/Multi-source: Natural visibility conditions are affected by the light scattering of air molecules (Rayleigh scattering) and by naturally occurring aerosols. The majority of aerosols, both natural and anthropogenic, that affect light extinction can be categorized as sulfates ($(NH_4)_2SO_4$), nitrates (NH_4NO_3), organic mass (OM), elemental carbon (EC), soil, sea salt, and coarse mass (CM). The light scattering efficiency of aerosols is affected by the size of the aerosol relative to the wavelength of light. Sulfates, nitrates, and sea salt are all hygroscopic, which affects their size and their light scattering efficiency as they acquire or shed water molecules. The relationship between the aerosol components and light extinction is shown through the equations in Figure 5. The hygroscopic effects are accounted for through the relative humidity adjustment factors (f(RH)) terms in the equations in Figure 5. The aerosol concentrations and monthly relative humidity adjustment factors for calculating natural visibility conditions are found in Tables 5 through 10.

The aerosol concentrations for the 20% best natural conditions are found in Table 5 and the annual average natural concentrations are found in Table 6.

Near-field: The near-field visibility analysis is generally performed using either VISCREEN or PLUVUE-II. For calculating the effect of a plume on visibility, a background visibility, expressed as a visual range, must be input to these models. Appropriate average natural conditions, by month and Class I area are listed in Table 10. The values in Table 10 were determined by calculating the month by month light extinction values and calculating the visual range (VR) ($VR=3912/b_{ext}$).

Example Calculation of Natural Conditions and Change in Light Extinction

The annual average concentration and the relative humidity adjustment factors ($f_{\{L,S,SS\}}$(RH)) for the Alpine Lakes Wilderness for January will be used for illustration of the calculations.

1. Look up the Alpine Lakes Wilderness annual average concentration values in Table 6 for sulfate ($(NH_4)_2SO_4$), nitrate (NH_4NO_3), organic mass (OM), Elemental Carbon (EC), soil, coarse mass (CM), sea salt, and Rayleigh scattering.

Table 2. Section of Table 6 Used for Step 1 Calculations of the Alpine Lakes Wilderness Example

Class I Area	$(NH_4)_2SO_4$ µg/m³	NH_4NO_3 µg/m³	OM µg/m³	EC µg/m³	Soil µg/m³	CM µg/m³	Sea Salt µg/m³	Rayleigh Mm⁻¹
Acadia NP	0.23	0.10	1.67	0.02	0.24	2.14	0.14	12
Agua Tibia Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.14	11
Alpine Lakes Wilderness	0.12	0.10	0.60	0.02	0.23	1.30	0.06	11
…	…	…	…	…	…	…	…	…

2. Look up the f(RH) factors for large sulfate/nitrate (table 7), small sulfate/nitrate (table 8), and sea salt (table 9); January in this example.
   a. $f_L(RH) = 3.86$
   b. $f_S(RH) = 5.87$
   c. $f_{SS}(RH) = 5.35$
3. Calculate the large and small sulfate, nitrate, and organic mass, as defined in Figure 5.

Table 3. Step 3 Calculation Results for the Alpine Lakes Wilderness Example

	Total	Large	Small
Sulfate	0.12	0.00072	0.11928
Nitrate	0.10	0.0005	0.0995
Organic Mass	0.60	0.018	0.582

4. Apply to b_{ext} equation in Figure 5:

b_{ext}=

$2.2 \times 5.87 \times 0.11928 + 4.8 \times 3.86 \times 0.00072$ {Sulfate}

$+ 2.4 \times 5.87 \times 0.0995 + 5.1 \times 3.86 \times 0.0005$ {Nitrate}

$+ 2.8 \times 0.582 + 6.1 \times 0.018$ {Organic Mass}

$+ 10 \times 0.02$ {Elemental Carbon}

$+ 1 \times 0.23$ {Soil}

$+ 0.6 \times 1.30$ {Coarse Mass}

$+ 1.7 \times 5.35 \times 0.06$} {Sea Salt

$+ 11$ {Rayleigh}

$+ 0.33 \times 0$ {NO_2}

b_{ext} $= 17.46\ Mm^{-1}$

To calculate the change in light extinction from the impacts from an air pollution source, the species concentrations from the source are added to the total species concentrations in steps 3 and 4 above and the new total light extinction is calculated. Therefore, if a source contributed 0.05 µg/m^3 of sulfate ($(NH_4)_2SO_4$) and 0.01 µg/m^3 of nitrate (NH_4NO_3) at a receptor, the total, large and small sulfate and nitrate values would be:

Table 4. Step 4 Calculation Results for the Alpine Lakes Wilderness Example

	Total	Large	Small
Sulfate	0.17 (0.12+0.05)	0.001445	0.168555
Nitrate	0.11 (0.10+0.01)	0.000605	0.109395

The other concentrations and the relative humidity adjustment factors would remain as in step 4 of the natural condition example. After recalculating the light extinction accounting for the effect of the source ($b_{ext(source+nat\ cond)}$), the new light extinction would be 18.25 Mm^{-1}.

The change in light extinction (Δb_{ext}) would simply be:

$$\Delta b_{ext} = (b_{ext(source+nat\ cond)} - b_{ext(nat\ cond)}) / b_{ext(nat\ cond)} \quad \text{or:}$$

$$\Delta b_{ext} = (18.25 - 17.46) / 17.46$$

$$\Delta b_{ext} = 0.045\ (4.5\%)$$

The example provided here is to illustrate the process. Usually the concentrations and relative humidity adjustment factors would be extracted from the appropriate tables and input to one of the air quality model post processing programs.

$$
\begin{aligned}
b_{ext} \quad = \quad & 2.2 \times f_S(RH) \times [\text{Small Sulfate}] + 4.8 \times f_L(RH) \times [\text{Large Sulfate}] \\
& + 2.4 \times f_S(RH) \times [\text{Small Nitrate}] + 5.1 \times f_L(RH) \times [\text{Large Nitrate}] \\
& + 2.8 \times [\text{Small Organic Mass}] + 6.1 \times [\text{Large Organic Mass}] \\
& + 10 \times [\text{Elemental Carbon}] \\
& + 1 \times [\text{Fine Soil}] \\
& + 0.6 \times [\text{Coarse Mass}] \\
& + 1.7 \times f_{SS}(RH) \times [\text{Sea Salt}] \\
& + \text{Rayleigh Scattering (Site Specific)} \\
& + 0.33 \times [NO_2\ (\text{ppb})] \quad \{\text{or as: } 0.1755 \times [NO_2\ (\mu g/m^3)]\}
\end{aligned}
$$

Where:

[ ] indicates concentrations in $\mu g/m^3$

$f_S(RH)$ = Relative humidity adjustment factor for small sulfate and nitrate

$f_L(RH)$ = Relative humidity adjustment factor for large sulfate and nitrate

$f_{SS}(RH)$ = Relative humidity adjustment factor for sea salt

For Total Sulfate $< 20\ \mu g/m^3$:

$$[\text{Large Sulfate}] = ([\text{Total Sulfate}] / 20\ \mu g/m^3) \times [\text{Total Sulfate}]$$

For Total Sulfate $\geq 20\ \mu g/m^3$:

$$[\text{Large Sulfate}] = [\text{Total Sulfate}]$$

And:

$$[\text{Small Sulfate}] = [\text{Total Sulfate}] - [\text{Large Sulfate}]$$

To calculate large and small nitrate and organic mass, substitute ({Large, Small, Total} {Nitrate, Organic Mass}) for Sulfate.

Figure 5. IMPROVE Equation for Calculating Light Extinction
http://vista.cira.colostate.edu/improve/Publications/GrayLit/019_RevisedIMPROVEeq/RevisedIMPROVEAlgorithm3.doc

Table 5. 20% Best Natural Conditions – Concentrations and Rayleigh Scattering By Class I Area

Class I Area	$(NH_4)_2SO_4$ µg/m3	NH_4NO_3 µg/m3	OM µg/m^3	EC µg/m^3	Soil µg/m^3	CM µg/m^3	Sea Salt µg/m^3	Rayleigh Mm^{-1}	Type
Acadia NP	0.09	0.03	0.68	0.01	0.10	0.94	0.03	12	B20%
Agua Tibia Wilderness	0.03	0.04	0.26	0.01	0.26	1.20	0.04	11	B20%
Alpine Lakes Wilderness	0.04	0.03	0.15	0.01	0.05	0.30	0.02	11	B20%
Anaconda Pintler Wilderness	0.04	0.03	0.12	0.01	0.07	0.31	0.00	10	B20%
Ansel Adams Wilderness	0.02	0.01	0.12	0.01	0.07	0.44	0.01	9	B20%
Arches NP	0.07	0.06	0.23	0.01	0.14	0.89	0.01	9	B20%
Badlands NP	0.05	0.05	0.23	0.01	0.22	0.99	0.00	11	B20%
Bandelier NM	0.07	0.06	0.31	0.01	0.16	0.91	0.00	9	B20%
Bering Sea Wilderness									B20%
Big Bend NP	0.05	0.04	0.24	0.01	0.11	0.80	0.00	10	B20%
Black Canyon of the Gunnison NP	0.06	0.04	0.24	0.01	0.13	0.88	0.00	9	B20%
Bob Marshall Wilderness	0.05	0.04	0.19	0.01	0.08	0.37	0.00	10	B20%
Bosque del Apache Wilderness	0.08	0.06	0.30	0.01	0.15	0.97	0.02	10	B20%
Boundary Waters Canoe Area Wilderness	0.11	0.02	0.50	0.01	0.13	0.86	0.01	11	B20%
Breton Wilderness	0.14	0.05	0.73	0.01	0.27	2.26	0.07	11	B20%
Bridger Wilderness	0.05	0.04	0.14	0.01	0.07	0.33	0.00	9	B20%
Brigantine Wilderness	0.12	0.04	0.86	0.01	0.24	1.73	0.04	12	B20%
Bryce Canyon NP	0.04	0.05	0.18	0.01	0.10	0.60	0.00	9	B20%
Cabinet Mountains Wilderness	0.05	0.05	0.13	0.01	0.09	0.42	0.01	10	B20%
Caney Creek Wilderness	0.07	0.06	0.68	0.01	0.14	1.51	0.02	11	B20%
Canyonlands NP	0.07	0.06	0.23	0.01	0.14	0.89	0.01	9	B20%
Cape Romain Wilderness	0.14	0.06	0.88	0.01	0.24	1.99	0.04	12	B20%
Capitol Reef NP	0.06	0.07	0.26	0.01	0.15	0.79	0.01	9	B20%
Caribou Wilderness	0.03	0.02	0.12	0.01	0.08	0.24	0.01	10	B20%
Carlsbad Caverns NP	0.06	0.05	0.26	0.01	0.12	0.82	0.00	9	B20%
Chassahowitzka Wilderness	0.14	0.08	1.02	0.01	0.28	2.46	0.02	11	B20%
Chiricahua NM	0.06	0.05	0.27	0.01	0.13	0.81	0.00	10	B20%
Chiricahua Wilderness	0.06	0.05	0.27	0.01	0.13	0.81	0.00	10	B20%
Cohutta Wilderness	0.09	0.08	0.69	0.01	0.15	1.06	0.01	11	B20%
Crater Lake NP	0.02	0.02	0.08	0.01	0.07	0.23	0.01	9	B20%
Craters of the Moon NM	0.06	0.05	0.19	0.01	0.12	0.69	0.01	10	B20%
Cucamonga Wilderness	0.03	0.03	0.15	0.01	0.14	0.67	0.01	9	B20%
Denali NP & Pres	0.04	0.02	0.08	0.01	0.05	0.31	0.01	11	B20%
Desolation Wilderness	0.04	0.03	0.15	0.01	0.09	0.51	0.01	9	B20%
Diamond Peak Wilderness	0.02	0.02	0.08	0.01	0.07	0.23	0.01	9	B20%
Dolly Sods Wilderness	0.10	0.05	0.80	0.01	0.17	0.96	0.01	10	B20%
Dome Land Wilderness	0.03	0.02	0.18	0.01	0.08	0.43	0.01	10	B20%
Eagle Cap Wilderness	0.05	0.02	0.17	0.01	0.10	0.50	0.01	10	B20%
Eagles Nest Wilderness	0.04	0.03	0.14	0.01	0.08	0.36	0.00	8	B20%
Emigrant Wilderness	0.03	0.02	0.10	0.00	0.08	0.50	0.01	10	B20%
Everglades NP	0.16	0.07	0.77	0.01	0.16	1.86	0.12	11	B20%
Fitzpatrick Wilderness	0.05	0.04	0.14	0.01	0.07	0.33	0.00	9	B20%
Flat Tops Wilderness	0.04	0.03	0.14	0.01	0.08	0.36	0.00	8	B20%
Galiuro Wilderness	0.06	0.05	0.27	0.01	0.13	0.81	0.00	10	B20%

Table 5. 20% Best Natural Conditions – Concentrations and Rayleigh Scattering By Class I Area

Class I Area	$(NH_4)_2SO_4$ µg/m3	NH_4NO_3 µg/m3	OM µg/m^3	EC µg/m^3	Soil µg/m^3	CM µg/m^3	Sea Salt µg/m^3	Rayleigh Mm^{-1}	Type
Gates of the Mountains Wilderness	0.04	0.04	0.13	0.01	0.07	0.49	0.00	9	B20%
Gearhart Mountain Wilderness	0.02	0.02	0.08	0.01	0.07	0.23	0.01	9	B20%
Gila Wilderness	0.06	0.04	0.22	0.01	0.09	0.45	0.00	9	B20%
Glacier NP	0.05	0.03	0.17	0.01	0.11	0.57	0.00	11	B20%
Glacier Peak Wilderness	0.02	0.03	0.09	0.00	0.04	0.28	0.01	11	B20%
Goat Rocks Wilderness	0.02	0.01	0.06	0.00	0.04	0.21	0.01	10	B20%
Grand Canyon NP	0.04	0.03	0.12	0.01	0.10	0.59	0.00	9	B20%
Grand Teton NP	0.06	0.05	0.17	0.01	0.08	0.33	0.00	9	B20%
Great Gulf Wilderness	0.09	0.04	0.56	0.01	0.10	1.05	0.02	11	B20%
Great Sand Dunes NP & Pres	0.06	0.05	0.29	0.01	0.15	0.90	0.00	9	B20%
Great Smoky Mountains NP	0.09	0.06	0.78	0.01	0.16	1.47	0.01	11	B20%
Guadalupe Mountains NP	0.06	0.05	0.26	0.01	0.12	0.82	0.00	9	B20%
Haleakala NP	0.05	0.04	0.24	0.01	0.11	1.59	0.13	10	B20%
Hawaii Volcanoes NP	0.03	0.04	0.27	0.01	0.06	0.64	0.11	10	B20%
Hells Canyon Wilderness	0.06	0.02	0.19	0.01	0.14	0.81	0.01	11	B20%
Hercules-Glades Wilderness	0.09	0.06	0.78	0.01	0.16	1.86	0.02	11	B20%
Hoover Wilderness	0.03	0.02	0.08	0.01	0.06	0.55	0.00	9	B20%
Isle Royale NP	0.10	0.02	0.34	0.01	0.09	0.79	0.01	12	B20%
James River Face Wilderness	0.11	0.06	0.71	0.01	0.20	1.39	0.01	11	B20%
Jarbidge Wilderness	0.05	0.03	0.14	0.01	0.05	0.33	0.00	10	B20%
John Muir Wilderness	0.02	0.01	0.12	0.01	0.07	0.44	0.01	9	B20%
Joshua Tree NP	0.04	0.02	0.20	0.01	0.17	0.94	0.02	10	B20%
Joyce Kilmer-Slickrock Wilderness	0.09	0.06	0.78	0.01	0.16	1.47	0.01	11	B20%
Kaiser Wilderness	0.02	0.01	0.12	0.01	0.07	0.44	0.01	9	B20%
Kalmiopsis Wilderness	0.03	0.02	0.31	0.01	0.05	0.99	0.04	12	B20%
Kings Canyon	0.03	0.03	0.18	0.01	0.08	0.73	0.02	11	B20%
La Garita Wilderness	0.06	0.04	0.24	0.01	0.13	0.88	0.00	9	B20%
Lassen Volcanic NP	0.03	0.02	0.12	0.01	0.08	0.24	0.01	10	B20%
Lava Beds NM	0.03	0.03	0.14	0.01	0.06	0.46	0.00	10	B20%
Linville Gorge Wilderness	0.08	0.06	0.67	0.01	0.14	1.04	0.01	11	B20%
Lostwood Wilderness	0.06	0.04	0.23	0.01	0.22	1.05	0.01	11	B20%
Lye Brook Wilderness	0.05	0.03	0.36	0.01	0.09	0.63	0.01	11	B20%
Mammoth Cave NP	0.11	0.08	0.86	0.01	0.24	1.54	0.01	11	B20%
Marble Mountain Wilderness	0.03	0.02	0.12	0.01	0.06	0.36	0.01	10	B20%
Maroon Bells-Snowmass Wilderness	0.04	0.03	0.14	0.01	0.08	0.36	0.00	8	B20%
Mazatzal Wilderness	0.06	0.05	0.30	0.01	0.14	0.80	0.00	10	B20%
Medicine Lake Wilderness	0.06	0.05	0.24	0.01	0.20	1.13	0.00	11	B20%
Mesa Verde NP	0.06	0.05	0.24	0.01	0.17	0.67	0.00	9	B20%
Mingo Wilderness	0.12	0.04	0.88	0.01	0.21	1.49	0.01	12	B20%
Mission Mountains Wilderness	0.05	0.04	0.19	0.01	0.08	0.37	0.00	10	B20%
Mokelumne Wilderness	0.04	0.03	0.15	0.01	0.09	0.51	0.01	9	B20%
Moosehorn Wilderness	0.11	0.04	0.76	0.01	0.12	1.25	0.02	12	B20%
Mount Adams Wilderness	0.02	0.01	0.06	0.00	0.04	0.21	0.01	10	B20%
Mount Baldy Wilderness	0.05	0.04	0.19	0.01	0.11	0.53	0.00	9	B20%
Mount Hood Wilderness	0.02	0.02	0.06	0.00	0.05	0.15	0.01	10	B20%

Table 5. 20% Best Natural Conditions – Concentrations and Rayleigh Scattering By Class I Area

Class I Area	$(NH_4)_2SO_4$ µg/m3	NH_4NO_3 µg/m3	OM µg/m^3	EC µg/m^3	Soil µg/m^3	CM µg/m^3	Sea Salt µg/m^3	Rayleigh Mm^{-1}	Type
Mount Jefferson Wilderness	0.02	0.02	0.08	0.00	0.03	0.31	0.01	11	B20%
Mount Rainier NP	0.03	0.02	0.18	0.01	0.06	0.83	0.02	11	B20%
Mount Washington Wilderness	0.02	0.02	0.08	0.00	0.03	0.31	0.01	11	B20%
Mount Zirkel Wilderness	0.06	0.04	0.16	0.01	0.09	0.60	0.00	8	B20%
Mountain Lakes Wilderness	0.02	0.02	0.08	0.01	0.07	0.23	0.01	9	B20%
North Absaroka Wilderness	0.05	0.04	0.16	0.00	0.11	0.82	0.00	9	B20%
North Cascades NP	0.02	0.03	0.09	0.00	0.04	0.28	0.01	11	B20%
Okefenokee Wilderness	0.13	0.07	0.92	0.01	0.22	1.69	0.03	11	B20%
Olympic NP	0.04	0.03	0.23	0.01	0.03	0.50	0.04	11	B20%
Otter Creek Wilderness	0.10	0.05	0.80	0.01	0.17	0.96	0.01	10	B20%
Pasayten Wilderness	0.04	0.03	0.07	0.00	0.07	0.24	0.01	10	B20%
Pecos Wilderness	0.04	0.03	0.16	0.01	0.08	0.67	0.00	8	B20%
Petrified Forest NP	0.06	0.06	0.28	0.01	0.15	0.75	0.00	9	B20%
Pine Mountain Wilderness	0.06	0.05	0.30	0.01	0.14	0.80	0.00	10	B20%
Pinnacles NM	0.06	0.04	0.31	0.01	0.16	1.50	0.06	11	B20%
Point Reyes NS	0.12	0.04	0.33	0.01	0.13	1.08	0.25	12	B20%
Presidential Range-Dry River Wilderness	0.09	0.04	0.56	0.01	0.10	1.05	0.02	11	B20%
Rawah Wilderness	0.06	0.04	0.16	0.01	0.09	0.60	0.00	8	B20%
Red Rock Lakes Wilderness	0.06	0.05	0.17	0.01	0.08	0.33	0.00	9	B20%
Redwood NP	0.05	0.03	0.28	0.01	0.06	1.02	0.10	11	B20%
Rocky Mountain NP	0.04	0.02	0.15	0.01	0.09	0.68	0.00	9	B20%
Roosevelt Campobello International Park	0.11	0.04	0.76	0.01	0.12	1.25	0.02	12	B20%
Saguaro NP	0.07	0.05	0.32	0.01	0.22	1.15	0.03	10	B20%
Saint Marks Wilderness	0.14	0.06	0.81	0.01	0.24	2.17	0.04	11	B20%
Salt Creek Wilderness	0.05	0.06	0.31	0.01	0.17	1.00	0.02	10	B20%
San Gabriel Wilderness	0.03	0.03	0.15	0.01	0.14	0.67	0.01	9	B20%
San Gorgonio Wilderness	0.03	0.02	0.15	0.01	0.10	0.62	0.02	10	B20%
San Jacinto Wilderness	0.03	0.02	0.15	0.01	0.10	0.62	0.02	10	B20%
San Pedro Parks Wilderness	0.05	0.04	0.14	0.01	0.09	0.34	0.01	8	B20%
San Rafael Wilderness	0.03	0.04	0.22	0.01	0.11	0.79	0.02	10	B20%
Sawtooth Wilderness	0.05	0.04	0.23	0.01	0.10	0.37	0.00	10	B20%
Scapegoat Wilderness	0.05	0.04	0.19	0.01	0.08	0.37	0.00	10	B20%
Selway-Bitterroot Wilderness	0.04	0.03	0.12	0.01	0.07	0.31	0.00	10	B20%
Seney Wilderness	0.08	0.01	0.38	0.01	0.09	0.80	0.01	12	B20%
Sequoia NP	0.03	0.03	0.18	0.01	0.08	0.73	0.02	11	B20%
Shenandoah NP	0.08	0.07	0.56	0.01	0.14	1.20	0.01	10	B20%
Shining Rock Wilderness	0.05	0.05	0.51	0.01	0.13	0.56	0.01	10	B20%
Sierra Ancha Wilderness	0.06	0.05	0.33	0.02	0.14	0.73	0.01	10	B20%
Simeonof Wilderness	0.06	0.05	0.25	0.02	0.04	1.18	0.25	12	B20%
Sipsey Wilderness	0.11	0.10	0.81	0.01	0.25	1.66	0.01	11	B20%
South Warner Wilderness	0.03	0.03	0.14	0.01	0.06	0.46	0.00	10	B20%
Strawberry Mountain Wilderness	0.05	0.02	0.17	0.01	0.10	0.50	0.01	10	B20%
Superstition Wilderness	0.07	0.05	0.31	0.01	0.16	0.84	0.00	10	B20%

Table 5. 20% Best Natural Conditions – Concentrations and Rayleigh Scattering By Class I Area

Class I Area	$(NH_4)_2SO_4$ μg/m3	NH_4NO_3 μg/m3	OM μg/m^3	EC μg/m^3	Soil μg/m^3	CM μg/m^3	Sea Salt μg/m^3	Rayleigh Mm^{-1}	Type
Swanquarter Wilderness	0.12	0.06	0.65	0.01	0.23	2.38	0.05	12	B20%
Sycamore Canyon Wilderness	0.06	0.05	0.28	0.01	0.12	0.62	0.00	9	B20%
Teton Wilderness	0.06	0.05	0.17	0.01	0.08	0.33	0.00	9	B20%
Theodore Roosevelt NP	0.07	0.04	0.26	0.01	0.21	1.20	0.01	11	B20%
Thousand Lakes Wilderness	0.03	0.02	0.12	0.01	0.08	0.24	0.01	10	B20%
Three Sisters Wilderness	0.02	0.02	0.08	0.00	0.03	0.31	0.01	11	B20%
Tuxedni Wilderness	0.03	0.04	0.09	0.01	0.03	0.52	0.05	12	B20%
UL Bend Wilderness	0.05	0.03	0.18	0.01	0.15	0.93	0.01	11	B20%
Upper Buffalo Wilderness	0.08	0.06	0.68	0.01	0.16	1.33	0.01	11	B20%
Ventana Wilderness	0.06	0.04	0.31	0.01	0.16	1.50	0.06	11	B20%
Virgin Islands NP	0.18	0.07	0.21	0.01	0.12	1.53	0.26	11	B20%
Voyageurs NP	0.12	0.02	0.56	0.01	0.10	0.86	0.01	12	B20%
Washakie Wilderness	0.05	0.04	0.16	0.00	0.11	0.82	0.00	9	B20%
Weminuche Wilderness	0.06	0.04	0.24	0.01	0.13	0.88	0.00	9	B20%
West Elk Wilderness	0.04	0.03	0.14	0.01	0.08	0.36	0.00	8	B20%
Wheeler Peak Wilderness	0.04	0.03	0.16	0.01	0.08	0.67	0.00	8	B20%
White Mountain Wilderness	0.05	0.03	0.24	0.01	0.08	0.67	0.01	9	B20%
Wichita Mountains Wilderness	0.03	0.04	0.28	0.01	0.15	1.52	0.01	11	B20%
Wind Cave NP	0.05	0.04	0.20	0.01	0.19	1.05	0.00	10	B20%
Wolf Island Wilderness	0.13	0.07	0.92	0.01	0.22	1.69	0.03	11	B20%
Yellowstone NP	0.06	0.05	0.17	0.01	0.08	0.33	0.00	9	B20%
Yolla Bolly-Middle Eel Wilderness	0.03	0.02	0.12	0.01	0.06	0.36	0.01	10	B20%
Yosemite NP	0.03	0.02	0.10	0.00	0.08	0.50	0.01	10	B20%
Zion NP	0.05	0.06	0.28	0.01	0.10	0.60	0.01	10	B20%

Table 6. Annual Average Natural Conditions - Concentrations and Rayleigh Scattering By Class I Area

Class I Area	$(NH_4)_2SO_4$ µg/m3	NH_4NO_3 µg/m3	OM µg/m^3	EC µg/m^3	Soil µg/m^3	CM µg/m^3	Sea Salt µg/m^3	Rayleigh Mm^{-1}	Type
Acadia NP	0.23	0.10	1.67	0.02	0.25	2.14	0.14	12	Annual
Agua Tibia Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.14	11	Annual
Alpine Lakes Wilderness	0.12	0.10	0.60	0.02	0.23	1.30	0.06	11	Annual
Anaconda Pintler Wilderness	0.12	0.10	0.60	0.02	0.39	1.79	0.02	10	Annual
Ansel Adams Wilderness	0.12	0.10	0.58	0.02	0.46	2.88	0.03	9	Annual
Arches NP	0.12	0.10	0.60	0.02	0.50	2.92	0.01	9	Annual
Badlands NP	0.12	0.10	0.60	0.02	0.50	3.00	0.01	11	Annual
Bandelier NM	0.12	0.10	0.60	0.02	0.50	2.86	0.02	9	Annual
Bering Sea Wilderness									Annual
Big Bend NP	0.12	0.10	0.60	0.02	0.50	3.00	0.03	10	Annual
Black Canyon of the Gunnison NP	0.12	0.10	0.60	0.02	0.49	2.59	0.01	9	Annual
Bob Marshall Wilderness	0.12	0.10	0.60	0.02	0.44	2.34	0.01	10	Annual
Bosque del Apache Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.04	10	Annual
Boundary Waters Canoe Area Wilderness	0.23	0.10	1.71	0.02	0.31	2.53	0.02	11	Annual
Breton Wilderness	0.23	0.10	1.78	0.02	0.48	3.01	0.19	11	Annual
Bridger Wilderness	0.12	0.10	0.60	0.02	0.44	1.88	0.01	9	Annual
Brigantine Wilderness	0.23	0.10	1.80	0.02	0.47	3.00	0.22	12	Annual
Bryce Canyon NP	0.12	0.10	0.60	0.02	0.50	2.87	0.01	9	Annual
Cabinet Mountains Wilderness	0.12	0.10	0.60	0.02	0.41	2.31	0.02	10	Annual
Caney Creek Wilderness	0.23	0.10	1.80	0.02	0.50	3.00	0.03	11	Annual
Canyonlands NP	0.12	0.10	0.60	0.02	0.50	2.92	0.01	9	Annual
Cape Romain Wilderness	0.23	0.10	1.80	0.02	0.45	3.00	0.20	12	Annual
Capitol Reef NP	0.11	0.10	0.58	0.02	0.50	2.78	0.00	9	Annual
Caribou Wilderness	0.12	0.10	0.60	0.02	0.44	1.82	0.01	10	Annual
Carlsbad Caverns NP	0.12	0.10	0.60	0.02	0.50	3.00	0.02	9	Annual
Chassahowitzka Wilderness	0.23	0.10	1.81	0.02	0.50	3.00	0.08	11	Annual
Chiricahua NM	0.12	0.10	0.60	0.02	0.50	3.00	0.02	10	Annual
Chiricahua Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.02	10	Annual
Cohutta Wilderness	0.23	0.10	1.71	0.02	0.50	2.45	0.02	11	Annual
Crater Lake NP	0.12	0.10	0.60	0.02	0.39	1.67	0.02	9	Annual
Craters of the Moon NM	0.12	0.10	0.60	0.02	0.50	2.92	0.01	10	Annual
Cucamonga Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.04	9	Annual
Denali NP & Pres	0.12	0.05	0.60	0.02	0.14	1.12	0.04	11	Annual
Desolation Wilderness	0.12	0.10	0.60	0.02	0.43	1.92	0.01	9	Annual
Diamond Peak Wilderness	0.12	0.10	0.60	0.02	0.39	1.67	0.02	9	Annual
Dolly Sods Wilderness	0.23	0.10	1.80	0.02	0.43	2.19	0.02	10	Annual
Dome Land Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.03	10	Annual
Eagle Cap Wilderness	0.12	0.10	0.60	0.02	0.50	2.99	0.04	10	Annual
Eagles Nest Wilderness	0.12	0.10	0.60	0.02	0.48	2.12	0.00	8	Annual
Emigrant Wilderness	0.12	0.10	0.60	0.02	0.44	3.00	0.02	10	Annual
Everglades NP	0.23	0.10	1.79	0.02	0.50	3.00	0.31	11	Annual
Fitzpatrick Wilderness	0.12	0.10	0.60	0.02	0.44	1.88	0.01	9	Annual
Flat Tops Wilderness	0.12	0.10	0.60	0.02	0.48	2.12	0.00	8	Annual
Galiuro Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.02	10	Annual

Table 6. Annual Average Natural Conditions - Concentrations and Rayleigh Scattering By Class I Area

Class I Area	$(NH_4)_2SO_4$ µg/m3	NH_4NO_3 µg/m3	OM µg/m^3	EC µg/m^3	Soil µg/m^3	CM µg/m^3	Sea Salt µg/m^3	Rayleigh Mm^{-1}	Type
Gates of the Mountains Wilderness	0.12	0.10	0.60	0.02	0.35	1.55	0.01	9	Annual
Gearhart Mountain Wilderness	0.12	0.10	0.60	0.02	0.39	1.67	0.02	9	Annual
Gila Wilderness	0.12	0.10	0.60	0.02	0.50	2.54	0.01	9	Annual
Glacier NP	0.11	0.10	0.59	0.02	0.50	3.00	0.01	11	Annual
Glacier Peak Wilderness	0.11	0.10	0.60	0.02	0.19	1.32	0.02	11	Annual
Goat Rocks Wilderness	0.12	0.10	0.60	0.02	0.23	1.23	0.03	10	Annual
Grand Canyon NP	0.12	0.10	0.60	0.02	0.50	2.88	0.02	9	Annual
Grand Teton NP	0.12	0.10	0.60	0.02	0.41	1.92	0.01	9	Annual
Great Gulf Wilderness	0.23	0.10	1.70	0.02	0.25	2.65	0.03	11	Annual
Great Sand Dunes NP & Pres	0.12	0.10	0.60	0.02	0.50	2.99	0.01	9	Annual
Great Smoky Mountains NP	0.23	0.10	1.80	0.02	0.48	2.92	0.02	11	Annual
Guadalupe Mountains NP	0.12	0.10	0.60	0.02	0.50	3.00	0.02	9	Annual
Haleakala NP	0.12	0.10	0.57	0.02	0.23	2.93	0.25	10	Annual
Hawaii Volcanoes NP	0.12	0.10	0.45	0.02	0.16	1.42	0.29	10	Annual
Hells Canyon Wilderness	0.12	0.10	0.60	0.02	0.48	2.97	0.01	11	Annual
Hercules-Glades Wilderness	0.23	0.10	1.80	0.02	0.50	3.00	0.02	11	Annual
Hoover Wilderness	0.12	0.10	0.60	0.02	0.50	2.97	0.01	9	Annual
Isle Royale NP	0.23	0.10	1.55	0.02	0.24	2.89	0.03	12	Annual
James River Face Wilderness	0.23	0.10	1.80	0.02	0.48	3.00	0.02	11	Annual
Jarbidge Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.02	10	Annual
John Muir Wilderness	0.12	0.10	0.58	0.02	0.46	2.88	0.03	9	Annual
Joshua Tree NP	0.12	0.10	0.60	0.02	0.50	3.00	0.03	10	Annual
Joyce Kilmer-Slickrock Wilderness	0.23	0.10	1.80	0.02	0.48	2.92	0.02	11	Annual
Kaiser Wilderness	0.12	0.10	0.58	0.02	0.46	2.88	0.03	9	Annual
Kalmiopsis Wilderness	0.12	0.10	0.60	0.02	0.20	2.24	0.23	12	Annual
Kings Canyon	0.11	0.10	0.60	0.02	0.50	3.00	0.04	11	Annual
La Garita Wilderness	0.12	0.10	0.60	0.02	0.49	2.59	0.01	9	Annual
Lassen Volcanic NP	0.12	0.10	0.60	0.02	0.44	1.82	0.01	10	Annual
Lava Beds NM	0.12	0.10	0.60	0.02	0.44	2.36	0.01	10	Annual
Linville Gorge Wilderness	0.23	0.10	1.80	0.02	0.45	2.60	0.02	11	Annual
Lostwood Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.03	11	Annual
Lye Brook Wilderness	0.23	0.10	1.59	0.02	0.28	1.79	0.02	11	Annual
Mammoth Cave NP	0.23	0.10	1.80	0.02	0.50	2.73	0.02	11	Annual
Marble Mountain Wilderness	0.12	0.10	0.52	0.02	0.42	2.08	0.04	10	Annual
Maroon Bells-Snowmass Wilderness	0.12	0.10	0.60	0.02	0.48	2.12	0.00	8	Annual
Mazatzal Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.02	10	Annual
Medicine Lake Wilderness	0.12	0.10	0.60	0.02	0.48	3.00	0.01	11	Annual
Mesa Verde NP	0.12	0.10	0.60	0.02	0.50	2.88	0.00	9	Annual
Mingo Wilderness	0.23	0.10	1.83	0.02	0.51	3.05	0.04	12	Annual
Mission Mountains Wilderness	0.12	0.10	0.60	0.02	0.44	2.34	0.01	10	Annual
Mokelumne Wilderness	0.12	0.10	0.60	0.02	0.43	1.92	0.01	9	Annual
Moosehorn Wilderness	0.23	0.10	1.79	0.02	0.23	2.56	0.11	12	Annual
Mount Adams Wilderness	0.12	0.10	0.60	0.02	0.23	1.23	0.03	10	Annual

Table 6. Annual Average Natural Conditions - Concentrations and Rayleigh Scattering By Class I Area

Class I Area	$(NH_4)_2SO_4$ µg/m3	NH_4NO_3 µg/m3	OM µg/m^3	EC µg/m^3	Soil µg/m^3	CM µg/m^3	Sea Salt µg/m^3	Rayleigh Mm^{-1}	Type
Mount Baldy Wilderness	0.12	0.10	0.57	0.02	0.50	2.82	0.01	9	Annual
Mount Hood Wilderness	0.12	0.10	0.60	0.02	0.29	1.58	0.05	10	Annual
Mount Jefferson Wilderness	0.12	0.10	0.60	0.02	0.26	1.98	0.05	11	Annual
Mount Rainier NP	0.12	0.10	0.60	0.02	0.24	2.27	0.07	11	Annual
Mount Washington Wilderness	0.12	0.10	0.60	0.02	0.26	1.98	0.05	11	Annual
Mount Zirkel Wilderness	0.12	0.10	0.60	0.02	0.45	2.69	0.00	8	Annual
Mountain Lakes Wilderness	0.12	0.10	0.60	0.02	0.39	1.67	0.02	9	Annual
North Absaroka Wilderness	0.12	0.10	0.60	0.02	0.43	2.84	0.01	9	Annual
North Cascades NP	0.11	0.10	0.60	0.02	0.19	1.32	0.02	11	Annual
Okefenokee Wilderness	0.23	0.10	1.80	0.02	0.50	3.00	0.08	11	Annual
Olympic NP	0.12	0.10	0.60	0.02	0.15	1.88	0.14	11	Annual
Otter Creek Wilderness	0.23	0.10	1.80	0.02	0.43	2.19	0.02	10	Annual
Pasayten Wilderness	0.12	0.10	0.60	0.02	0.33	1.50	0.01	10	Annual
Pecos Wilderness	0.12	0.10	0.60	0.02	0.50	2.29	0.03	8	Annual
Petrified Forest NP	0.12	0.10	0.60	0.02	0.50	3.00	0.01	9	Annual
Pine Mountain Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.02	10	Annual
Pinnacles NM	0.12	0.10	0.60	0.02	0.35	3.00	0.19	11	Annual
Point Reyes NS	0.12	0.10	0.60	0.02	0.24	3.00	2.11	12	Annual
Presidential Range-Dry River Wilderness	0.23	0.10	1.70	0.02	0.25	2.65	0.03	11	Annual
Rawah Wilderness	0.12	0.10	0.60	0.02	0.45	2.69	0.00	8	Annual
Red Rock Lakes Wilderness	0.12	0.10	0.60	0.02	0.41	1.92	0.01	9	Annual
Redwood NP	0.12	0.10	0.60	0.02	0.16	3.00	0.96	11	Annual
Rocky Mountain NP	0.12	0.10	0.60	0.02	0.50	2.90	0.00	9	Annual
Roosevelt Campobello International Park	0.23	0.10	1.79	0.02	0.23	2.56	0.11	12	Annual
Saguaro NP	0.12	0.10	0.60	0.02	0.50	3.00	0.06	10	Annual
Saint Marks Wilderness	0.23	0.10	1.80	0.02	0.50	3.00	0.10	11	Annual
Salt Creek Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.04	10	Annual
San Gabriel Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.04	9	Annual
San Gorgonio Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.05	10	Annual
San Jacinto Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.05	10	Annual
San Pedro Parks Wilderness	0.12	0.10	0.60	0.02	0.50	2.19	0.01	8	Annual
San Rafael Wilderness	0.11	0.10	0.60	0.02	0.50	3.00	0.11	10	Annual
Sawtooth Wilderness	0.12	0.08	0.60	0.02	0.41	1.64	0.01	10	Annual
Scapegoat Wilderness	0.12	0.10	0.60	0.02	0.44	2.34	0.01	10	Annual
Selway-Bitterroot Wilderness	0.12	0.10	0.60	0.02	0.39	1.79	0.02	10	Annual
Seney Wilderness	0.23	0.10	1.74	0.02	0.26	1.95	0.02	12	Annual
Sequoia NP	0.11	0.10	0.60	0.02	0.50	3.00	0.04	11	Annual
Shenandoah NP	0.23	0.10	1.80	0.02	0.41	2.88	0.02	10	Annual
Shining Rock Wilderness	0.23	0.10	1.76	0.02	0.50	1.76	0.02	10	Annual
Sierra Ancha Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.02	10	Annual
Simeonof Wilderness	0.12	0.10	0.46	0.02	0.13	3.00	1.26	12	Annual
Sipsey Wilderness	0.23	0.10	1.80	0.02	0.50	3.00	0.04	11	Annual
South Warner Wilderness	0.12	0.10	0.60	0.02	0.44	2.36	0.01	10	Annual

Table 6. Annual Average Natural Conditions - Concentrations and Rayleigh Scattering By Class I Area

Class I Area	$(NH_4)_2SO_4$ µg/m3	NH_4NO_3 µg/m3	OM µg/m^3	EC µg/m^3	Soil µg/m^3	CM µg/m^3	Sea Salt µg/m^3	Rayleigh Mm^{-1}	Type
Strawberry Mountain Wilderness	0.12	0.10	0.60	0.02	0.50	2.99	0.04	10	Annual
Superstition Wilderness	0.11	0.10	0.59	0.02	0.50	3.00	0.02	10	Annual
Swanquarter Wilderness	0.23	0.10	1.63	0.02	0.41	3.00	0.14	12	Annual
Sycamore Canyon Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.03	9	Annual
Teton Wilderness	0.12	0.10	0.60	0.02	0.41	1.92	0.01	9	Annual
Theodore Roosevelt NP	0.12	0.10	0.60	0.02	0.50	3.00	0.01	11	Annual
Thousand Lakes Wilderness	0.12	0.10	0.60	0.02	0.44	1.82	0.01	10	Annual
Three Sisters Wilderness	0.12	0.10	0.60	0.02	0.26	1.98	0.05	11	Annual
Tuxedni Wilderness	0.12	0.09	0.60	0.02	0.10	2.06	0.38	12	Annual
UL Bend Wilderness	0.12	0.10	0.60	0.02	0.45	3.00	0.00	11	Annual
Upper Buffalo Wilderness	0.23	0.10	1.80	0.02	0.50	3.00	0.03	11	Annual
Ventana Wilderness	0.12	0.10	0.60	0.02	0.35	3.00	0.19	11	Annual
Virgin Islands NP	0.23	0.10	0.35	0.02	0.50	3.00	0.84	11	Annual
Voyageurs NP	0.23	0.10	1.75	0.02	0.26	2.73	0.04	12	Annual
Washakie Wilderness	0.12	0.10	0.60	0.02	0.43	2.84	0.01	9	Annual
Weminuche Wilderness	0.12	0.10	0.60	0.02	0.49	2.59	0.01	9	Annual
West Elk Wilderness	0.12	0.10	0.60	0.02	0.48	2.12	0.00	8	Annual
Wheeler Peak Wilderness	0.12	0.10	0.60	0.02	0.50	2.29	0.03	8	Annual
White Mountain Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.03	9	Annual
Wichita Mountains Wilderness	0.12	0.10	0.60	0.02	0.50	3.00	0.03	11	Annual
Wind Cave NP	0.12	0.10	0.60	0.02	0.49	2.98	0.01	10	Annual
Wolf Island Wilderness	0.23	0.10	1.80	0.02	0.50	3.00	0.08	11	Annual
Yellowstone NP	0.12	0.10	0.60	0.02	0.41	1.92	0.01	9	Annual
Yolla Bolly-Middle Eel Wilderness	0.12	0.10	0.52	0.02	0.42	2.08	0.04	10	Annual
Yosemite NP	0.12	0.10	0.60	0.02	0.44	3.00	0.02	10	Annual
Zion NP	0.12	0.10	0.60	0.02	0.50	3.00	0.01	10	Annual

Table 7. Monthly f_L(RH) – Large $(NH_4)_2SO_4$ and NH_4NO_3 Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acadia NP	2.74	2.46	2.45	2.66	2.67	2.73	2.99	3.03	3.16	2.91	2.89	2.96
Agua Tibia Wilderness	2.10	2.08	2.11	1.98	1.98	1.93	1.93	2.01	2.02	1.99	1.87	1.95
Alpine Lakes Wilderness	3.86	3.58	3.04	2.92	2.99	2.58	2.62	2.67	2.97	3.60	4.00	3.99
Anaconda Pintler Wilderness	2.75	2.46	2.24	2.08	2.06	2.01	1.76	1.72	1.88	2.22	2.66	2.74
Ansel Adams Wilderness	2.56	2.34	2.20	1.88	1.79	1.59	1.52	1.52	1.59	1.70	2.01	2.34
Arches NP	2.28	2.12	1.73	1.57	1.50	1.28	1.34	1.47	1.51	1.56	1.90	2.13
Badlands NP	2.31	2.31	2.31	2.21	2.34	2.25	2.08	2.05	2.02	2.05	2.38	2.33
Bandelier NM	2.10	1.90	1.72	1.51	1.53	1.38	1.63	1.87	1.80	1.59	1.87	2.04
Bering Sea Wilderness	3.02	3.17	3.20	3.19	3.23	3.34	3.78	4.16	3.64	3.19	3.12	3.13
Big Bend NP	1.72	1.61	1.44	1.38	1.47	1.48	1.58	1.74	1.83	1.63	1.63	1.70
Black Canyon of the Gunnison NP	2.15	2.05	1.83	1.75	1.74	1.51	1.59	1.78	1.80	1.68	1.96	2.06
Bob Marshall Wilderness	2.82	2.54	2.35	2.22	2.21	2.19	1.98	1.92	2.15	2.43	2.78	2.81
Bosque del Apache Wilderness	2.03	1.82	1.55	1.37	1.36	1.27	1.61	1.79	1.73	1.54	1.73	2.00
Boundary Waters Canoe Area Wilderness	2.50	2.25	2.28	2.09	2.20	2.43	2.57	2.71	2.78	2.38	2.64	2.64
Breton Wilderness	2.91	2.76	2.74	2.72	2.83	2.94	3.10	3.07	2.97	2.82	2.83	2.90
Bridger Wilderness	2.22	2.10	2.04	1.95	1.95	1.67	1.46	1.44	1.68	1.83	2.19	2.16
Brigantine Wilderness	2.49	2.32	2.38	2.28	2.50	2.56	2.69	2.81	2.82	2.71	2.45	2.50
Bryce Canyon NP	2.31	2.16	1.82	1.56	1.47	1.26	1.30	1.46	1.46	1.55	1.87	2.15
Cabinet Mountains Wilderness	3.07	2.73	2.45	2.26	2.24	2.21	1.98	1.92	2.19	2.53	3.03	3.11
Caney Creek Wilderness	2.77	2.53	2.37	2.43	2.68	2.71	2.59	2.60	2.71	2.69	2.67	2.79
Canyonlands NP	2.32	2.16	1.78	1.58	1.51	1.28	1.36	1.53	1.55	1.58	1.93	2.17
Cape Romain Wilderness	2.66	2.47	2.42	2.32	2.56	2.80	2.82	3.04	3.03	2.86	2.65	2.70
Capitol Reef NP	2.36	2.22	1.84	1.63	1.54	1.31	1.36	1.52	1.55	1.61	1.95	2.22
Caribou Wilderness	2.96	2.58	2.35	2.10	2.01	1.85	1.79	1.82	1.88	2.03	2.50	2.82
Carlsbad Caverns NP	2.07	1.81	1.50	1.42	1.51	1.48	1.72	1.90	2.03	1.64	1.76	2.00
Chassahowitzka Wilderness	3.03	2.82	2.74	2.65	2.63	3.00	3.02	3.15	3.14	3.03	2.97	3.09
Chiricahua NM	1.87	1.79	1.52	1.24	1.22	1.13	1.64	1.87	1.66	1.45	1.55	1.89
Chiricahua Wilderness	1.84	1.76	1.49	1.22	1.20	1.12	1.64	1.86	1.64	1.43	1.53	1.87
Cohutta Wilderness	2.84	2.61	2.49	2.36	2.72	2.97	3.00	3.07	3.08	2.89	2.72	2.85
Crater Lake NP	3.71	3.25	3.07	2.91	2.70	2.50	2.31	2.33	2.49	2.99	3.67	3.74
Craters of the Moon NM	2.58	2.34	2.03	1.84	1.83	1.65	1.40	1.39	1.52	1.80	2.35	2.54
Cucamonga Wilderness	2.21	2.14	2.13	1.96	1.95	1.90	1.91	1.96	1.98	1.96	1.90	2.02
Denali NP & Pres	2.48	2.44	2.15	1.96	1.98	2.13	2.47	2.90	2.95	2.84	2.69	2.68
Desolation Wilderness	2.73	2.42	2.18	1.84	1.74	1.56	1.47	1.49	1.58	1.73	2.12	2.54
Diamond Peak Wilderness	3.82	3.38	3.18	3.04	2.79	2.60	2.33	2.35	2.58	3.18	3.80	3.86
Dolly Sods Wilderness	2.53	2.39	2.38	2.20	2.63	2.65	2.74	2.90	2.94	2.65	2.45	2.61
Dome Land Wilderness	2.26	2.07	2.00	1.79	1.73	1.63	1.61	1.64	1.68	1.71	1.81	2.01
Eagle Cap Wilderness	3.44	3.02	2.54	2.31	2.28	2.01	1.78	1.75	1.97	2.61	3.34	3.56
Eagles Nest Wilderness	2.02	2.01	1.87	1.87	1.92	1.69	1.68	1.83	1.86	1.73	1.96	1.97
Emigrant Wilderness	2.67	2.42	2.26	1.92	1.81	1.59	1.49	1.50	1.58	1.72	2.08	2.45
Everglades NP	2.43	2.31	2.26	2.16	2.15	2.38	2.32	2.49	2.55	2.42	2.34	2.39
Fitzpatrick Wilderness	2.22	2.10	2.04	1.95	1.94	1.68	1.47	1.44	1.68	1.83	2.18	2.16
Flat Tops Wilderness	2.09	2.04	1.87	1.84	1.86	1.62	1.59	1.70	1.79	1.72	1.97	2.03
Galiuro Wilderness	1.80	1.67	1.47	1.21	1.18	1.10	1.43	1.66	1.53	1.42	1.57	1.87
Gates of the Mountains Wilderness	2.46	2.25	2.15	2.05	2.02	2.00	1.81	1.77	1.91	2.15	2.37	2.41

Table 7. Monthly $f_L(RH)$ – Large $(NH_4)_2SO_4$ and NH_4NO_3 Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gearhart Mountain Wilderness	3.30	2.89	2.62	2.45	2.29	2.13	1.88	1.90	2.03	2.47	3.09	3.27
Gila Wilderness	1.93	1.78	1.52	1.31	1.28	1.23	1.72	1.76	1.68	1.50	1.67	1.96
Glacier NP	3.21	2.84	2.69	2.55	2.58	2.56	2.24	2.22	2.57	2.81	3.08	3.13
Glacier Peak Wilderness	3.69	3.39	2.97	2.85	2.79	2.54	2.49	2.59	2.91	3.45	3.83	3.84
Goat Rocks Wilderness	3.83	3.44	3.10	2.97	2.82	2.60	2.48	2.55	2.88	3.49	3.91	3.98
Grand Canyon NP	2.13	2.01	1.74	1.46	1.36	1.19	1.29	1.49	1.47	1.50	1.75	1.98
Grand Teton NP	2.27	2.14	2.01	1.91	1.90	1.68	1.48	1.44	1.64	1.84	2.16	2.24
Great Gulf Wilderness	2.51	2.32	2.36	2.41	2.45	2.55	2.72	2.87	2.98	2.80	2.67	2.60
Great Sand Dunes NP & Pres	2.11	2.04	1.85	1.77	1.80	1.62	1.70	1.97	1.92	1.72	2.04	2.09
Great Smoky Mountains NP	2.85	2.57	2.51	2.35	2.72	2.98	2.98	3.08	3.10	2.87	2.71	2.85
Guadalupe Mountains NP	2.14	1.82	1.49	1.38	1.48	1.47	1.78	1.98	2.10	1.60	1.78	2.08
Haleakala NP	2.34	2.27	2.25	2.20	2.13	2.09	2.16	2.14	2.10	2.19	2.33	2.30
Hawaii Volcanoes NP	2.56	2.45	2.47	2.47	2.47	2.45	2.53	2.59	2.55	2.57	2.78	2.55
Hells Canyon Wilderness	3.05	2.65	2.22	1.97	1.91	1.81	1.55	1.52	1.68	2.15	2.90	3.15
Hercules-Glades Wilderness	2.70	2.48	2.30	2.30	2.57	2.59	2.56	2.60	2.69	2.54	2.57	2.72
Hoover Wilderness	2.63	2.38	2.21	1.88	1.77	1.56	1.46	1.47	1.55	1.69	2.05	2.42
Isle Royale NP	2.53	2.21	2.26	2.07	1.99	2.32	2.65	2.69	2.82	2.28	2.76	2.74
James River Face Wilderness	2.44	2.30	2.29	2.12	2.47	2.58	2.65	2.78	2.82	2.57	2.36	2.51
Jarbidge Wilderness	2.51	2.28	1.90	1.92	1.97	1.82	1.51	1.37	1.34	1.56	2.14	2.42
John Muir Wilderness	2.51	2.29	2.20	1.95	1.86	1.65	1.60	1.61	1.69	1.78	2.03	2.28
Joshua Tree NP	2.06	1.99	1.97	1.82	1.81	1.74	1.68	1.82	1.83	1.81	1.75	1.87
Joyce Kilmer-Slickrock Wilderness	2.86	2.58	2.51	2.36	2.71	2.97	2.98	3.06	3.08	2.87	2.72	2.85
Kaiser Wilderness	2.58	2.35	2.22	1.90	1.80	1.62	1.56	1.57	1.64	1.75	2.03	2.36
Kalmiopsis Wilderness	3.57	3.17	3.03	2.88	2.75	2.60	2.52	2.53	2.60	2.92	3.51	3.55
Kings Canyon	2.47	2.26	2.18	1.94	1.85	1.65	1.59	1.60	1.68	1.77	2.01	2.24
La Garita Wilderness	2.14	2.03	1.81	1.70	1.69	1.49	1.63	1.87	1.83	1.67	1.98	2.08
Lassen Volcanic NP	2.99	2.61	2.38	2.13	2.03	1.86	1.81	1.84	1.90	2.06	2.54	2.86
Lava Beds NM	3.31	2.88	2.64	2.44	2.29	2.13	1.98	1.99	2.10	2.43	3.03	3.26
Linville Gorge Wilderness	2.71	2.54	2.48	2.31	2.70	2.96	3.00	3.20	3.19	2.84	2.62	2.74
Lostwood Wilderness	2.51	2.45	2.54	2.06	2.03	2.21	2.23	2.05	2.02	2.13	2.69	2.67
Lye Brook Wilderness	2.46	2.30	2.34	2.31	2.42	2.47	2.60	2.76	2.84	2.70	2.54	2.51
Mammoth Cave NP	2.79	2.57	2.47	2.56	3.29	3.76	3.67	2.92	2.95	2.71	2.61	2.82
Marble Mountain Wilderness	3.48	3.08	2.95	2.78	2.67	2.53	2.50	2.52	2.55	2.78	3.32	3.42
Maroon Bells-Snowmass Wilderness	2.02	1.99	1.84	1.84	1.83	1.59	1.69	1.90	1.89	1.71	1.94	1.96
Mazatzal Wilderness	1.91	1.80	1.59	1.32	1.25	1.13	1.38	1.61	1.51	1.45	1.63	1.89
Medicine Lake Wilderness	2.53	2.46	2.46	2.02	2.00	2.13	2.12	1.95	1.98	2.10	2.63	2.65
Mesa Verde NP	2.45	2.25	1.98	1.57	1.61	1.31	1.62	1.87	1.75	1.66	2.01	2.30
Mingo Wilderness	2.73	2.52	2.34	2.28	2.53	2.60	2.64	2.67	2.71	2.56	2.56	2.73
Mission Mountains Wilderness	2.93	2.62	2.37	2.20	2.21	2.19	1.98	1.92	2.15	2.46	2.91	2.96
Mokelumne Wilderness	2.72	2.42	2.20	1.86	1.75	1.57	1.48	1.50	1.58	1.73	2.11	2.52
Moosehorn Wilderness	2.65	2.39	2.38	2.52	2.49	2.57	2.83	2.95	3.07	2.83	2.77	2.78
Mount Adams Wilderness	3.78	3.40	3.10	2.98	2.78	2.60	2.43	2.52	2.84	3.45	3.87	3.92
Mount Baldy Wilderness	2.00	1.86	1.62	1.34	1.29	1.18	1.50	1.73	1.60	1.51	1.73	2.01
Mount Hood Wilderness	3.71	3.33	3.08	2.96	2.74	2.55	2.34	2.42	2.72	3.35	3.81	3.84
Mount Jefferson Wilderness	3.89	3.48	3.27	3.16	2.89	2.66	2.35	2.35	2.63	3.34	3.92	3.95

Table 7. Monthly $f_L(RH)$ – Large $(NH_4)_2SO_4$ and NH_4NO_3 Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mount Rainier NP	3.93	3.54	3.23	3.12	2.96	2.75	2.61	2.69	3.04	3.66	4.04	4.07
Mount Washington Wilderness	4.09	3.63	3.49	3.41	3.06	2.80	2.37	2.34	2.62	3.41	4.07	4.10
Mount Zirkel Wilderness	2.00	1.99	1.89	1.92	1.98	1.72	1.63	1.70	1.81	1.75	1.97	1.95
Mountain Lakes Wilderness	3.51	3.03	2.80	2.62	2.44	2.25	2.08	2.09	2.23	2.65	3.37	3.52
North Absaroka Wilderness	2.16	2.05	2.01	1.95	1.94	1.77	1.58	1.50	1.67	1.87	2.12	2.14
North Cascades NP	3.60	3.32	2.99	2.88	2.74	2.59	2.49	2.63	2.97	3.43	3.77	3.76
Okefenokee Wilderness	2.94	2.73	2.73	2.65	2.74	3.11	3.00	3.17	3.16	3.05	2.96	3.03
Olympic NP	3.80	3.50	3.30	3.21	2.76	2.89	2.61	2.94	3.23	3.73	3.99	3.95
Otter Creek Wilderness	2.55	2.41	2.40	2.23	2.64	2.69	2.80	2.96	3.00	2.69	2.48	2.63
Pasayten Wilderness	3.65	3.34	2.97	2.84	2.72	2.53	2.45	2.56	2.88	3.39	3.78	3.81
Pecos Wilderness	2.09	1.93	1.73	1.57	1.58	1.44	1.65	1.90	1.84	1.63	1.90	2.05
Petrified Forest NP	2.11	1.95	1.64	1.40	1.32	1.18	1.46	1.72	1.58	1.53	1.81	2.09
Pine Mountain Wilderness	1.96	1.86	1.64	1.35	1.28	1.15	1.38	1.62	1.53	1.48	1.66	1.93
Pinnacles NM	2.84	2.86	2.87	2.27	2.15	1.99	1.91	1.97	1.98	2.10	2.16	2.46
Point Reyes NS	2.96	2.73	2.61	2.28	2.20	2.04	2.12	2.16	2.18	2.23	2.47	2.75
Presidential Range-Dry River Wilderness	2.52	2.32	2.37	2.42	2.49	2.61	2.78	2.93	3.03	2.83	2.68	2.59
Rawah Wilderness	1.91	1.96	1.89	1.96	2.04	1.79	1.71	1.78	1.86	1.75	1.94	1.90
Red Rock Lakes Wilderness	2.39	2.20	2.06	1.95	1.92	1.80	1.60	1.54	1.69	1.93	2.30	2.37
Redwood NP	3.31	3.10	3.16	3.04	3.11	3.08	3.26	3.28	3.11	2.99	3.20	3.12
Rocky Mountain NP	1.77	1.85	1.84	1.95	2.04	1.80	1.73	1.77	1.84	1.70	1.84	1.76
Roosevelt Campobello International Park	2.66	2.39	2.38	2.53	2.49	2.57	2.82	2.93	3.05	2.83	2.78	2.79
Saguaro NP	1.69	1.56	1.40	1.13	1.12	1.05	1.37	1.62	1.47	1.38	1.50	1.83
Saint Marks Wilderness	2.98	2.78	2.73	2.69	2.74	3.04	3.17	3.21	3.10	2.96	2.94	3.06
Salt Creek Wilderness	2.01	1.79	1.51	1.45	1.55	1.48	1.64	1.80	1.91	1.64	1.72	1.91
San Gabriel Wilderness	2.25	2.17	2.14	1.96	1.95	1.90	1.91	1.95	1.98	1.97	1.91	2.04
San Gorgonio Wilderness	2.21	2.23	2.13	1.90	1.90	1.69	1.62	1.71	1.72	1.70	1.73	1.92
San Jacinto Wilderness	2.12	2.09	2.06	1.90	1.90	1.81	1.71	1.88	1.89	1.87	1.80	1.92
San Pedro Parks Wilderness	2.14	1.97	1.73	1.55	1.53	1.38	1.59	1.83	1.77	1.61	1.91	2.08
San Rafael Wilderness	2.50	2.37	2.34	2.12	2.10	2.05	2.10	2.15	2.20	2.15	2.07	2.25
Sawtooth Wilderness	2.79	2.44	2.05	1.83	1.80	1.66	1.37	1.35	1.43	1.77	2.47	2.75
Scapegoat Wilderness	2.74	2.47	2.30	2.18	2.16	2.14	1.93	1.87	2.07	2.35	2.70	2.72
Selway-Bitterroot Wilderness	2.90	2.57	2.26	2.05	2.03	1.95	1.67	1.63	1.81	2.19	2.76	2.91
Seney Wilderness	2.75	2.42	2.49	2.35	2.30	2.55	2.75	3.01	3.03	2.78	2.88	2.85
Sequoia NP	2.40	2.22	2.21	2.05	1.95	1.67	1.60	1.59	1.69	1.78	2.04	2.17
Shenandoah NP	2.44	2.28	2.29	2.12	2.45	2.56	2.65	2.79	2.81	2.53	2.34	2.55
Shining Rock Wilderness	2.78	2.56	2.48	2.33	2.72	2.98	3.02	3.17	3.18	2.91	2.68	2.79
Sierra Ancha Wilderness	1.92	1.81	1.59	1.32	1.25	1.13	1.42	1.65	1.54	1.47	1.66	1.93
Simeonof Wilderness	3.39	3.40	3.15	3.26	3.40	3.69	4.00	4.14	3.61	3.09	3.21	3.44
Sipsey Wilderness	2.79	2.58	2.42	2.36	2.64	2.86	2.94	2.92	2.93	2.78	2.64	2.80
South Warner Wilderness	3.06	2.67	2.39	2.16	2.05	1.90	1.68	1.69	1.79	2.11	2.67	2.97
Strawberry Mountain Wilderness	3.55	3.10	2.69	2.47	2.37	2.10	1.82	1.81	2.05	2.73	3.45	3.65
Superstition Wilderness	1.84	1.72	1.53	1.26	1.20	1.11	1.36	1.56	1.46	1.40	1.58	1.85
Swanquarter Wilderness	2.48	2.35	2.31	2.18	2.38	2.55	2.67	2.72	2.64	2.55	2.40	2.49
Sycamore Canyon Wilderness	2.01	1.93	1.70	1.40	1.33	1.17	1.38	1.67	1.58	1.52	1.70	1.97
Teton Wilderness	2.22	2.09	2.01	1.92	1.91	1.72	1.52	1.47	1.65	1.86	2.15	2.19

Table 7. Monthly $f_L(RH)$ – Large $(NH_4)_2SO_4$ and NH_4NO_3 Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Theodore Roosevelt NP	2.47	2.42	2.45	2.12	2.14	2.21	2.14	1.99	1.99	2.10	2.58	2.57
Thousand Lakes Wilderness	3.04	2.63	2.42	2.17	2.06	1.88	1.82	1.85	1.91	2.08	2.61	2.91
Three Sisters Wilderness	4.03	3.59	3.43	3.34	3.02	2.78	2.40	2.38	2.65	3.39	4.02	4.04
Tuxedni Wilderness	2.97	2.83	2.47	2.40	2.38	2.50	2.96	3.19	3.18	2.91	2.91	3.03
UL Bend Wilderness	2.33	2.20	2.19	2.03	1.96	1.95	1.80	1.66	1.76	2.00	2.31	2.32
Upper Buffalo Wilderness	2.71	2.48	2.31	2.33	2.61	2.64	2.57	2.59	2.71	2.58	2.59	2.72
Ventana Wilderness	2.80	2.67	2.63	2.20	2.10	1.96	1.97	2.01	2.05	2.11	2.21	2.51
Virgin Islands NP	2.04	2.00	1.94	2.03	2.06	2.04	2.05	2.14	2.14	2.18	2.20	2.12
Voyageurs NP	2.46	2.22	2.22	2.07	2.09	2.46	2.46	2.59	2.70	2.35	2.58	2.55
Washakie Wilderness	2.16	2.05	2.01	1.94	1.93	1.74	1.54	1.48	1.66	1.86	2.12	2.14
Weminuche Wilderness	2.19	2.05	1.81	1.65	1.64	1.44	1.60	1.85	1.79	1.65	1.97	2.11
West Elk Wilderness	2.11	2.04	1.84	1.77	1.77	1.54	1.63	1.83	1.83	1.69	1.96	2.04
Wheeler Peak Wilderness	2.14	2.00	1.78	1.65	1.67	1.52	1.66	1.94	1.89	1.68	1.98	2.10
White Mountain Wilderness	2.00	1.79	1.51	1.40	1.44	1.37	1.64	1.82	1.85	1.59	1.72	1.95
Wichita Mountains Wilderness	2.39	2.25	2.10	2.11	2.39	2.24	2.02	2.13	2.35	2.22	2.28	2.41
Wind Cave NP	2.23	2.22	2.22	2.18	2.32	2.18	2.00	1.97	1.95	2.00	2.30	2.24
Wolf Island Wilderness	2.86	2.67	2.61	2.54	2.63	2.96	2.94	3.13	3.12	2.99	2.88	2.95
Yellowstone NP	2.24	2.11	2.03	1.95	1.94	1.78	1.59	1.53	1.69	1.91	2.19	2.22
Yolla Bolly-Middle Eel Wilderness	3.12	2.76	2.60	2.37	2.29	2.13	2.14	2.18	2.21	2.33	2.75	2.98
Yosemite NP	2.61	2.45	2.34	1.99	1.88	1.61	1.48	1.46	1.54	1.69	2.06	2.38
Zion NP	2.32	2.18	1.83	1.56	1.45	1.26	1.24	1.38	1.40	1.51	1.84	2.14

Table 8. Monthly $f_S(RH)$ – Small $(NH_4)_2SO_4$ and NH_4NO_3 Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acadia NP	3.80	3.28	3.30	3.71	3.72	3.81	4.28	4.34	4.58	4.10	4.06	4.19
Agua Tibia Wilderness	2.68	2.61	2.63	2.42	2.40	2.33	2.33	2.45	2.49	2.46	2.29	2.42
Alpine Lakes Wilderness	5.87	5.35	4.34	4.13	4.30	3.50	3.61	3.69	4.27	5.43	6.15	6.08
Anaconda Pintler Wilderness	3.72	3.23	2.87	2.62	2.60	2.52	2.14	2.07	2.33	2.87	3.60	3.71
Ansel Adams Wilderness	3.51	3.11	2.87	2.34	2.18	1.86	1.75	1.76	1.88	2.05	2.55	3.12
Arches NP	2.96	2.70	2.09	1.84	1.75	1.40	1.49	1.69	1.76	1.83	2.33	2.69
Badlands NP	2.94	2.96	3.01	2.87	3.10	2.91	2.64	2.59	2.56	2.58	3.11	2.98
Bandelier NM	2.66	2.36	2.10	1.77	1.80	1.55	1.93	2.30	2.21	1.87	2.32	2.60
Bering Sea Wilderness	4.16	4.48	4.52	4.50	4.64	4.86	5.71	6.43	5.40	4.52	4.36	4.37
Big Bend NP	2.11	1.92	1.65	1.56	1.67	1.67	1.83	2.07	2.22	1.92	1.92	2.04
Black Canyon of the Gunnison NP	2.71	2.56	2.23	2.12	2.12	1.75	1.87	2.17	2.21	2.00	2.42	2.57
Bob Marshall Wilderness	3.84	3.35	3.06	2.86	2.86	2.84	2.49	2.39	2.77	3.22	3.81	3.83
Bosque del Apache Wilderness	2.56	2.23	1.83	1.54	1.54	1.39	1.90	2.16	2.09	1.79	2.09	2.53
Boundary Waters Canoe Area Wilderness	3.23	2.81	2.93	2.63	2.89	3.22	3.44	3.71	3.83	3.08	3.49	3.49
Breton Wilderness	4.08	3.82	3.79	3.74	3.94	4.12	4.41	4.37	4.18	3.92	3.93	4.06
Bridger Wilderness	2.78	2.60	2.55	2.43	2.45	1.99	1.65	1.63	2.03	2.25	2.78	2.68
Brigantine Wilderness	3.34	3.07	3.17	2.99	3.37	3.45	3.68	3.90	3.91	3.73	3.27	3.36
Bryce Canyon NP	3.02	2.77	2.23	1.84	1.70	1.38	1.42	1.67	1.67	1.81	2.30	2.75
Cabinet Mountains Wilderness	4.30	3.69	3.23	2.91	2.91	2.87	2.50	2.40	2.84	3.40	4.26	4.37
Caney Creek Wilderness	3.85	3.44	3.14	3.24	3.66	3.71	3.49	3.51	3.73	3.72	3.68	3.88
Canyonlands NP	3.03	2.77	2.17	1.86	1.76	1.40	1.52	1.78	1.81	1.87	2.38	2.77
Cape Romain Wilderness	3.66	3.33	3.24	3.07	3.46	3.88	3.91	4.31	4.30	4.00	3.62	3.73
Capitol Reef NP	3.10	2.86	2.27	1.94	1.81	1.45	1.52	1.77	1.81	1.91	2.43	2.86
Caribou Wilderness	4.17	3.50	3.11	2.68	2.54	2.28	2.21	2.26	2.36	2.60	3.39	3.93
Carlsbad Caverns NP	2.70	2.25	1.75	1.63	1.77	1.70	2.06	2.34	2.59	1.95	2.16	2.57
Chassahowitzka Wilderness	4.31	3.92	3.79	3.62	3.57	4.22	4.26	4.50	4.49	4.29	4.18	4.43
Chiricahua NM	2.29	2.19	1.75	1.34	1.31	1.18	1.94	2.28	1.95	1.64	1.79	2.34
Chiricahua Wilderness	2.25	2.14	1.71	1.30	1.28	1.17	1.95	2.26	1.93	1.61	1.75	2.31
Cohutta Wilderness	3.99	3.59	3.38	3.16	3.76	4.19	4.24	4.37	4.41	4.09	3.77	4.00
Crater Lake NP	5.58	4.73	4.37	4.09	3.70	3.37	3.05	3.08	3.38	4.26	5.52	5.64
Craters of the Moon NM	3.40	3.00	2.52	2.22	2.23	1.94	1.56	1.55	1.76	2.17	3.04	3.32
Cucamonga Wilderness	2.87	2.73	2.68	2.40	2.37	2.29	2.31	2.38	2.43	2.42	2.34	2.54
Denali NP & Pres	3.21	3.19	2.71	2.39	2.46	2.69	3.27	4.05	4.17	3.90	3.59	3.58
Desolation Wilderness	3.77	3.22	2.82	2.26	2.09	1.80	1.67	1.71	1.84	2.08	2.72	3.44
Diamond Peak Wilderness	5.79	4.97	4.61	4.35	3.90	3.55	3.08	3.12	3.55	4.63	5.75	5.88
Dolly Sods Wilderness	3.39	3.16	3.17	2.87	3.63	3.62	3.78	4.06	4.15	3.63	3.27	3.53
Dome Land Wilderness	2.97	2.64	2.51	2.17	2.08	1.91	1.89	1.93	2.01	2.06	2.23	2.56
Eagle Cap Wilderness	5.05	4.28	3.45	3.05	3.02	2.56	2.20	2.15	2.53	3.62	4.89	5.26
Eagles Nest Wilderness	2.48	2.48	2.29	2.32	2.42	2.03	2.02	2.24	2.31	2.09	2.42	2.42
Emigrant Wilderness	3.69	3.25	2.98	2.39	2.21	1.86	1.71	1.73	1.85	2.07	2.68	3.32
Everglades NP	3.14	2.93	2.83	2.67	2.63	3.03	2.91	3.22	3.33	3.12	2.95	3.08
Fitzpatrick Wilderness	2.78	2.60	2.54	2.43	2.44	1.99	1.66	1.63	2.02	2.25	2.77	2.68
Flat Tops Wilderness	2.61	2.53	2.28	2.26	2.31	1.91	1.86	2.04	2.19	2.06	2.42	2.51
Galiuro Wilderness	2.17	1.99	1.68	1.30	1.26	1.14	1.62	1.96	1.75	1.60	1.82	2.31
Gates of the Mountains Wilderness	3.20	2.85	2.71	2.57	2.53	2.50	2.21	2.14	2.37	2.74	3.09	3.12

Table 8. Monthly f_S(RH) – Small $(NH_4)_2SO_4$ and NH_4NO_3 Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gearhart Mountain Wilderness	4.80	4.05	3.60	3.30	3.04	2.76	2.37	2.39	2.62	3.36	4.45	4.76
Gila Wilderness	2.40	2.16	1.77	1.45	1.41	1.33	2.11	2.12	2.00	1.73	1.99	2.45
Glacier NP	4.53	3.87	3.63	3.39	3.51	3.48	2.91	2.87	3.47	3.86	4.29	4.37
Glacier Peak Wilderness	5.53	4.98	4.21	3.99	3.90	3.43	3.35	3.54	4.14	5.12	5.80	5.80
Goat Rocks Wilderness	5.81	5.08	4.46	4.23	3.97	3.57	3.35	3.48	4.11	5.22	5.98	6.09
Grand Canyon NP	2.73	2.53	2.12	1.69	1.52	1.27	1.42	1.72	1.69	1.74	2.11	2.49
Grand Teton NP	2.88	2.66	2.48	2.35	2.34	2.00	1.68	1.62	1.94	2.25	2.73	2.82
Great Gulf Wilderness	3.34	3.02	3.12	3.23	3.31	3.46	3.76	4.03	4.22	3.90	3.64	3.50
Great Sand Dunes NP & Pres	2.66	2.55	2.27	2.16	2.22	1.92	2.04	2.47	2.41	2.07	2.57	2.63
Great Smoky Mountains NP	4.01	3.52	3.43	3.14	3.76	4.20	4.21	4.39	4.45	4.05	3.76	3.99
Guadalupe Mountains NP	2.85	2.28	1.74	1.57	1.73	1.69	2.16	2.48	2.74	1.90	2.20	2.71
Haleakala NP	2.98	2.85	2.81	2.72	2.60	2.53	2.65	2.63	2.56	2.69	2.95	2.89
Hawaii Volcanoes NP	3.35	3.10	3.14	3.13	3.14	3.11	3.24	3.42	3.34	3.38	3.76	3.34
Hells Canyon Wilderness	4.28	3.56	2.83	2.42	2.34	2.19	1.80	1.75	2.01	2.75	4.03	4.45
Hercules-Glades Wilderness	3.70	3.33	3.01	3.01	3.47	3.48	3.41	3.51	3.67	3.43	3.46	3.73
Hoover Wilderness	3.63	3.18	2.89	2.33	2.16	1.82	1.66	1.68	1.81	2.02	2.62	3.25
Isle Royale NP	3.26	2.74	2.87	2.58	2.46	3.00	3.59	3.68	3.92	2.88	3.72	3.67
James River Face Wilderness	3.25	3.03	3.02	2.72	3.31	3.48	3.59	3.83	3.91	3.48	3.11	3.38
Jarbidge Wilderness	3.29	2.92	2.31	2.34	2.44	2.22	1.73	1.51	1.48	1.80	2.70	3.13
John Muir Wilderness	3.42	3.02	2.86	2.44	2.29	1.94	1.86	1.87	2.01	2.16	2.60	3.03
Joshua Tree NP	2.62	2.49	2.44	2.19	2.16	2.05	1.97	2.18	2.21	2.19	2.11	2.31
Joyce Kilmer-Slickrock Wilderness	4.02	3.54	3.42	3.15	3.74	4.19	4.21	4.35	4.41	4.04	3.77	4.00
Kaiser Wilderness	3.55	3.13	2.89	2.36	2.21	1.90	1.81	1.83	1.95	2.12	2.59	3.16
Kalmiopsis Wilderness	5.32	4.56	4.30	4.02	3.79	3.54	3.43	3.44	3.56	4.12	5.21	5.28
Kings Canyon	3.35	2.97	2.82	2.42	2.28	1.93	1.85	1.87	2.01	2.15	2.56	2.96
La Garita Wilderness	2.71	2.54	2.21	2.04	2.05	1.72	1.93	2.31	2.26	2.00	2.46	2.62
Lassen Volcanic NP	4.24	3.55	3.16	2.73	2.58	2.31	2.24	2.29	2.39	2.64	3.46	4.00
Lava Beds NM	4.84	4.05	3.63	3.28	3.04	2.76	2.53	2.55	2.75	3.29	4.35	4.75
Linville Gorge Wilderness	3.76	3.46	3.37	3.07	3.74	4.18	4.24	4.62	4.61	4.00	3.59	3.80
Lostwood Wilderness	3.21	3.15	3.36	2.60	2.54	2.86	2.89	2.60	2.53	2.72	3.60	3.52
Lye Brook Wilderness	3.25	2.99	3.10	3.06	3.24	3.30	3.52	3.80	3.95	3.71	3.42	3.35
Mammoth Cave NP	3.86	3.47	3.32	3.54	4.90	5.77	5.58	4.09	4.15	3.73	3.54	3.91
Marble Mountain Wilderness	5.15	4.40	4.15	3.84	3.67	3.44	3.41	3.44	3.50	3.89	4.87	5.04
Maroon Bells-Snowmass Wilderness	2.48	2.44	2.23	2.25	2.25	1.87	2.02	2.35	2.35	2.04	2.36	2.38
Mazatzal Wilderness	2.36	2.20	1.88	1.46	1.36	1.18	1.54	1.89	1.74	1.66	1.91	2.33
Medicine Lake Wilderness	3.25	3.15	3.21	2.52	2.49	2.71	2.71	2.42	2.46	2.65	3.48	3.48
Mesa Verde NP	3.32	2.96	2.55	1.88	1.96	1.46	1.94	2.35	2.13	2.04	2.57	3.06
Mingo Wilderness	3.74	3.38	3.07	2.97	3.39	3.52	3.57	3.64	3.72	3.47	3.43	3.74
Mission Mountains Wilderness	4.03	3.51	3.08	2.82	2.84	2.83	2.49	2.40	2.78	3.28	4.04	4.08
Mokelumne Wilderness	3.75	3.23	2.86	2.29	2.12	1.81	1.68	1.72	1.84	2.08	2.71	3.41
Moosehorn Wilderness	3.59	3.14	3.16	3.44	3.38	3.49	3.98	4.18	4.40	3.94	3.82	3.82
Mount Adams Wilderness	5.71	5.00	4.46	4.23	3.89	3.55	3.26	3.41	4.02	5.13	5.89	5.98
Mount Baldy Wilderness	2.51	2.30	1.92	1.51	1.43	1.25	1.73	2.08	1.88	1.76	2.08	2.54
Mount Hood Wilderness	5.56	4.87	4.40	4.19	3.79	3.44	3.07	3.22	3.79	4.93	5.76	5.81
Mount Jefferson Wilderness	5.95	5.16	4.78	4.57	4.09	3.65	3.10	3.11	3.63	4.91	5.98	6.05

Table 8. Monthly $f_S(RH)$ – Small $(NH_4)_2SO_4$ and NH_4NO_3 Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mount Rainier NP	6.01	5.29	4.71	4.51	4.23	3.82	3.59	3.73	4.39	5.55	6.23	6.27
Mount Washington Wilderness	6.35	5.47	5.22	5.07	4.42	3.93	3.16	3.09	3.63	5.07	6.31	6.35
Mount Zirkel Wilderness	2.43	2.44	2.31	2.37	2.51	2.07	1.92	2.02	2.23	2.12	2.41	2.37
Mountain Lakes Wilderness	5.20	4.32	3.90	3.58	3.26	2.96	2.69	2.70	2.94	3.67	4.96	5.24
North Absaroka Wilderness	2.68	2.51	2.50	2.42	2.40	2.13	1.83	1.72	1.98	2.31	2.65	2.65
North Cascades NP	5.37	4.86	4.24	4.04	3.80	3.51	3.34	3.61	4.23	5.08	5.68	5.66
Okefenokee Wilderness	4.16	3.79	3.80	3.65	3.79	4.46	4.24	4.55	4.55	4.35	4.18	4.33
Olympic NP	5.76	5.20	4.81	4.64	3.81	4.04	3.52	4.16	4.70	5.63	6.11	6.02
Otter Creek Wilderness	3.41	3.20	3.20	2.91	3.64	3.70	3.88	4.18	4.26	3.72	3.32	3.56
Pasayten Wilderness	5.46	4.89	4.20	3.96	3.77	3.42	3.28	3.49	4.08	5.00	5.72	5.74
Pecos Wilderness	2.65	2.40	2.10	1.85	1.88	1.65	1.96	2.34	2.27	1.94	2.36	2.60
Petrified Forest NP	2.67	2.43	1.96	1.59	1.46	1.26	1.67	2.06	1.85	1.79	2.20	2.66
Pine Mountain Wilderness	2.44	2.29	1.95	1.51	1.41	1.20	1.54	1.91	1.77	1.70	1.96	2.39
Pinnacles NM	4.02	4.05	4.09	3.01	2.81	2.54	2.40	2.52	2.54	2.74	2.82	3.36
Point Reyes NS	4.16	3.74	3.53	2.96	2.80	2.55	2.69	2.77	2.80	2.90	3.30	3.80
Presidential Range-Dry River Wilderness	3.36	3.02	3.15	3.26	3.37	3.56	3.86	4.14	4.33	3.96	3.68	3.50
Rawah Wilderness	2.31	2.39	2.32	2.44	2.61	2.19	2.05	2.16	2.31	2.12	2.37	2.29
Red Rock Lakes Wilderness	3.09	2.76	2.57	2.41	2.38	2.17	1.86	1.77	2.01	2.39	2.96	3.05
Redwood NP	4.81	4.41	4.51	4.27	4.40	4.37	4.73	4.76	4.46	4.24	4.62	4.45
Rocky Mountain NP	2.09	2.24	2.24	2.45	2.62	2.22	2.09	2.15	2.29	2.04	2.23	2.08
Roosevelt Campobello International Park	3.61	3.14	3.16	3.45	3.37	3.49	3.95	4.15	4.36	3.93	3.84	3.85
Saguaro NP	1.99	1.80	1.56	1.18	1.16	1.07	1.51	1.89	1.66	1.54	1.72	2.25
Saint Marks Wilderness	4.24	3.89	3.79	3.72	3.79	4.32	4.56	4.63	4.43	4.19	4.16	4.39
Salt Creek Wilderness	2.57	2.19	1.75	1.67	1.82	1.69	1.93	2.16	2.37	1.94	2.07	2.38
San Gabriel Wilderness	2.94	2.78	2.72	2.41	2.37	2.29	2.32	2.39	2.44	2.44	2.36	2.58
San Gorgonio Wilderness	2.94	2.94	2.74	2.36	2.34	2.00	1.88	2.02	2.05	2.04	2.10	2.43
San Jacinto Wilderness	2.73	2.65	2.59	2.33	2.30	2.16	2.02	2.26	2.30	2.28	2.19	2.38
San Pedro Parks Wilderness	2.73	2.45	2.10	1.81	1.80	1.55	1.87	2.24	2.16	1.91	2.36	2.65
San Rafael Wilderness	3.38	3.13	3.07	2.68	2.64	2.57	2.66	2.74	2.84	2.77	2.63	2.94
Sawtooth Wilderness	3.78	3.18	2.55	2.20	2.17	1.95	1.51	1.50	1.61	2.11	3.26	3.70
Scapegoat Wilderness	3.70	3.24	2.97	2.79	2.78	2.75	2.41	2.31	2.65	3.09	3.67	3.68
Selway-Bitterroot Wilderness	3.99	3.41	2.90	2.56	2.54	2.43	2.00	1.93	2.21	2.82	3.78	4.01
Seney Wilderness	3.69	3.10	3.30	3.10	3.03	3.45	3.80	4.27	4.31	3.82	3.97	3.87
Sequoia NP	3.25	2.91	2.87	2.59	2.46	1.97	1.85	1.84	2.02	2.18	2.64	2.85
Shenandoah NP	3.26	2.99	3.02	2.72	3.28	3.46	3.59	3.85	3.91	3.41	3.08	3.44
Shining Rock Wilderness	3.89	3.51	3.37	3.11	3.77	4.22	4.29	4.58	4.60	4.12	3.69	3.88
Sierra Ancha Wilderness	2.38	2.21	1.87	1.46	1.36	1.19	1.60	1.95	1.78	1.69	1.96	2.41
Simeonof Wilderness	4.86	4.88	4.44	4.64	4.92	5.46	6.08	6.35	5.30	4.29	4.52	4.98
Sipsey Wilderness	3.89	3.52	3.23	3.13	3.60	3.99	4.13	4.09	4.12	3.87	3.61	3.89
South Warner Wilderness	4.36	3.67	3.20	2.81	2.64	2.39	2.04	2.07	2.24	2.76	3.71	4.20
Strawberry Mountain Wilderness	5.26	4.45	3.71	3.32	3.18	2.70	2.26	2.24	2.66	3.84	5.11	5.44
Superstition Wilderness	2.25	2.06	1.77	1.38	1.29	1.15	1.52	1.81	1.66	1.58	1.83	2.28
Swanquarter Wilderness	3.31	3.09	3.01	2.78	3.09	3.39	3.57	3.68	3.55	3.40	3.14	3.33
Sycamore Canyon Wilderness	2.52	2.41	2.05	1.59	1.47	1.23	1.53	1.98	1.85	1.77	2.03	2.45
Teton Wilderness	2.78	2.59	2.49	2.37	2.36	2.06	1.75	1.67	1.96	2.28	2.70	2.73

Table 8. Monthly $f_S(RH)$ – Small $(NH_4)_2SO_4$ and NH_4NO_3 Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Theodore Roosevelt NP	3.17	3.11	3.22	2.71	2.74	2.85	2.73	2.49	2.48	2.66	3.42	3.37
Thousand Lakes Wilderness	4.34	3.60	3.22	2.79	2.62	2.34	2.26	2.31	2.41	2.69	3.58	4.11
Three Sisters Wilderness	6.22	5.38	5.09	4.92	4.35	3.89	3.21	3.17	3.68	5.02	6.20	6.24
Tuxedni Wilderness	4.11	3.89	3.26	3.14	3.11	3.31	4.13	4.57	4.57	4.04	4.04	4.23
UL Bend Wilderness	2.94	2.75	2.77	2.55	2.44	2.41	2.19	1.97	2.12	2.50	2.96	2.95
Upper Buffalo Wilderness	3.73	3.33	3.03	3.07	3.54	3.57	3.43	3.50	3.71	3.51	3.52	3.74
Ventana Wilderness	3.92	3.69	3.61	2.86	2.69	2.46	2.46	2.55	2.61	2.72	2.89	3.43
Virgin Islands NP	2.41	2.36	2.27	2.39	2.44	2.40	2.43	2.57	2.58	2.63	2.68	2.54
Voyageurs NP	3.16	2.77	2.82	2.59	2.65	3.28	3.25	3.48	3.66	3.02	3.37	3.32
Washakie Wilderness	2.68	2.52	2.49	2.40	2.40	2.09	1.77	1.68	1.98	2.29	2.66	2.65
Weminuche Wilderness	2.80	2.58	2.22	1.97	1.97	1.64	1.89	2.28	2.20	1.97	2.45	2.69
West Elk Wilderness	2.64	2.53	2.24	2.15	2.16	1.79	1.92	2.24	2.26	2.02	2.41	2.53
Wheeler Peak Wilderness	2.72	2.50	2.17	1.97	2.02	1.76	1.98	2.42	2.36	2.01	2.48	2.66
White Mountain Wilderness	2.54	2.19	1.76	1.58	1.65	1.53	1.94	2.20	2.29	1.87	2.07	2.45
Wichita Mountains Wilderness	3.17	2.94	2.69	2.68	3.15	2.86	2.49	2.70	3.07	2.87	2.97	3.20
Wind Cave NP	2.81	2.81	2.86	2.82	3.06	2.81	2.50	2.46	2.44	2.52	2.97	2.83
Wolf Island Wilderness	4.02	3.68	3.58	3.45	3.59	4.17	4.13	4.47	4.46	4.23	4.05	4.18
Yellowstone NP	2.82	2.61	2.53	2.42	2.41	2.16	1.86	1.76	2.02	2.36	2.78	2.80
Yolla Bolly-Middle Eel Wilderness	4.48	3.82	3.53	3.13	3.00	2.75	2.81	2.87	2.93	3.11	3.84	4.24
Yosemite NP	3.62	3.32	3.13	2.52	2.34	1.89	1.69	1.67	1.78	2.04	2.65	3.22
Zion NP	3.05	2.81	2.26	1.84	1.67	1.37	1.33	1.54	1.58	1.75	2.25	2.72

Table 9. Monthly f_{SS}(RH) – Sea Salt Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acadia NP	3.90	3.48	3.40	3.66	3.71	3.81	4.19	4.27	4.44	4.13	4.10	4.19
Agua Tibia Wilderness	2.94	2.95	3.02	2.85	2.88	2.81	2.78	2.90	2.90	2.83	2.56	2.69
Alpine Lakes Wilderness	5.35	4.96	4.27	4.11	4.18	3.64	3.68	3.73	4.12	4.98	5.51	5.53
Anaconda Pintler Wilderness	4.00	3.56	3.18	2.90	2.85	2.75	2.33	2.25	2.52	3.10	3.81	3.97
Ansel Adams Wilderness	3.55	3.25	3.04	2.54	2.38	2.05	1.91	1.91	2.03	2.21	2.72	3.21
Arches NP	3.25	2.99	2.26	1.97	1.86	1.48	1.59	1.82	1.88	1.96	2.60	3.02
Badlands NP	3.37	3.33	3.27	3.05	3.25	3.15	2.89	2.81	2.74	2.82	3.41	3.38
Bandelier NM	2.91	2.59	2.22	1.87	1.90	1.67	2.11	2.54	2.37	2.00	2.49	2.78
Bering Sea Wilderness	4.39	4.57	4.60	4.58	4.57	4.70	5.26	5.73	5.11	4.59	4.52	4.54
Big Bend NP	2.20	2.03	1.75	1.67	1.84	1.87	2.03	2.34	2.47	2.09	2.10	2.22
Black Canyon of the Gunnison NP	3.05	2.89	2.47	2.31	2.28	1.89	2.04	2.36	2.37	2.18	2.71	2.92
Bob Marshall Wilderness	4.08	3.66	3.35	3.11	3.08	3.04	2.68	2.59	2.94	3.42	3.98	4.05
Bosque del Apache Wilderness	2.77	2.43	1.95	1.62	1.62	1.47	2.06	2.40	2.29	1.92	2.27	2.71
Boundary Waters Canoe Area Wilderness	3.73	3.35	3.29	2.91	3.00	3.44	3.68	3.88	3.98	3.45	3.89	3.91
Breton Wilderness	4.10	3.89	3.87	3.85	4.02	4.21	4.44	4.38	4.23	3.99	4.01	4.11
Bridger Wilderness	3.25	3.05	2.90	2.67	2.62	2.17	1.81	1.79	2.17	2.43	3.15	3.17
Brigantine Wilderness	3.53	3.24	3.30	3.15	3.49	3.63	3.84	4.02	4.02	3.82	3.48	3.55
Bryce Canyon NP	3.24	3.00	2.40	1.96	1.80	1.45	1.52	1.80	1.78	1.93	2.52	2.99
Cabinet Mountains Wilderness	4.42	3.93	3.50	3.18	3.13	3.06	2.67	2.59	3.01	3.58	4.33	4.46
Caney Creek Wilderness	3.90	3.52	3.31	3.41	3.83	3.88	3.69	3.68	3.82	3.76	3.77	3.93
Canyonlands NP	3.30	3.04	2.33	1.99	1.87	1.48	1.63	1.90	1.94	2.00	2.64	3.07
Cape Romain Wilderness	3.74	3.44	3.37	3.23	3.62	3.99	4.04	4.32	4.29	4.03	3.74	3.81
Capitol Reef NP	3.35	3.11	2.45	2.08	1.93	1.54	1.62	1.90	1.94	2.05	2.68	3.13
Caribou Wilderness	4.16	3.63	3.28	2.89	2.75	2.47	2.33	2.37	2.49	2.74	3.48	3.97
Carlsbad Caverns NP	2.75	2.36	1.86	1.72	1.89	1.86	2.27	2.59	2.75	2.09	2.29	2.68
Chassahowitzka Wilderness	4.29	3.99	3.89	3.76	3.77	4.29	4.34	4.51	4.49	4.33	4.23	4.38
Chiricahua NM	2.53	2.38	1.91	1.41	1.38	1.21	2.12	2.55	2.18	1.78	1.99	2.56
Chiricahua Wilderness	2.48	2.33	1.86	1.37	1.35	1.20	2.12	2.54	2.16	1.75	1.94	2.52
Cohutta Wilderness	3.97	3.62	3.44	3.26	3.82	4.20	4.24	4.35	4.35	4.05	3.82	4.02
Crater Lake NP	5.15	4.56	4.31	4.12	3.80	3.52	3.20	3.23	3.44	4.17	5.10	5.19
Craters of the Moon NM	3.78	3.41	2.86	2.51	2.48	2.16	1.72	1.69	1.93	2.43	3.38	3.72
Cucamonga Wilderness	3.07	3.01	3.03	2.79	2.80	2.72	2.72	2.80	2.81	2.76	2.58	2.77
Denali NP & Pres	3.68	3.57	3.07	2.74	2.74	3.01	3.53	4.13	4.19	4.09	3.92	3.94
Desolation Wilderness	3.85	3.39	3.02	2.48	2.32	2.01	1.84	1.87	2.02	2.28	2.94	3.58
Diamond Peak Wilderness	5.29	4.72	4.45	4.27	3.92	3.65	3.23	3.26	3.56	4.43	5.26	5.34
Dolly Sods Wilderness	3.60	3.35	3.31	3.03	3.66	3.76	3.91	4.12	4.16	3.72	3.47	3.72
Dome Land Wilderness	3.10	2.86	2.75	2.42	2.33	2.15	2.11	2.16	2.22	2.26	2.40	2.71
Eagle Cap Wilderness	4.84	4.27	3.57	3.22	3.14	2.74	2.33	2.27	2.60	3.61	4.68	4.99
Eagles Nest Wilderness	2.86	2.82	2.54	2.52	2.57	2.20	2.20	2.44	2.46	2.27	2.73	2.79
Emigrant Wilderness	3.70	3.37	3.13	2.60	2.42	2.05	1.88	1.88	2.01	2.24	2.84	3.39
Everglades NP	3.60	3.44	3.37	3.22	3.21	3.58	3.50	3.72	3.78	3.61	3.50	3.55
Fitzpatrick Wilderness	3.25	3.05	2.88	2.66	2.62	2.18	1.82	1.79	2.16	2.43	3.13	3.18
Flat Tops Wilderness	2.99	2.88	2.54	2.47	2.47	2.07	2.03	2.23	2.35	2.25	2.75	2.89
Galiuro Wilderness	2.42	2.19	1.82	1.35	1.31	1.16	1.76	2.18	1.94	1.73	2.00	2.52
Gates of the Mountains Wilderness	3.62	3.27	3.05	2.85	2.80	2.74	2.43	2.35	2.58	2.99	3.41	3.52

Table 9. Monthly f_{ss}(RH) – Sea Salt Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gearhart Mountain Wilderness	4.63	4.06	3.67	3.40	3.16	2.90	2.49	2.50	2.70	3.39	4.31	4.60
Gila Wilderness	2.63	2.35	1.91	1.52	1.48	1.36	2.22	2.36	2.19	1.87	2.17	2.65
Glacier NP	4.61	4.12	3.87	3.64	3.63	3.59	3.11	3.11	3.63	4.03	4.43	4.51
Glacier Peak Wilderness	5.14	4.73	4.19	4.03	3.93	3.60	3.51	3.63	4.04	4.79	5.31	5.34
Goat Rocks Wilderness	5.30	4.79	4.32	4.15	3.94	3.65	3.46	3.55	3.99	4.83	5.40	5.51
Grand Canyon NP	2.93	2.73	2.26	1.78	1.61	1.32	1.50	1.85	1.79	1.84	2.29	2.70
Grand Teton NP	3.34	3.10	2.82	2.59	2.56	2.21	1.85	1.78	2.12	2.48	3.10	3.29
Great Gulf Wilderness	3.60	3.29	3.29	3.34	3.41	3.58	3.85	4.07	4.20	3.96	3.81	3.73
Great Sand Dunes NP & Pres	2.98	2.84	2.48	2.33	2.36	2.08	2.24	2.66	2.56	2.26	2.82	2.94
Great Smoky Mountains NP	4.01	3.57	3.47	3.22	3.82	4.23	4.24	4.37	4.38	4.03	3.81	4.02
Guadalupe Mountains NP	2.82	2.35	1.84	1.64	1.82	1.83	2.36	2.72	2.85	2.01	2.28	2.76
Haleakala NP	3.52	3.43	3.40	3.35	3.25	3.18	3.29	3.27	3.22	3.33	3.52	3.47
Hawaii Volcanoes NP	3.80	3.68	3.71	3.72	3.72	3.69	3.79	3.83	3.79	3.83	4.08	3.80
Hells Canyon Wilderness	4.39	3.81	3.15	2.75	2.63	2.44	1.97	1.90	2.19	3.00	4.13	4.51
Hercules-Glades Wilderness	3.86	3.51	3.23	3.22	3.66	3.72	3.69	3.73	3.81	3.57	3.65	3.88
Hoover Wilderness	3.66	3.31	3.05	2.53	2.36	2.00	1.82	1.82	1.96	2.18	2.79	3.34
Isle Royale NP	3.78	3.34	3.28	2.93	2.78	3.31	3.83	3.87	4.06	3.40	4.05	4.04
James River Face Wilderness	3.43	3.19	3.16	2.90	3.46	3.69	3.79	3.97	4.00	3.61	3.31	3.56
Jarbidge Wilderness	3.65	3.28	2.62	2.69	2.71	2.44	1.95	1.67	1.60	2.01	3.03	3.51
John Muir Wilderness	3.46	3.18	3.07	2.68	2.51	2.17	2.06	2.08	2.20	2.35	2.75	3.12
Joshua Tree NP	2.83	2.76	2.75	2.52	2.53	2.41	2.28	2.53	2.53	2.48	2.32	2.54
Joyce Kilmer-Slickrock Wilderness	4.01	3.58	3.46	3.24	3.81	4.22	4.23	4.35	4.35	4.03	3.82	4.02
Kaiser Wilderness	3.58	3.27	3.08	2.58	2.42	2.10	1.99	2.00	2.12	2.29	2.75	3.24
Kalmiopsis Wilderness	4.98	4.45	4.28	4.09	3.89	3.66	3.49	3.51	3.60	4.08	4.90	4.96
Kings Canyon	3.40	3.13	3.03	2.66	2.50	2.16	2.05	2.07	2.20	2.33	2.71	3.05
La Garita Wilderness	3.03	2.83	2.41	2.21	2.19	1.86	2.10	2.50	2.42	2.16	2.72	2.93
Lassen Volcanic NP	4.21	3.66	3.33	2.93	2.78	2.50	2.36	2.40	2.51	2.78	3.54	4.02
Lava Beds NM	4.64	4.04	3.68	3.37	3.15	2.89	2.62	2.65	2.82	3.32	4.21	4.56
Linville Gorge Wilderness	3.80	3.52	3.43	3.18	3.80	4.20	4.25	4.51	4.48	3.97	3.67	3.86
Lostwood Wilderness	3.77	3.66	3.67	2.86	2.79	3.07	3.11	2.82	2.80	2.99	3.93	3.95
Lye Brook Wilderness	3.53	3.26	3.27	3.20	3.36	3.48	3.70	3.93	4.04	3.82	3.63	3.61
Mammoth Cave NP	3.99	3.63	3.45	3.50	4.52	5.19	5.08	4.16	4.17	3.81	3.73	4.03
Marble Mountain Wilderness	4.85	4.32	4.16	3.92	3.76	3.53	3.44	3.46	3.51	3.86	4.63	4.78
Maroon Bells-Snowmass Wilderness	2.89	2.82	2.52	2.49	2.45	2.04	2.22	2.57	2.54	2.26	2.71	2.80
Mazatzal Wilderness	2.60	2.40	2.03	1.53	1.42	1.21	1.66	2.06	1.90	1.77	2.10	2.55
Medicine Lake Wilderness	3.79	3.66	3.56	2.80	2.75	2.94	2.93	2.66	2.73	2.95	3.85	3.92
Mesa Verde NP	3.40	3.10	2.61	1.95	2.00	1.53	2.04	2.45	2.28	2.05	2.69	3.15
Mingo Wilderness	3.92	3.58	3.30	3.19	3.58	3.72	3.80	3.82	3.85	3.61	3.66	3.90
Mission Mountains Wilderness	4.24	3.79	3.38	3.10	3.08	3.04	2.68	2.59	2.96	3.48	4.17	4.26
Mokelumne Wilderness	3.81	3.38	3.04	2.51	2.34	2.02	1.86	1.88	2.02	2.27	2.91	3.52
Moosehorn Wilderness	3.80	3.42	3.32	3.50	3.47	3.60	3.98	4.15	4.31	4.02	3.97	3.99
Mount Adams Wilderness	5.24	4.74	4.34	4.18	3.91	3.66	3.41	3.51	3.93	4.78	5.36	5.44
Mount Baldy Wilderness	2.74	2.50	2.05	1.58	1.50	1.29	1.87	2.28	2.06	1.87	2.26	2.74
Mount Hood Wilderness	5.16	4.67	4.33	4.18	3.87	3.61	3.29	3.38	3.78	4.67	5.29	5.33
Mount Jefferson Wilderness	5.38	4.84	4.55	4.42	4.05	3.74	3.27	3.28	3.63	4.64	5.41	5.46
Mount Rainier NP	5.42	4.92	4.50	4.36	4.13	3.86	3.67	3.76	4.20	5.05	5.56	5.62

Table 9. Monthly f_{SS}(RH) – Sea Salt Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mount Washington Wilderness	5.61	5.03	4.81	4.71	4.24	3.91	3.31	3.25	3.60	4.73	5.59	5.62
Mount Zirkel Wilderness	2.85	2.83	2.61	2.61	2.67	2.24	2.10	2.23	2.38	2.31	2.75	2.78
Mountain Lakes Wilderness	4.89	4.26	3.93	3.67	3.40	3.11	2.82	2.83	3.04	3.67	4.68	4.91
North Absaroka Wilderness	3.18	2.97	2.83	2.66	2.64	2.35	2.02	1.89	2.16	2.53	3.03	3.13
North Cascades NP	5.03	4.65	4.22	4.08	3.88	3.68	3.53	3.70	4.13	4.78	5.24	5.25
Okefenokee Wilderness	4.13	3.83	3.82	3.69	3.85	4.38	4.28	4.51	4.48	4.31	4.18	4.27
Olympic NP	5.27	4.87	4.61	4.51	3.94	4.12	3.76	4.16	4.51	5.17	5.51	5.46
Otter Creek Wilderness	3.63	3.40	3.34	3.06	3.67	3.82	3.98	4.19	4.23	3.78	3.51	3.76
Pasayten Wilderness	5.09	4.67	4.18	4.00	3.84	3.58	3.45	3.58	3.99	4.71	5.25	5.30
Pecos Wilderness	2.91	2.64	2.25	1.97	2.00	1.78	2.15	2.57	2.44	2.09	2.56	2.83
Petrified Forest NP	2.93	2.66	2.11	1.66	1.53	1.30	1.81	2.26	2.03	1.91	2.40	2.88
Pine Mountain Wilderness	2.69	2.50	2.11	1.60	1.47	1.24	1.67	2.09	1.92	1.82	2.16	2.62
Pinnacles NM	3.94	3.97	3.99	3.12	2.94	2.67	2.54	2.63	2.65	2.80	2.96	3.36
Point Reyes NS	4.20	3.88	3.72	3.25	3.12	2.88	2.96	3.01	3.05	3.12	3.48	3.90
Presidential Range-Dry River Wilderness	3.60	3.28	3.31	3.36	3.45	3.66	3.92	4.14	4.27	3.99	3.83	3.72
Rawah Wilderness	2.70	2.74	2.58	2.65	2.76	2.36	2.23	2.37	2.45	2.31	2.69	2.66
Red Rock Lakes Wilderness	3.51	3.18	2.91	2.67	2.63	2.41	2.06	1.94	2.20	2.63	3.29	3.46
Redwood NP	4.66	4.38	4.48	4.34	4.41	4.35	4.56	4.59	4.34	4.19	4.51	4.44
Rocky Mountain NP	2.44	2.56	2.47	2.64	2.75	2.37	2.26	2.36	2.41	2.20	2.51	2.41
Roosevelt Campobello International Park	3.82	3.43	3.32	3.52	3.47	3.61	3.96	4.13	4.29	4.02	3.99	4.01
Saguaro NP	2.24	2.00	1.69	1.21	1.20	1.08	1.67	2.13	1.86	1.65	1.89	2.44
Saint Marks Wilderness	4.18	3.89	3.82	3.76	3.85	4.30	4.49	4.54	4.39	4.19	4.15	4.30
Salt Creek Wilderness	2.72	2.37	1.88	1.77	1.96	1.87	2.15	2.44	2.59	2.12	2.26	2.56
San Gabriel Wilderness	3.12	3.04	3.04	2.77	2.78	2.69	2.69	2.77	2.79	2.74	2.59	2.79
San Gorgonio Wilderness	2.97	3.06	2.93	2.60	2.63	2.28	2.13	2.30	2.31	2.24	2.25	2.55
San Jacinto Wilderness	2.92	2.91	2.91	2.67	2.69	2.55	2.33	2.64	2.64	2.57	2.40	2.60
San Pedro Parks Wilderness	3.00	2.71	2.25	1.94	1.91	1.66	2.04	2.45	2.33	2.05	2.57	2.88
San Rafael Wilderness	3.49	3.35	3.34	3.00	2.99	2.90	2.97	3.04	3.09	3.00	2.86	3.12
Sawtooth Wilderness	4.05	3.53	2.89	2.53	2.44	2.18	1.66	1.61	1.76	2.38	3.55	4.00
Scapegoat Wilderness	3.97	3.57	3.27	3.04	3.01	2.96	2.60	2.51	2.83	3.30	3.86	3.93
Selway-Bitterroot Wilderness	4.20	3.71	3.21	2.86	2.80	2.66	2.18	2.09	2.39	3.06	3.96	4.20
Seney Wilderness	4.05	3.60	3.60	3.30	3.20	3.58	3.91	4.28	4.30	4.00	4.19	4.16
Sequoia NP	3.27	3.07	3.10	2.84	2.66	2.21	2.06	2.05	2.21	2.35	2.75	2.93
Shenandoah NP	3.44	3.17	3.17	2.90	3.42	3.66	3.78	3.97	3.98	3.56	3.28	3.62
Shining Rock Wilderness	3.90	3.55	3.43	3.21	3.82	4.22	4.28	4.48	4.48	4.06	3.76	3.92
Sierra Ancha Wilderness	2.62	2.42	2.02	1.53	1.42	1.22	1.73	2.14	1.95	1.81	2.15	2.62
Simeonof Wilderness	4.83	4.85	4.54	4.68	4.83	5.20	5.57	5.72	5.11	4.48	4.62	4.89
Sipsey Wilderness	3.94	3.60	3.36	3.28	3.72	4.06	4.18	4.14	4.13	3.91	3.74	3.96
South Warner Wilderness	4.32	3.75	3.31	2.94	2.77	2.51	2.13	2.15	2.31	2.83	3.71	4.19
Strawberry Mountain Wilderness	4.97	4.37	3.77	3.44	3.28	2.88	2.41	2.38	2.73	3.77	4.82	5.10
Superstition Wilderness	2.49	2.27	1.92	1.44	1.34	1.17	1.64	1.98	1.82	1.69	2.01	2.49
Swanquarter Wilderness	3.52	3.30	3.25	3.09	3.42	3.71	3.88	3.96	3.83	3.67	3.43	3.55
Sycamore Canyon Wilderness	2.78	2.62	2.22	1.68	1.55	1.27	1.67	2.17	2.00	1.90	2.25	2.69
Teton Wilderness	3.26	3.04	2.83	2.61	2.59	2.27	1.93	1.83	2.14	2.50	3.07	3.21
Theodore Roosevelt NP	3.67	3.56	3.51	2.93	2.97	3.09	2.96	2.72	2.72	2.93	3.75	3.78

Table 9. Monthly $f_{ss}(RH)$ – Sea Salt Relative Humidity Adjustment Factor

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Thousand Lakes Wilderness	4.27	3.70	3.38	2.99	2.82	2.52	2.37	2.42	2.53	2.82	3.62	4.08
Three Sisters Wilderness	5.53	4.97	4.74	4.63	4.20	3.89	3.35	3.31	3.65	4.70	5.53	5.56
Tuxedni Wilderness	4.28	4.06	3.53	3.46	3.44	3.64	4.26	4.56	4.51	4.17	4.17	4.37
UL Bend Wilderness	3.44	3.22	3.12	2.79	2.70	2.67	2.42	2.18	2.35	2.77	3.34	3.40
Upper Buffalo Wilderness	3.85	3.47	3.23	3.27	3.72	3.78	3.69	3.70	3.84	3.64	3.67	3.86
Ventana Wilderness	3.91	3.76	3.70	3.08	2.93	2.69	2.69	2.75	2.80	2.87	3.06	3.48
Virgin Islands NP	3.17	3.12	3.04	3.15	3.19	3.17	3.18	3.31	3.30	3.36	3.39	3.28
Voyageurs NP	3.69	3.31	3.20	2.90	2.89	3.46	3.55	3.71	3.87	3.42	3.83	3.80
Washakie Wilderness	3.18	2.98	2.83	2.64	2.62	2.31	1.96	1.85	2.15	2.50	3.04	3.14
Weminuche Wilderness	3.08	2.85	2.39	2.11	2.09	1.77	2.05	2.46	2.36	2.12	2.69	2.95
West Elk Wilderness	3.00	2.87	2.49	2.36	2.33	1.94	2.10	2.44	2.43	2.20	2.72	2.89
Wheeler Peak Wilderness	3.00	2.76	2.35	2.11	2.15	1.92	2.17	2.63	2.52	2.18	2.71	2.93
White Mountain Wilderness	2.71	2.37	1.89	1.68	1.76	1.66	2.14	2.46	2.49	2.02	2.25	2.63
Wichita Mountains Wilderness	3.35	3.12	2.91	2.94	3.40	3.21	2.84	3.01	3.32	3.10	3.20	3.40
Wind Cave NP	3.25	3.20	3.13	3.01	3.22	3.06	2.75	2.68	2.63	2.75	3.28	3.24
Wolf Island Wilderness	4.03	3.74	3.66	3.55	3.72	4.20	4.20	4.46	4.42	4.22	4.08	4.15
Yellowstone NP	3.29	3.05	2.87	2.66	2.65	2.39	2.05	1.93	2.21	2.59	3.14	3.25
Yolla Bolly-Middle Eel Wilderness	4.38	3.89	3.66	3.31	3.18	2.92	2.89	2.94	3.00	3.20	3.84	4.19
Yosemite NP	3.58	3.38	3.23	2.71	2.54	2.08	1.84	1.79	1.93	2.18	2.78	3.25
Zion NP	3.26	3.03	2.44	1.96	1.78	1.44	1.41	1.66	1.67	1.88	2.48	2.98

Table 10. Monthly Average Natural Conditions Visual Range In Kilometers

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acadia NP	173	177	177	174	174	173	170	169	167	171	171	170
Agua Tibia Wilderness	226	227	226	228	228	229	229	228	228	228	230	229
Alpine Lakes Wilderness	224	228	236	238	236	243	242	242	237	227	222	222
Anaconda Pintler Wilderness	256	259	262	267	268	271	273	272	271	269	265	259
Ansel Adams Wilderness	258	263	266	269	269	270	274	275	272	267	259	258
Arches NP	265	268	274	276	277	281	280	278	277	276	271	268
Badlands NP	233	233	233	234	232	233	235	236	236	236	232	233
Bandelier NM	269	272	276	280	281	283	278	274	276	277	274	269
Bering Sea Wilderness												
Big Bend NP	236	234	233	234	233	231	225	220	227	233	235	235
Black Canyon of the Gunnison NP	278	280	282	283	282	282	281	278	276	280	280	278
Bob Marshall Wilderness	257	259	262	263	263	266	265	262	262	264	260	258
Bosque del Apache Wilderness	249	252	256	259	259	260	255	252	253	256	253	249
Boundary Waters Canoe Area Wilderness	184	187	189	190	190	191	193	194	191	188	184	184
Breton Wilderness	173	176	176	179	177	174	172	170	169	174	171	171
Bridger Wilderness	278	280	286	290	292	296	295	292	292	291	285	280
Brigantine Wilderness	159	161	161	161	160	158	156	157	158	160	160	159
Bryce Canyon NP	268	269	270	271	271	275	279	279	275	273	268	268
Cabinet Mountains Wilderness	252	254	253	255	251	251	249	247	247	248	252	251
Caney Creek Wilderness	174	177	180	183	183	183	186	186	183	179	174	173
Canyonlands NP	257	261	264	263	259	259	260	260	258	258	259	257
Cape Romain Wilderness	167	169	174	177	178	181	180	178	177	177	172	169
Capitol Reef NP	269	271	277	280	281	285	284	281	281	280	275	271
Caribou Wilderness	250	256	259	263	264	267	267	267	266	264	257	252
Carlsbad Caverns NP	266	271	276	277	275	276	272	270	267	274	271	267
Chassahowitzka Wilderness	171	173	174	175	175	171	171	169	169	171	171	170
Chiricahua NM	253	254	258	261	262	263	256	253	256	259	257	252
Chiricahua Wilderness	253	254	258	262	262	263	256	253	256	259	258	252
Cohutta Wilderness	181	184	185	187	183	180	180	179	179	181	183	181
Crater Lake NP	255	263	266	269	273	276	280	279	276	267	256	255
Craters of the Moon NM	245	248	252	255	255	257	261	261	259	255	248	246
Cucamonga Wilderness	263	264	264	267	267	268	268	267	267	267	268	266
Denali NP & Pres	257	257	261	263	263	261	257	251	250	252	254	254
Desolation Wilderness	270	275	279	285	287	290	292	292	290	287	280	273
Diamond Peak Wilderness	253	261	264	267	271	275	279	279	275	264	254	253
Dolly Sods Wilderness	197	200	201	203	204	206	206	205	205	204	203	200
Dome Land Wilderness	242	244	244	247	241	241	239	237	236	241	243	241
Eagle Cap Wilderness	229	234	241	245	245	249	252	253	249	240	230	227
Eagles Nest Wilderness	302	302	304	304	303	308	308	305	304	307	303	303
Emigrant Wilderness	242	245	248	253	254	258	259	259	258	256	250	245
Everglades NP	168	170	171	172	172	169	170	167	166	168	169	168
Fitzpatrick Wilderness	280	282	283	284	284	289	292	293	288	286	280	281
Flat Tops Wilderness	301	302	305	305	304	309	310	307	306	307	303	302
Galiuro Wilderness	254	255	258	262	262	263	259	256	258	259	257	252
Gates of the Mountains Wilderness	281	285	287	288	289	289	292	293	291	286	283	282

Table 10. Monthly Average Natural Conditions Visual Range In Kilometers

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gearhart Mountain Wilderness	262	269	274	277	280	283	287	287	285	277	266	263
Gila Wilderness	275	278	282	285	285	286	278	278	279	282	279	275
Glacier NP	224	228	230	231	231	231	235	235	231	228	225	225
Glacier Peak Wilderness	233	237	243	245	245	249	250	248	244	236	231	231
Goat Rocks Wilderness	243	249	254	256	259	263	265	263	258	248	241	241
Grand Canyon NP	267	269	273	278	280	282	281	277	278	277	273	269
Grand Teton NP	274	278	277	276	275	273	270	268	266	269	272	273
Great Gulf Wilderness	192	192	195	195	195	197	196	193	193	196	192	192
Great Sand Dunes NP & Pres	255	260	260	263	257	254	253	252	251	255	257	255
Great Smoky Mountains NP	184	185	187	188	188	190	192	193	190	188	185	184
Guadalupe Mountains NP	265	270	276	278	276	276	271	268	266	274	271	266
Haleakala NP	232	234	234	235	237	238	236	236	237	235	232	233
Hawaii Volcanoes NP	243	246	246	246	246	246	244	243	244	243	238	243
Hells Canyon Wilderness	224	229	234	237	238	239	242	243	241	235	226	223
Hercules-Glades Wilderness	178	180	182	182	179	179	180	179	178	180	179	178
Hoover Wilderness	259	263	265	271	273	276	278	277	276	274	268	262
Isle Royale NP	182	185	184	186	187	183	179	179	177	184	179	179
James River Face Wilderness	181	183	187	187	186	188	192	193	193	191	185	182
Jarbidge Wilderness	245	246	246	249	244	243	242	240	239	243	246	243
John Muir Wilderness	256	260	261	264	258	254	254	253	252	255	258	256
Joshua Tree NP	242	246	247	251	252	255	256	256	255	253	249	246
Joyce Kilmer-Slickrock Wilderness	186	187	187	189	189	190	190	189	188	189	189	188
Kaiser Wilderness	260	264	266	272	273	277	278	278	276	274	269	264
Kalmiopsis Wilderness	194	200	202	205	207	209	211	210	209	204	195	195
Kings Canyon	229	232	233	236	237	240	240	240	239	238	235	232
La Garita Wilderness	252	259	263	266	268	271	273	273	271	266	256	253
Lassen Volcanic NP	263	264	267	269	269	272	270	266	267	269	265	263
Lava Beds NM	244	250	253	257	258	261	261	261	260	258	251	246
Linville Gorge Wilderness	180	182	183	185	180	177	177	175	175	178	181	180
Lostwood Wilderness	229	230	228	234	235	232	232	234	235	233	227	227
Lye Brook Wilderness	196	198	197	197	196	195	194	192	191	192	195	195
Mammoth Cave NP	187	188	189	189	189	192	191	188	188	191	188	188
Marble Mountain Wilderness	251	255	256	254	242	235	237	249	248	252	254	250
Maroon Bells-Snowmass Wilderness	274	281	284	287	289	291	292	291	291	286	276	275
Mazatzal Wilderness	252	253	256	260	261	263	259	256	258	258	256	252
Medicine Lake Wilderness	231	232	231	236	237	235	235	237	237	236	230	229
Mesa Verde NP	264	267	271	277	276	281	276	272	275	275	270	266
Mingo Wilderness	166	169	172	174	173	173	176	176	174	171	166	166
Mission Mountains Wilderness	249	252	254	255	251	250	250	249	249	251	251	249
Mokelumne Wilderness	252	259	263	266	269	272	275	273	268	257	251	250
Moosehorn Wilderness	159	163	166	167	170	172	174	173	170	162	158	157
Mount Adams Wilderness	242	248	251	253	258	262	267	267	262	250	241	241
Mount Baldy Wilderness	261	266	269	275	276	280	281	281	279	277	271	264
Mount Hood Wilderness	241	249	253	256	259	262	265	265	262	255	243	241
Mount Jefferson Wilderness	237	240	240	238	239	238	234	232	230	234	235	235

Table 10. Monthly Average Natural Conditions Visual Range In Kilometers

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mount Rainier NP	215	220	224	226	228	231	233	232	227	218	213	213
Mount Washington Wilderness	216	223	224	225	230	234	240	241	237	225	217	216
Mount Zirkel Wilderness	296	296	297	296	295	300	301	300	298	299	296	296
Mountain Lakes Wilderness	284	285	286	287	287	290	294	295	292	288	284	284
North Absaroka Wilderness	246	251	256	258	260	262	264	261	256	249	244	244
North Cascades NP	243	246	246	247	246	241	243	240	240	242	243	242
Okefenokee Wilderness	162	166	168	169	174	173	176	172	169	163	160	161
Olympic NP	233	235	235	238	231	230	228	226	225	230	234	231
Otter Creek Wilderness	180	183	188	190	191	194	195	193	189	183	178	178
Pasayten Wilderness	269	271	274	277	276	279	276	272	272	276	272	269
Pecos Wilderness	294	297	303	308	310	313	307	302	304	305	300	294
Petrified Forest NP	269	271	274	279	280	282	278	275	276	277	274	270
Pine Mountain Wilderness	238	238	238	247	248	251	252	251	251	249	248	244
Pinnacles NM	211	215	216	222	223	226	225	224	224	223	219	214
Point Reyes NS	128	134	133	132	130	127	122	119	117	121	124	126
Presidential Range-Dry River Wilderness	186	188	189	191	192	192	192	191	190	191	192	190
Rawah Wilderness	297	296	297	296	294	298	300	299	297	299	296	297
Red Rock Lakes Wilderness	261	264	263	266	264	265	261	261	264	266	262	264
Redwood NP	176	182	187	191	192	196	204	206	201	192	180	177
Rocky Mountain NP	261	265	265	262	263	262	258	256	254	258	259	259
Roosevelt Campobello Int Pk	170	173	173	175	172	169	169	166	166	168	171	170
Saguaro NP	252	250	250	248	247	251	252	251	250	252	250	252
Saint Marks Wilderness	182	185	189	190	188	189	187	185	184	187	186	184
Salt Creek Wilderness	245	247	247	250	250	251	251	250	250	250	251	249
San Gabriel Wilderness	262	262	264	268	268	272	273	271	271	271	271	267
San Gorgonio Wilderness	253	255	258	262	262	263	258	254	257	258	256	251
San Jacinto Wilderness	247	247	248	250	250	252	253	251	250	251	252	250
San Pedro Parks Wilderness	280	284	285	286	285	279	277	276	278	281	281	279
San Rafael Wilderness	243	246	250	253	253	256	252	248	249	252	247	244
Sawtooth Wilderness	259	263	269	272	272	274	278	278	277	273	263	259
Scapegoat Wilderness	249	253	255	257	257	257	260	261	258	254	249	249
Selway-Bitterroot Wilderness	251	256	261	264	265	266	270	271	268	262	253	251
Seney Wilderness	179	182	181	182	183	180	178	175	175	178	177	177
Sequoia NP	230	232	232	234	236	239	240	240	239	238	234	233
Shenandoah NP	191	193	193	195	191	190	189	187	186	190	192	190
Shining Rock Wilderness	193	196	197	199	194	191	190	188	188	192	195	193
Sierra Ancha Wilderness	252	253	256	260	261	263	259	256	257	258	256	252
Simeonof Wilderness	138	138	143	141	138	133	128	127	135	144	142	138
Sipsey Wilderness	176	178	180	181	178	175	174	174	174	176	178	176
South Warner Wilderness	243	249	253	256	258	260	263	263	261	257	249	245
Strawberry Mountain Wilderness	227	233	239	242	244	248	252	252	248	238	228	226
Superstition Wilderness	254	256	259	262	263	264	261	258	259	260	258	254
Swanquarter Wilderness	172	174	174	176	174	171	170	169	170	171	173	172
Sycamore Canyon Wilderness	267	268	272	277	278	281	277	273	274	275	272	268
Teton Wilderness	280	282	283	285	285	288	291	292	289	286	281	281

Table 10. Monthly Average Natural Conditions Visual Range In Kilometers

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Theodore Roosevelt NP	223	228	231	234	235	238	238	238	237	235	229	225
Thousand Lakes Wilderness	258	259	258	263	262	261	262	265	265	263	256	257
Three Sisters Wilderness	217	223	225	227	231	234	240	240	236	226	217	217
Tuxedni Wilderness	195	198	205	206	206	204	195	192	192	196	196	194
UL Bend Wilderness	235	236	236	237	238	238	240	242	241	238	234	235
Upper Buffalo Wilderness	177	180	182	182	178	178	179	179	177	179	179	177
Ventana Wilderness	213	215	216	223	225	227	227	227	226	225	223	218
Virgin Islands NP	188	189	190	188	187	188	187	185	185	184	183	185
Voyageurs NP	177	179	179	181	180	176	176	175	174	178	175	176
Washakie Wilderness	270	272	272	273	273	276	279	280	277	274	270	270
Weminuche Wilderness	272	273	276	277	277	281	280	276	276	279	275	273
West Elk Wilderness	298	301	305	308	308	312	309	305	306	308	303	300
Wheeler Peak Wilderness	296	300	306	308	307	309	303	300	299	304	301	297
White Mountain Wilderness	265	267	271	273	272	275	273	268	269	272	267	265
Wichita Mountains Wilderness	232	233	232	233	231	233	235	235	236	235	231	232
Wind Cave NP	246	248	250	250	247	249	252	250	247	249	248	246
Wolf Island Wilderness	173	175	176	177	176	172	172	170	170	171	173	172
Yellowstone NP	280	282	283	284	284	287	290	291	288	285	280	280
Yolla Bolly-Middle Eel Wilderness	246	251	254	258	259	262	261	260	260	258	251	248
Yosemite NP	243	245	246	252	253	257	259	259	258	256	251	246
Zion NP	247	249	254	257	259	262	262	260	260	258	254	250

3.4. Ozone

3.4.1. Introduction (Revised)

Ozone is an air pollutant that forms on warm, sunny days when precursor emissions—nitrogen oxides (NO_x) and volatile organic compounds (VOCs)—react in the presence of sunlight. Because ozone is a regional pollutant, precursor sources both near and far from FLM areas can contribute to ozone formation.

Ozone is phytotoxic, causing damage to vegetation throughout the world (Ashmore et al. 2004). Some plant species are more sensitive to ozone than are humans (EPA 2007b). Ozone pollution has been shown to reduce plant growth, alter species composition, and predispose trees to insect and disease attack. Ozone also causes direct foliar injury to many plant species. Affected leaves are often marked with discoloration and lesions, and they age more rapidly than normal leaves (EPA 2007b).

FLAG is intended to provide information to assist the FLMs in identifying ozone impacts to vegetation on lands they manage. Therefore, the objectives of this chapter are to document information currently known about vegetation response to ozone exposure, and to describe FLM procedures for responding to new source review (NSR) permit applications. If the FLMs have evidence that ozone is adversely impacting an area they manage, they will recommend that additional emissions of ozone precursors are minimized until those adverse impacts are mitigated.

3.4.2. Ozone Effects on Vegetation (Revised)

Most ozone effects research has focused on agricultural crops. However, research has identified many native plants in natural ecosystems that are sensitive to ozone (EPA 1996e). Some of these ozone-sensitive plant species have been used as "bioindicators" of ozone to document phytotoxicity of ozone in the field due to ambient ozone. A listing of key literature describing known ozone effects on native vegetation is provided in Appendix G.

The definitions for ozone injury and damage used by FLMs are based on the classical definitions (for example, see Guderian 1977). Injury is all physical or biological responses to pollutants, such as change in metabolism, reduced photosynthesis, leaf necrosis, premature leaf drop, and chlorosis. Damage is reduction in the intended use or value of the biological or physical resource; for example, economic production, ecological structure and function, aesthetic value, and biological or genetic diversity that may be altered through the impact of pollutants.

Ozone enters plants through leaf stomata. It oxidizes plant tissue, causing changes in biochemical and physiological processes. These biochemical and physiological changes occur within the leaf long before visible necrotic symptoms appear (Guderian et al. 1985). Plants must expend energy to detoxify ozone and repair injured tissue that could otherwise be used for growth or for maintenance of plant health. The injured plant cells eventually die if detoxification and repair cannot keep up with ozone uptake. The mesophyll cells under the upper epidermis of leaves are the most sensitive to ozone, and those are the first cells to die. The adjacent epidermal cells then die, forming a small black or brown interveinal necrotic lesion that becomes visible on the upper surface of the leaf. These visible lesions most frequently begin to develop on leaves that have just become fully matured, with older leaves on a stem showing increased amounts of injury. These lesions, termed oxidant stipple[7], are quite specific indicators that the plant has been exposed to ozone. Other plant symptoms that can result from exposure to ozone, with or without the presence of oxidant stipple, include chlorosis, premature senescence, and reduced growth. However, these symptoms are non-specific for ozone since other stressors (e.g., disease, insects) can also cause them to occur. Further, these non-specific symptoms are difficult to quantify in natural ecosystems, although limited data are available from exposure response experiments to estimate growth losses from specific ozone exposures. In general, the only indicator that a FLM has to document that ozone has impacted vegetation is visible symptoms of injury such as oxidant stipple.

In addition to affecting individual plants, ozone can also affect entire ecosystems. Research shows that plants growing in areas with high exposure to ambient ozone may undergo natural selection for ozone tolerance (EPA 2007b). The final result could be the elimination of the most ozone-sensitive genotypes from the area. Regardless of the amount of ozone exposure, the magnitude of plant response may vary depending on the geographic area because of changes in meteorological and climatic conditions, and differences in plant conditions in space and time. Factors of most importance that influence plant response to ozone are the species/genotype, soil moisture, and nitrogen availability. Other factors influencing plant response to ozone include nutrient status, atmospheric humidity, temperature, solar radiation, phenological stage of development, carbon dioxide concentrations, day length, regional climatic differences, other pollutant interactions, and population/ecosystem interactions (EPA 2007b).

Changes in growth, ecosystem form or function, or biological or genetic diversity caused by ozone have been difficult to document in natural ecosystems. However, recent research in Great Smoky Mountains National Park showed that in years with high ozone, tree growth was

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[7] Specific symptoms of ozone injury in some plant species are different. A few species develop white or tan rather than brown or black lesions. This is termed "fleck" or "weather fleck" instead of oxidant stipple. In conifers, ozone causes banding of necrotic and green tissue near the tips of older needles, termed "chlorotic mottle."

significantly reduced and trees had increased rates of water loss (McLaughlin et al. 2007a). Increased water loss resulted in soil moisture depletion and reduced late-season streamflows (McLaughlin et al. 2007b). The experiment was conducted over a range of forest types and included several different tree species. These findings may have implications for climate change. Climate change is predicted to increase temperatures and drought conditions in some areas. Ozone may exacerbate the effects of drought by increasing water loss from trees.

Given the difficulty in determining ozone-induced physiological or growth changes in natural ecosystems, FLMs will utilize as indicators of ozone effects on vegetation (1) symptoms that are clearly ozone induced such as oxidant stipple, and (2) ozone exposures that have been shown to be phytotoxic.

3.4.3. Established Metrics to Determine Phytotoxic Ozone Concentrations (Revised)

EPA has set primary and secondary ozone standards to protect human health and welfare. On March 12, 2008, EPA revised the primary and secondary ozone standards to 0.075 ppm (8-hour standard). On January 6, 2010, the EPA proposed further strengthening of the primary (human health) ozone standard and establishing a new secondary ozone standard to protect ecosystems and sensitive plants (EPA 2010b). For questions regarding site specific issues the applicant is encouraged to consult with the FLM. More detailed discussions regarding other ozone metrics may be available on the respective agency web sites provided in section 3.4.7.

3.4.4. Identification of Ozone Sensitive AQRVs or Sensitive Receptors (Revised)

FLMs have determined that given the high ecological, aesthetic, and intrinsic value of federal lands, special attention should be given to native species. Ideally, protection efforts would focus on the identification and protection of at risk native species in an area. Unfortunately, AQRV identification is limited by incomplete species inventories and/or lack of exposure/response data for most species of native vegetation. Sensitive species identification will improve as more information becomes available. In the meantime, the Agencies are providing lists of sensitive plant species for each Class I area, i.e., those species that have been observed to exhibit ozone symptoms at ambient ozone exposures. This information is available at the respective agency web sites (see below). However, those ambient levels have not necessarily occurred at the specific Class I area where the plants occur.

Since FLAG 2000, the FLMs have acquired additional information regarding ozone effects to vegetation, including lists of ozone sensitive species. Much of this information is included in the NPS and FWS ARIS data base referenced previously, and will be updated as necessary. The ARIS web site is as follows:

- http://www.nature.nps.gov/air/permits/aris/index.cfm

In addition, the NPS has evaluated the risk to vegetation from ozone exposure at approximately 270 park units. The ozone risk assessment can be found at:

- http://www.nature.nps.gov/air/Permits/ARIS/networks/ozonerisk.cfm

Forest Service pertinent ozone information, including a list of ozone sensitive species, can be found at:

- http://www.fs.fed.us/air

3.4.5. Review Process for Sources that Could Affect Ozone Levels or Vegetation in FLM Areas (Revised)

As mentioned above, NO_x and VOC are ozone precursors. States and the EPA have based ozone control strategies in various parts of the country on the determination of which precursor is most likely to influence the formation of ozone. Information suggests that in areas where ozone formation is driven by VOC emissions, i.e., VOC-limited areas, VOC to NO_x ratios are less than 4:1. In VOC-limited areas, minimizing or reducing VOC emissions is the most effective means of limiting or lowering ozone concentrations. Conversely, in NO_x-limited areas, where VOC to NO_x ratios are greater than 15:1, controlling NO_x emissions is most effective. It is generally thought that most rural areas of the U.S. are NO_x-limited, most or all of the time, with the possible exception of the rural areas of southern California. The FLMs do not have current data to show that all areas are not NO_x limited, nor do they consider VOCs to be unimportant as ozone precursors. However, until there is enough information available for FLAG to determine whether ozone formation in each FLM area is primarily limited by NO_x or VOC emissions, we will assume all FLM areas are NO_x-limited and will focus on control of NO_x emissions. Where FLMs have information indicating a specific area is VOC limited, they will shift the ozone protection strategy to focus on VOC rather than NO_x emissions.

The FLMs recognize that oxidant stipple can occur at hourly ozone concentrations that can be considered natural background levels (Singh et al. 1978). Many of the high hourly background concentrations can be attributed to stratospheric intrusions or stratospheric mixing in the upper troposphere (Singh et al. 1978); but stratospheric intrusions rarely occur in the middle and southern latitudes after May (Singh et al. 1980, Wooldridge et al. 1997), and thus do not coincide with the major portion of the growing season.

However, oxidant stipple has been observed on foliage in the spring when these intrusions can occur. In general, oxidant stipple observed on foliage from June through September cannot be attributed to natural background ozone from stratospheric sources. Low levels of ambient ozone may occasionally occur in the troposphere from non-anthropogenic and non-stratospheric sources.

The occurrence of oxidant stipple necrosis on plant foliage may indicate further ozone induced physiological and growth impacts. Point sources emit precursors that could produce ozone at the FLM area, and increased ozone could induce further injury or damage to vegetation. However, we assume that restriction on increases in ozone precursors will prevent additional ambient ozone and subsequent increases in injury or damage to vegetation in FLM managed areas. It is important that ambient ozone monitoring be conducted by the State or Local air pollution control agency or by the FLM to determine the seasonal ozone exposure.

FLM actions or specific requests on a permit application will be based on the existing air pollution situation at the FLM area(s) that may be affected by the source. Some FLMs may, with appropriate documentation, rely on growth loss rather than foliar necrosis to make an adverse impact finding. Each FLM will determine if actions are warranted to limit emissions that might lead to increased ambient ozone, based on the expected impact of ozone in their particular area.

FLM response will depend on whether or not:

- ozone specific vegetation effects have been documented in the area (as evidenced by foliar injury or damage to vegetation);
- ozone exposure levels occurring in the area are high enough that they could affect vegetation (i.e., ozone exposures are at levels shown to be phytotoxic).

For a project that exceeds the initial annual emissions over distance (Q/D) screening criteria, Figure 6 outlines the general FLM review process for responding to NSR permit applications based on ozone exposure and vegetation effects at the receptor site. As noted in Figure 6, ambient ozone concentrations are considered along with data from exposure response studies (EPA 2007b) to determine whether a source will cause or contribute to phytotoxic ozone levels (i.e., levels toxic to plants) at the affected site. The FLM may ask the applicant to calculate the ozone exposure values if these data are not already available. Ozone damage to vegetation is determined from field observations at the impacted site.

Management decisions regarding acceptance of an existing or future ozone exposure will be area-specific and may differ significantly between agencies, or even regionally within agencies. Each FLM will determine if injury and/or damage are necessary to warrant action, based on the expected impact in the area they manage. The decisions are based on the FLM interpretation of regulations, past experience in the NSR arena, availability of ozone effect exposure/response information for species that occur in the area, and other factors. The FLM may also consider current trends in ozone exposures and meteorological conditions during peak ozone exposures (because dry soil conditions may induce plants to close stomates to limit water loss, thus limiting ozone uptake), as well as expected reductions in ozone precursor emissions. The FLM will negotiate with the NSR permit applicant and the permitting authority regarding possible mitigation strategies (e.g., using more efficient emissions control technologies, obtaining emission offsets, etc.).

3.4.6. Further Guidance to FLMs (Revised)

As mentioned above, limited information about ozone exposure/response relationships in plants and lack of an ozone source/receptor model make it difficult to protect FLM areas from the effects of ozone from new sources. However, there are other area-specific gaps in information that also limit protection efforts. It is important for local land managers to attempt to collect the missing information. This section provides guidance specifically to FLMs on what types of data should be collected and how the data could be collected.

Identifying and Monitoring Ozone-sensitive AQRVs

Although many FLM areas have identified ozone-sensitive plant species in their areas, most areas need more details regarding plant species location and abundance. FLAG recommends FLMs gather this information, where needed, and refine their lists of area-specific ozone-sensitive plants. The FLMs have placed ozone sensitive plant species lists for many of their areas in the NRIS-AIR or Air Resources Information System databases.

FLAG recommends that once local FLMs have developed lists of potentially sensitive AQRVs specific for their site, they conduct surveys to detect the presence of ozone-induced foliar injury on the selected species. The USFS Forest Health Monitoring (FHM) Program and the National Park Service Inventory and Monitoring Program have developed foliar injury survey protocols and QA/QC procedures that can be used to collect this information. Another resource is the foliar injury training module developed by the NPS Air Resources Division and The Pennsylvania State University, available at http://www.nature.nps.gov/air/edu/O3Training/index.cfm. This module helps field staff identify and quantify ozone injury symptoms on plant foliage. Field crews should obtain proper training and field experience in identifying foliar injury symptoms before surveys can be conducted.

Ideally, to verify ozone-induced foliar injury symptoms in the field, exposure/response fumigation studies should be conducted on these species, using concentrations that reflect current ambient exposure. Plants should also be tested at higher exposures, simulating increased levels of ambient ozone that might occur in the future. Due to the expense of constructing and operating such systems, it would be most appropriate for agencies to join resources and develop regional fumigation facilities. At a minimum, such facilities should be constructed both in the eastern and western U.S., since ambient conditions at an eastern facility might not be appropriate for western species and vice versa.

Ambient Ozone Monitoring

Many FLM areas do not currently have either on-site or nearby ambient ozone monitoring data. FLAG recommends that local FLMs make every effort to collect this information and that they use quality-assured ambient ozone monitoring protocols developed by the EPA and the state air quality agency. Continuous monitoring is desirable to determine the temporal dynamics of ozone exposure for vegetation. Unfortunately, continuous monitoring is expensive and requires electric power that is often not available in or near remote FLM areas. When installing a continuous monitor is not an option, FLAG recommends use of passive monitors. Passive monitors give total exposure loading values (SUM00) for a specified period of time. The data are useful for indicating year-to-year changes in total ozone exposure at an individual site, and for indicating where continuous monitors should be installed. However, FLMs recognize the limitation of passive samplers in relating ozone exposure to plant response.

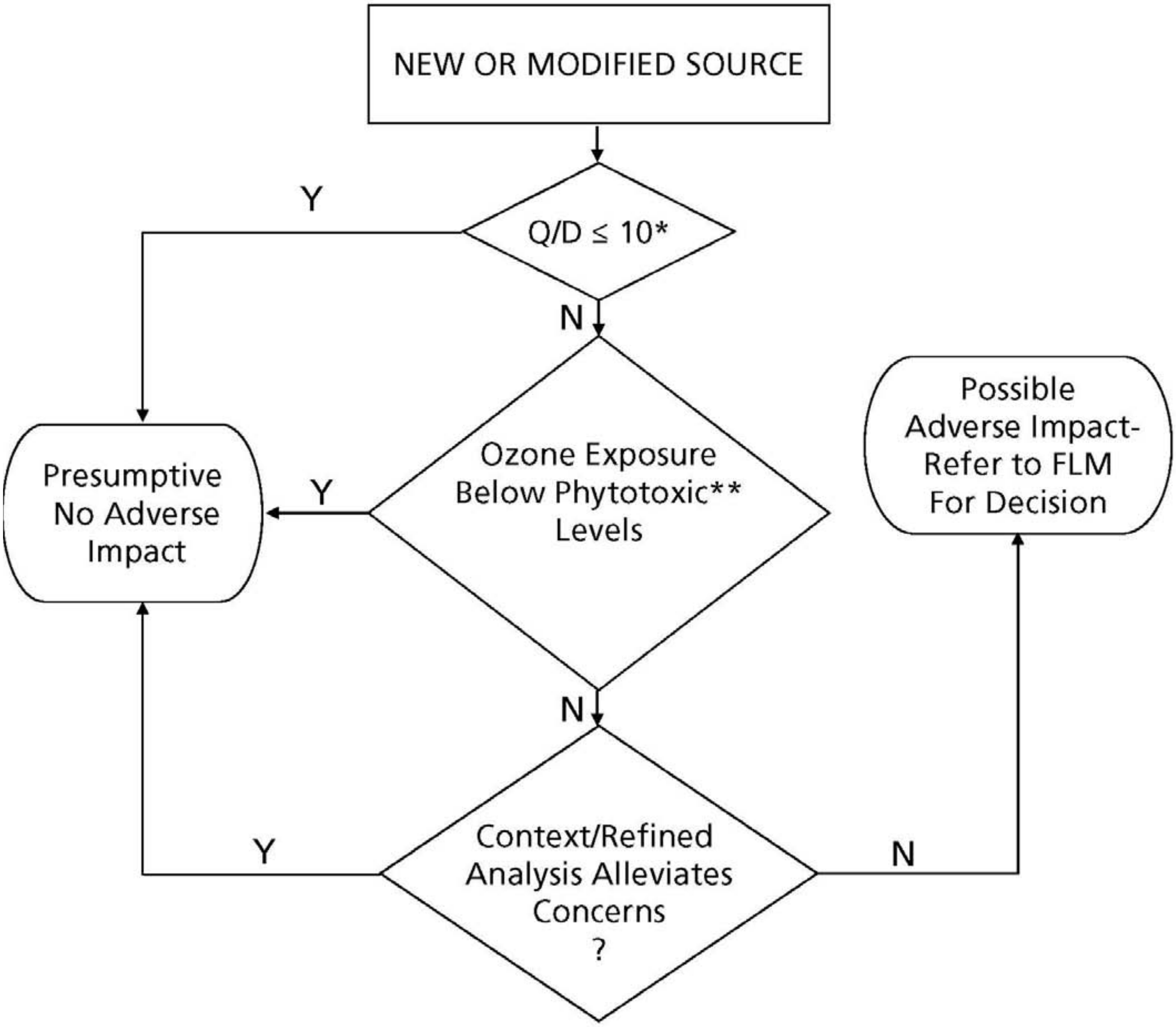

Figure 6. FLM Assessment of Potential Ozone Effects from New Emissions Source (Revised)
*Q/D test only applies to sources located greater that 50 km from a Class I area.
**Note: Ambient ozone concentrations are considered along with data from exposure response studies (EPA 2007b) to determine whether a source will cause or contribute to phytotoxic ozone levels (i.e., levels toxic to plants) at the affected site.

3.4.7. Ozone Air Pollution Web Sites (Revised)

EPA ozone information:

- http://www.epa.gov/ozone
- http://www.epa.gov/castnet

NPS ozone information:

- http://www.nature.nps.gov/air/permits/aris/index.cfm
- http://www.nature.nps.gov/air/Monitoring/network.cfm
- http://www.nature.nps.gov/air/studies/ecoOzone.cfm

FWS Information:

- http://www.fws.gov/refuges/whm/AirQuality/index.html

U.S. Forest Service information:

- http://www.fs.fed.us/air
- http://www.fs.fed.us/psw/programs/atdep

Ozone effects research, USDA ARS, North Carolina:

- http://www.ars.usda.gov/Main/docs.htm?docid=8453

Ozone exposure metrics for vegetation:

- http://www.asl-associates.com/

3.5. Deposition

3.5.1. Introduction (Revised)

Atmospheric deposition has been studied extensively throughout the world, beginning in the 1800's in England, Sweden, Norway, and Germany. Research has primarily focused on the deposition of acidic pollutants and long-term acidification. Many publications describe current conditions, monitoring and modeling methods, and the results of acidification experiments. In the United States, research on acidification was first begun in 1962 at Hubbard Brook, New Hampshire. Subsequent work in the Adirondack lakes and other areas furthered the understanding of acid deposition effects. It is now recognized that, in addition to causing acidification, deposition of pollutants can affect many ecosystem characteristics, including nutrient cycling and biological diversity.

Although much progress has been made to control sulfur dioxide and nitrogen oxide emissions, deposition of sulfur (S) and nitrogen (N) compounds continues to be a problem in North America and Europe (EPA 2007a). As a result, certain sensitive freshwater lakes and streams continue to lose acid-neutralizing capacity (ANC) and sensitive soils continue to be acidified. Other ecosystems, including forests, grasslands, estuaries, and N-limited lakes exhibit unwanted fertilization and other effects from excess N deposition.

In this section, the Agencies focus on S and N deposition and associated effects to ecosystems, but other potentially damaging pollutants are routinely deposited. For example, mercury emitted from coal-fired powerplants, incinerators, and other sources deposits into ecosystems and accumulates to sometimes toxic levels in fish and wildlife (EPA 1997). EPA sampled fish from over 75,000 lakes nationwide and found that mercury concentrations in large predatory fish exceeded the human health screening value for mercury in nearly half the lakes (EPA 2009b). The Great Waters Program found that, in addition to mercury, airborne toxics including dioxins, furans, polycyclic organic matter, polychlorinated biphenyls (PCBs), and pesticides are deposited widely across the Great Lakes, the Chesapeake Bay, Lake Champlain, and many coastal estuaries, posing ecological and human health risks (EPA 2000a). Even in relatively remote western and Alaska national parks, deposition has increased concentrations of certain toxic compounds in fish and wildlife above health thresholds (Landers et al. 2008).

Federal Land Managers (FLMs) have documented the effects of S and N deposition on many air quality related values (AQRVs). Documented effects include acidification of lakes, streams, and soils; leaching of nutrients from soils; injury to high-elevation spruce forests; changes in terrestrial and aquatic species composition and abundance; changes in nutrient cycling; unnatural fertilization of terrestrial ecosystems; and eutrophication of estuarine and some lake systems. FLMs recognize that other undocumented effects may also be occurring.

The FLAG deposition subgroup was formed to identify common approaches among these agencies for evaluating atmospheric deposition and its effects on AQRVs. In addition, the subgroup was directed to recommend methods for establishing critical deposition loading values ("critical loads") and, where possible, recommend such critical loads for specific areas. These tasks were assigned to Phase I or Phase II, depending on their degree of difficulty.

During the scoping process, the FLAG Deposition Subgroup determined that Phase I tasks would include the summarization of information currently available about deposition and its effects on FLM areas and the development of recommendations on methods to model and evaluate current and future deposition and its effects on AQRVs. In addition, critical load values, where available from previous FLM guidance documents, would be referenced. FLMs agreed that site-specific AQRV and critical load information would be maintained on FLM web sites, rather than included in the Phase I report. In this way, the information can be updated and the most recent versions made quickly available to the public. Some of this information is already available on FLM web sites, and the FLMs are committed to entering remaining available information as soon as possible.

The subgroup recognizes that the development and refinement of site-specific critical load values for all FLM areas are crucial for AQRV protection. However, because of the complexity of this undertaking, and the lack of information for many areas, it was deferred to future FLAG development.

Future deposition effects work will involve developing methods for establishing critical deposition loading values for FLM areas, and establishing critical loads for areas with adequate information. For areas lacking sufficient information to determine critical loads, strategies will be developed to obtain needed information. Previously established critical loads will be reviewed and refined as necessary. The subgroup will also explore alternative methods for estimating background deposition rates, including extrapolation techniques or modeling that considers the spatial scale of ecosystems and differences in elevation. Methods for addressing problems with dry deposition and cloud and fog deposition measurements will also be considered. In addition, future work may provide research or monitoring recommendations to improve our understanding of deposition and its effects, including effects on cultural resources.

3.5.2. Current Trends in Deposition (Revised)

Title IV of the Clean Air Act was passed by Congress as part of the 1990 Clean Air Act Amendments to reduce emissions of sulfur dioxide and nitrogen oxides from fossil fuel-burning power plants in order to reduce deposition of S and N compounds and protect ecosystems suffering damage from acid deposition. Since the implementation of Title IV, wet sulfate deposition, a major component of acid rain, has significantly decreased. Average annual sulfate deposition in the Northeast in 2000–2002 was 40% lower than it was in 1989–1991, deposition in the mid-Atlantic and Midwest was 35% lower, and deposition in the Southeast was 25% lower (NAPAP 2005).

Wet nitrate deposition, on the other hand, has not decreased regionally from historical levels because of the relatively moderate reduction in nitrogen oxides from power plants and the continuing large contribution (over 50% of total nitrogen oxides emissions) from other sources of nitrogen oxides such as vehicles and nonroad vehicles (NAPAP 2005).

Deposition monitoring data can be used to identify decreases in S and N deposition due to decreases in emissions. The National Atmospheric Deposition Program (NADP) provides one of the best and most comprehensive long-term records of wet deposition chemistry in the U.S. Annual reports on deposition nationwide as well as deposition trend plots for all NADP sites are available at http://nadp.sws.uiuc.edu/. An analysis of long-term trends (1985-2004) in precipitation chemistry from NADP sites across the U.S. found that concentrations of sulfate have decreased in nearly all parts of the country. Nitrate, however, has increased in many areas and ammonium, another component of N deposition, has also increased significantly in many areas, particularly in the West (Lehmann et al. 2005). Publications on trends in deposition are available from NADP at:

- http://nadp.sws.uiuc.edu/lib/

In this chapter, it is assumed that S is deposited into the environment primarily as sulfate ion and N is deposited primarily as inorganic nitrate and ammonium ions. Other ionic forms of S and N occur in the atmosphere, but information on their deposition into ecosystems is limited. For example, organic N in deposition is not routinely measured because of the expense and complexity of the measurements. Organic N includes peroxyacetyl nitrate (PAN) (produced in the atmosphere by nitrogen oxides and hydrocarbon reactions), urea, and amino acids. Both natural and anthropogenic processes contribute to organic N formation, including industry, agriculture, biomass burning, and biological activity. Limited monitoring suggests that organic N deposition varies widely, but on average constitutes about 30 percent of total N (Neff et al. 2002)

3.5.3. Identification and Assessment of AQRVs (Revised)

AQRVs sensitive to pollutant deposition have been identified in various documents published by the USFS, NPS, and FWS, which are listed in the 'General References' of Appendix G of this report. The FLMs have previously used a combination of approaches to identify AQRVs, including national and regional workshops, regional reviews, and site-specific studies. AQRV identification was based on information from peer-reviewed scientific literature and expert judgment. Because information on AQRVs may change as new data become available, the FLMs agree that AQRV information will be made available on FLM web sites to allow for updating and improve accessibility, as discussed in the Introduction to this chapter.

Information on AQRVs for many USFS Class I areas can be found at

- http://www.fs.fed.us/air

The USFS is currently adding to and updating this information.

Information on AQRVs for NPS Class I areas and some FWS Class I areas is available from NPS Air Web at:

- http://www.nature.nps.gov/air

Information on AQRVs for FWS Class I areas is under development at:

- http://www.fws.gov/refuges/whm/AirQuality/index.html

Table 11. Indicators for monitoring and evaluating effects from deposition of S and N (Revised)

Ecosystem	Indicators for Sulfur Deposition
Freshwater	Chemical change (ANC depression), changes in phytoplankton and benthic community composition, species diversity, biomass
Terrestrial	Leaching of soil cations, soil acidification, mobilization of aluminum ions; Lichen species and vitality
Estuarine	Saltwater not sensitive to S deposition; leaching of nutrients may occur in sandy nearshore soils
Ecosystem	**Indicators for Nitrogen Deposition**
Freshwater	Chemical change (ANC depression), changes in phytoplankton and benthic community composition, species diversity, biomass
Terrestrial	Changes in: litter and soil carbon and N dynamics; biomass; soil N processes; litter decomposition rates; soil microbe functional groups; soil organic matter quality and quantity; soil water chemistry; Lichen species and vitality
Estuarine	Changes in: phytoplankton species composition and biomass; aquatic invertebrates; seagrass health and distribution; nutrient ratios; dissolved oxygen; trophic status

FLMs recommend that permit applicants consult with the appropriate FLM to determine the need for an AQRV analysis and, if applicable, the methods for the analysis.

All FLMs use a similar conceptual approach to identify AQRVs that reflects the FLMs' interest in maintaining the integrity of ecosystem structure and function and protecting the most sensitive ecosystem components. AQRVs can be categorized by the type of ecosystem in which they are found, such as terrestrial, freshwater, and estuarine ecosystems. Each ecosystem and its AQRVs responds somewhat differently to deposition and approaches to evaluating deposition effects must therefore be developed accordingly. In terrestrial ecosystems, detection of changes in production, decomposition, and nutrient cycling processes provide information on deposition stress. In aquatic and estuarine ecosystems, detection of changes in water chemistry and aquatic community composition and structure provide similar information. Table 11 summarizes AQRV indicators that may be used to assess effects in various ecosystems.

Terrestrial, freshwater, and estuarine AQRVs are discussed below. In addition, methods to evaluate S- and N-induced deposition stress are discussed.

Terrestrial Ecosystems

Terrestrial ecosystem AQRVs include flora, fauna, and soils. FLMs have identified, where possible, AQRVs, or characteristics of AQRVs, most likely to be sensitive to S and N deposition ("sensitive receptors"). For example, high-elevation spruce forests may be sensitive receptors. FLMs assess the condition of these sensitive receptors by evaluating some aspect of the receptor (the "sensitive receptor indicator" or "indicator"). For example, an indicator for high-elevation red spruce forests is the occurrence and extent of winter foliar injury. In general, the FLM has focused on deposition effects to vegetation and chemical receptors in terrestrial ecosystems, with little emphasis on fauna. In addition, there is increasing awareness among FLMs that certain soil fauna (e.g., microorganisms and invertebrates) are very sensitive to deposition and can be used as sensitive receptors.

In terrestrial ecosystems, sulfate production is regulated primarily by chemical processes (Johnson et al. 1983) and it is rarely a limiting nutrient. Soil response to acidic deposition can be evaluated by monitoring the leaching of essential soil cations, soil acidification, and mobilization of ionic aluminum. These processes have been studied both in field and laboratory experiments, and are defined in detail in the literature (Mollitor and Raynal 1983; Richter et al. 1983; Johnson et al. 1983; Reuss and Johnson 1986). Effects of S deposition can be detected by monitoring calcium and magnesium ions and S in the litter layer and surface soils; calcium, magnesium, potassium, and sulfate ions in soil solution; cation exchange capacity (CEC); and base saturation.

In general, biological AQRVs do not provide reliable indicators of S deposition in terrestrial ecosystems except under extreme S deposition. Lichens have been used in some areas as biomonitors to demonstrate spatial trends in S deposition, particularly in areas with pronounced S deposition gradients. For example, isotopic analysis of lichens from Mt. Zirkel Wilderness, Colorado, indicated that power plants in the nearby Yampa Valley were the source of elevated S in the lichens (Jackson et al. 1996).

Unlike S, the production and mobility of N in ecosystems is regulated almost entirely by biological processes. N is a limiting nutrient in many terrestrial ecosystems. In these ecosystems, growth of plants is limited by N availability; additional N from atmospheric inputs increases plant growth. Most ecosystems can retain and process significant additions of N, with resulting increases in production and changes in species diversity, biomass, and nutrient cycling. However, these changes are usually considered to be inconsistent with desired ecosystem conditions for natural areas. The ability to retain and process N varies significantly depending on watershed successional status, site and fire history, soil conditions, vegetation, and other non-human factors. When N inputs exceed an ecosystem's assimilation capacity, N is lost or leached, usually as nitrate, from the soil and can be detected in adjacent streams or lakes. This may occur following a major disturbance such as fire, logging, land use change, grazing, agriculture, or where atmospheric N deposition or experimental inputs exceed what the ecosystem can assimilate (Fenn and Dunn 1989; Fenn 1991, Fenn et al. 1996; Adams et al. 1997).

Studies in northern Europe (Dise and Wright 1995) found that European forests leached detectable levels of nitrate at inputs of about 10-25 kilograms N per hectare per year (kg N ha^{-}1yr^{-1}). Tundra and high-elevation alpine sites may leach N at much lower levels of input. Mountain watersheds in the western U.S. show signs of N leakage at wet deposition levels of 3-5 kg N ha^{-1}yr^{-1} (Eilers et al. 1994; Williams et al. 1996; Williams and Tonnessen, in review). However, even high elevation, poorly vegetated ecosystems with limited soil development can process more than 80% of the atmospheric N input before it reaches the aquatic system (Campbell et al. 1995, Kendall et al. 1995). Although nitrogen leaching has often been used as an indicator of excess N deposition, major changes occur in below- and above-ground biomass, species diversity, and nutrient cycling long before N input levels are sufficient to cause nitrate leaching (NAPAP 1993; Tilman et al. 1997; Vitousek et al. 1997). For example, with ambient deposition rates of 7-10 kg N ha^{-1}yr^{-1}, a Minnesota Long-Term Ecological Research (LTER) grassland study observed shifts from native, warm-season grasses to low diversity mixtures dominated by cool-season grasses and a greater than 50% decline in species richness (Wedin and Tilman 1996; Tilman et al. 1997). Significant losses in terrestrial diversity may have already occurred over extensive areas of the U.S., particularly in forest understories, shrublands, grasslands, and in soil microbial communities. (Suding et al. 2005; Weiss 2006).

Because significant ecological changes may occur before nitrate loss can be detected, more sensitive indicators than nitrate leaching are needed to evaluate N deposition effects. Such indicators include changes in carbon and N dynamics of litter and soil and biomass (Aber and Driscoll 1997; Magill et al. 1997). With knowledge of inputs and small-scale N fertilization studies, changes in soil organic matter quality and quantity in response to N deposition can be evaluated. Soil microbial communities control the quantity and quality of N available to ecosystems and may be very sensitive indicators of N deposition. Changes in soil microbe functional groups or biomass may provide good estimates of ecosystem critical loads and incremental effects. Soil N mineralization, small root growth, and carbon:nitrogen ratios of soil and microbial biomass are also sensitive to N deposition. Evidence suggests that current deposition rates may alter the production of dissolved organic carbon and organic N compounds in soils, which are important nutrient and energy sources for both terrestrial and aquatic ecosystems (Grandy et al. 2008; Aber et al. 1995; Sinsabaugh et al. 2005). These could also be used as indicators of N deposition effects. However, because there are many other variables that also affect soil processes, it may be very difficult to discern effects on any soil indicators that are solely attributable to N.

Freshwater Ecosystems

AQRVs in freshwater ecosystems include lakes and streams and their associated flora and fauna. Sensitive receptors include water chemistry and clarity, phytoplankton, zooplankton, fish, amphibians, macroinvertebrates, and benthic organisms. Water chemistry indicators that respond to deposition include pH, ANC, conductance, cations and anions, metals, and dissolved oxygen. Physical indicators, such as water clarity, and biological indicators, including species diversity, abundance, condition factor and productivity of fish, amphibians, macroinvertebrates, and plankton can also be used to detect deposition effects in aquatic ecosystems. Much research has been done on the sensitivity of aquatic species to deposition, many of which are discussed in the 1990 National Acid Precipitation Assessment Program (NAPAP) State of Science report (NAPAP 1991a) and the 1998 NAPAP report (NAPAP 1998).

Sulfur is not a limiting nutrient in freshwater ecosystems. However, there are regions of the U.S. where a relatively high percentage of surface water is sensitive to current acidic inputs. These include portions of the Northeast (particularly Maine and the Adirondack and Catskill Mountains), southeastern streams, and some high elevation western lakes, particularly in the Rocky Mountains (NAPAP 2005). There are a number of FLM areas in acid-sensitive regions, including national parks, national forests, and wilderness areas. In these areas, S deposition can cause decreases in ANC and pH. For these sensitive or low-ANC waters, the best approach to quantify S deposition effects is the procedure currently used, monitoring changes in ANC and pH.

Nitrogen deposition, like S deposition, can cause episodic acidification of surface water in certain sensitive high-elevation ecosystems that have low-ANC headwater lakes and streams. Episodic acidification occurs in these areas when deposition is as low as 3-5 kg N ha^{-1}yr^{-1} (Williams et al. 1996).

Estuarine Ecosystems

AQRV sensitive receptors in estuarine ecosystems include plankton, sea grasses, and water chemistry and clarity. Associated coastal forest and dune soils may also be useful as sensitive receptors. Water and soil nutrient concentrations, phytoplankton species composition and abundance, sea grass health, and dissolved oxygen concentrations can be used to evaluate deposition effects.

In estuaries, S is not a limiting nutrient. In addition, estuarine waters are highly buffered and, therefore, not subject to acidification. However, many coastal forest and dune soils are dominated by sandy soils that are sensitive to leaching of limiting nutrients because of very low cation exchange capacity (Au 1974). Monitoring for change in estuarine areas with high S deposition should therefore focus on soil ion mobility. As soil calcium and magnesium levels are generally adequate because of deposition from marine sources, potassium is likely the only limiting nutrient subject to significant loss by sulfate leaching.

The role of N in estuaries is probably the best-documented example of anthropogenic alteration with a literature record dating back to the 1950s. Production and use of fertilizers, land use changes, and fossil fuel combustion have greatly increased the available N, normally a limiting nutrient, which enters coastal waters (Galloway et al. 2003). This has increased estuarine production and accelerated the process of eutrophication. Eutrophication can result in dramatic algae blooms, anoxia, the production of toxic hydrogen sulfide gas, and species extirpation in estuarine ecosystems. Human induced eutrophication has been documented for many areas along the Atlantic and Gulf coasts, including the Chesapeake Bay, Tampa Bay, Sarasota Bay, Florida Bay, and Long Island Sound.

A number of FLM areas along the Atlantic and Gulf coasts contain significant coastal waters that may be sensitive to eutrophication. Little is known about excess N effects in most of these areas, although eutrophication is well documented in Florida Bay, located in Everglades National Park. Also, recent evidence indicates that coastal waters in Chassahowitzka Wilderness (Florida) experience N-induced algal blooms (Dixon and Estevez in draft). In most coastal waters, 10-45% of the N entering the system is atmospheric, either from direct deposition to surface water or deposition to the watershed. Complete elimination of atmospheric N inputs would not entirely mitigate ecosystem change due to N because of the substantial contributions from agricultural and urban runoff. However, for most estuaries, any reduction in N input would be beneficial in restoring ecosystem structure and function.

The monitoring procedures recommended, and currently used, in estuaries are similar to those used in freshwater, with emphasis on incremental changes in plankton, aquatic plant, benthic, and invertebrate community composition; species diversity, distribution, and biomass; and ecosystem trophic status.

Significance of Long-Term Monitoring to Evaluate Trends and Validate Modeling

Long-term monitoring is critical to evaluate trends in deposition and deposition effects. Monitoring programs should concentrate not only on areas with high past and/or present sulfate, nitrate, or ammonium deposition, but also in areas that are very sensitive to deposition and in areas where deposition is expected to increase. For selected monitoring sites, the FLM should (1) obtain ion deposition data for the site, as from NADP or CASTNet, (2) identify sensitive AQRVs and appropriate variables to monitor, (3) evaluate the present condition of the sensitive AQRVs, (4) determine the degree to which results from one site can be extrapolated to other FLM areas in the region, and lastly (5) implement a long-term monitoring program, using carefully selected variables.

Long-term monitoring data are also needed to support and validate models used to predict deposition and deposition effects, including the effects of increases or decreases of S and N on ecosystems. Long term studies in both aquatic and terrestrial ecosystems such as Hubbard Brook, Lake Tahoe, and the Experimental Lakes Area have provided useful information for modeling (Bormann and Likens 1967; Holm-Hanson et al. 1976; Likens and Bormann 1977, Leonard et al. 1979; Byron and Eloranta 1984; Schindler et al. 1985; Schindler 1987; Schindler et al. 1990; Jassby et al. 1995). NAPAP and the National Science Foundation LTER program have addressed monitoring to meet modeling needs in both terrestrial and aquatic ecosystems.

Data requirements to support models vary, but the quality of input data will determine the quality of a model's predictions. Modeling is further discussed in the 'Other AQRV Identification and Assessment Tools' (see section 3.5.5).

3.5.4. Determining Critical Loads (Revised)

FLAG 2000 introduced the concept of critical loads as it relates to air resource management in Class I areas. Since FLAG 2000 was published, the Agencies have adopted the widely used definition of critical load, "the quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge" (Nilsson and Grennfelt 1988). Critical loads have been widely accepted in Europe and Canada as a basis for negotiating control strategies for transboundary air pollution (Posch et al. 1997).

In Canada, researchers have estimated the critical loads of S in wet deposition necessary to protect moderately sensitive lakes in eastern provinces. That value, equivalent to 6.7 kg $ha^{-1}yr^{-1}$ of S in wet deposition, was used by Canada to argue for the U.S. to implement the Clean Air Act Amendments of 1990, which call for the initial reduction of sulfur dioxide emissions in the eastern U.S. and later from all electric utilities nationwide. With additional data on lake and stream chemistry available for sensitive systems in Nova Scotia, Ontario, and Quebec, the Canadians are now recommending a more stringent critical load, equivalent to 2.7 kg $ha^{-1}yr^{-1}$ of wet deposition S.

In both European countries and in North America, attention has expanded beyond ecosystem damage caused by S deposition to ecosystem damage caused by N deposition. In some European forests, chronically high N deposition has exceeded the assimilation capacity of local ecosystems, resulting in the release of nitrate into surface waters (Dise and Wright 1995). Watersheds that are leaking nitrate into surface waters during the growing season, are referred to as "N saturated" (Aber et al. 1989). Nitrogen saturation has been linked to forest decline in Europe (Schulze 1989). Based on a set of regional N addition experiments conducted at sites in northern Europe (NITREX), Wright (1995) recommended a N critical load of less than 10 kg $ha^{-1}yr^{-1}$ to protect European forests and fresh waters from N saturation. However, this critical load does not protect ecosystems from the changes caused by N deposition prior to actual N saturation, including shifts in composition and abundance of soil fauna species and alterations in soil chemistry. (Fenn et al. 2003; Driscoll et al. 2003)

In the United States, two states have attempted to set deposition standards or critical loads to protect sensitive ecosystems. In 1982, the State of Minnesota passed the Acid Deposition Control Act to limit wet sulfate deposition to 11 kg $ha^{-1}yr^{-1}$, which is equivalent to 3.7 kg S $ha^{-1}yr^{-1}$. At this sulfate level, precipitation pH was likely to remain above 4.7, which would protect lakes with ANC less than 50 microequivalents per liter (μeq l^{-1}).

In 1989, the California legislature adopted the Atmospheric Acidity Protection Act, which required the Air Resources Board (CARB) to "develop and adopt standards, to the extent supportable by scientific data, at levels which are necessary and appropriate to protect public health and sensitive ecosystems from adverse effects resulting from atmospheric acidity" (CARB 1993). An assessment of existing data identified the high elevation watersheds, surface waters, and mixed conifer forests of the Sierra Nevada and the Los Angeles Basin as sensitive ecosystems. CARB analyses suggested that appropriate standards would include a critical load value for inorganic N to protect forests, and critical loads for both N and S to protect poorly buffered lakes and streams. However, no acidity standards to protect human health or critical loads to protect ecosystems have been set in California to date.

The Clean Air Act Amendments of 1990, Title IV, section 404, called on the Environmental Protection Agency (EPA) to prepare a report on the feasibility and effectiveness of setting deposition standards nationwide to protect sensitive aquatic and terrestrial resources. The completed report includes a number of modeling analyses that project the effect of reductions in both S and N deposition in areas studied during NAPAP. EPA concluded that deposition standards could not be set at this time because of 1) the lack of clearly defined policy regarding appropriate or desired goals for protecting sensitive aquatic or terrestrial resources, and 2) key scientific uncertainties, particularly regarding nitrogen watershed processes. In addition, EPA recognized that a national deposition standard might be inappropriate because of differences among ecosystems. However, in response to public comments on the report, EPA stated that "Given an adequate level of monitoring and assessment data, Class I areas could serve as potential targets for standard setting activities." (EPA 1995)

Since FLAG 2000, other U.S. agencies and organizations have started considering how to work with critical loads. A National Academy of Sciences Report, *Air Quality Management in the United States* (2004), recognized the potential of critical loads for establishing standards to protect ecosystems, prompting the EPA to explore critical loads as an accountability tool to assess ongoing programs. Also, in the 2005 Prevention of Significant Deterioration for Nitrogen Oxides Final Rule, EPA stated it would consider critical loads information from any state as part of their air quality management approach, including whether such an approach satisfies PSD requirements. (EPA 2005.) The U.S. has signed, but not ratified, the European Union's protocol for establishing critical loads, contained in the 1999 *Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (AKA The Gothenburg Protocol)*, available at:

- http://www.unece.org/env/lrtap/multi_h1.htm

In 2006, EPA held the Multiagency Critical Loads Workshop to share information on critical loads and to develop a broad federal strategy for planning, executing, and evaluating critical loads projects, and to consider critical load use in a policy or management framework. As a result of recommendations from the workshop, the Critical Loads Ad-Hoc Committee (CLAD) was formed to foster critical loads science and development. Information on CLAD and the Multiagency Critical Loads Workshop Report are available at:

- http://nadp.sws.uiuc.edu/clad/

In 2008, EPA used critical loads to assess progress under the Acid Rain and related programs. For the analysis, EPA compared critical loads exceedances in Adirondack lakes before and after implementation of acid rain controls (EPA 2009a).

Critical Loads in FLM Areas (Revised)

In the Clean Air Act, as amended in 1977, Congress gave FLMs an "affirmative responsibility" to protect AQRVs in Class I areas from the adverse effects of air pollution.

Congress' intent was, "…In cases of doubt the land manager should err on the side of protecting the air quality-related values for future generations…" (Senate Report No. 95-127, 95th Congress, 1st Session 1977). In an effort to ensure AQRV protection, FLMs have established critical loads for many FLM areas. FLMs agree that a critical load should protect the most sensitive AQRVs within each FLM area and should be based on the best science available. As new scientific information becomes available, critical loads should be reviewed and updated. Critical loads should ensure that no unacceptable change occurs to the resource.

A journal article published in the July 2005 issue of *BioScience*, entitled "Protecting Resources on Federal Lands: Implications of Critical Loads for Atmospheric Deposition of Nitrogen and Sulfur" (Porter, Blett, Potter, Huber 2005) provides an update on the Agencies' perspectives with respect to critical loads. Among other things, the article describes the history of critical loads, the advances in science related to critical loads, and how to apply the concept of critical loads (including some specific case studies). Subsequent articles provide additional information and perspectives on critical loads (Burns et al. 2008; Dennis et al. 2007). These and other articles and reports on critical loads are available from:

- http://www.nature.nps.gov/air/Studies/criticalLoads/index.cfm
- http://www.nrs.fs.fed.us/clean_air_water/clean_water/critical_loads/

FLMs have used a combination of approaches to establish critical loads, including national and regional workshops, regional reviews, and site-specific studies (see Appendix G). In all cases, the FLMs have used peer-reviewed scientific literature and expert judgment to make their decisions. For example, the NPS has compiled regional reviews that have evaluated existing information on air quality, deposition, and effects on AQRVs in national parks. For these reviews, NPS grouped parks by region and ecosystem type, including the Pacific Northwest, the Colorado Plateau, and the Rocky Mountains, and conducted an empirical assessment of the status of aquatic and terrestrial resources. An analysis of deposition effects was done, using current deposition data for S and N and effects information from field observations and research. These reviews provide the basis for critical load development by identifying sensitive resources and impacts to those resources. Park-specific information on sensitive resources, impacts, and critical loads is available at:

- http://www.nature.nps.gov/air/permits/aris/index.cfm

The USFS has conducted a series of national and regional workshops to establish critical loads and concern thresholds. In the late 1980s, the USFS published prototype methods for evaluating the effects of acid deposition on AQRVs (Fox et al. 1989; Fox et al. 1987). Subsequently, the USFS held regional workshops to develop updated and more area-specific screening procedures for new air pollutant emissions sources (Adams et al. 1991; Peterson et al. 1992; Haddow et al. 1998; Peterson et al. 1993; Stanford et al. 1997). These workshops were comprised of national and regional USFS land managers, deposition experts from the academic and air pollution research community, and agency air quality professionals. Dependent on the workshop leadership, each regional workshop followed a slightly different process and a variety of outputs and formats resulted. However, all workshops used a collaborative process to determine S and N deposition rates that would pose a risk to the aquatic and terrestrial ecosystems protected in FLM areas, while addressing the scientific uncertainty inherent in ecosystem response to acidic deposition. Critical load guidelines for many USFS Class I areas are published in the regional workshop reports (see Appendix G) and are available at:

- http://www.fs.fed.us/air

As resources permit, the Agencies will develop methods and a process for establishing critical deposition loading values for all FLM areas and for recommending critical loads for areas where adequate information exists. For areas lacking sufficient information to determine critical loads, the Agencies are developing strategies to obtain needed information.

Current information and links on critical loads work being done by the U.S. Forest Service can be found at the following web site:

- http://www.fs.fed.us/air

The Agencies anticipate using critical loads as they are developed as an assessment tool, and, in concert with the Deposition Analysis Thresholds and Concern Thresholds (see below), a tool for assessing new source impacts. The Agencies also intend to continue to consult with States and the EPA as critical load development work progresses.

3.5.5. Other AQRV Identification and Assessment Tools (Revised)

In addition to AQRV monitoring, there are several tools available to the FLM for identifying AQRVs and assessing the response of sensitive AQRVs to pollutant deposition. These include the Air Resources Information System (ARIS), the Natural Resource Information System – Air Module (NRIS-Air), and deposition models such as the Model of Acidification of Groundwater in Catchments (MAGIC) and MAGIC-With Aggregated Nitrogen Dynamics (MAGIC-WAND).

Air Resources Information System (ARIS)

FLAG 2000 also introduced "Air Synthesis" as an information management and decision-support computer system under development by NPS and FWS. The NPS and FWS have since redesigned and renamed Air Synthesis, now called Air Resources Information System (ARIS). ARIS provides information on air quality related values in NPS and FWS Class I areas, as well as in many NPS Class II areas. Information can be accessed for specific areas or for all units within NPS Inventory & Monitoring (I & M) networks.[8] ARIS identifies specific AQRVs, and provides information on air quality and its effects in parks and wildernesses. ARIS maintains information for all 48 NPS Class I air quality areas and several FWS Class I areas. Information is being developed for the remaining FWS Class I areas, and additional Class II areas. Additional information on ARIS can be found at:

- http://www.nature.nps.gov/air/permits/aris/index.cfm

Information for FWS Class I areas is under development at:

- http://www.fws.gov/refuges/whm/AirQuality/index.html

Natural Resource Information System – Air Module (NRIS-Air)

Publicly available USDA Forest Service Class I and II area information and related resource data can be linked to or found at http://www.fs.fed.us/air. If desired information and data cannot be found, contact any air program manager or specialist at national or regional offices for assistance.

Information from NRIS-Air, including USFS Class I area AQRV information, is available at:

- http://www.fs.fed.us/air

Deposition Effects Models

A number of watershed process models have been developed and tested in an attempt to simulate the effects of S and N on soils, forests, and surface waters. These models are used by FLMs to predict effects from increases in deposition and vary from detailed, compartment models of watersheds to lumped parameter models that do not track different ions through each soil compartment. For a review of models developed under NAPAP see NAPAP 1991.

A commonly applied watershed model is MAGIC. MAGIC was first developed for eastern U.S. watersheds and then extensively tested and validated throughout Europe and North America (Cosby et al. 1985, 1995, 1996). The model was used by NAPAP in its 1990 Integrated Assessment to project surface water chemistry resulting from various deposition scenarios (NAPAP 1991b). In another application in the eastern U.S., MAGIC has been linked with a simple, empirical, dose/response fish model developed at University of Virginia that makes it possible to predict changes in fish productivity based on modeled changes in stream water chemistry.

As a result of NAPAP, there was increased awareness of the potential impacts of inorganic N deposition on watersheds and surface waters. In response, the MAGIC model was updated with a module called With Aggregated Nitrogen Dynamics (WAND). MAGIC-WAND is a process-based model that uses site-specific information on hydrology, soils, and hydrochemistry. The model predicts changes through time in lake or stream chemistry. These time-series of changes in pH and ANC can subsequently be used by FLMs to calculate critical S or N loads for watersheds.

MAGIC-WAND has been extensively tested in the Adirondacks and at watersheds in Maine. For example, the Bear Brook Watershed Manipulation Project uses MAGIC-WAND to predict the effects of experimentally added N and S on a test watershed. MAGIC-WAND has also been applied to watersheds in FLM areas in the Cascades, the Sierra Nevada, the Rocky Mountains, and the Wind River Range in an effort to quantify critical S and N loads to aquatic and terrestrial resources. In the southeastern U.S., MAGIC-WAND is being used under the auspices of the Southern Appalachian Mountains Initiative (SAMI) to predict the effects of future deposition scenarios on FLM areas. Future SAMI modeling efforts will link watershed model results with fish dose/response models. The ultimate goal is to calibrate MAGIC-WAND with landscape level data in order to set regional critical loads.

Other models are also in use. For example, the USFS Rocky Mountain Region recommends using either CALPUFF or AERMOD (or other approved models) to estimate S and N deposition. *The Screening Methodology for Calculating ANC Change to High Elevation Lakes* (USDA Forest Service 2000) summarizes procedures for estimating total deposition of S and N. The document also recommends computations for estimating alkalinity changes in lakes caused by increases in S and N deposition. Another model, the Nutrient Cycling Model (NuCM) has been used in the East to predict the effect of changes in deposition on nutrient concentrations in soils and vegetation.

3.5.6. Recommendations for Evaluating Potential Effects from Proposed Increases in Deposition to an FLM Area (Revised)

FLAG 2000 described a process to help the Agencies and permit applicants assess the total sulfur and/or total nitrogen deposition impacts of proposed new or modified sources.

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[8] The NPS I & M program consists of over 270 park units organized into 32 networks to conduct long-term natural resource monitoring on park "vital signs," that is, selected physical, chemical, and biological elements and processes of park ecosystems that represent the overall health or condition of the park.

Since that time, the Agencies have refined the concept of using concern thresholds, pollutant exposures, and deposition analysis thresholds in the permit review process. The approaches used by the respective agencies may vary somewhat, but in essence are all similar.

Deposition Analysis Thresholds (DATs)

The NPS and FWS have introduced and developed the concept of Deposition Analysis Thresholds (DATs) to use as screening level values for the additional modeled amount of sulfur and nitrogen deposition within FLM areas from new or modified PSD sources. A DAT is defined as the additional amount of nitrogen or sulfur deposition within an FLM area, below which estimated impacts from a proposed new or modified source are considered negligible. In other words, if the new or modified source has a predicted nitrogen or sulfur deposition impact below the respective DAT, the NPS and FWS will consider that impact to be negligible, and no further analysis would be required for that pollutant. In cases where a source's impact equals or exceeds the DAT, the NPS/FWS will make a project specific assessment of whether the projected increase in deposition would likely result in an "adverse impact" on resources considering existing AQRV conditions, the magnitude of the expected increase, and other factors.

The DATs are based on "naturally occurring deposition" that park and wilderness ecosystems may have experienced prior to anthropogenic influences and are scaled to enable assessment of the impacts of individual sources of air pollution. The DAT established for both nitrogen and sulfur in eastern and western FLM areas and wildernesses is 0.010 and 0.005 kilograms/hectare/year (kg/ha/yr), respectively. More information regarding the sulfur and nitrogen DATs can be found at:

- http://www.nature.nps.gov/air/Pubs/pdf/flag/nsDATGuidance.pdf

While DATs are a tool to assess the impact of a single new source, these levels may not be protective in areas that are already impaired or where there are multiple new sources impacting a single area. The critical load concept, discussed above, may be a more effective tool for assessing cumulative impacts.

Concern Thresholds and Pollutant Exposures

The Forest Service has continued to develop AQRV concern thresholds and pollutant exposure(s) thresholds (for sulfur or nitrogen deposition) that when exceeded may indicate an adverse impact to one or more AQRVs. These thresholds are very similar to the NPS/FWS Deposition Analysis Thresholds (DATs) in that they establish a point below which adverse impacts are not expected. Impacts above the thresholds may or may not cause an adverse impact; depending on current levels of deposition and resource condition. The values for these thresholds vary between FS Class I areas; therefore an applicant will need to check for Class I area-specific thresholds on the following Internet site:

- http://www.fs.fed.us/air/technical/class_1/alpha.php

FLM Response to Potential Deposition Impacts

For a project that exceeds the initial annual emissions over distance (Q/D) screening criteria, the permit applicant should consult with the appropriate regulatory agency and FLM for the affected area(s) to determine if a deposition impact analysis should be done (e.g., expected sulfur and/or nitrogen deposition impacts are above the DAT) or respective concern threshold). For such cases, FLMs request that proponents provide sufficient information for the FLM to evaluate the potential effects of emissions increases on AQRVs. FLMs have provided information to applicants through guidance documents, correspondence, meetings, and phone consultations. This chapter summarizes current information for evaluating new emissions on deposition and sensitive AQRVs and includes recommendations for:

- the types of data, information, and analysis needed before a permit application can be considered complete, including analytical and modeling protocols for a proponent's use in conducting an AQRV impact analysis;
- approaches and sources of appropriate values for estimating wet and dry deposition; and
- permit conditions to mitigate source impacts.

The process begins with the question "$Q/D \leq 10$?" as the first level screening criteria (see Figure 7). The next question is whether or not the DAT/concern threshold is exceeded. If not, no adverse impacts are expected. If so, the Agencies will determine if the contextual considerations (see section 4.3) or any refined analyses alleviate any deposition concerns. If not, the Agencies will defer to the FLM to make a case-by-case adverse impact finding. In determining if the proposed action will cause or contribute to an adverse effect to AQRVs, the FLM will consider information on deposition-sensitive AQRVs, deposition loads at which these AQRVs are affected (i.e., critical loads), the current pollutant deposition rates in the area, and the expected impacts from the proposed source. Procedures for estimating the source's impacts are found in 'Estimation of Current and Future Deposition Rates' section of this report. In areas where no information is available, information from a nearby, or ecologically similar area, may be used. An adverse effect may occur if the critical load is exceeded for an area, and the new source impact is above the levels of concern (i.e., DAT/concern threshold). AQRV and critical load information are discussed earlier in this report.

If the available information is insufficient for the FLM to determine if the proposed action will cause or contribute to an adverse effect to AQRVs, the FLM may ask for deposition and deposition effects monitoring and/or research in the FLM area. If the proposed action will likely cause or contribute to an adverse effect to AQRVs, the FLM may recommend permit conditions that ensure mitigation, including stricter emissions controls and effective emissions offsets. If no mitigation is possible, the FLM may recommend denial of the permit.

Available Deposition Monitoring Data

Atmospheric pollutants are deposited to ecosystems primarily through wet deposition and dry deposition. FLMs participate in national monitoring programs to monitor wet and dry deposition, including the National Atmospheric Deposition Program (NADP) and the Clean Air Status and Trends Network (CASTNet). A 1999 report, "The Role of Monitoring Networks in the Management of the Nation's Air Quality," (CENR, 1999) identified these two networks as being critical for characterizing baseline air quality data in the U.S.

Wet Deposition (Revised)

Wet deposition includes rain, snow, fog, cloud water, and dew. In most FLM areas, rain and snow are the primary contributors to wet deposition. However, in some high elevation areas, fog, cloud water, and dew are significant contributors, as discussed below.

Because rain and snow are the primary constituents of wet deposition at most FLM areas, the FLM generally relies on data from NADP to evaluate wet deposition of pollutants. NADP samplers collect rain and snow and NADP has documented deposition for many years in a nationwide network that currently includes over 220 monitoring

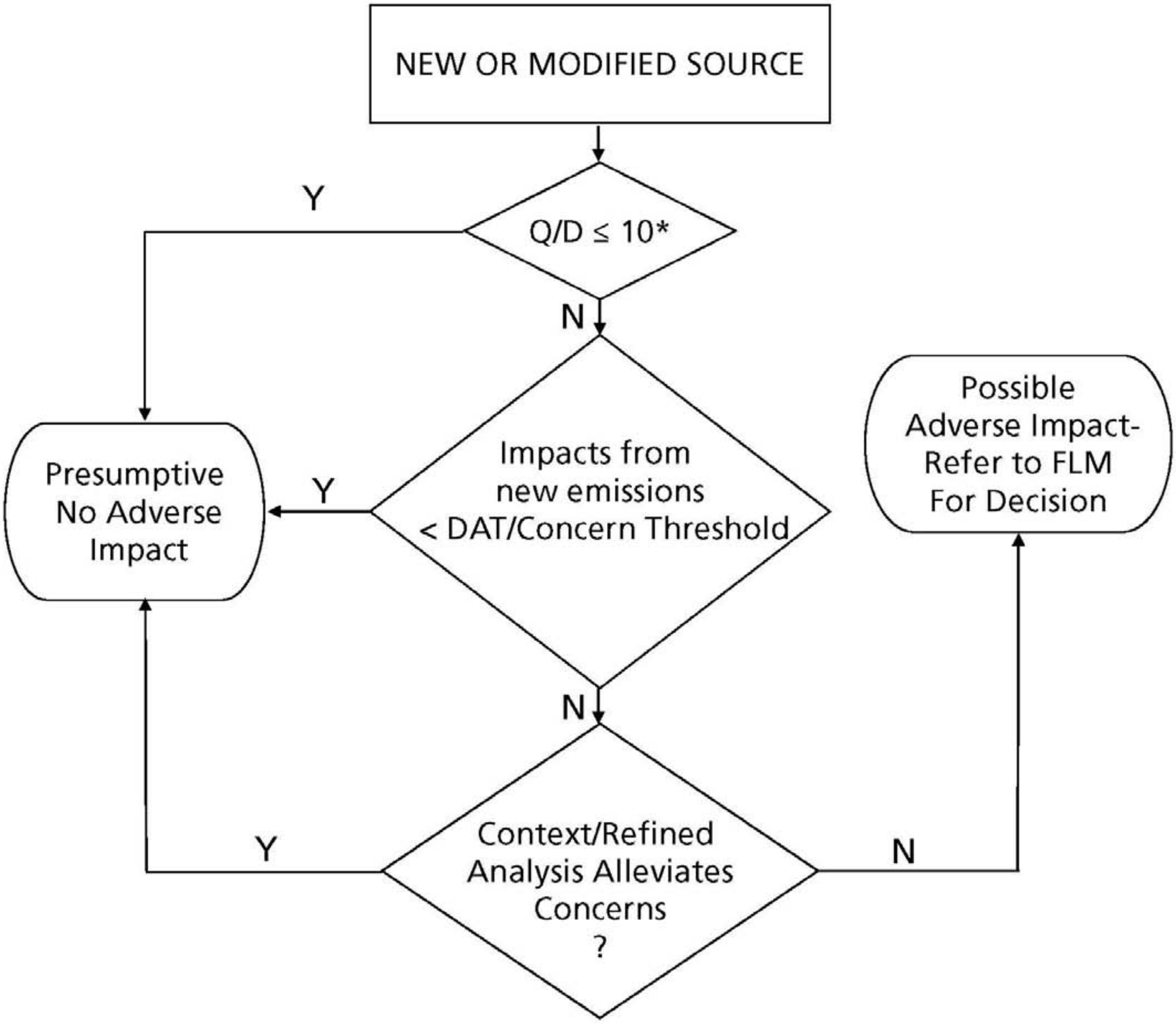

Figure 7. FLM Assessment of Potential Deposition Effects from New Emissions Sources (Revised)
*Q/D test only applies to sources located greater that 50 km from a Class I area.

sites. The network collects data to evaluate spatial and temporal long-term trends in precipitation chemistry. The precipitation at each site is collected weekly and sent to a central analytical laboratory for analysis of hydrogen (acidity as pH), sulfate, nitrate, ammonium, chloride, and base cations, including calcium, magnesium, potassium, and sodium. Data and isopleth maps of pollutant concentrations and deposition are available on the NADP web site at:

- http://nadp.sws.uiuc.edu/

FLMs agree that it is preferable to obtain NADP data from the web site, rather than summarizing wet deposition data in this report. In this way, current data can be easily accessed by FLMs and the public.

Approximately 50 FLM areas have NADP samplers in or immediately adjacent to them. Because some of these areas are classified as wilderness, FLMs install sampling equipment in adjacent non-wilderness areas in order to preserve the wilderness character of the area. Ambient air in these adjacent areas is considered representative of air in the wilderness area.

A number of FLM areas do not have an NADP sampler in or adjacent to them. Where possible, the FLM has identified an NADP site whose data may be used to characterize deposition at the area. Deposition rates generally increase with elevation and deposition in high-elevation areas may be difficult to characterize with data from a lower-elevation NADP site. FLM consultation may be necessary to estimate deposition in these areas.

Areas that experience significant deposition from fog and cloud water or large amounts of snow may need to use alternate sampling methods and data in addition to NADP protocols and NADP data to characterize them. Wet deposition in these areas may need to be sampled with alternate methods, including cloud water samplers and snowpack sampling or estimated by modeling. At sites where such data or modeled estimates are available, they should be used to calculate total deposition. At mountain sites frequented by clouds and fog, deposition from clouds may equal or exceed that from precipitation. Cloud water is generally more acidic and contains higher concentrations of base cations than rain water; therefore, it can contribute significantly to total loadings of S and N (Hemmerlein and Perkins 1992). Various methods have been developed to measure deposition from cloud water. The Mountain Acid Deposition Program (MADPro) used automated cloud water collectors to sample at three high-elevation eastern sites (Anderson et al. 1999). Forests covered by fog for significant periods of time may be especially susceptible to injury from acid deposition. Acidic cloud water has predisposed red spruce in the high elevations of the northeast U.S. Appalachians to winter injury and cumulative impacts with other biotic and abiotic stresses have caused mortality. The contribution of clouds and fog to deposition at high elevations may overshadow both deposition from precipitation and dry deposition (Hidy 1998). The EPA estimated that as a result of cloud cover, high elevation forests might experience four times the amount of total pollutant deposition as lower elevation forests without cloud cover (NAPAP 1991). High elevation lakes are also impacted by fog and clouds, as well as rain and snow. Measurements in high elevation areas that do not include all contributions to wet deposition will result in under-estimates.

Modeling has been used to estimate total wet deposition in some areas. For example, the Southern Appalachian Man and the Biosphere Cooperative (as part of the Southern Appalachian Assessment) has used NADP data, topographical data, and meteorological data to model wet deposition loading at locations in the southeastern U.S.

Dry Deposition (Revised)

Dry deposition includes gases, aerosols and particles. The primary gases involved with N and S deposition are ammonia (NH_3), nitric oxide (NO), nitrogen dioxide (NO_2), nitric acid (HNO_3), and sulfur dioxide (SO_2), while the primary particles are nitrate (NO_3^-), ammonium (NH_4^+), and sulfate (SO_4^{2-}) ions (Hanson and Lindberg 1991). Ammonia, NO, NO_2 and SO_2 are taken up by plants through stomata, while HNO_3, due to its high deposition velocity, is deposited to plant surfaces in addition to being taken up by stomata. Nitrate, ammonium, and sulfate particles deposit to surfaces (Bytnerowicz and Fenn 1996).

Dry deposition is much more difficult to estimate than wet deposition. The estimation of dry deposition rates requires information on the ambient concentrations of pollutants, meteorological data, and information on land use, vegetation, and surface conditions, all of which are site-specific. Because of this site-specificity, it is difficult to spatially extrapolate dry deposition data as is often done for wet deposition data.

In general, FLMs rely on data from CASTNet for estimates of dry deposition in FLM areas (http://www.epa.gov/castnet). CASTNet was developed by EPA, as a result of the Clean Air Act Amendments of 1990, and currently includes over 70 sites. These include a combination of former National Dry Deposition Network sites, Park Research and Intensive Monitoring of Ecosystems Network sites (PRIMENet), and others. Dry deposition is measured at 26 NPS areas and 2 USFS areas. FLMs agree that it is preferable to obtain CASTNet data from the web site, rather than summarizing dry deposition data in this report. In this way, current data can be easily accessed by FLMs and the public.

Other methods for measuring dry deposition are available. For example, information on vertical changes in concentrations of major gases and particles of interest over plant canopies can be used for calculation of deposition of these compounds to forests and other ecosystems (Hicks et al. 1987). Models, such as "Big-Leaf" (Baldocchi et al. 1987) allow estimating dry deposition to uniform canopies, such as agricultural crops or lowland forests. However, no models have been developed so far for reliable estimates of deposition of gases and particles to forests and other ecosystems in complex mountain terrain (Bytnerowicz et al. 1997). Therefore, no good large-scale estimates of dry deposition are available for western U.S. forests.

Another approach to evaluating dry deposition is net throughfall technique. By measuring concentrations of ions in throughfall (bulk precipitation) and after subtracting concentrations of the same ions in precipitation in an open area, fluxes of ions such as nitrate, ammonium, and sulfate can be calculated. A branch washing technique is similar to the net throughfall approach and is used when no wet precipitation is present. The pre-washed branches are exposed to ambient air for a certain time period and then carefully rinsed with water (Lindberg and Lovett 1985). Information about amounts of nitrate, ammonium and sulfate rinsed from branches of a known surface area, time of exposure, and leaf area index of a given forest stand allow the calculation of fluxes of the measured ions to trees. Adding stomatal uptake of gases (calculated from information on gas concentration and stomatal conductance), and estimates of deposition to other landscape forms (such as soils and rocks) allow for quite reliable estimates of dry deposition at a forest stand level (Bytnerowicz et al. 2000). Such estimates have been made for the subalpine zone of the eastern Sierra Nevada and mixed conifer forests on the western Sierra Nevada and the San Bernardino Mountains (Bytnerowicz and Fenn 1996; Bytnerowicz et al. 1999). Both the net throughfall and branch washing techniques, although providing relatively accurate estimates of deposition to certain ecosystems, cannot be applied to every type of vegetation. These techniques work well for conifers with relatively thick cuticles. For plants with thinner cuticle, extraction of ions from plant interior or transcuticular uptake of deposited ions may not allow for making good estimates of dry deposition to plant surfaces.

Recent developments, such as passive samplers that allow for relatively inexpensive determinations of nitric oxide, nitrogen dioxide, ammonia, nitric acid and sulfur dioxide concentrations, provide some promising opportunities for large-scale estimates of distribution of these pollutants. This, together with information on landscape-level vegetation coverage, leaf area index, and deposition velocity of the monitored pollutants, will allow calculating deposition of the measured gases to various landscape forms. Although this approach would not include deposition fluxes of particulate pollutants, a large portion of dry N and S deposition (gases) would be covered. Information on fluxes of the N and S particulate component (nitrate, ammonium, and sulfate ion concentrations) can be estimated based on their concentrations from annular denuder/filter pack systems or other comparable techniques and literature values of deposition velocities of these ions.

For many FLM areas, detailed site-specific information and monitoring needed for dry deposition measurements are not available. Therefore, the FLM may choose to recommend a reasonable estimate of dry deposition. NAPAP's 1991 summary report concluded that dry deposition of sulfur is 30-60% of the total (wet plus dry) deposition at regionally representative sites; dry deposition of nitrogen is 30-70% of the total (wet plus dry) deposition at regionally representative sites (NAPAP 1991a). An analysis of one year (1991) of NADP, CASTNet, and IMPROVE (Interagency Monitoring of Protected Visual Environments) data from national parks and wildernesses found that wet deposition dominated total deposition in both the East and the West. Dry deposition of sulfur was 20-50% of the total; dry deposition of nitrogen was 30-60% of the total (Hidy 1998). These estimates, and similar ones, have led to the common assumption that dry deposition is approximately 50% of the total deposition. Therefore, for many FLM areas without on-site or nearby representative dry deposition sampling, the FLM may recommend that dry deposition is equal to wet deposition. The FLM recommends this as a "best available estimate," recognizing that in some areas it may result in under- or over-estimating total deposition. Total deposition, which is the sum of wet plus dry deposition, therefore equals twice the wet deposition.

In summary,

Total Deposition = Wet Deposition + Dry Deposition
Or,
Total Deposition = 2 x Wet Deposition (assuming Dry Deposition = Wet Deposition)

There are numerous monitoring stations in or near FLM areas for estimating wet and dry deposition values. For some areas the FLM assumes that dry deposition equals wet deposition, recognizing that this may result in under- or over-estimates of total deposition. Deposition monitoring data and information on the appropriate dry deposition data to use at sites where data are available are included on the respective Agencies web sites referenced previously.

FLMs will continue to participate in monitoring and research to further our understanding of dry deposition dynamics and improve our measurements of dry deposition.

Other Deposition Measurement Methods

Pollutant deposition, particularly in areas where traditional wet and dry deposition sampling is impractical, can also be estimated by other methods. These methods include bulk samplers that collect both wet and dry deposition and snowpack measurements that estimate the total amount of pollutants in the snow column at the time of maximum snow accumulation. Special methods have also been developed for collecting fog and cloud water (Anderson et al. 1999).

In addition, methods are being developed to estimate dry deposition rates from pollutant concentrations obtained by IMPROVE fine particle samplers. IMPROVE samplers are located at many FLM areas and expanded coverage is planned for 1999.

Modeling Deposition Rates

Deposition from existing sources can be estimated from deposition monitoring data, but contributions to deposition from the proposed source and other sources permitted but not yet operating should be modeled.

Modeling should be done in accordance with recommendations developed by the Interagency Work Group on Air Quality Modeling (IWAQM) Phase 2:

- http://www.epa.gov/scram001/7thconf/calpuff/phase2.pdf

IWAQM provides the procedures that can be used to estimate S and N deposition from a proposed source and other sources permitted but not yet operating. The FLMs propose that these procedures be used to estimate S and N deposition. For S deposition, the wet and dry fluxes of sulfur dioxide and sulfate are calculated, normalized by the molecular weight of S, and expressed as total S. For N deposition, IWAQM recommends that the wet and dry fluxes of nitric acid (HNO_3) and nitrate (NO_3^-) and the dry flux of nitrogen oxides (NO_x) be calculated, normalized by the molecular weight of N, and expressed as total N. In addition, the FLMs agree that wet and dry fluxes of ammonium sulfate ($(NH_4)_2SO_4$) and ammonium nitrate (NH_4NO_3) should be calculated, normalized by the molecular weight of N, and added to the estimate of total N. Therefore, total N deposition is the sum of N contributed by dry and wet fluxes of HNO_3, NO_3^-, $(NH_4)_2SO_4$, and NH_4NO_3 and the dry flux of NO_x.

The FLMs recognize that the ammonia (NH_3) in these compounds is derived from both man-made and natural sources. Free gaseous NH_3 has a high deposition velocity and tends to deposit quickly. However, if sulfates and nitrates (which are primarily man-made) are present in the atmosphere, free NH_3 quickly reacts to form $(NH_4)_2SO_4$ and NH_4NO_3. These compounds, because of their fine particle size and slower deposition velocity than free gaseous NH_3, can be transported long distances and deposited in a FLM area, adding to the total N deposition loading.

An appropriate estimate of ambient free gaseous NH_3 is needed for the modeling analysis. IWAQM refers to Langford et al. (1992), who suggest that typical (within a factor of 2) background values of NH_3 are: 10 parts per billion (ppb) for grasslands, 0.5 ppb for forest, and 1 ppb for arid lands at 20°C. Langford et al. (1992) provide strong evidence that background levels of NH_3 show strong dependence with ambient temperature (variations of a factor of 3 or 4) and a strong dependence on the soil pH. However, given all the uncertainties in NH_3 data, IWAQM recommends use of the background levels provided above, unless better data are available for the specific modeling domain. IWAQM notes that in areas where there are high ambient levels of sulfate, values such as 10 ppb might overestimate the formation of particulate nitrate from a given source, for these polluted conditions. IWAQM further notes that areas in the vicinity of strong point sources of NH_3, such as feed lots or other agricultural areas, may experience locally high levels of background NH_3.

Questions regarding these recommendations should be resolved through consultation with the appropriate FLM and the appropriate State and/or EPA modeling representative. Applicants should provide a modeling protocol to the appropriate FLM prior to conducting modeling analyses.

Estimation of Current and Future Deposition Rates (Revised)

In order to evaluate a proposed source's contribution to total (wet + dry) deposition in a FLM area, it is necessary to first estimate current pollutant deposition rates. The current rate is a result of deposition from all existing natural and anthropogenic sources. FLMs use two approaches to estimating the current rate of deposition. One approach estimates the current rate by averaging data from an appropriate monitoring site for the pollutant of interest, using all years with complete data records. The second, more conservative, approach assumes that the current rate is equivalent to the highest rate for the pollutant of interest in the data record.

The method for estimating future total deposition rates is:

- From the respective Agency web sites, identify available on-site or representative wet and dry deposition data for the FLM area. Wet deposition data can be obtained through NADP (http://nadp.sws.uiuc.edu/). For NPS sites without an NADP sampler, use estimates of total wet nitrogen and total wet sulfur from the Air Quality Estimates for 1999-2003 at http://www.nature.nps.gov/air/Maps/AirAtlas/index.cfm.

  Dry deposition data can be obtained through CASTNet at (http://www.epa.gov/castnet).

  Verify if dry deposition is assumed to equal wet deposition for the site. For high-elevation sites, consult with the FLM to determine if deposition from cloud water, fog, dew, or snowpack should be considered. For sites without on-site data, consult FLM for further guidance.

- After consulting with the FLM, estimate either:

  - the average annual or seasonal wet and dry deposition rates for the appropriate pollutant using all years with complete data records; or
  - the highest annual or seasonal wet and dry deposition rates for the appropriate pollutant using all years with complete data records.
- Calculate current total deposition (wet + dry = total).
- Estimate, using the appropriate dispersion model as described in the 'Modeling Deposition Rates' section above, the proposed source's contribution to future total deposition on an annual or seasonal basis.
- Estimate, using appropriate dispersion model as described in the 'Modeling Deposition Rates' section above, the contribution of any sources permitted but not yet operating to future total deposition and the affect of any enforceable emission reductions. This estimate may be available from the State permitting authority.
- The current pollutant deposition rate plus the proposed source's contribution to deposition plus the contribution from other sources permitted but not yet operating minus credit for enforceable emission reductions equals the future total deposition rate.

Current + Proposed + Permitted (not yet operating) – credit for enforceable reductions = Future Total Deposition

This future total deposition rate for a given pollutant can then be used to determine the potential for adverse effects to AQRVs. If appropriate, the change in deposition rate can be used to estimate changes in pH or ANC in an ecosystem. If the future total deposition rate is expected to cause an adverse effect to AQRVs and/or exceeds the critical load established for a FLM area, the FLM may recommend mitigation. If no critical load has been established for the FLM area, the FLM will use the best information available in determining whether to recommend mitigation.

3.5.7. Summary (Revised)

- Deposition of S and N has the potential to affect terrestrial, freshwater, and estuarine ecosystems on FLM lands.
- The FLM has identified, where possible, AQRVs sensitive to deposition of S and N on FLM lands and the critical loads associated with those AQRVs.
- A proponent of a source of new emissions with the potential to contribute to S or N deposition in an FLM area should consult with the FLM to determine what analyses are needed to assess AQRV effects. The FLM may request a deposition impact analysis, described in detail in this chapter and summarized below.
  - Estimate the current deposition rate to the FLM area. A list of monitoring sites providing data to characterize deposition in FLM areas is included on the respective Agencies web sites.
  - Estimate the future deposition rate by adding the existing rate, the new emissions' contribution to deposition, the contribution of sources permitted but not yet operating, and then subtracting the credit for enforceable emission reductions. Modeling of new, reduced, and permitted but not yet operating emissions' contribution to deposition should be conducted following current EPA modeling guidance.
  - Compare the future deposition rate with the recommended screening criteria (e.g., critical load, concern threshold, or screening level value) for the affected FLM area. A list of documents summarizing these screening criteria, where available, can be found in Appendix G.

  Information for USFS Class I areas is also available at:

  http://www.fs.fed.us/air

  Information for NPS and FWS Class I areas is available at:

  http://www.nature.nps.gov/air/Permits/ARIS/

  Information for FWS Class I areas is under development at:

  http://www.fws.gov/refuges/whm/AirQuality/index.html

  The appropriate FLM should be contacted for additional information.

3.5.8. Web sites for Deposition and Related Information (Revised)

Clean Air Status and Trends Network (CASTNet) dry deposition data:

- http://www.epa.gov/castnet

National Acid Precipitation Assessment Program 2005 Report:

- http://www.esrl.noaa.gov/csd/AQRS/reports/napapreport05.pdf

National Atmospheric Deposition Program (NADP) wet deposition data:

- http://nadp.sws.uiuc.edu/

National Park Service Airweb:

- http://www.nature.nps.gov/air/

Natural Resources Conservation Service, Snow Water Equivalent Information (SNOTEL):

- http://www.wcc.nrcs.usda.gov/snow

Southern Appalachian Mountain Initiative:

- http://www.tva.gov/sami

USDA Forest Service National Air Resource Management Web Site:

- http://www.fs.fed.us/air/

EPA Office of Air and Radiation:

- http://www.epa.gov/oar

EPA, Deposition to Estuaries:

- http://epa.gov/owow/airdeposition/

EPA, STOrage and RETrieval System for Water and Biological Monitoring Data (STORET):

- http://www.epa.gov/storet

U.S. Fish and Wildlife Service Air Quality Branch:

- http://www.fws.gov/refuges/whm/AirQuality/index.html

U.S. Geological Survey, National Water-Quality Assessment (NAWQA) Program:

- http://water.usgs.gov/nawqa

U.S. Geological Survey, Acid Rain Program:

- http://bqs.usgs.gov/acidrain

U.S. Geological Survey, Water Data Storage and Retrieval System (WATSTORE):

- http://water.usgs.gov/owq/data.html

4. Expansion of Discussion of Process for Adverse Impact Determination (New Chapter)

Based on feedback from permit applicants and State permitting authorities, the Agencies are providing a more detailed description of the adverse impact decision making process once a source analysis has raised concerns during a first-level and any subsequent analyses.

If the first-level analysis yields impacts above the defined threshold(s), the applicant may propose to address preliminary FLM concerns directly through proposed emission reductions for the project, or through implementation of other measures to mitigate emission impacts. Alternatively, the applicant may undertake a more refined analysis to potentially alleviate preliminary concerns. Of course, this refined analysis should occur in a time-frame that enables permitting authorities to adhere to their regulatory guidelines.

Additional emission reductions, mitigation proposals, or more refined analysis are not legal requirements. They are options that can be utilized to help alleviate preliminary FLM concerns about emission impacts on Class I areas. Permit applicants can request that FLMs conduct their evaluation based on information provided in the application.

4.1. Background

The FLAG visibility thresholds have been interpreted by some as a one-dimensional or bright line test that inevitably leads to an adverse impact determination. This, however, is not the intent; these screening-levels were envisioned as a "visibility analysis threshold" similar to the newer deposition analysis thresholds (DATs) discussed above for sulfur and nitrogen deposition.

The Agencies want to emphasize that the FLAG report provides criteria as to when the FLMs will definitively not object to, or declare an adverse impact for, a proposed new source. FLAG assures an applicant that, if they conduct their analyses correctly and demonstrate that change in extinction or deposition falls below the specified thresholds, the FLMs will not raise concerns regarding the project. However, the converse does not necessarily apply — a FLAG threshold exceedance does not mean the FLM will certainly find that a project will adversely affect air quality related values. If a threshold is exceeded, the FLMs will consider the factors discussed below and make a project-specific determination as to whether or not the impacts are adverse.

Seney National Wildlife Refuge, Michigan.
Credit: Atlee Hart

4.2. Regulatory Factors

According to the EPA definition of "adverse impact on visibility," the FLM must determine whether the proposed source's predicted impact "interferes with the management, protection, preservation, or enjoyment of the visitor's visual experience" taking into account the "geographic extent, intensity, duration, frequency and time of visibility impairments, and how these factors correlate with (1) times of visitor use of the Federal Class I area, and (2) the frequency and timing of natural conditions that reduce visibility." (40 C.F.R. §51.301).

Considering the regulatory factors is inherent in the first-level modeling exercise. The model describes the geographic area predicted to be impacted. The visibility extinction values describe the intensity of the impact. Similarly, the model provides some level of assessment regarding duration, frequency, and time of impact. A more refined modeling analysis should further inform consideration of these factors. Regarding how these factors correlate with visitor use, the responsibilities of the Agencies include protecting the resources for all visitors. Visitor data show that nearly all Class I areas have some level of visitation each month. Regarding correlation with the frequency and timing of natural conditions that reduce visibility, the first-level modeling analysis will not provide this information directly, but, by using the percentile approach and monthly relative humidity values, the Agencies have attempted to provide a reasonable approach to addressing weather impacts.

Similarly, if the sulfur or nitrogen DAT is exceeded, or if high ozone levels are anticipated, the FLMs should determine if those impacts would adversely affect sensitive AQRVs. This adverse impact determination should be made on a project-specific basis and will be largely driven by management objectives for the area.

4.3. Contextual Considerations

The Agencies recognize that the context within which new source permitting occurs is shifting. Many older major stationary sources will be installing pollution controls over the next 10 to 15 years (e.g., in response to the Regional Haze Rule). New motor vehicle emission and fuel standards will reduce tailpipe pollution from mobile sources gradually, but significantly, over a similar time frame. States are developing visibility protection plans that ensure "reasonable progress" toward natural conditions, pursuant to the EPA's Regional Haze Rule. These plans will be reviewed and revised every five to ten years, and thus provide a mechanism for revisiting sources as better technology becomes available or as otherwise needed to maintain progress toward visibility goals. The location and effect of pending pollution control programs on specific Class I areas remains somewhat uncertain; however, the Agencies recognize and appreciate that significant emission reductions are anticipated, especially in the eastern U.S.

As part of the discussions with permitting authorities or permit applicants when screening level thresholds are exceeded, the Agencies will consider contextual information, including, for example:

- Current pollutant concentrations and AQRV impacts in the Class I area
- Air quality trends in the Class I area
- Emission changes that have occurred or would occur (i.e., enforceable) by the time the new source begins operation
- Whether there are approved SIPs that account for new source growth and demonstrate attainment of national ambient air quality standards and "reasonable progress" toward visibility goals
- The expected useful life of the source
- The stringency of the emission limits (e.g., Best Available Control Technology)
- Other considerations such as options put forth by the applicant that would produce ancillary environmental benefits to AQRVs (e.g., reductions in toxic air contaminants, pollution prevention investments)
- Comments received from the public or other agencies during the comment period prior to issuing the permit.

4.4. Preliminary Adverse Impact Concerns

After considering the regulatory factors and contextual considerations listed above, the Agencies, in consultation with the FLM, will evaluate, on a project-specific basis, whether the evidence supports a finding that the new source would possibly cause or contribute to an adverse impact on air quality related values. If so, the Agencies will notify the permit applicant and the permitting agency and provide the permit applicant the opportunity to consider mitigation strategies that will alleviate the potential adverse impact concerns. These strategies may include:

- Obtaining emission offsets for pollutants that cause or contribute to the potential adverse impacts on Class I area resources;
- Reducing emission rates through more stringent pollution control technology or operational or design changes; and
- Monitoring or special studies that increase understanding of how Class I area resources or visitors are affected by air pollution, which may serve as a basis for revisiting permit conditions in future years. (Note: monitoring and study alone does not constitute mitigation.)

Again, proposing any such mitigation strategy is voluntary. Nevertheless, if the FLMs deem a proposed mitigation strategy as adequate to protect AQRVs, and the mitigation strategy is made enforceable via the PSD permit or some other mechanism, the FLM will not make an adverse impact finding with respect to the issues addressed by the mitigation strategy.

4.5. Adverse Impact Determination

If an applicant is unable or unwilling to implement an appropriate mitigation strategy to alleviate potential adverse impact concerns, the FLM will determine whether or not the potential impacts of the project as proposed should be formally deemed adverse to air quality related values in the affected Class I areas. If the FLM concludes that there are potential adverse impacts, he will inform the permitting authority of this decision.

Historically, the FLMs have made adverse impact findings for less that one percent of the permit applications that the Agencies review. In those rare cases, the FLMs will strive to provide the permitting authority with an ample technical and policy/management-related foundation, including a discussion of the analysis results and the regulatory and contextual factors discussed above. The FLMs' ability to provide this foundation will depend on the completeness and adequacy of information provided by the permit applicant. Where information is lacking, or uncertain, the FLMs will err on the side of protecting air quality related values.

Denali National Park and Preserve, Alaska.
Credit: National Park Service/Trey Simmons.

5. Future FLAG Work

5.1. Implementing FLAG Recommendations (Revised)

FLAG participants believe that the recommendations in this revised document should be implemented as soon as possible. Therefore, an attempt has been made to present thorough and clear information on the processes that will be used to protect and improve AQRVs in FLM areas.

Many of the issues and recommendations discussed herein are complex and require specialized knowledge. Consequently, State agencies and others who intend to use this information in NSR/PSD permitting, land planning and use, and other activities, may want or require further guidance and implementation assistance. The Agencies anticipate that much of this guidance and assistance will be provided locally through established formal and informal links between FLMs, States, EPA and others. For example, the Agencies intend to provide further information through their respective web sites, and through participating in related training sessions and/or workshops.

5.2. Phase I Updates (Revised)

This revised *FLAG Phase I Report* is intended to clearly state FLM positions regarding NSR/PSD as it currently exists. As the FLMs learn more about how to better assess the health and status of AQRVs, and as EPA produces new modeling tools, the FLAG report may be revised again. Any such revisions to the report will be announced on the Agencies' web sites.

5.3. Phase II Tasks (Revised)

FLAG Phase I focused on issues that could be resolved relatively quickly, without extensive research or the collection of new data. The FLMs envisioned a Phase II that would address the more complex issues and concerns, including those that may require additional data collection. Unfortunately, lack of available resources has prevented the Agencies from embarking on a formal FLAG Phase II process. Nevertheless, the Agencies continue to gather effects-based information as part of their ongoing resource protection responsibilities. The new information gathered since FLAG 2000 is reflected in this revision. As the Agencies generate additional data or information, they will make that available to interested parties via their respective web sites.

Appendix A: Glossary

The list below contains definitions for some of the terms used in the *FLAG Phase I Report*. These terms are defined in the sense that they relate to the work of the Federal Land Managers (FLMs) in protecting air resources.

For terms whose definition is lengthy or complex, the associated *Code of Federal Regulations* (CFR) section or other reference is cited.

Air Quality Related Value (AQRV). A resource, as identified by the FLM for one or more Federal areas, that may be adversely affected by a change in air quality. The resource may include visibility or a specific scenic, cultural, physical, biological, ecological, or recreational resource identified by the FLM for a particular area.

Adverse Impact on an AQRV. An unacceptable effect, as identified by an FLM, that results from current, or would result from predicted, deterioration of air quality in a Federal Class I or Class II area. A determination of unacceptable effect shall be made on a case-by-case basis for each area taking into account existing air quality conditions. It should be based on a demonstration that the current or predicted deterioration of air quality will cause or contribute to a diminishment of the area's national significance, impairment of the structure and functioning of the area's ecosystem, or impairment of the quality of the visitor experience in the area.

Adverse Impact on Visibility. Visibility impairment which interferes with the management, protection, preservation, or enjoyment of a visitor's visual experience of a Federal Class I or Class II area. This determination must be made on a case-by-case basis taking into account the geographic extent, intensity, duration, frequency and time of visibility impairments, and how these factors correlate with (1) times of visitor use of the Class I area, and (2) the frequency and timing of natural conditions that reduce visibility. This term does not include effects on integral vistas. [40 CFR §51.301(a)]

Absorption. The process by which incident light is removed from the atmosphere and retained by a particle.

Absorption Coefficient. A number that is proportional to the "amount" of light removed from a sight path by absorption per unit distance.

Acidification. The decrease of acid neutralizing capacity in water or base saturation in soil caused by natural or anthropogenic processes.

Aerosol. A mixture of microscopic solid or liquid particles in a gaseous medium. Smoke, haze, and fog are aerosol examples.

Airshed. A geographic area that, because of topography, meteorology, and/or climate, is frequently affected by the same air mass.

AOT40. Sum of all hourly average concentrations after subtracting 40 ppb from each hourly value.

BACT (Best Available Control Technology). The control level (or control measures) required for sources subject to PSD. (See 40 CFR §52.21(b)(12), or 40 CFR §51.166(b)(12)).

Class I Area. As defined in the Clean Air Act, the following areas that were in existence as of August 7, 1977: national parks over 6,000 acres, national wilderness areas and national memorial parks over 5,000 acres, and international parks.

Critical Load. The quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge.

Cumulative. The impact on an AQRV resulting from the total pollutant loading from all sources including the contributing effects of known and reasonably foreseeable new and modified sources of air pollution. A single source may cause individually minor, but cumulatively significant, effects on AQRVs.

Damage. Any reduction in the intended use or value of a biological or physical resource. For example, economic production, ecological structure or function, aesthetic value, or biological or genetic diversity that may be altered by a pollutant.

Deposition Analysis Threshold. A screening threshold developed by NPS and FWS that defines the additional amount of nitrogen or sulfur deposition within an FLM area, below which estimated impacts from a proposed new or modified source are considered negligible.

Emission Offset. A Federally enforceable reduction in emissions from an existing source that mitigates the impacts of a proposed new or modified source on AQRVs, PSD increments, and/or NAAQS. Also, Federally enforceable reductions in actual emissions from existing sources in a nonattainment area such that the total allowable emissions from a new or modified source and existing sources will be sufficiently less than the total emissions from existing sources before the application for a permit to construct so as to represent reasonable further progress towards attainment of the NAAQS. (See 42 U.S.C. § 7503(a)(1)(A))

Extinction. The attenuation of light due to scattering and absorption as it passes through a medium.

Fugitive Emissions. Emissions which do not pass through a stack, chimney, vent, or other functionally equivalent opening.

Federal Land Manager (FLM). The Secretary of the Department with authority over such lands. [40 CFR §51.166(b)(24)] The FLM for the Department of the Interior has been delegated to the Assistant Secretary for Fish and Wildlife and Parks; the FLM for the Department of Agriculture has been delegated to the Forest Service, and has been redelegated to the Regional Forester or individual Forest Supervisor.

Flux. Gaseous uptake into plant tissue.

Green Line. The total pollutant loading (contributions from existing and proposed sources) below which there is a very high degree of certainty that no AQRV will be adversely affected.

Haze. An atmospheric aerosol of sufficient concentration to be visible. The particles are so small that they cannot be seen individually, but are still effective attenuating light and reducing visual range.

Hydrocarbons. Compounds containing only hydrogen and carbon. Examples: methane, benzene, and decane.

Hygroscopic. Readily absorbing moisture, as from the atmosphere.

Injury. Any physical or biological response to pollutants, such as a change in metabolism, reduced photosynthesis, leaf necrosis, premature leaf drop, or chlorosis.

LAER (Lowest Achievable Emissions Rate. The control level required of a source subject to nonattainment review. (See 40 CFR §51.165(a)(1)(xiii))

Limit of Acceptable Change. The amount of change that could occur without significantly altering an AQRV or sensitive receptor.

Micrometer. A unit of length equal to one millionth of a meter; the unit of measure for particle size.

Mie Theory. A complex mathematical model that allows the computation of the amount of energy (light) scattered by spherical particles.

N100. Number of hourly average concentrations ≥100 ppb.

Natural Conditions. Conditions substantially unaltered by humans or human activities. As applied in the context of visibility, natural conditions include naturally occurring phenomena that reduce visibility as measured in terms of light extinction, visual range, contrast, or coloration.

Natural Visibility Conditions. Visibility conditions attributable to Rayleigh scattering and aerosol associated with natural processes.

Nephelometer. An instrument that measures the amount of light scattered.

Nitrates. Those gases and aerosols that have origins in the gas-to-aerosol conversion of nitrogen oxides, e.g., NO_2 ; of primary interest are nitric acid and ammonium nitrate. Ammonium nitrate is very hygroscopic so its contribution to visibility impairment is magnified in the presence of water vapor.

Nitrogen Dioxide (NO_2). A gas consisting of one nitrogen and two oxygen atoms It absorbs blue light and therefore has a reddish-brown color associated with it.

Nonattainment Area. An area designated by the EPA Administrator pursuant to Section 107(d) of the Clean Air Act as having air quality which does not meet one or more National Ambient Air Quality Standard (NAAQS). For a list of nonattainment areas, see 40 CFR Part 81, Subpart C.

Oxidant Stipple. Small brown or black interveinal necrotic lesions on the adaxial surface of leaf tissue that can be attributed to exposure to ozone.

Phytotoxic. Poisonous to plants.

Post-Construction Monitoring. Monitoring required as a permit condition that the permitting authority considers necessary to determine the effect emissions from a stationary source may have, or are having, on the air quality or on the AQRVs of an area. Such monitoring includes both “ambient” monitoring and “AQRV” monitoring and may involve short-term and long-term measurements made at locations representative of the greatest expected impacts.

PSD Increments. The maximum increases in ambient pollution concentrations allowed over baselines concentrations. See 40 CFR §51.166 (c) for increments for specific pollutants.

RACT (Reasonable Available Control Technology). The lowest emissions limit that a particular source can meet by the application of control technology that is reasonably available considering technological and economic feasibility.

Rayleigh Scattering. The scattering of light by particles much smaller than the wavelength of the light, e.g., molecular scattering in the natural atmosphere.

Reconstructed Extinction. Extinction estimate that results from summing up the product of the mass of each measured particle species and the appropriate absorption or extinction coefficient.

Red Line. The total pollutant loading (contributions from existing and proposed sources) at which there is a very high degree of certainty that at least one AQRV will be adversely affected.

Regional Haze Visibility Impairment. Any humanly perceptible change in visibility (light extinction, visual range, contrast, coloration) from that which would have existed under natural conditions, caused predominantly by a combination of many sources from, and occurring over, a wide geographic area.

Re-opener. A permit condition that requires the permitting authority, at a specified time after permit issuance, to review and revise, if necessary, the permit based on new information such as the findings from post-construction monitoring, updated emissions inventories, updated modeling, research, or information on air pollution effects to terrestrial, aquatic, and visibility resources.

Scattering. An interaction of a light with an object (e.g., a fine particle) that causes the light to be redirected in its path.

Scattering Coefficient. Measure of the ability of particles to scatter light; measured in number proportional to the "amount" of light scattered per unit distance.

Screening Level or Screening Level Value (SLV). The concentration or dose of air pollution below which estimated impacts from a proposed new or modified source are considered insignificant. The SLV is dependent on existing air quality and on the condition of the AQRV of concern.

Sensitive Receptor. The AQRV, or part thereof, that is the most responsive to, or the most easily affected by the type of air pollution in question. For example, at Great Smoky Mountains National Park, spruce-fir forest is a sensitive receptor of the AQRV flora.

Sensitive Receptor Indicator. A measurable physical, chemical, biological, or social (e.g., odor) characteristic of a sensitive receptor. For example, for the sensitive receptor, Crater Lake, water clarity is a sensitive receptor indicator.

Stationary Source. A source of pollution that is well defined, such as the smokestack of a coal-fired power plant or smelter.

Sulfates. Those aerosols that have origins in the gas-to-aerosol conversion of sulfur dioxide; of primary interest are sulfuric acid and ammonium sulfate. Sulfuric acid and ammonium sulfate are very hygroscopic so their contribution to visibility impairment is magnified in the presence of water vapor.

Sulfur Dioxide (SO_2). A gas consisting of one sulfur and two oxygen atoms. Of interest because sulfur dioxide converts to an aerosol.

SUM00. The sum of all hourly average concentrations above 0 ppb.

SUM06. The sum of all hourly average concentrations at or above 60 ppb.

Target Load. The acceptable concentration or dose of an air pollutant that provides a reasonable margin of safety below the critical load. The target load should be achievable under existing conditions.

Transmissometer. An instrument that measures the amount of light extinction over a fixed, specified path length.

Visibility Impairment. Any humanly perceptible change in visibility (visual range, contrast, coloration) from that which would have existed under natural conditions. [40 CFR §51.301(x)]

Visual Range. The distance at which a large black object would just disappear from view.

Volatile Organic Compound (VOC). Any compound of carbon, except those excluded by EPA that participates in atmospheric photochemical reactions. (See 40 CFR §51.100(s))

W126. An ozone index that multiplies each specific concentration by a sigmoidal weighted function, then sums all values. $Wi = 1/[1 + Me^{-(A \times Ci)}]$, where M and A are constants 4403 and 126 ppm^{-1}, respectively, w_i is the weighting factor for c_i, and c_i is concentration in ppm.

Appendix B: Legal Framework for Managing Air Quality and Air Quality Effects on Federal Lands

Introduction

The regulation of air pollution sources has clearly been delegated to EPA, and as applicable, the States. However, Federal Land Managers (FLMs) have the responsibility to protect the particular values of the lands over which they have jurisdiction, to the extent they have been delegated the authority, from the adverse impacts of activities inside and outside these areas.

This Appendix sets out the basic legal authorities and responsibilities with which the FLMs comprising FLAG must comply, in addition to those authorities which they can utilize to protect AQRVs on public lands.

For the purposes of this Appendix only, the term "public lands" is defined to include units of the National Park, National Wildlife Refuge, and National Forest Systems.

Agency Organic Acts

Department of the Interior: National Park Service (NPS):

This Organic Act is very specific in that it mandates national park unit managers:

[T]o conserve the scenery and the natural and historic objects and wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.

16 U.S.C. §1(1997); and

[T]he authorization of activities shall be construed and the protection, management, and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided for by Congress.

16 U.S.C. § 1a-1 (1997)

Department of the Interior: Fish and Wildlife Service (FWS):

With respect to National Wildlife Refuge System lands (Refuge System lands under the jurisdiction of the United States Fish and Wildlife Service (FWS)), FWS managers are required to manage Refuge System lands so to:

[E]nsure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans.

16 U.S.C. §668dd(a)(4)(B)(1997)

Department of Agriculture: Forest Service (Forest Service)

National Forest System lands are defined as:

[A]ll National Forests reserved or withdrawn from the public domain of the United States, all national forests acquired through purchase, exchange, donation, or other means, all national grasslands and land utilization projects...and all lands waters, and other interests administered by the Forest Service.

16 U.S.C. §1609(a)(1997)

The Forest Service's Organic Administration Act of 1897 directs the Secretary of Agriculture to:

[M]ake provisions for the protection against destruction by fire and depredations upon the public forests and national forests...

16 U.S.C. Sec. §551(1997)

The National Forest units are managed consistent with Land and Resource Management Plans (LRMPs) under the provisions of the National Forest Management Act (NFMA). 16 §U.S.C. 1604 (1997). Any measures addressing AQRVs on National Forest System lands will be implemented through, and be consistent with, the provisions of an applicable LRMP or its revision (16 U.S.C. §1604(i)).

The Secretary of Agriculture is required by law to prepare a Renewable Resource Assessment by 1979, and every 10 years thereafter. By law this Assessment is required to address:

- A description of Forest Service programs in research, cooperative programs and management of the National Forest System, their relationships, and the relationships of these programs and responsibilities to public and private activities; and
- An analysis of the potential effects of global climate change on the condition of renewable resources on the Forests and rangelands of the United States; and
- An analysis of the rural and urban forestry opportunities to mitigate the buildup of atmospheric carbon dioxide and reduce the risk of global climate change.

16 U.S.C. §1601(a) (1997)

In addition, the Secretary of Agriculture is required to prepare and transmit to the President, a Renewable Resource Program (the Program) every 5 years. This Program must include program recommendations which recognize the fundamental need to protect, and where appropriate, improve the quality of ... air resources. 16 U.S.C. §1602(5)(C).

The Forest Service's implementing regulations for NFMA are found at 36 C.F.R. §219 et seq. LRMPs are, in part, specifically based on:

[R]ecognition that the National Forests are ecosystems and their management for goods and services requires an awareness and consideration of the interrelationships among plants, animals, soil, water, air, and other environmental factors within such ecosystems.

36 C.F.R. §219.1(b)(3)

The Wilderness Act. 16 U.S.C. §1131 (1997)

AQRVs in Wilderness areas may receive further protection by the language of the Wilderness Act itself which states:

Wilderness areas... shall be administered for the use of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness .... (16 U.S.C. Sec. §1131).

For Wilderness Areas in the National Forest System, the Act's implementing regulations are found at 36 C.F.R. §293. These Wilderness Areas shall be administered:

...[For] such other purposes for which it may have been established in such a manner as to preserve and protect [their] wilderness character. In carrying out such purposes, National Forest Wilderness resources shall be managed to promote, perpetuate, and, where necessary, restore the wilderness character of the land...

36 C.F.R. §293.2 (1997)

The Clean Air Act, 42 U.S.C. §7401 et seq.

Because of a perceived need for national and regional air quality research to support State programs, Congress passed its first federal air quality initiative in 1955. (Air Pollution Control Act of 1955, Ch. 360, 69 Stat. 322). In response to increasing harm to public health and welfare and to inadequate controls and enforcement, Congress has slowly but steadily expanded and refined the law, now known as the Clean Air Act (CAA), to cover more types of pollutants and emitters; e.g., stationary and mobile sources of pollution. These efforts have culminated in the 1990 Amendments to the CAA, which represent the most comprehensive and detailed set of measures to date to both prevent and curtail air pollution.

The declaration of purpose, as revised in 1990 states in part:

The purposes of this subchapter are: to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population.

42 U.S.C. § 7401(b)(1); and

A primary goal of this Act is to encourage or otherwise promote reasonable Federal, State, and local government actions, consistent with the provisions of this Act, for pollution prevention.

42 U.S.C. §7401(c)

The CAA provides an additional legal framework for FLMs to preserve and protect AQRVs from pollution sources emanating both within and outside National Park, Forest, and Refuge boundaries.

National Ambient Air Quality Standards (NAAQS) and State Implementation Plans (SIPs):

The CAA establishes a regulatory program with the goal of achieving and maintaining "national ambient air quality standards" (NAAQS) through state or, if necessary, federal implementation plans (SIPs or FIPs).[1]

The U.S. Environmental Protection Agency (EPA) is charged with promulgating:

- "primary" NAAQS for "criteria" pollutants "to protect the public health," allowing an adequate margin of safety;" and
- "secondary" NAAQS "to protect the public welfare from any known or anticipated adverse effects associated with the presence of such air pollutant in the ambient air."[2]

The above secondary standards may help protect public land AQRVs.[3] To date, EPA has promulgated NAAQS for six criteria pollutants: sulfur dioxide, particulate matter, nitrogen dioxide, carbon monoxide, ozone and lead. In 2006, EPA issued revised, and more stringent NAAQS for "fine particulate matter." In 2008 EPA revised the ozone standard, to address human health and welfare concerns. In 2010, EPA promulgated one-hour standards for nitrogen dioxide and sulfur dioxide. However, EPA openly acknowledged that these revised NAAQS were not fully adequate to protect the above "secondary" values, in particular those sensitive AQRVs on public lands. EPA proposed further revisions to the primary and secondary ozone standards in January 2010 and is currently developing a proposal for secondary NO_x and SO_x standards that are intended to address aquatic acidification due to acid deposition.

Prevention of Significant Deterioration (PSD):

The CAA, as amended in 1977, includes the following major purposes regarding the "prevention of significant deterioration" (PSD) provisions:

[T]o protect public health and welfare from any actual or potential adverse effect . . . from air pollution . . .

notwithstanding attainment and maintenance of all national ambient air quality standards.

42 U.S.C. § 7470(1)

[T]o preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value.

42 U.S.C. §7470(2)

The PSD section provides some protection for park and wilderness AQRVs through establishment of ceilings on additional amounts of air pollution over baseline levels in clean air areas (increments). It requires EPA or the State to provide to the FLM notice of any proposed major emitting facility[4] whose emissions may affect a Class I area (42 U.S.C. §7475(d)(2)(A), and also by charging:

[T]he Federal Land Manager [1] and the Federal official charged with direct responsibility for management of such lands with "an affirmative responsibility to protect the air quality related values (including visibility) of any such lands within a class I area and to consider, in consultation with the Administrator, whether a proposed major emitting facility will have an adverse impact on such values.

42 U.S.C. §7475(d)(2)(B).

Class I areas include national parks larger than 6,000 acres and national wilderness areas and national memorial parks which exceed 5,000 acres, in existence on August 7, 1977. The 1990 Amendments provided that subsequent additions to the boundaries of such areas are also Class I areas. Currently, 48 areas in the National Park system, 21 Refuge System units, and 88 areas under the administration of the Forest Service are designated as Class I.

Under the PSD provisions and implementing regulations (40 C.F.R. §51.166(p)), for Class I areas, once baseline concentrations come under review by submission of a PSD preconstruction permit application for a major new or modified emissions source, only the smallest increment of certain pollutants — sulfur dioxide, nitrogen oxide and particulate matter — may be added to the air by the proposed new source, and other "increment consuming" sources.

Under the PSD provisions a FLM has several tools he/she may use to protect AQRVs.

A state may not issue a PSD permit to allow construction or modification of a major emitting facility when the applicable Federal Land Manager files a notice alleging the facility may cause or contribute to a change in the Class I area's air quality and by identifying the potential adverse impact of such a change, unless:

The facility owner demonstrates that the facility's emissions of particulate matter, sulfur dioxide, and nitrogen oxides will not cause or contribute to concentrations which will exceed the maximum allowable increases for that Class I area.

42 U.S.C. §7475(d)(2)(C)(i)(paraphrased) and 42 U.S.C. §7476.

Even if no increment violation is predicted,

[T]he state may not issue a PSD permit, if the Federal Land Manager demonstrates to the satisfaction of the State that the emissions from such facility will have an adverse impact on the air quality-related values (including visibility) of Class I lands.

42 U.S.C. §7475(d)(2)(C)(ii)(paraphrased)

Neither the CAA nor the implementing regulations specify criteria for the FLM to "satisfy" state permitting agencies. Consequently, some states have taken a liberal view of their discretion to reject an FLM's adverse impact determination. However, EPA's Environmental Appeals Board (the Board) has ruled that state discretion in rejecting a FLM's finding of adverse impacts is not "unfettered" (see the Board's decisions regarding the permit appeals for the Old Dominion Electric Cooperative and Hadson Power projects in Virginia). Nevertheless, the appropriate role of the FLM in the PSD permit process was addressed in EPA's 1996 proposed New Source Review Reform regulations. The final regulations have not yet been promulgated.

Visibility Protection. Subpart II, 42 U.S.C. §7491 et seq. (1997)

The Visibility portion of the CAA:

"... [D]eclares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory class I Federal areas which impairment results from man made air pollution."

42 U.S.C. §7491(a)(1).

To help carry out this goal, the Secretaries of the Interior and Agriculture are charged with identifying Class I areas where visibility is an important value. EPA is charged with reporting to Congress on methods to implement the national goal and with promulgating regulations to ensure reasonable progress toward meeting the goal.

In 1980, EPA issued enforceable regulations for visibility impairment "reasonably attributable" to a specific source or small group of sources. In particular, major stationary sources emitting any pollutant which may "reasonably be anticipated to cause or contribute to any impairment of visibility" is required to install best available retrofit technology (BART). In addition, in April 1999 EPA promulgated final regulations addressing regional haze.

The regional haze rule protects air quality in Class I areas by requiring States to plan to achieve "natural" visibility conditions over a 60-year time frame.

The 1990 Amendments added a new section on visibility, which authorizes EPA in conjunction with NPS and other federal agencies, to conduct visibility research and to evaluate clean air corridors and emissions sources and source regions causing visibility impairment in Class I areas. In this regard, EPA was required to establish the Grand Canyon Visibility Transport Commission (GCVTC) by 1991 and consider the recommendations GCVTC would make (42 U.S.C. §7492(f). NPS, FS, FWS, and BLM played a vital role in the work of the GCVTC and committees in an effort to improve air quality in the Grand Canyon and other parks and wilderness areas in the "Golden Circle" on the Colorado Plateau.

As part of the visibility protection process, states are required to promulgate a plan to prevent any future, and remedy any existing impairment of visibility in Class I areas... 40 C.F.R. §51.300 (1997). EPA has defined "visibility impairment" as:

[A]ny humanly perceptible change in visibility (visual range, contrast, coloration) from that which would have existed under natural conditions.

40 C.F.R. §51.301(x)(1997).7

However, EPA has promulgated its visibility regulations to allow FLMs to use their existing authorities to address "visibility impairment" (rather than "significant impairment") so that "the affected Federal Land Manager may certify to the State, at any time, that there exists impairment of visibility in any mandatory Class I Federal area." 40 C.F.R. §51.302(c).

Nonattainment Areas, 42 U.S.C. §7501 et seq.:

Areas that have failed to meet NAAQS for one or more criteria pollutants are designated as "nonattainment" areas. Under the 1990 Amendments, Congress provides for further classification of nonattainment areas based on severity of the nonattainment and availability and feasibility of appropriate pollution control measures and for a compliance schedule ranging from 1993 in marginal nonattainment areas to 2010 for Los Angeles.

The 1990 Amendments authorize EPA to issue control technique guidance documents (CTGs) covering a variety of topics, such as control of idling vehicles and voluntary removal of pre-1980 model year light duty vehicles (cash for clunker programs). (42 U.S.C. §7408.) EPA is authorized to issue CTGs, in lieu of regulations, to reduce "volatile organic compounds" (VOC) emissions from any consumer or commercial product. (42 U.S.C. §7511b.)

Proposed new or modified major stationary sources within nonattainment areas are required to meet emissions limits based on "lowest achievable emission rate" technology (LAER) and may be constructed only if their emissions are sufficiently offset by reductions in emissions from other sources. The 1990 Amendments also require analysis of alternative sites, sizes, production processes, and control techniques and a finding that the benefits of the source outweigh its environmental and social costs. (42 U.S.C. §7501-15.)

General

CAA Subchapter III 42 U.S.C. §7601 et seq. contains definitions, requirements for reports to Congress, authorizations for appropriations, and procedures for EPA rule making and judicial review. Citizen suits are authorized: 1) against EPA for failure to perform a nondiscretionary duty under the CAA, or 2) against others for alleged violations of an emission limitation, standard, or order. (42 U.S.C.§7601 et seq.)

Acid Deposition

The 1990 Amendments add Title IV, which contains requirements for electric utilities to reduce emissions associated with acid rain. To reduce the adverse effects of acid deposition, Title IV requires a reduction in annual emissions of sulfur dioxide of ten million tons from 1980 emission levels and a reduction of nitrogen oxides emissions of approximately two million tons from 1980 emission levels, in the 48 contiguous states and the District of Columbia. (42 U.S.C. §7651.) The Title creates a system of market-based emission allowances, which can be traded among sources. See (42 U.S.C. §7651a-o.)

Operating Permits

The 1990 Amendments add Subchapter V, 42 U.S.C. §7661 et seq., which establishes a nation-wide permit program for existing stationary sources. Permit requirements will include emission limitations. EPA may veto state permits, which do not comply with provisions of the CAA. (42 U.S.C. §7661a-f.)

Conformity, 42 U.S.C. §7506 (1997)

(Paraphrased) No federal agency may engage in, support in any way,... license or permit, or otherwise approve any activity which does not conform to an approved state (or federal) implementation plan. Conformity shall be an affirmative responsibility of the head of each agency. Conformity means:

- Conforming to the SIP's purpose of eliminating or reducing the number of NAAQS violations;
- That any such activities will not:
  - Cause or contribute to new violations in any area; or

- Increase the frequency or severity of any existing standard violation...

EPA, in its "criteria and procedures" for implementing "conformity" has decided that only those activities that "a federal agency can practicably control, and will maintain control over due to a continuing program responsibility" are subject to same. 40 C.F.R. §93.152.

Although required to comply with the conformity provisions (42 U.S.C. §7618(1997)), the FLM cannot use these provisions to protect AQRVs from adverse impacts from off site sources.

Impact on Federal Land Managers

The CAA reinforces the FLMs' Organic Act and Wilderness Act roles as protectors of AQRVs on public lands.

The CAA also imposes on FLMs an obligation to comply with the Act's many provisions regarding the abatement of air pollution to the same extent as any private person (42 U.S.C. §7418).

Thus, under various authorities, FLMs are responsible for protecting AQRVs within their respective unit boundaries and taking appropriate action to do so, when reviewing emission sources both within units, and in proximity to unit boundaries.

FLMs, under the CAA, have an affirmative responsibility for protecting AQRVs (including visibility) in reviewing proposed PSD permits. However, because of the uncertainty involved in "satisfying" State permitting agencies in the PSD process, and the appropriate delegated role for FLMs in non-PSD situations, the existing framework may provide an inadequate means for FLMs to protect AQRVs from adverse impacts caused by sources outside unit boundaries.

Endnotes

1) Clean Air Act, 42 U.S.C. §7401-7671q (as amended 1990).

2) *Clean Air Deskbook*, The Environmental Law Reporter, Environmental Law Institute, 1992.

3) *Managing National Park System Resources: A Handbook on Legal Duties, Opportunities, and Tools*, Chap. 4 "The Clean Air Act" by Molly Ross at pp. 51-65, The Conservation Foundation, 1990.

4) *Atmospheric Environment* Vol. 27B, No. 1, "The 20-Year History of the Evolution of Air Pollution Control Legislation in the U.S.A." by Richard H. Schulze at pp. 15-25., 1993

5) Wilderness Act of 1964, 16 U.S.C. §1131 et seq, P.L. 577, 78 stat 890 as amended.

6) *The Principal Laws Relating to Forest Service Activities*, USDA - Forest Service ISBN 0-16-041927-1, 1993

7) Organic Administration Act of 1897, 16 U.S.C. §473-475, §477-482, §551.

Appendix C: General Policy for Managing Air Quality Related Values in Class I Areas

Most Federal Land Manager (FLM) enabling legislation and regulations developed to implement Federal Laws do not directly address air quality, or air pollution effects on Parks or Wildernesses. They do, however, provide broad direction on what should be protected in Parks and Wildernesses (the earth and its community of life) and to what degree (preserve natural conditions or conserve resources unimpaired). Accordingly, FLMs have developed the following policies related to air quality and Class I areas:

1. Class I areas are not merely a commodity for human use and consumption. Park and Wilderness ecosystems have intrinsic values other than user/public concerns.
2. A principal objective of FLM management is to offer a natural user experience, rather than strictly an enjoyable one. The amount of enjoyment is purely a personal matter for the individual user to decide.
3. All Class I components are equally important; none is of lesser value than another.
4. A Class I component is important even if users of the area are unaware of its existence.
5. All life forms are equally important. For example, microorganisms are as essential as elk, wild flowers, or grizzly bears.
6. The goal of Class I management is to protect not only resources with immediate aesthetic appeal (i.e., sparkling clean streams) but also unseen ecological processes (such as natural biodiversity and gene pools).
7. The most sensitive Class I components are to be emphasized more than those of “average” or “normal” sensitivity. Sensitivity is generally determined by inertia (resistance to change), elasticity (how far the component can be stretched from its natural condition without being permanently modified), and resiliency (the number of times it can revert to its natural condition after experiencing human-caused change).
8. Each Class I component is important in itself; as well as in terms of how it interacts with other components of the ecosystem. That is, the individual parts of the Class I ecosystem are as significant as the sum of the parts.
9. The physical components of the ecosystem (for instance, lake chemistry) are as essential as its biological constituents (i.e., salamanders). That is, the earth is as essential as the community of life.
10. Class I components are to be protected from “human-caused change” rather than from “damage.” Terms such as “damage” and “harm” are prejudicial, whereas “human-caused change” is value-neutral. (For example, deposits of nitrogen in a lake from nitrogen oxide, a common air pollutant, might result in more plant growth and larger fish. This would, however, be an unnatural - and therefore unacceptable - change in the aquatic ecosystem).
11. The goal of Class I management is to protect natural conditions, rather than the conditions when first monitored. That is, if initial monitoring in a Class I area identifies human-caused changes, appropriate actions should be taken to remedy them, in order to move towards a more natural condition.
12. The designation of a Park or Wilderness as Class I or II does not dictate the management goals for it; these are identified in the enabling legislation. The designation only determines which options are available to meet the goals. Class I Parks or Wildernesses, for instance, can be protected through AQRV analysis, whereas the protection of Class II Parks and Wildernesses can be achieved using BACT requirements.
13. The FLMs will do their best to manage and protect resources at every area that they administer.
14. Although monitoring is critical to many air resource management decisions, it must not interfere needlessly with Park or Wilderness. Where possible, the most intrusive monitoring and instrumentation should be conducted adjacent to the Class I area - if such areas adequately represent the area of concern.

Appendix D: Best Available Control Technology (BACT) Analysis

Given the need to minimize emissions and their resulting air quality impacts, the FLMs recommend that the applicant conduct the BACT analysis using EPA's top-down approach. In brief, a top-down process ranks all available control technologies in descending order of control effectiveness. All of the available control systems for the source, including the most stringent, must be considered. The applicant first examines the most effective, or top, alternative. That alternative is established as the BACT unless the applicant demonstrates, and the permitting authority agrees, that technical considerations, or energy, environmental, or economic impacts justify a conclusion that the most stringent technology is not achievable in that case. FLMs utilize EPA's BACT/RACT/LAER Clearinghouse, and other information, for assessing control technologies proposed by permit applicants.

If the most stringent technology is eliminated in this fashion, then the next most stringent alternative is considered, and so on. Permit applicants should refer to chapter B of the EPA Draft New Source Review Workshop Manual for a detailed discussion of the top-down policy (EPA 1990).

The FLM reviews the applicant's BACT analysis to determine if the best available pollution control technology is being proposed, thereby minimizing the proposed emission increases and their corresponding impact on the FLM area in question. The FLM does this by comparing the proposed controls to recent BACT determinations for similar facilities. If the FLM disagrees with the applicant's BACT analysis, technical comments are submitted to the permitting authority that has the ultimate responsibility to make the BACT determination and issue the permit.

The environmental impacts analysis of the BACT review is not to be confused with the air quality-related analysis. The environmental impacts analysis of the BACT review should concentrate on impacts other than ambient air quality impacts of the regulated pollutant in question, such as solid or hazardous waste generation, discharges of polluted water from a control device, or emissions of unregulated pollutants. Thus, the fact that a given control alternative would result in only a slight improvement in ambient concentrations of the pollutant in question when compared with a less stringent control alternative, should not be viewed as a basis for rejecting the more stringent control alternative.

Regarding the economic impact analysis, given the special protection Class I areas are afforded under the Clean Air Act, FLMs believe that the need to minimize potential impacts on a Class I area should be a major consideration in the BACT determination for a project proposed near such an area. Therefore, if a source proposes to locate near a Class I area, additional costs to minimize impacts on sensitive Class I resources may be warranted, even though such costs may be considered economically unjustified under other circumstances.

Appendix E: Maps of Federal Class I Areas

Figure 8. National Park Service Class I Areas
Map produced by the National Park Service Air Resources Division March 2010.

Figure 9. Fish and Wildlife Service Class I Areas
Map produced by the National Park Service Air Resources Division March 2010.

Figure 10. Forest Service Class I Wilderness Areas
Map produced by the National Park Service Air Resources Division March 2010.

Appendix F: FLAG 2000 Participants

The individuals listed in the attached table participated in the development of the *FLAG Phase I Report* (December 2000). The contact information was not updated as part of this FLAG 2010 revision. The abbreviations for the FLAG subgroup or committee on which participants served are shown below.

LC = Leadership Committee

CC = Coordinating Committee

P = Policy Subgroup

V = Visibility Subgroup

O = Ozone Subgroup

D = Deposition Subgroup

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Appendix G: Bibliography (Revised)

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U.S. Department of the Interior

Natural Resource Program Center

U. S. Forest Service
Air Quality Program

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AMEND: 340-226-0100

RULE TITLE: Highest and Best Practicable Treatment and Control: Policy and Application

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Removing:
(2) A source is in compliance with section (1) if the source is in compliance with all other applicable emission standards and requirements contained in OAR 340 divisions 200 through 268.
(3) The EQC may adopt additional rules as necessary to ensure that the highest and best practicable treatment and control is provided as specified in section (1). Such rules may include, but are not limited to, requirements:
(a) Applicable to a source category, regulated pollutant or geographic area of the state;
(b) Necessary to protect public health and welfare for air contaminants that are not otherwise regulated by the EQC; or
(c) Necessary to address the cumulative impact of sources on air quality.

RULE TEXT:
(1) As specified in OAR 340-226-0110 through 340-226-0140 and sections (2) and (3), DEQ will include appropriate conditions in permits to ensure that the highest and best practicable treatment and control of air contaminant emissions is in every case provided so as to maintain overall air quality at the highest possible levels, and to maintain contaminant concentrations, visibility reduction, odors, soiling and other deleterious factors at the lowest possible levels. The permit conditions must ensure that the degree of treatment and control provided must be such that degradation of existing air quality is minimized to the greatest extent possible.
(2) The EQC encourages the owner or operator of a source to further reduce emissions from the source beyond applicable control requirements where feasible.
(3) Nothing in OAR 340-226-0100 through 340-226-0140 revokes or modifies any existing permit term or condition unless or until DEQ revokes or modifies the term or condition by a permit revision.
[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025

STATUTES/OTHER IMPLEMENTED: ORS 468A.025

AMEND: 340-226-0130

RULE TITLE: Highest and Best Practicable Treatment and Control: Typically Achievable Control Technology (TACT)

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Updating OARs that new or modified emissions units are subject to.

RULE TEXT:

TACT determinations will be based on information known to DEQ while considering pollution prevention, impacts on other environmental media, energy impacts, capital and operating costs, cost effectiveness, and the age and remaining economic life of existing emission control devices. DEQ may consider emission control technologies typically applied to other types of emissions units where such technologies could be readily applied to the emissions unit. If an emission limitation is not feasible, a design, equipment, work practice, operational standard, or combination thereof, may be required.

(1) Existing Sources. For existing sources, the emission limit established will be typical of the emission level achieved by emissions units similar in type and size. An existing emissions unit must meet TACT for existing sources if:

(a) The emissions unit is not already subject to emission standards for the regulated pollutant under OAR chapter 340, divisions 224, 230, 234, 236 or 238, OAR 340-232-0010 through 340-232-0230, OAR 340-240-0110 through 340-240-0180, or OAR 340-240-0320 through 340-240-0430;

(b) The source is required to have a permit;

(c) The emissions unit has emissions of criteria pollutants equal to or greater than 5 tons per year of particulate or 10 tons per year of any gaseous pollutant; and

(d) DEQ determines that air pollution control devices and emission reduction processes in use for the emissions unit do not represent TACT, and that further emission control is necessary to address documented nuisance conditions, address an increase in emissions, ensure that the source is in compliance with other applicable requirements, or protect public health or welfare or the environment.

(2) New and Modified Sources. For new and modified sources, the emission limit established will be typical of the emission level achieved by well controlled new or modified emissions units similar in type and size that were recently installed. A new or modified emissions unit must meet TACT for new or modified sources if:

(a) The new or modified emissions unit is not subject to a control technology requirement based on Major NSR in OAR chapter 340, division 224, a Type A State NSR action under OAR chapter 340, division 224, an applicable Standard of Performance for New Stationary Sources in OAR chapter 340, division 238, OAR 340-240-0110 through 340-240-0180, OAR 340-240-320 through 340-240-0430, or any other standard applicable only to new or modified sources in OAR chapter 340, divisions 230, 234, 236, or 238 for the regulated pollutant emitted;

(b) The source is required to have a permit;

(c) The emissions unit:

(A) If new, would have emissions of any criteria pollutant equal to or greater than 1 ton per year in any area, or of PM10 equal to or greater than 500 pounds per year in a PM10 nonattainment area; or

(B) If modified, would have an increase in emissions from the permitted level for the emissions unit of any criteria pollutant equal to or greater than 1 ton per year in any area, or of PM10 equal to or greater than 500 pounds per year in a PM10 nonattainment area; and

(d) DEQ determines that the proposed air pollution control devices and emission reduction processes do not represent TACT.

(3) Before making a TACT determination, DEQ will notify the owner or operator of a source that it intends to make such a determination using information known to DEQ. The owner or operator of the source may supply DEQ with additional information by a reasonable date set by DEQ.

(4) The owner or operator of a source subject to TACT must submit, by a reasonable date established by DEQ, compliance plans and specifications for DEQ's approval. The owner or operator of the source must demonstrate compliance in accordance with a method and compliance schedule approved by DEQ.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040]

STATUTORY/OTHER AUTHORITY: ORS 468, 468A

STATUTES/OTHER IMPLEMENTED: ORS 468.020, 468A.025

AMEND: 340-226-0140

RULE TITLE: Highest and Best Practicable Treatment and Control: Additional Control Requirements for Stationary Sources of Air Contaminants

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Amending (1) to read: "Requirements will be established to prevent violation of an ambient air quality standard caused or projected to be caused substantially by emissions from the source as determined by modeling, monitoring, or a combination thereof. Any air quality analysis must be conducted in accordance with the procedures in OAR chapter 340, division 225. For existing sources, DEQ may conduct monitoring or modeling or may require a source to conduct monitoring or modeling to determine whether the source’s emissions will cause or contribute to a new exceedance of an ambient air quality standard.

RULE TEXT:

In addition to other applicable requirements, DEQ may establish control requirements by permit if necessary as specified in sections (1) through (5):

(1) Requirements will be established to prevent violation of an ambient air quality standard caused or projected to be caused substantially by emissions from the source as determined by modeling, monitoring, or a combination thereof. Any air quality analysis must be conducted in accordance with the procedures in OAR chapter 340, division 225. For existing sources, DEQ may conduct monitoring or modeling or may require a source to conduct monitoring or modeling to determine whether the source’s emissions will cause or contribute to a new exceedance of an ambient air quality standard.

(2) Requirements will be established to prevent significant impairment of visibility in Class I areas caused or projected to be caused substantially by a source as determined by modeling, monitoring, or a combination thereof. For existing sources, DEQ will conduct monitoring to confirm visibility impairment.

(3) A requirement applicable to a major source will be established if it has been adopted by EPA but has not otherwise been adopted by the EQC.

(4) An additional control requirement will be established if requested by the owner or operator of a source.

(5) Requirements will be established if necessary to protect public health or welfare for the following air contaminants and sources not otherwise regulated under OAR chapter 340, divisions 200 through 268:

(a) Chemical weapons; and

(b) Combustion and degradation by-products of chemical weapons.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.040

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.040

AMEND: 340-226-0210

RULE TITLE: Grain Loading Standards: Particulate Emission Limitations for Sources Other Than Fuel Burning Equipment, Refuse Burning Equipment and Fugitive Emissions

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Updating particulate emission requirements.

RULE TEXT:

(1) This rule does not apply to the following:

(a) Fugitive emissions sources;

(b) Fuel burning equipment;

(c) Refuse burning equipment; or to

(d) Solid fuel burning devices certified under OAR 340-262-0500.

(2) No person may cause, suffer, allow, or permit particulate matter emissions from any air contaminant source in excess of the following limits:

(a) For sources installed, constructed, or modified before June 1, 1970:

(A) 0.10 grains per dry standard cubic foot if all representative compliance source test results collected prior to April 16, 2015, demonstrate that emissions are no greater than 0.080 grains per dry standard cubic foot;

(B) 0.15 grains per dry standard cubic foot if any representative compliance source test results collected prior to April 16, 2015 demonstrate that emissions are greater than 0.080 grains per dry standard cubic foot, or if there are no representative compliance source test results; and

(C) In addition to the limits in paragraphs (A) and (B), for equipment or a mode of operation that is used less than 876 hours per calendar year, 0.20 grains per dry standard cubic foot.

(b) For sources installed, constructed, or modified on or after June 1, 1970 but prior to April 16, 2015:

(A) 0.10 grains per dry standard cubic foot if all representative compliance source test results prior to April 16, 2015 demonstrate that emissions are no greater than 0.080 grains per dry standard cubic foot; or

(B) 0.14 grains per dry standard cubic foot if any representative compliance source test results prior to April 16, 2015 are greater than 0.080 grains per dry standard cubic foot, or if there are no representative compliance source test results; and.

(c) For sources installed, constructed or modified on or after April 16, 2015, 0.10 grains per dry standard cubic foot.

(3) Compliance with the emissions standards in section (2) is determined using:

(a) Oregon Method 5;

(b) DEQ Method 8, as approved by DEQ for sources with exhaust gases at or near ambient conditions;

(c) DEQ Method 7 for direct heat transfer sources [NOTE: DEQ Methods are described in the DEQ Source Sampling Manual published with OAR 340-200-0035]; or

(d) An alternative method approved by DEQ.

(e) For purposes of this rule, representative compliance source test results are data that was obtained:

(A) No more than ten years before April 16, 2015; and

(B) When a source is operating and maintaining air pollution control devices and emission reduction processes at the highest reasonable efficiency and effectiveness to minimize emissions based on the current configuration of the emissions unit and pollution control equipment.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.070

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.070

AMEND: 340-228-0210

RULE TITLE: General Emission Standards for Fuel Burning Equipment: Grain Loading Standards

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Updating Grain Loading Standards for fuel burning equipment.

RULE TEXT:

(1) This rule applies to fuel burning equipment, except solid fuel burning devices that have been certified under OAR 340-262-0500.

(2) No person may cause, suffer, allow, or permit particulate matter emissions from any fuel burning equipment in excess of the following limits:

(a) For sources installed, constructed, or modified before June 1, 1970:

(A) 0.10 grains per dry standard cubic foot if all representative compliance source test results collected prior to April 16, 2015 demonstrate emissions no greater than 0.080 grains per dry standard cubic foot;

(B) 0.15 grains per dry standard cubic foot if any representative compliance source test results collected prior to April 16, 2015 demonstrate that emissions greater than 0.080 grains per dry standard cubic foot, or if there are no representative compliance source test results; and

(C) In addition to the limits in paragraphs (A) and (B), for equipment or a mode of operation (e.g., backup fuel) that is used less than 876 hours per calendar year, 0.20 grains per dry standard cubic foot.

(b) For sources installed, constructed, or modified on or after June 1, 1970 but prior to April 16, 2015:

(A) 0.10 grains per dry standard cubic foot if all representative compliance source test results prior to April 16, 2015 demonstrate that emissions are no greater than 0.080 grains per dry standard cubic foot; or

(B) 0.14 grains per dry standard cubic foot if any representative compliance source test results collected prior to April 16, 2015 demonstrate that emissions are greater than 0.080 grains per dry standard cubic foot, or if there are no representative compliance source test results;

(c) For sources installed, constructed or modified on or after April 16, 2015, 0.10 grains per dry standard cubic foot.

(d) For sources installed, constructed or modified before June 1, 1970, 0.17 grains per dry standard cubic foot if the owner or operator requested this alternative limit by no later than Oct. 1, 2019 and demonstrated, based on a signed report prepared by a registered professional engineer that specializes in boiler/multiclone operation, that the fuel burning equipment was unable to comply with the standard in subparagraph (a)(B).

(3) Compliance with the emissions standards in section (2) is determined using Oregon Method 5, or an alternative method approved by DEQ. [NOTE: Sampling methods are found in the DEQ Source Sampling Manual published with OAR 340-200-0035.]

(a) For fuel burning equipment that burns wood fuel by itself or in combination with any other fuel, the emission results are corrected to 12% CO2.

(b) For fuel burning equipment that burns fuels other than wood, the emission results are corrected to 50% excess air.

(c) For purposes of this rule, representative compliance source test results are data that was obtained:

(A) No more than ten years before April 16, 2015; and

(B) When a source is operating and maintaining air pollution control devices and emission reduction processes at the highest reasonable efficiency and effectiveness to minimize emissions based on the current configuration of the fuel burning equipment and pollution control equipment.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.070

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.070

AMEND: 340-232-0030

RULE TITLE: Definitions

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Correcting typo, "EPa" to "EPA".

RULE TEXT:

The definitions in OAR 340-200-0020, 340-204-0010 and this rule apply to this division. If the same term is defined in this rule and 340-200-0020 or 340-204-0010, the definition in this rule applies to this division.

(1) "Aerospace component" means the fabricated part, assembly of parts, or completed unit of any aircraft, helicopter, missile or space vehicle.

(2) "Air dried coating" means coatings which are dried by the use of air at ambient temperature.

(3) "Applicator" means a device used in a coating line to apply coating.

(4) "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.

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

(6) "Can coating" means any coating applied by spray, roller, or other means to the inside and/or outside surfaces of metal cans, drums, pails, or lids.

(7) "Carbon bed breakthrough" means the initial indication of depleted adsorption capacity characterized by a sudden measurable increase in VOC concentration exiting a carbon adsorption bed or column.

(8) "Certified storage device" means vapor recovery equipment for gasoline storage tanks as certified by the State of California Air Resources Board Executive Orders, copies of which are on file with DEQ, or which has been certified by other air pollution control agencies and approved by DEQ.

(9) "Class II hardboard paneling finish" means finishers which meet the specifications of Voluntary Product Standard PS-59-73 as approved by the American National Standards Institute.

(10) "Clear coat" means a coating which lacks color and opacity or is transparent and uses the undercoat as a reflectant base or undertone color.

(11) "Coating" means a material applied to a surface which forms a continuous film and is used for protective and/or decorative purposes.

(12) "Coating line" means one or more apparatus or operations which include a coating applicator, flash-off area, and oven or drying station wherein a surface coating is applied, dried, and/or cured.

(13) "Condensate" means hydrocarbon liquid separated from natural gas which condenses due to changes in the temperature and/or pressure and remains liquid at standard conditions.

(14) "Crude oil" means a naturally occurring mixture which consists of hydrocarbons and/or sulfur, nitrogen, and/or oxygen derivatives of hydrocarbons and which is a liquid at standard conditions.

(15) "Custody transfer" means the transfer of produced petroleum and/or condensate after processing and/or treating in the producing operations, from storage tanks or automatic transfer facilities to pipelines or any other forms of transportation.

(16) "Cutback asphalt" means a mixture of a base asphalt with a solvent such as gasoline, naphtha, or kerosene. Cutback asphalts are rapid, medium, or slow curing (known as RC, MC, SC), as defined in ASTM D2399.

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

(18) "External floating roof" means a cover over an open top storage tank consisting of a double deck or pontoon single deck which rests upon and is supported by the volatile organic liquid being contained, and is equipped with a closure seal or seals to close the space between the roof edge and tank shell.

(19) "Extreme performance coatings" means coatings designed for extreme environmental conditions such as exposure to any one of the following: continuous ambient weather conditions, temperature consistently above 95°C, detergents, abrasive and scouring agents, solvents, corrosive atmosphere, or similar environmental conditions.
(20) "Extreme performance interior topcoat" means a topcoat used in interior spaces of aircraft areas requiring a fluid, stain or nicotine barrier.
(21) "Fabric coating" means any coating applied on textile fabric. Fabric coating includes the application of coatings by impregnation.
(22) "Flexographic printing" means the application of words, designs and pictures to a substrate by means of a roll printing technique in which the pattern to be applied is raised above the printing roll and the image carrier is made of rubber or other elastomeric materials.
(23) "Freeboard ratio" means the freeboard height divided by the width (not length) of the degreaser's air/solvent area.
(24) "Forced air dried coating" means a coating which is dried by the use of warm air at temperatures up to 90°C (194°F).
(25) "Gas freed" means a marine vessel's cargo tank has been certified by a Marine Chemist as "Safe for Workers" according to the requirements outlined in the National Fire Protection Association Rule 306.
(26) "Gasoline" means any petroleum distillate having a Reid vapor pressure of 27.6 kPa (4.0 psi) or greater which is used to fuel internal combustion engines.
(27) "Gasoline dispensing facility" means any site where gasoline is dispensed to motor vehicle, boat, or airplane gasoline tanks from stationary storage tanks.
(28) "Gaseous service" means equipment which processes, transfers or contains a VOC or mixture of VOCs in the gaseous phase.
(29) "Hardwood plywood" is plywood whose surface layer is a veneer of hardwood.
(30) "High performance architectural coating" means coatings applied to aluminum panels and moldings being coated away from the place of installation.
(31) "Internal floating roof" means a cover or roof in a fixed roof tank which rests upon or is floating upon the petroleum liquid being contained, and is equipped with a closure seal or seals to close the space between the roof edge and tank shell.
(32) "Large appliance" means any residential and commercial washers, dryers, ranges, refrigerators, freezers, water heaters, dish washers, trash compactors, air conditioners, and other similar products.
(33) "Leaking component" means any petroleum refinery source which has a VOC concentration exceeding 10,000 parts per million (ppm) when tested in the manner described in EPA Method 21. These sources include, but are not limited to, pumping seals, compressor seals, seal oil degassing vents, pipeline valves, flanges and other connections, pressure relief devices, process drains, and open-ended pipes. Excluded from these sources are valves which are not externally regulated.
(34) "Lightering" means the transfer of a liquid product identified in OAR 340-232-0110(1)(a) or (1)(b), as applicable, into a cargo tank from one marine tank vessel to another.
(35) "Liquid-mounted" means a primary seal mounted so the bottom of the seal covers the liquid surface between the tank shell and the floating roof.
(36) "Liquid service" means equipment which processes, transfers or contains a VOC or mixture of VOCs in the liquid phase.
(37) "Loading event" means the loading or lightering of a liquid product identified in OAR 340-232-0110(1)(a) or (1)(b), as applicable, into a marine tank vessel's cargo tank, or the loading of any product into a marine tank vessel's cargo tank where the prior cargo was a liquid product identified in OAR 340-232-0110(1)(a) or (1)(b), as applicable. The event begins with the connection of a marine tank vessel to a storage or cargo tank by means of piping or hoses for the transfer of a fuel product from the storage or cargo tank into the receiving marine tank vessel. The event ends with disconnection of the pipes and/or hoses upon completion of the loading process.
(38) "Marine tank vessel" means any marine vessel constructed or converted to carry liquid bulk cargo that transports a

liquid product identified in OAR 340-232-0110(1)(a) or (1)(b), as applicable.

(39) "Marine terminal" means any facility or structure used to load or unload any fuel product cargo into or from marine tank vessels.

(40) "Marine vessel" means any tugboat, tanker, freighter, passenger ship, barge or other boat, ship or watercraft.

(41) "Maskant for chemical processing" means a coating applied directly to an aerospace component to protect surface areas when chemical milling, anodizing, aging, bonding, plating, etching and/or performing other chemical operations on the surface of the component.

(42) "Miscellaneous metal parts and products" means any metal part or metal product, even if attached to or combined with a nonmetal part or product, except cans, coils, metal furniture, large appliances, magnet wires, automobiles, ships, and airplane bodies.

(43) "Natural finish hardwood plywood panels" means panels whose original grain pattern is enhanced by essentially transparent finishes frequently supplemented by fillers and toners.

(44) "Operator" means any person who leases, operates, controls, or supervises a facility at which gasoline is dispensed.

(45) "Oven dried" means a coating or ink which is dried, baked, cured, or polymerized at temperatures over 90°C (194°F).

(46) "Packaging rotogravure printing" means rotogravure printing upon paper, paper board, metal foil, plastic film, and other substrates, which are, in subsequent operations, formed into packaging products and labels for articles to be sold.

(47) "Paper coating" means any coating applied on paper, plastic film, or metallic foil to make certain products, including but not limited to adhesive tapes and labels, book covers, post cards, office copier paper, drafting paper, or pressure sensitive tapes. Paper coating includes the application of coatings by impregnation and/or saturation.

(48) "Petroleum refinery" means any facility engaged in producing gasoline, aromatics, kerosene, distillate fuel oils, residual fuel oils, lubricants, asphalt, or other products through distillation of petroleum, crude oil, or through redistillation, cracking, or reforming of unfinished petroleum derivatives. "Petroleum refinery" does not mean a re-refinery of used motor oils or other waste chemicals. "Petroleum refinery" does not include asphalt blowing or separation of products shipped together.

(49) "Pretreatment wash primer" means a coating which contains a minimum of 0.5% acid by weight for surface etching and is applied directly to bare metal surfaces to provide corrosion resistance and adhesion.

(50) "Prime coat" means the first of two or more films of coating applied in an operation.

(51) "Printed interior panels" means panels whose grain or natural surface is obscured by fillers and basecoats upon which a simulated grain or decorative pattern is printed.

(52) "Printing" means the formation of words, designs and pictures, usually by a series of application rolls each with only partial coverage.

(53) "Publication rotogravure printing" means rotogravure printing upon paper which is subsequently formed into books, magazines, catalogues, brochures, directories, newspaper supplements, and other types of printed materials.

(54) "Reasonably available control technology" or "RACT" means the lowest emission limitation that a particular source or source category is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility.

(55) "Roll printing" means the application of words, designs and pictures to a substrate by means of hard rubber or steel rolls.

(56) "Sealant" means a coating applied for the purpose of filing voids and providing a barrier against penetration of water, fuel or other fluids or vapors.

(57) "Specialty printing" means all gravure and flexographic operations which print a design or image, excluding publication gravure and packaging printing. Specialty Printing includes printing on paper plates and cups, patterned gift wrap, wallpaper, and floor coverings.

(58) "Submerged fill" means 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, means any fill pipe, the discharge of which is entirely submerged when the liquid level is 18 inches, or is twice the diameter of the fill pipe,

whichever is greater, above the bottom of the tank.

(59) "Thirty-day rolling average" means any value arithmetically averaged over any consecutive thirty days.

(60) "Tileboard" means paneling that has a colored waterproof surface coating.

(61) "Topcoat" means a coating applied over a primer or intermediate coating for purposes such as appearance, identification or protection.

(62) "True vapor pressure" means the equilibrium pressure exerted by a petroleum liquid as determined in accordance with methods described in American Petroleum Institute Bulletin 2517, "Evaporation Loss from Floating Roof Tanks," February, 1980.

(63) "Vapor balance system" means a combination of pipes 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.

(64) "Vapor-mounted" means a primary seal mounted so there is an annular vapor space underneath the seal. The annular vapor space is bounded by the primary seal, the tank shell, the liquid surface, and the floating roof.

(65) "Vapor tight" means, as used in OAR 340-232-0110, a condition that exists when the concentration of a VOC, measured one centimeter from any source, does not exceed 10,000 ppm (expressed as methane) above background.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

[NOTE: Publications referenced and not linked to below are available from the agency.]

[NOTE: View a PDF of referenced EPA Methods by clicking on "Tables" link following OAR 340-232-8010.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025

STATUTES/OTHER IMPLEMENTED: ORS 468A.025

AMEND: 340-232-0040

RULE TITLE: General Non-Categorical Requirements

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Amending language to specify maximum production throughput of a sources is based on them operating 8,760 hours per year.

RULE TEXT:

(1) All existing sources operating prior to November 15, 1990, located inside the areas cited in OAR 340-232-0020(1)(a) or (1)(c), containing emissions units or devices for which no categorical RACT requirements exist and which can emit over 100 tons per year of VOC from aggregated, non-regulated emissions units, based on the design capacity or maximum production or throughput capacity of the source operating 8,760 hours per year without the use of control devices or limits on hours of operation, must have RACT requirements developed on a case-by-case basis by DEQ. Sources that have complied with NSR requirements per OAR chapter 340, division 224 and are subject to Best Available Control Technology (BACT) or Lowest Achievable Emission Rate (LAER) requirements are presumed to have met RACT requirements.

(2) A source may request RACT not be applied or removed by demonstrating to DEQ that the aggregated, non-regulated emissions units are unable to emit more than 100 tons per year of VOC, based on the design capacity or maximum production or throughput capacity of the source operating 8,760 hours per year without the use of control devices.

(3) Within 3 months of written notification by DEQ of the applicability of this rule, or, for good cause shown, up to an additional three months as approved by DEQ, the source must submit to DEQ a complete analysis of RACT for each category of emissions unit at the source, taking into account technical and economic feasibility of available control technology, and the emission reductions each technology would provide. This analysis does not need to include any emissions units subject to a specific categorical RACT requirement under this division. These RACT requirements approved by DEQ will be incorporated in the source's Air Contaminant Discharge Permit, and will be effective upon approval by EPA as a source specific SIP revision. The source must comply with the applicable RACT requirements beginning one year from the date of notification by DEQ of EPA approval.

(4) Failure by a source to submit a RACT analysis required by section (2) does not excuse the source from the obligation to comply with a RACT determination established by DEQ.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025

STATUTES/OTHER IMPLEMENTED: ORS 468A.025

AMEND: 340-232-0090

RULE TITLE: Bulk Gasoline Terminals Including Truck and Trailer Loading

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Correcting typo "Mnaual" to "Manual".

RULE TEXT:

(1) No terminal owner or operator, may allow VOCs to be emitted into the atmosphere in excess of 80 milligrams of VOC per liter of gasoline loaded from the operation of loading truck tanks, and truck trailers at bulk gasoline terminals with a daily throughputs of greater than 76,000 liters (20,000 gallons) per day of gasoline, determined by a thirty-day rolling average:

(a) The owner or operator of a gasoline loading terminal must only allow the transfer of gasoline between the facility and a truck tank or a truck trailer when a current leak test certification for the delivery vessel is on file with the terminal or a valid permit as required by OAR 340-232-0100(1)(c) is displayed on the delivery vessel;

(b) The owner or operator of a truck tank or a truck trailer must not make any connection to the terminal's gasoline loading rack unless the gasoline delivery vessel has been tested in accordance with OAR 340-232-0100(1);

(c) The truck driver or other operator who fills a delivery truck tank and/or trailer tank must not take on a load of gasoline unless the vapor return hose is properly connected;

(d) All equipment associated with the vapor balance system must be maintained to be vapor tight and in good working order.

(2) Compliance with section (1) must be determined by testing in accordance with Method 33 on file with DEQ. [NOTE: This Method is in the DEQ Source Sampling Manual published at OAR 340-200-0035.]The method for determining compliance with section (1) are delineated in 40 CFR part 60, subpart XX, §60.503.

(3) Bulk Gasoline terminals must comply with the following within the limits of section (1):

(a) All displaced vapors and gases during tank truck gasoline loading operations must be vented only to the vapor control system;

(b) The loading device must not leak when in use. The loading device must be designed and operated to allow no more than 10 cubic centimeters drainage per disconnect on the basis of 5 consecutive disconnects;

(c) All loading liquid lines must be equipped with fittings which make vapor-tight connections and which close automatically and immediately when disconnected;

(d) All vapor lines must be equipped with fittings which make vapor-tight connections and which close automatically and immediately when disconnected or which contain vapor tight unidirectional valves;

(e) Gasoline must be handled in a manner to prevent its being discarded in sewers or stored in open containers or handled in any manner that would result in evaporation. If more than 5 gallons are spilled, the operator must report the spillage in accordance with OAR 340-214-0300 through 340-214-0350;

(f) The vapor balance system must be operated in a manner to prevent the pressure therein from exceeding the tank truck or trailer pressure relief settings.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.050, 468A.070

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.050, 468A.070

AMEND: 340-232-0160

RULE TITLE: Surface Coating in Manufacturing

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "If surface coating is performed but is not specifically listed in section (5), then that surface coating is subject to OAR 340-232-0040, if applicable. " to (1).
Adding (B) and (C) to (2)(b).

RULE TEXT:
(1) No person may operate a coating line which emits into the atmosphere VOCs in excess of the limits in section (5), expressed as pounds VOC per gallon of coating applied, excluding water and exempt solvents, unless an alternative emission limit is approved by DEQ pursuant to section (3) or emissions are controlled to an equivalent level pursuant to section (7). If surface coating is performed but is not specifically listed in section (5), then that surface coating is subject to OAR 340-232-0040, if applicable.
(2) Exemptions:
(a) This rule does not apply to airplanes painted out of doors in open air; automobile and truck refinishing; customized top coating of automobiles and trucks, if production is less than 35 vehicles per day; marine vessels and vessel parts painted out in the open air; flat wood coating; wood furniture and wood cabinets; wooden doors, mouldings, and window frames; machine staining of exterior wood siding; high temperature coatings (for service above 500° F.); lumber marking coatings; potable water tank inside coatings; high performance inorganic zinc coatings, air dried, applied to fabricated steel; and markings by stencil for railroad cars;
(b) This rule does not apply to:
(A) Sources whose VOC potential to emit before add on controls from activities identified in section (5) is less than 10 tons per year;
(B) Sources with VOC actual emissions before add on controls from activities identified in section (5) are less than 3 pounds per hour;
(C) Sources with VOC actual emissions before add on controls from activities identified in section (5) are less than 15 pounds per day; or
(D) Sources used exclusively for chemical or physical analysis or determination of product quality and commercial acceptance, such as research facilities, pilot plant operations, and laboratories, unless:
(i) The operation of the source is an integral part of the production process; or
(ii) The emissions from the source exceed 363 kilograms (800 pounds) in any calendar month.
(3) Exceptions:
(a) On a case-by-case basis, DEQ may approve exceptions to the emission limits specified in section (5), upon documentation by the source that an alternative emission limit would satisfy the federal criteria for RACT;
(b) Included in this documentation must be a complete analysis of technical and economic factors which:
(A) Prevent the source from using both compliance coatings and air pollution control devices; and
(B) Justify the alternative emission limit sought by the source.
(c) The alternative emission limit approved by DEQ will be incorporated into the source's Air Contaminant Discharge Permit, or Title V operating permit, and will be effective upon approval by EPA as a source specific SIP revision.
(4) Applicability: This rule applies to each coating line, which includes the application area, flashoff area, air and forced air dryer, and oven used in the surface coating of the parts and products in subsections (5)(a) through (j).
(5) Process and Limitation: These emission limitations must be based on a daily average except subsection (5)(e) must be based on a monthly average. If more than one emission limitation in this rule applies to a specific coating, then the most stringent emission limitation must be applied:
(a) Can Coating:
(A) Sheet basecoat, exterior and interior, and over-varnish; two-piece can exterior, basecoat and over-varnish, 2.8 pounds/gallon;

(B) Two- and three-piece can interior and exterior body spray, two-piece can exterior end, spray or roll coat, 4.2 pounds/gallon;
(C) Three-piece can side-seam spray 5.5 pounds/gallon;
(D) End sealing compound 3.7 pounds/gallon;
(E) End Sealing Compound for fatty foods 3.7 pounds/gallon.
(b) Fabric Coating 2.9 pounds/gallon;
(c) Vinyl Coating 3.8 pounds/gallon;
(d) Paper Coating 2.9 pounds/gallon;
(e) Existing Coating of Paper and Film in the Medford-Ashland AQMA 55 pounds VOC per 1000 square yards of material per pass;
(f) Auto and Light Duty Truck Coating:
(A) Prime 1.9 pounds/gallon;
(B) Topcoat 2.8 pounds/gallon;
(C) Repair 4.8 pounds/gallon;
(g) Metal Furniture Coating 3.0 pounds/gallon;
(h) Magnet Wire Coating 1.7 pounds/gallon;
(i) Large Appliance Coating 2.8 pounds/gallon;
(j) Miscellaneous Metal Parts and Products:
(A) Clear Coatings 4.3 pounds/gallon;
(B) Forced Air Dried or Air Dried 3.5 pounds/gallon;
(C) Extreme Performance Coatings 3.5 pounds/gallon;
(D) Other Coatings, i.e., powder, oven dried, 3.0 pounds/gallon;
(E) High Performance Architectural Coatings 3.5 pounds/gallon.
(6) Compliance Determination: Compliance with this rule must be determined by testing in accordance with 40 CFR part 60 EPA Method 18, 24, 25, a material balance method, or an equivalent plant specific method approved by and on file with DEQ. The limit in section (1) of VOC in the coating is based upon an assumed solvent density, and other assumptions unique to a coating line; where conditions differ, such as a different solvent density, a plant specific limit developed pursuant to the applicable Control Technology Guideline document may be submitted to DEQ for approval.
(7) Reduction Method: Compliance with the emission limits of sections (3) and (5) must be achieved by:
(a) The application of low solvent content coating technology;
(b) An incineration system which oxidizes at least 90.0 percent of the non-methane VOCs entering the incinerator, VOC measured as total combustible carbon, to carbon dioxide and water; or
(c) An equivalent means of VOC removal. The equivalent means must be approved by DEQ and will be incorporated in the source's Air Contaminant Discharge Permit or Title V permit, and will be effective upon approval by EPA as a source-specific SIP revision. Other alternative emission controls approved by DEQ and allowed by EPA may be used to provide an equivalent means of VOC removal.
(8) Recordkeeping Requirements:
(a) A current list of coatings must be maintained which provides all the coating data necessary to evaluate compliance, including the following information, where applicable:
(A) Coating catalyst and reducer used;
(B) Mix ratio of components used;
(C) VOC content of coating as applied; and
(D) Oven temperature.
(b) Where applicable, a monthly record must be maintained indicating the type and amount of solvent used for cleanup and surface preparation;
(c) Such records must be retained and available for inspection by DEQ for a period of five years.
[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR

340-200-0040.]

[NOTE: View a PDF of referenced EPA Methods by clicking on “Tables” link below OAR 340-232-8010.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.070

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.070

AMEND: 340-232-0170

RULE TITLE: Aerospace Component Coating Operations

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Minor typo corrections.

RULE TEXT:

(1) No owner or operator of an aerospace component coating facility may emit into the atmosphere VOCs in excess of the following limits, expressed as pounds VOC per gallon of coating applied, excluding water and exempt solvents, unless an alternative emission limit is approved by DEQ pursuant to section (4) or emissions to the atmosphere are controlled to an equivalent level pursuant to section (10):

(a) Primer — 2.9 pounds/gallon;

(b) Interior Topcoat — 2.8 pounds/gallon;

(c) Electric or Radiation Effect Coating — 6.7 pounds/gallon;

(d) Extreme Performance Interior Topcoat — 3.5 pounds/gallon;

(e) Fire Insulation Coating — 5.0 pounds/gallon;

(f) Fuel Tank Coating — 6.0 pounds/gallon;

(g) High Temperature Coating for conditions between 350° F. –500° F. — 6.0 pounds/gallon;

(h) Sealant — 5.0 pounds/gallon;

(i) Self-Priming Topcoat — 3.5 pounds/gallon;

(j) Topcoat — 3.5 pounds/gallon;

(k) Pretreatment Wash Primer — 3.5 pounds/gallon;

(l) Sealant Bonding Primer — 6.0 pounds/gallon;

(m) Temporary Protective Coating — 2.1 pounds/gallon;

(2) Exemptions: This rule does not apply to the following:

(a) The exterior of fully assembled airplanes painted out of doors, high temperature coatings (for conditions over 500° F.), adhesive bonding primer, flight test coatings, and space vehicle coatings;

(b) Sources whose potential to emit from activities identified in section (1) before add on controls of VOCs are less than ten tons per year (or 3 pounds VOC/hour or 15 pounds VOC/day actual);

(c) The use of separate coating formulations in volumes of less than 20 gallons per calendar year. No source may use more than a combined total of 250 gallons per calendar year of exempt coatings. Records of coating usage must be maintained as per section (8); or

(d) Sources used exclusively for chemical or physical analysis or determination of product quality and coating performance (such as research facilities and laboratories) unless:

(A) The operation of the source is an integral part of the production process; or

(B) The emissions from the source exceed 363 kilograms (800 pounds) in any calendar month.

(3) Exceptions:

(a) On a case-by-case basis, DEQ may approve exceptions to the emission limits specified in section (1), upon documentation by the source that an alternative emission limit would satisfy the federal criteria for RACT;

(b) Included in this documentation must be a complete analysis of technical and economic factors which:

(A) Prevent the source from using both compliance coatings and air pollution control devices; and

(B) Justify the alternative emission limit sought by the source.

(c) The alternative emission limit approved by DEQ will be incorporated into the source's Air Contaminant Discharge Permit and will be effective upon approval by EPA as a source-specific SIP revision.

(4) Applicability: This rule applies to each coating line, which includes the application area, flashoff area, air and forced air dryer, and oven used in the surface coating of aerospace components in subsections (1)(a) through (m) . If more than one emission limitation in this rule applies to a specific coating, then the most stringent emission limitation must be applied.

(5) Solvent Evaporation Minimization:

(a) Closed containers must be used for the storage or disposal of cloth or paper used for solvent surface preparation and cleanup;

(b) Fresh and spent solvent must be stored in closed containers;

(c) Organic compounds may not be used for the cleanup of spray equipment unless equipment is used to collect the cleaning compounds and to minimize their evaporation;

(d) Containers of coating, catalyst, thinner, or solvent may not be left open to the atmosphere when not in use.

(6) Stripper Limitations: No stripper may be used which contains more than 400 grams/liter (3.3 lbs./gal.) of VOC or which has a true vapor pressure of 1.3 kPa (0.19 psia) at actual usage temperature.

(7) Maskant for Chemical Processing Limitation: No maskant may be applied for chemical processing unless the VOC emissions from coating operations are reduced by 85 percent, or the coating contains less than 600 grams of VOC per liter (5.0 pounds/gallon) of coating excluding water, as applied.

(8) Compliance determination: Compliance with this rule must be determined by testing in accordance with 40 CFR part 60, Appendix A, Method 24 for determining the VOC content of the coating materials. Emissions from the coating processes and/or VOC emissions control efficiencies must be determined by testing in accordance with 40 CFR part 60, Appendix A, Method 18, 25, California Method ST-7, a material balance method, or an equivalent plant specific method approved by EPA and DEQ and on file with DEQ. The limit in section (1) of VOC in the coating is based upon an assumed solvent density, and other assumptions unique to a coating line; where conditions differ, such as a different solvent density, a plant specific limit may be submitted to DEQ and EPA for approval.

(9) Reduction Method: The emission limits of section (1) must be achieved by:

(a) The application of a low solvent content coating technology;

(b) A vapor collection and disposal system; or

(c) An equivalent means of VOC removal. The equivalent means must be approved by DEQ and will be incorporated in the source's Air Contaminant Discharge Permit or Title V Operating Permit, and will be effective upon approval by EPA as a source-specific SIP revision. Other alternative emission controls approved by DEQ and allowed by EPA may be used to provide an equivalent means of VOC removal.

(10) Recordkeeping Requirements:

(a) A current list of coatings must be maintained which provides all of the coating data necessary to evaluate compliance, including the following information, where applicable:

(A) A daily record indicating the mix ratio of components used; and

(B) The VOC content of the coating as applied.

(b) A monthly record must be maintained indicating the type and amount of solvent used for cleanup and surface preparation;

(c) A monthly record must be maintained indicating the amount of stripper used;

(d) Such records must be retained and available for inspection by DEQ for a period of five years.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040.]

[NOTE: View a PDF of California Test Methods by clicking on “Tables” link below.]

[NOTE: View a PDF of referenced EPA Methods by clicking on “Tables” link below OAR 340-232-8010.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.070

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.070

State of Oregon Department of Environmental Quality

OAR 340-232-0170
Attachments

SOURCE TEST PROCEDURE **ST-7**

ORGANIC COMPOUNDS

REF: Regulation 8

1. APPLICABILITY

1.1 This procedure is used to quantify emissions of organic compounds. It is applicable to the determination of compliance with Regulation 8.

1.2 The combustion technique detailed in ST-7 is not applicable when carbon dioxide constitutes over 85%, on a molar basis, of the total carbon (organic plus inorganic, as C_1), in the sample.

1.3 The use of a flame ionization detector (FID) for direct measurement of organic compounds may be used when carbon dioxide constitues over 85%, on a molar basis, of the total carbon in the sample.

2. PRINCIPLE

2.1 Combustion Technique: A continuous sample of effluent is passed through a combustion tube. The combusted sample is conditioned to remove water and particulate. The continuously combusted sample is analyzed for Total Carbon (TC) using a non-dispersive infrared (NDIR) CO_2 analyzer. At the same time, a continuous sample of effluent is conditioned to remove water and particulate material. This sample which has bypassed the combustion tube is analyzed to determine the background CO_2, CO, and methane concentrations which are subtracted from the TC value to determine the non-methane organic carbon (NMOC) concentration. The background CO_2 concentration is measured using the same NDIR as that used to measure TC.

2.2 FID Direct Measurement: A continuous sample of effluent is conditioned to remove water and particulate material. The conditioned sample is analyzed for total hydrocarbons (THC) by FID. NMOC concentration is calculated by subtracting the methane concentration from the THC concentration.

2.3 The methane content of the sample is determined either (A) by filling an evacuated cylinder with sample for subsequent gas chromatographic analysis or (B) by directing a portion of the conditioned sample through a bed of activated carbon to remove NMOC and then into a FID.

3. RANGE AND SENSITIVITY

3.1 The minimum measurable concentration of carbon dioxide is 10 ppm if the appropriate NDIR cell is used.

3.2 The maximum concentration of organic compounds for which the combustion technique in this procedure is applicable is 5% when the appropriate NDIR cell is used.

3.3 The minimum sensitivity of the NDIR is 2% of full scale.

3.4 Use of the combustion technique requires a molar concentration ratio of oxygen to VOC of 5:1 or greater.

3.5 The minimum measurable concentration of THC by FID is 5 ppmv when interferences are not present.

3.6 The minimum sensitivity of the FID is 2% of full scale.

4. INTERFERENCES

4.1 Combustion Technique:Negative bias may occur due to reaction of highly reactive organics (e.g., aldehydes or acids) with internal surfaces or if the condensation point of the sample is above the condenser temperature. Combustion at the emission point, prior to condenser and the use of the minimum probe to combustor tubing length, greatly reduces this bias.

4.2 Combustion Technique: High concentrations or widely varying concentrations of methane, carbon monoxide or carbon dioxide may adversely affect the accuracy of this procedure for the measurement of the organic compounds present. Alternate methods may be used upon prior approval by the Source Test Section Manager.

4.3 FID Direct Measurement: Response factors vary be tween hydrocarbons. Propane used as a span gas minimizes this variability. The measurement of chlorinated hydrocarbons, in some instances, may require the use of an alternative span gas. Use of an alternative span gas must be approved by the Source Test Manager.

4.4 FID Methane Measurement: The activated charcoal scrubber adsorbs non-methane hydrocarbons from sample gas before its subsequent analysis by FID. Previous contamination or unclean activated charcoal in this scrubber can lead to the determination of erroneously high levels of methane. This problem is obviated by establishing a zero methane base-line response. Methane determination requires that the response time must be sufficient to allow for the residence time of sample gas in the carbon adsorber.

5. APPARATUS

5.1 Carbon dioxide analyzer. Use a non-dispersive infrared gas analyzer (in accordance with ST-5).

5.2 Carbon monoxide analyzer. Use a non-dispersive infrared gas analyzer (in accordance with ST-6).

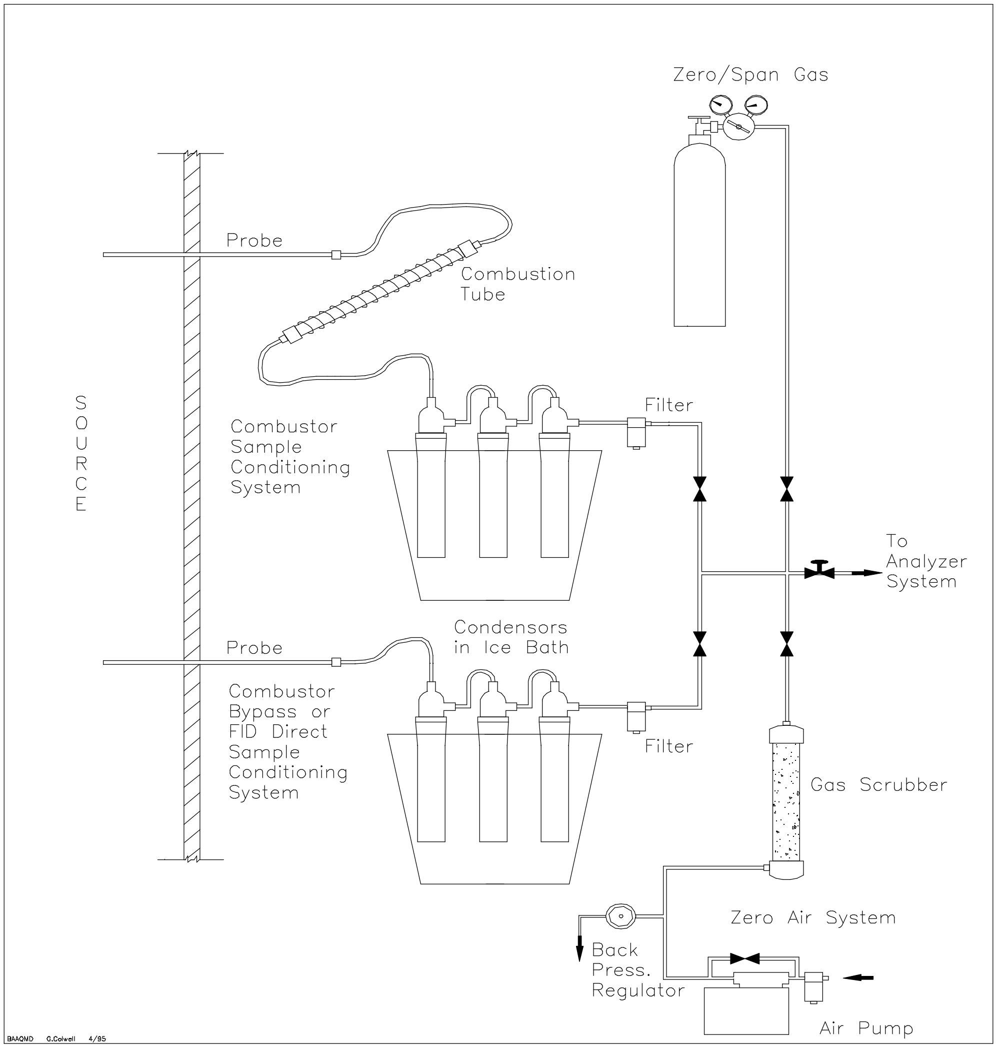
5.3 Flame ionization detector.

5.4 Chart recorder. Record the continuous output from each analyzer.

5.5 Sample conditioning, zero air, and span gas system. Assemble this system as shown in Figure 7-1. Sample conditioning system shall provide a dry, particulate-free gas flow to the instrument. The zero-air system shall provide clean, dry CO_2 free air for instrument calibration. The span-gas system shall provide known concentration of the appropriate gas for use in calibrating the analyzers. Except as specified, all materials which come in contact with either the sample or span gases must be constructed of Teflon or stainless steel.

Figure 7-1

Sample Conditioning, Zero Air, Zero/Span Gas Systems



5.7 Sample probe. Use a tube of inert material and sufficient length to traverse the stack being tested. If the stack temperature exceeds 425C (800F), use a quartz probe. Other probes are acceptable subject to approval by the Source Test Section.

5.8 Condensers. Use modified Greenberg-Smith impingers with the im paction plates removed and the inlet tubes shortened to a length of 10 CM (4 inches).

5.9 Cooling system. Immerse the impingers in an ice bath during the test.

5.10 Particulate filter. Use a Balston type 95 holder with a grade B filter, or equivalent, in the sample system.

5.11 Pumps. Use leak-free, Teflon-lined, diaphragm pumps in the sample and zero air system. The pumps shall have a free-flow capacity of at least 28 liters/min. (1.0 CFM).

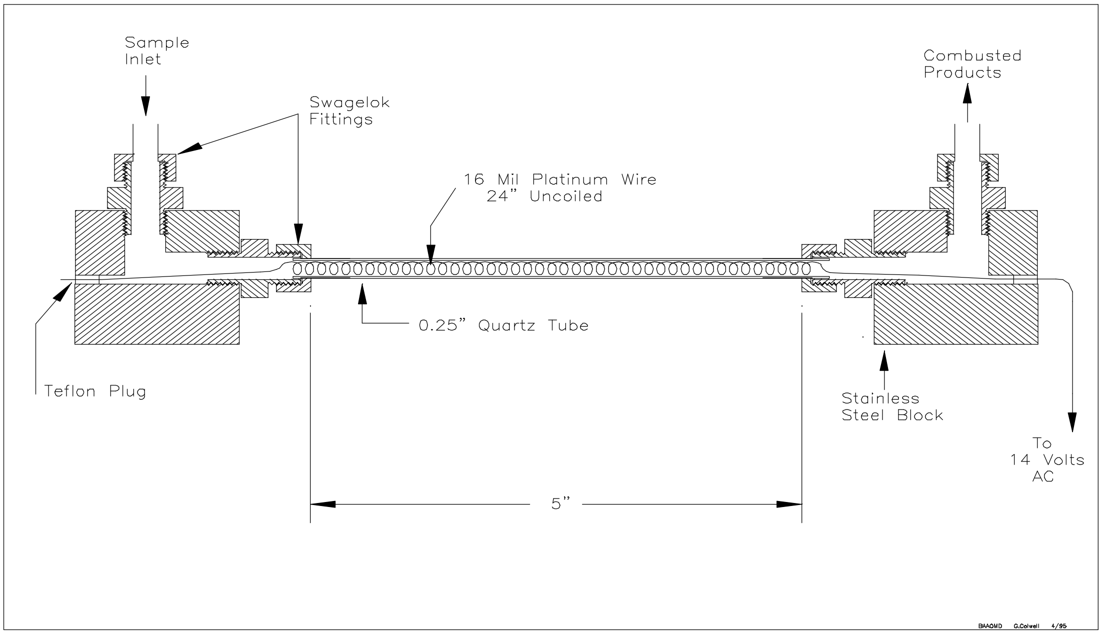
5.12 Gas scrubber. Use a bed of silica gel, Ascarite (or soda-lime), and charcoal to remove moisture, carbon dioxide, and hydrocarbons from the zero air system.

5.13 Span gas. Use a high-pressure cylinder containing a known concentration of propane in air or nitrogen. A cylinder containing a known concentration of solvent, where applicable, may also be used. This option may only be used with prior approval of the Source Test Section.

5.14 Combustor. Use a system to oxidize all organics in the sample including methane. Examples of acceptable combustion tubes found adequate by the BAAQMD are described in Figures 7-2 and 7-3.

Figure 7-2

Internally Heated Combustion Tube



6. PRE-TEST PROCEDURES

6.1 Warm-up the instruments according to manufacturers' instructions.

6.2 Assemble the sampling system as shown in Figure 7-4 or 7-5.

6.3 Leak-test the sampling system by starting the pump, plugging the probe, and assuring that the pressure to the analyzer falls to zero.

6.4 Introduce zero-air into the analyzers and calibrate the instruments ac cording to manufacturers' instructions.

6.5 Introduce span-gas into the analyzers and calibrate the instruments according to manufacturers' instruction.

6.6 Conduct a preliminary concentration traverse (in accordance with ST-18) to determine if stratification of the stack gases exists. If the hydrocarbon concentration at any point differs from the average concentration by more than 10%, traverse the stack during the test; if not, sample at any single point.

Figure 7-3

Externally Heated Combustion Tube

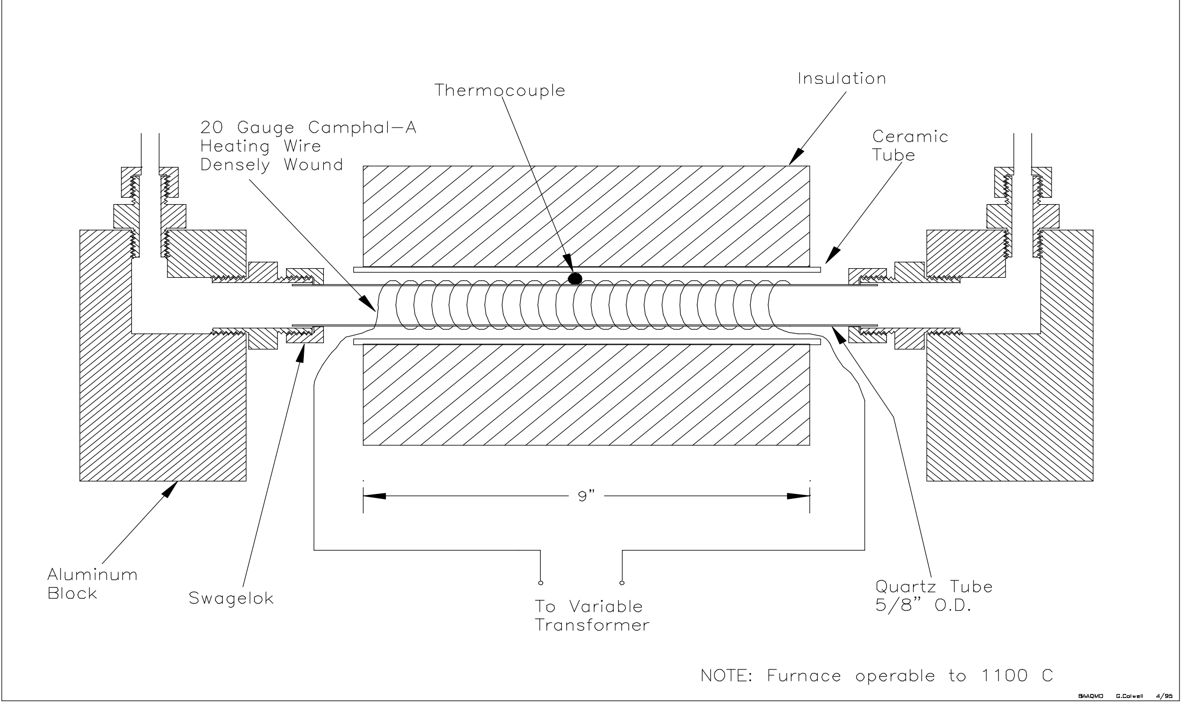


Figure 7-4

Analyzer Manifold for ST-7

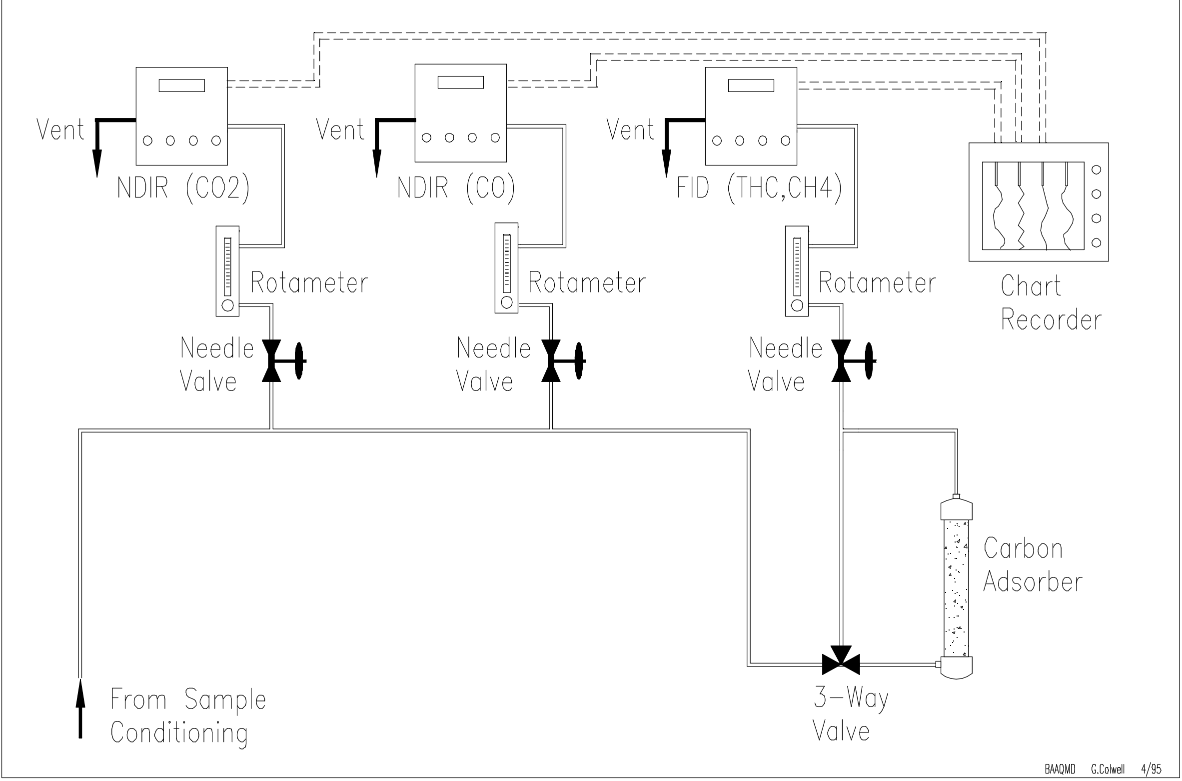
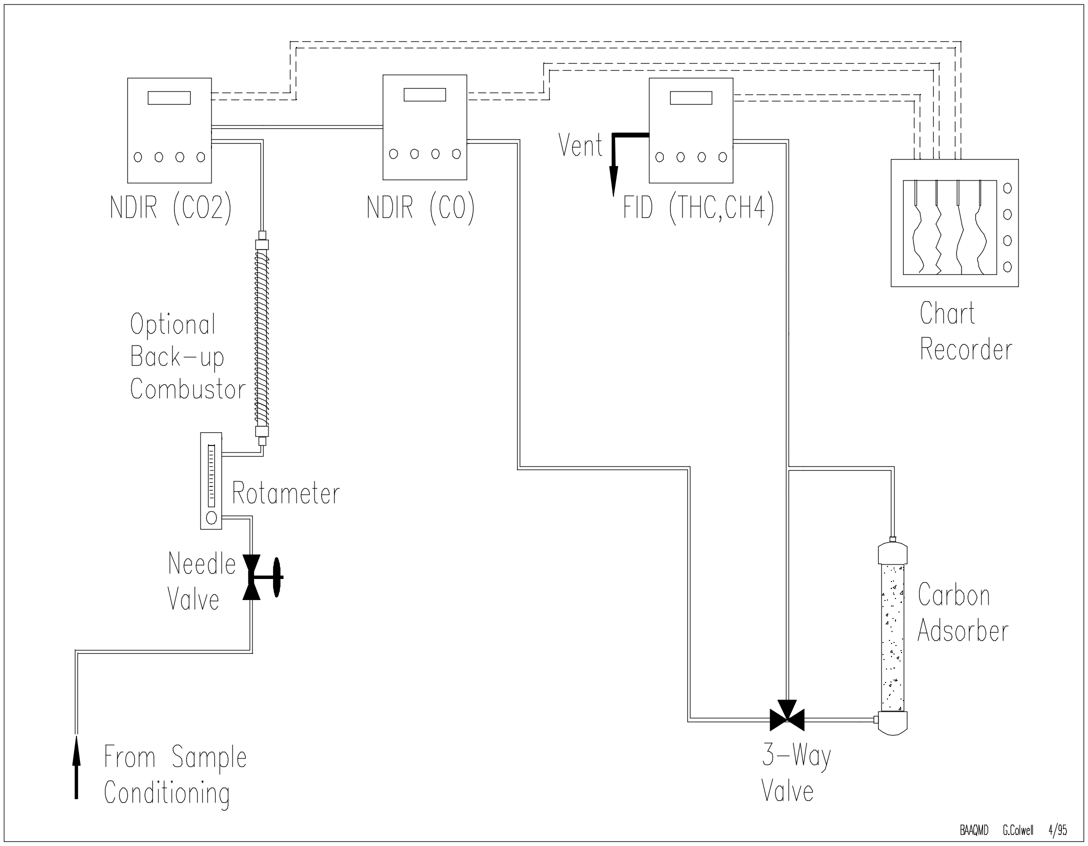


Figure 7-5

Analyzer Manifold for Combustor of Less Than 100% Efficiency



6.7 Prepare the chart recorder according to manufacturer's instructions.

6.8 Set the voltage to the combustor to at least 14 volts A.C. for the combustor illustrated in Figure 7-2. Efficiency of this combustor will be a function of the platinum wire, voltage, sample flow-rate and sample composition. All voltages will be combustor specific and efficiency data may be requested by the Source Test Section.

6.9 Set the temperature of the combustor to 870 °C ±10°C (1598°F ±18°F) for the combustor in Figure 7-3. The residence time of sample through this combustor must be greater than 2 seconds. Efficiency data may be required by the Source Test Section.

7. SAMPLING

7.1 Each test run shall be of 30 minute duration when testing from continuous operations. Each test run of a batch operation shall be for 90% of the batch time or thirty minutes, whichever is less.

7.2 At sources requiring both inlet and outlet tests on a control device (e.g., afterburners), the test times may be adjusted to aid in obtaining representative results.

7.3 Introduce sample gas into the analytical system at the same flow rate used to calibrate the analyzers.

7.4 By-pass the combustion tube (at approximately ten minute intervals), to measure the background CO_2, CO, and methane in the sample stream.

7.5 Verify that the CO and THC concentrations from the combustor are zero. Non-zero concentrations of these parameters must be continuously monitored during all combustion technique testing.

7.6 Determine the methane concentration by either passing a portion of the sample stream through an activated carbon scrubber to remove non-methane hydrocarbons and then through a flame ionization detector or by obtaining a grab sample for analysis by Lab 17.

7.7 Maintain ice in the cooling system throughout the test.

7.8 Calibrate the analyzers before and after each test run. Record each step of the process on the chart recording.

7.9 Conduct three consecutive test runs.

8. AUXILIARY TESTS

8.1 Stack gas flow rate. Use ST-17 to determine the stack gas flow rate after each test run.

8.2 Moisture content. Use ST-23 to determine the moisture content of the stack gases.

9. CALCULATIONS

9.1 Use Equations 1 and 2 to calculate Non-Methane Organic Compound concentrations from Combustion Technique data.

$$C_{TC} = (C_{TC})_{Comb} + (C_{CO})_{Comb} + (C_{THC})_{Comb} \qquad (1)$$

$$C_{NMOC} = C_{TC} - C_{CO_2} - C_{CO} - C_M \qquad (2)$$

9.2 Use Equation 3 to calculate Non-Methane Organic Compound concentrations from FID Direct Measurement data:

$$C_{NMOC} = C_{THC} - C_M \qquad (3)$$

9.3 Mass flow rate of the non-methane organic compounds, as carbon are calculated according to equation 4.

$$M_{NMOC} = \frac{12 (\text{lb C/lb-mole } C_1) \times Q_o \times C_{NMOC} \times 60 \text{ (min/hr)}}{386.9 \text{ (SDCF/lb-mole)} \times 10^6 \text{(ppm)}} \qquad (4)$$

9.4 Mass flow rate of Volatile Organic Compounds are calculated according to equation 5:

$$M_{VOC} = \frac{X_{VOC} \text{ x } Q_o \text{ x } C_{NMOC} \text{ x } 60 \text{ (min/hr)}}{386.9 \text{ (SDCF/lb-mole) x } 10^6 \text{(ppm)}} \qquad (5)$$

9.5 Molecular weight and VOC Density Calculations. If organic mass rate emissions are subject to rules requiring the determination of precusor organic compounds or volatile organic compounds, then the average molecular weight of VOC per carbon (X_{VOC})must be determined. If it is not practicable to determine or estimate X_{VOC}, then a value of 14 lb/lb-mol shall be used. Calculations of exhaust emission rates shall be based upon the same X_{VOC} as that determined for the inlet. Use the worksheet shown in Figure 7-6 to correctly calculate or estimate the average molecular weight.

9.6 Mass flow rate of carbon monoxide is calculated according to equation 6:

$$M_{CO} = \frac{28 \text{(lb CO/lb-mole) x } Q_o \text{ x } C_{CO} \text{ x } 60 \text{ (min/hr)}}{386.9 \text{ (SDCF/lb-mole) x } 10^6 \text{(ppm)}} \qquad (6)$$

9.7 The VOC Emission Factor, $(m_{Ctg})_{overall}$, from coating operations, will be calculated according to equation 7. If organic emissions are subject to equivalent control (for example: Regulation 8 Rule 11, Section 302), the Equivalent Coatings Emission Factor, $(m_{EQCtg})_{overall}$, shall be calculated using worksheet shown in Figure 7-7. Fugitive emissions shall be added to measured emission rates by calculating solvent usage rate (lb/hr), subtracting control device inlet VOC rate and adding the result to the control device outlet VOC rate.

$$(m_{Ctg})_{overall} = \frac{(M_{VOC})_{overall}}{\text{Application Rate (gal/hr)}} \qquad (7)$$

9.8 If organic emissions are controlled by incineration, the efficiency of oxidation to carbon dioxide for the determination of exemption in Regulation 8, Rule 1, Section 110.3, shall be calculated using equations 8 or 9. Operations whose emissions are not controlled by incineration or are not subject to the exemption, shall be calculated using equations 10 or 11.

9.8.1 If the control device is an incinerator and $(M_{CO})_{out}$ is greater than $(M_{CO})_{in}$, then control efficiency will be calculated using equation 8 or 9:

$$E_{device} = \frac{(M_{NMOC})_{in} - (M_{NMOC})_{out} - (^{12}/_{28}) \times \{(M_{CO})_{out} - (M_{CO})_{in}\}}{(M_{NMOC})_{in}} \times 100\% \qquad (8)$$

$$E_{device} = \frac{(M_{VOC})_{in} - (M_{VOC})_{out} - (^{X}VOC/_{28}) \times \{(M_{CO})_{out} - (M_{CO})_{in}\}}{(M_{VOC})_{in}} \times 100\% \qquad (9)$$

9.8.2 In all other situations, the control efficiency will be calculated using equation 10 or 11:

$$E_{device} = \frac{(M_{NMOC})_{in} - (M_{NMOC})_{out}}{(M_{NMOC})_{in}} \times 100\% \qquad (10)$$

$$E_{device} = \frac{(M_{VOC})_{in} - (M_{VOC})_{out}}{(M_{VOC})_{in}} \times 100\% \qquad (11)$$

9.9 Overall mass rate emissions shall include fugitive emissions according to equations 12 through 15.

9.9.1 Overall mass rate emissions of Non-Methane Organic Carbon shall include fugitive emissions as given by equations 12 and 13:

$$(M_{NMOC})_{fugitive} = (M_{NMOC})_{process} - (M_{NMOC})_{in} \qquad (12)$$

$$(M_{NMOC})_{overall} = (M_{NMOC})_{out} + (M_{NMOC})_{fugitive} \qquad (13)$$

9.9.2 Overall mass rate emissions of Volatile Organic Compounds shall include fugitive emissions as given by equations 14 and 15:

$$(M_{VOC})_{fugitive} = (M_{VOC})_{process} - (M_{VOC})_{in} \qquad (14)$$

$$(M_{VOC})_{overall} = (M_{VOC})_{out} + (M_{VOC})_{fugitive} \qquad (15)$$

9.10 Sample calculations.

Example 1: Incinerator Abating Cyclohexanone

Given:

Process data shows coating applied at a rate of 8 gallons per hour. Laboratory analysis of the coating indicates it contains 5 pounds VOC per gallon. The VOC is pure Cyclohexanone ($C_6H_{10}O$). The Incinerator outlet flow is virtually the same as the inlet flow.

Inlet measurements to the Afterburner:

Q_o = 1,000 SDCFM
$(C_{TC})_{comb}$ = 22,400 ppm
$(C_{CO})_{comb}$ < 10 ppm
$(C_{THC})_{comb}$ < 5 ppm
C_{CO} = 250 ppm
C_M = 150 ppm
C_{CO2} = 10,000 ppm

Outlet measurements from the Afterburner:

C_{THC} = 200 ppm
C_M = 100 ppm
C_{CO} = 50 ppm

Calculation of Afterburner Inlet parameters:

$$C_{TC} = (C_{TC})_{Comb} + (C_{CO})_{Comb} + (C_{THC})_{Comb} \qquad (1)$$

$$= 22400 - (<10) - (<5)$$

$$C_{TC} = 22400 \text{ ppm}$$

$$C_{NMOC} = C_{TC} - C_{CO2} - C_{CO} - C_M \qquad (2)$$

$$= 22400 - 10000 - 250 - 150$$

$$C_{NMOC} = 12000 \text{ ppm}$$

$$M_{NMOC} = \frac{12(\text{lb C/lb-mole } C_1) \times Q_o \times C_{NMOC} \times 60 \text{ (min/hr)}}{386.9 \text{ (SDCF/lb-mole)} \times 10^6 \text{(ppm)}} \qquad (4)$$

$$= (12 \times 1000 \times 12000 \times 60)/(386.9 \times 10^6)$$

$$M_{NMOC} = 22.3 \text{ lbs NMOC/hr}$$

X_{VOC} = 16.33 lb VOC/lb-mol C_1 (From Worksheet IV-22)

$$M_{VOC} = \frac{X_{VOC} \times Q_o \times C_{NMOC} \times 60 \text{ (min/hr)}}{386.9 \text{ (SDCF/lb-mole)} \times 10^6 \text{(ppm)}} \qquad (5)$$

$$= (16.33 \times 1000 \times 12000 \times 60)/(386.9 \times 10^6)$$

M_{VOC} = 30.39 lb VOC/hr

Calculation of Afterburner Outlet parameters:

$$C_{NMOC} = C_{THC} - C_M \qquad (3)$$

$$= 200 - 100$$

C_{NMOC} = 100 ppmv

$$M_{NMOC} = \frac{12(\text{lb C/lb-mole } C_1) \times Q_o \times C_{NMOC} \times 60 \text{ (min/hr)}}{386.9 \text{ (SDCF/lb-mole)} \times 10^6 \text{(ppm)}} \qquad (4)$$

$$= (12 \times 1000 \times 100 \times 60)/(386.9 \times 10^6)$$

M_{NMOC} = 0.19 lb NMOC/hr

$$M_{VOC} = \frac{X_{VOC} \times Q_o \times C_{NMOC} \times 60 \text{ (min/hr)}}{386.9 \text{ (SDCF/lb-mole)} \times 10^6 \text{(ppm)}} \qquad (5)$$

$$= (16.33 \times 1000 \times 100 \times 60)/(386.9 \times 10^6)$$

M_{VOC} = .25 lb VOC/hr

Calculation of Afterburner and Process parameters:

$$E_{device} = \frac{(M_{VOC})_{in} - (M_{VOC})_{out}}{(M_{VOC})_{in}} \times 100\% \qquad (11)$$

$$= ((30.39 - .25)/30.39) \times 100\ \%$$

E_{device} = 99.1 %

$$(M_{NMOC})_{fugitive} = (M_{NMOC})_{process} - (M_{NMOC})_{in} \qquad (12)$$

$$= (12/16.33) \times 40 - 22.3$$

$(M_{NMOC})_{fugitive}$ = 7.09 lb NMOC/hr

$$(M_{NMOC})_{overall} = (M_{NMOC})_{out} + (M_{NMOC})_{fugitive} \qquad (13)$$

$$= 0.19 + 7.09$$

$(M_{NMOC})_{overall}$ = 7.28 lb NMOC/hr

$$(M_{VOC})_{fugitive} = (M_{VOC})_{process} - (M_{VOC})_{in} \qquad (14)$$

$$= 40 - 30.39$$

$(M_{VOC})_{fugitive} = 9.61$ lb VOC/hr

$$(M_{VOC})_{overall} = (M_{VOC})_{out} + (M_{VOC})_{fugitive} \qquad (15)$$

$$= .25 + 9.61$$

$(M_{VOC})_{overall} = 9.86$ lb VOC/hr

$$(m_{Ctg})_{overall} = \frac{(M_{VOC})_{overall}}{\text{Application Rate (gal/hr)}} \qquad (7)$$

$$= \frac{9.86}{8.0}$$

$$= 1.23 \text{ lb VOC/gallon coating applied}$$

Example 2:

Given:

A source subject to Regulation 8, Rule 2, uses incineration to control non-methane organic carbon emissions. The process operates 20 hours per day.

Inlet Measurements to the Afterburner:

Q_o = 100 SDCFM
C_{TC} = 10300 ppmv
C_{CO_2} = 500 ppmv
C_{CO} = 800 ppmv
C_M < 5 ppmv

Outlet Measurements from the Afterburner:

Q_o = 500 SDCFM
C_{THC} = 500 ppmv
C_{CO} = 400 ppmv
C_M = 100 ppmv

Calculation of Afterburner Inlet parameters:

$$C_{NMOC} = C_{TC} - C_{CO2} - C_{CO} - C_M \qquad (2)$$

$$= 10300 - 500 - 800 - (<5)$$

$C_{NMOC} = 9000$ ppmv

$$M_{NMOC} = \frac{12(\text{lb C/lb-mole } C_1) \times Q_o \times C_{NMOC} \times 60 \text{ (min/hr)}}{386.9 \text{ (SDCF/lb-mole)} \times 10^6 \text{ (ppm)}} \qquad (4)$$

$$= (12 \times 100 \times 9000 \times 60)/386.9 \times 10^{6})$$

$$M_{NMOC} = 1.675 \text{ lb NMOC/hr}$$

$$M_{CO} = \frac{28(\text{lb CO/lb-mole}) \times Q_o \times C_{CO} \times 60 \text{ (min/hr)}}{386.9 \text{ (SDCF/lb-mole)} \times 10^6 \text{ (ppm)}} \qquad (6)$$

$$= (28 \times 100 \times 800 \times 60)/(386.9 \times 10^{6})$$

$$M_{CO} = 0.347 \text{ lb CO/hr}$$

Calculation of Afterburner Outlet parameters:

$$C_{NMOC} = C_{THC} - C_M \qquad (3)$$

$$= 500 - 100$$

$$C_{NMOC} = 400 \text{ ppmv}$$

$$M_{NMOC} = \frac{12(\text{lb C/lb-mole } C_1) \times Q_o \times C_{NMOC} \times 60 \text{ (min/hr)}}{386.9 \text{ (SDCF/lb-mole)} \times 10^6 \text{ (ppm)}} \qquad (4)$$

$$= (12 \times 500 \times 400 \times 60)/386.9 \times 10^{6})$$

$$M_{NMOC} = 0.372 \text{ lb NMOC/hr}$$

$$M_{CO} = \frac{28(\text{lb CO/lb-mole}) \times Q_o \times C_{CO} \times 60 \text{ (min/hr)}}{386.9 \text{ (SDCF/lb-mole)} \times 10^6 \text{ (ppm)}} \qquad (6)$$

$$= (28 \times 500 \times 400 \times 60)/(386.9 \times 10^{6})$$

$$M_{CO} = 0.868 \text{ lb CO/hr}$$

Calculation of Afterburner Efficiency:

$$E_{device} = \frac{(M_{NMOC})_{in} - (M_{NMOC})_{out} - (^{12}/_{28}) \times \{(M_{CO})_{out} - (M_{CO})_{in}\}}{(M_{NMOC})_{in}} \times 100\% \qquad (8)$$

$$= \frac{(1.675 - 0.372 - (^{12}/_{28}) \times \{(0.868 - 0.347))}{1.675} \times 100\%$$

$$E_{device} = 64.5\ \%$$

Emission Rate (lb/day) = Emission Rate (lb/hr) x Operating Time (hr/day)

= 0.372 lb NMOC / hr x 20 hr / day

= 7.44 lb NMOC/day

Example 3: Paint spray booth abated by a Charcoal Adsorber

Given:

Solvent fumes to the adsorber are primarily from methyl ethyl ketone (MEK). Material and Safety Data Sheets (MSDS) indicate that other solvents are also present, but plant operating data show their contribution is unknown and less than 10 % of the total. The coating is 5.2 lb VOC/gal and 3.0 lb solids/gal. Regulations do not allow the use of a coating with a solvent content in excess of 3.5 lb VOC/gal unless emissions are controlled to an extent equivalent to that of a compliant coating. There is no water in the coating. No dilution of gas occurs through the adsorber bed.

Estimate:

X_{VOC} = 18 lb/lb-mol (ref. sect 9.5 and Fig. 7-6)

Process Measurements:

Paint is drawn out of a one foot diameter drum at a rate of 3.0 inches per hour. 100 pieces per hour at 400 in^2 per piece are coated with paint. Quality assurance data indicate that there are 0.20 grams of solids per 4 in^2.

Inlet Measurements:

Q_o = 1000 SDCFM
C_{TC} = 2350 ppm
C_{CO} < 10 ppm
C_{CO2} = 350 ppm
C_M < 5 ppm

Outlet Measurements:

C_{THC} = 40 ppm
C_M < 5 ppm

Calculation of process parameters:

One way to calculate the volume of paint used is:
Paint Used = 3/12 ft/hr x π (1 ft^2)/4 x 7.48 gal/ft^3
Paint Used = 1.469 gph

An alternative way to calculate paint usage would be:

Paint Used = (0.2 g solids/4 in^2)x(lb/453.6 g)x(100 pieces/hr)x(400 in^2/piece)x(gal/3 lb solids)
Paint Used = 1.469 gph

$(M_{VOC})_{process}$ = 1.469 gph x 5.2 lb VOC/gal
$(M_{VOC})_{process}$ = 7.638 lb VOC/hr

Calculation of Adsorber Inlet parameters:

C_{NMOC} = 2000 ppmv

$$M_{VOC} = \frac{X_{VOC} \times Q_o \times C_{NMOC} \times 60\ (\text{min/hr})}{386.9\ (\text{SDCF/lb-mole}) \times 10^6\ (\text{ppm})} \qquad (5)$$

$= (18 \times 1000 \times 2000 \times 60)/(386.9 \times 10^6)$

M_{VOC} = 5.582 lb VOC/hr

Calculation of Adsorber Outlet parameters:

$$C_{NMOC} = C_{THC} - C_M \qquad (3)$$

C_{NMOC} = 40 ppmv

$$M_{VOC} = \frac{X_{VOC} \times Q_o \times C_{NMOC} \times 60\ (\text{min/hr})}{386.9\ (\text{SDCF/lb-mole}) \times 10^6\ (\text{ppm})} \qquad (5)$$

$= (18 \times 1000 \times 40 \times 60)/(386.9 \times 10^6)$

M_{VOC} = .112 lb VOC/hr

$$(M_{VOC})_{fugitive} = (M_{VOC})_{process} - (M_{VOC})_{in} \qquad (16)$$

= 7.638 - 5.582

$(M_{VOC})_{fugitive}$ = 1.056

Calculation of Adsorber Bed parameters:

$$E_{device} = \frac{(M_{VOC})_{in} - (M_{VOC})_{out}}{(M_{VOC})_{in}} \times 100\% \qquad (11)$$

= (5.582 - 0.112)/5.582 x 100 %

E_{device} = 98.0 %

Calculation of Emissions per gallon equivalent coating: (ref. Fig. 7-7)

Line A	= 0	There is no water in this coating
Line B	= 0	There are no exempt volatiles in this coating
Line C		Leave blank. This is not listed on the MSDS cited in this example
Line D	= 0	No water
Line E	= 0	No exempt volatiles
Line F	= 0.671	5.2 lb VOC per 8.2 lb Coating
Line G	= 7.36	There is no PNRS, therefore assign it this default value
Line H	= 6.885	MEK has a known density
Line I	= 8.2	Specified operating condition
Line J	= 5.2	F/(1/I - D/8.34 - E/G)
Line K	= 1.168	Exhaust of .112 plus fugitive of 1.056 From source test data and calculations
Line L	= 3.5	Specified in this example. Actual value will depend on which regulation applies
Line M	= 0.245	1 - J/H
Line N	= 1.469	Calculated above
Line P	= 1.469	(1 - A - B) × N
Line Q	= 0.492	1 - L/H
Line R	= 0.359	P x M
Line S	= 0.731	R/Q
Line T	= 1.60	K/S

$(m_{EQCtg})_{overall}$ = 1.60 lb VOC/gal Equivalent Coating

Example 4 Petroleum Dry Cleaner

Given:

Petroleum Dry Cleaner washes two 10 lb loads per hour. The solvent used has an average molecular weight per carbon of 14. Gases are vented to a solvent recovery dryer.

Outlet Measurements:

Q_o = 1000 SDCFM
C_{THC} = 100 ppm
C_M < 5 ppm

Calculation of Recovery Dryer Exhaust:

$$M_{VOC} = \frac{X_{VOC} \text{ x } Q_o \text{ x } C_{NMOC} \text{ x } 60 \text{ (min/hr)}}{386.9 \text{ (SDCF/lb-mole) x } 10^6 \text{ (ppm)}} \qquad (5)$$

$$= (14 \text{ x } 1000 \text{ x } 100 \text{ x } 60)/(386.9 \text{ x } 10^6)$$

M_{VOC} = 0.217 lb VOC/hr

M_{VOC} /100 kg clothes = M_{VOC}/(2 load/hr x 10 lb/load) x (5/5) x ($^{Kg/lb}/_{Kg/lb}$)

= 5 x M_{VOC} ($^{Kg}/_{lb}$)(hr) 100 Kg Clothes

M_{VOC} /100 kg clothes = 1.085 kg VOC/100 kg clothes

10. Reporting

10.1 Results shall be reported as shown in Figure 7-8.

11. Nomenclature

C_{CO} [=] Concentration of Carbon Monoxide, ppmv

C_{CO2} [=] Concentration of Carbon Dioxide, ppmv

C_{M} [=] Concentration of Methane, ppmv

C_{NMOC} [=] Concentration of Non-Methane Organic Carbon, ppmv

C_{TC} [=] Concentration of Total Carbon, ppmv

C_{THC} [=] Concentration of Total Hydorcarbons, ppmv

E_{device} [=] Efficiency with which NMOC or VOC emissions are abated by the Control Device on a mass basis, %

M_{CO} [=] Mass flow rate of CO, lbs/hr

M_{NMOC} [=] Mass flow rate of NMOC, lbs/hr

M_{VOC} [=] Mass flow rate of VOC, lbs/hr

Q_{o} [=] Volumetric Flowrate, SDCFM

X_{VOC} [=] Molecular weight of VOC per Carbon, lb VOC/lb-mol C_1

$(C_{CO})_{comb}$ [=] Apparent CO concentration measured at combustor. Non-zero only when combustor is less than 100% efficient, ppmv

$(C_{TC})_{comb}$ [=] Apparent CO_2 (Total Carbon) measured at combustor. $(C_{TC})_{Comb}$ is less than C_{TC} only when combustor is less than 100% efficient, ppmv

$(C_{THC})_{comb}$ [=] Apparent THC measured at combustor. Non-zero only when combustor is less than 100% efficient, ppmv

$(m_{Ctg})_{overall}$ [=] Mass flow rate of VOC, including fugitives, exhausted from a coating operation relative to the quantity of coating applied, lb/gal

$(m_{EQCtg})_{overall}$ [=] Mass flow rate of VOC, including fugitives, exhausted from a coating operation relative the quantity of equivalent coating used had a compliant coating been used in place of the actual coating, lb/gal

$(M_{CO})_{in}$ [=] Mass flow rate of CO at the inlet of a given abatement device, lb/hr

$(M_{CO})_{out}$ [=] Mass flow rate of CO at the outlet of a given abatement device, lb/hr

$(M_{NMOC})_{fugitives}$ [=] Mass flow rate of NMOC attributed to fugitive emissions from a given process, lb NMOC/hr

$(M_{NMOC})_{in}$ [=] Mass flow rate of NMOC at the inlet of a given abatement device, lb NMOC/hr

$(M_{NMOC})_{out}$ [=] Mass flow rate of NMOC at the outlet of a given abatement device, lb NMOC/hr

$(M_{NMOC})_{overall}$ [=] Mass flow rate of NMOC attributed to fugitive and exhausted emissions from abatement devices associated with a given process, lb NMOC/hr

$(M_{NMOC})_{process}$ [=] The calculated usage rate of NMOC based on process data, lb NMOC/hr

$(M_{VOC})_{fugitives}$ [=] Mass flow rate of organics as VOC attributed to fugitive emissions, lb VOC/hr

$(M_{VOC})_{in}$ [=] Mass flow rate of organics as VOC at the inlet of a given abatement device, lb VOC/hr

$(M_{VOC})_{out}$ [=] Mass flow rate of organics as VOC at the exhaust of a given abatement device, lb VOC/hr

$(M_{VOC})_{overall}$ [=] Mass flow rate of organics as VOC attributed to fugitive and exhausted emissions from abatement devices associated with a given process, lb VOC/hr

$(M_{VOC})_{process}$ [=] The calculated usage rate of organic compounds based on process data, lb VOC/hr

Figure 7-6: Molecular Weight and VOC Density Calculation Worksheet

	a	b	c	d	e	f	g	h
	Weight of Solvent	Weight fraction of each Component	Molecular Weight of each Component	Number of Carbons Per Component	Molecular Weight Per Carbon	Molecular Weight Fraction for each Component	VOC Density (lb/gal)	VOC Density Per Component
	*	a / a_{total}	**	**	c / d	b x e	**	b x g
A								
B								
C								
D								
E								
etc.								
Total		1.000						

Average Molecular Weight per Carbon (from total sum f) ____________________

Average Solvent Density (from total sum h) ____________________

* From Laboratory Analysis or Coating Data Sheet

** From Reference Material

Figure 7-7 Equivalent Coatings Worksheet

A) Volume fraction H_2O*, gal H_2O/gal CTG __________

B) Volume fraction PNRS*, gal PNRS/gal CTG __________

C) Volume fraction VOC*, gal VOC/gal NECTG __________

D) Weight fraction H_2O*, lb H_2O/lb CTG __________

E) Weight fraction PNRS*, lb PNRS/lb CTG __________

F) Weight fraction VOC*, lb VOC/lb CTG __________

G) Density of PNRS*, lb PNRS/gal PNRS __________
If unknown use 7.36

H) Assumed solvent density, lb VOC/gal VOC __________
If unknown use 7.36

I) Coating density*, lb CTG/gal CTG __________

J) Lb VOC/gal NECTG $J = \frac{H \times C}{1 - A - B}$ __________

or

$$J = \frac{F}{\frac{1}{I} - \frac{D}{8.34} - \frac{E}{G}}$$

K) Emission rate **, lb VOC/hr, includes fugitives __________

L) Regulation limit, lb VOC/gal EQCTG __________

M) Gal solids/gal NECTG $M = 1 - J/H$ __________

N) Application Rate **, gal CTG/hr __________

P) Gal NECTG/hr $P = N(1 - A - B)$ __________

Q) Gal solids/gal EQCTG $Q = 1 - L/H$ __________

R) Gal solids/hr $R = P \times M$ __________

S) Gal EQCTG/hr $S = R/Q$ __________

T) Lb VOC emitted/gal EQCTG, $(m_{EQCtg})_{overall}$ $T = K/S$ __________

CTG - Coating as applied
PNRS - photochemically non-reactive solvent
NECTG - non-exempt coating (excludes water and PNRS)
EQCTG - equivalent coating
* From coating data
** From source test data

Figure 7-8

Report No.: ____________ **Test Date:** ____________	**BAY AREA** **AIR QUALITY MANAGEMENT DISTRICT** **Summary of** **Source Test Results**	**Test Times:** **Run A:** ____________ **Run B:** ____________ **Run C:** ____________

Source Information		**Test Representatives**
Firm Name and Address	Firm Representative and Title Phone No. ( )	
Permit Conditions:	Source: Plant No. Permit No. Operates Hr/Day & Day/Yr.	Operating Parameters
Applicable Regulations:		

Source Test Results and Comments:

		RUN A		RUN B		RUN C		AVERAGE	
METHOD:	**TEST**	IN*	OUT*	IN	OUT	IN	OUT	IN	OUT
	Run Time,minutes								
	Sample point temperature, F								
ST-17	Stack Volume Flowrate,SDCFM								
ST-14	O_2 , percent								
ST-5	CO_2, percent								
ST-6	CO, PPM								
ST-23	H_2O, percent								
ST-7	Non-methane organic carbon, as C_1								
	a) PPM								
	b) lb/hr								
ST-7	Volatile Organic Compounds, as C_1								
	a) PPM								
	b) lb/hr								
ST-7	Abatement Efficiency, %								

* Control device inlet

** Control device outlet

Test Team Leader Date	Reviewed by Date	Approved By Date

AMEND: 340-234-0010

RULE TITLE: Definitions

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "with the exception of references to Total Reduced Sulfur" to end note.

RULE TEXT:

The definitions in OAR 340-200-0020, 340-204-0010 and this rule apply to this division. If the same term is defined in this rule and 340-200-0020 or 340-204-0010, the definition in this rule applies to this division.

(1) "Baseline emissions rate" means a source's actual emissions rate during the baseline period, as defined in OAR 340-200-0020, expressed as pounds of emissions per thousand square feet of finished product, on a 1/8" basis.

(2) "BLS" means black liquor solids, dry weight.

(3) "Continuous monitoring" means instrumental sampling of a gas stream on a continuous basis, excluding periods of calibration.

(4) "Daily arithmetic average" means the average concentration over the twenty-four hour period in a calendar day, as determined by continuous monitoring equipment or reference method testing. Determinations based on EPA reference methods using the DEQ Source Sampling Manual consist of three separate consecutive runs having a minimum sampling time of sixty minutes each and a maximum sampling time of eight hours each. [NOTE: DEQ's Source Sampling Manual is published with OAR 340-200-0035; EPA Reference Methods are found at Appendix A to 40 C.F.R. Part 60.] The three values for concentration (ppm or grains/dscf) are averaged and expressed as the daily arithmetic average which is used to determine compliance with process weight limitations, grain loading or volumetric concentration limitations and to determine daily emission rate.

(5) "Dry standard cubic meter" means the amount of gas that would occupy a volume of one cubic meter, if the gas were free of uncombined water, at a temperature of 20° C. (68° F.) and a pressure of 760 mm of mercury (29.92 inches of mercury). The corresponding English unit is dry standard cubic foot.

(6) "Kraft mill" or "mill" means any industrial operation which uses for a cooking liquor an alkaline sulfide solution containing sodium hydroxide and sodium sulfide in its pulping process.

(7) "Lime kiln" means any production device in which calcium carbonate is thermally converted to calcium oxide.

(8) "Non-condensables" mean gases and vapors, contaminated with TRS compounds, from the digestion and multiple-effect evaporation processes of a mill.

(9) "Operations" includes plant, mill, or facility.

(10) "Other sources" as used in OAR 340-234-0200 through 340-234-0270 means sources of TRS emissions in a kraft mill other than recovery furnaces, lime kilns, smelt dissolving tanks, sewers, drains, categorically insignificant activities and wastewater treatment facilities including but not limited to:

(a) Vents from knotters, brown stock washing systems, evaporators, blow tanks, blow heat accumulators, black liquor storage tanks, black liquor oxidation system, pre-steaming vessels, tall oil recovery operations; and

(b) Any vent which is shown to contribute to an identified nuisance condition.

(11) "Production" as used in OAR 340-234-0200 through 340-234-0270 means the daily amount of air-dried unbleached pulp, or equivalent, produced during the 24-hour period each calendar day, or DEQ approved equivalent period, and expressed in air-dried metric tons (admt) per day. The corresponding English unit is air-dried tons (adt) per day;

(12) "Recovery furnace" means the combustion device in which dissolved wood solids are incinerated and pulping chemicals recovered from the molten smelt. For OAR 340-234-0200 through 340-234-0270, this term includes a direct contact evaporator, if present.

(13) "Recovery system" means the process by which all or part of the cooking chemicals may be recovered, and cooking liquor regenerated from spent cooking liquor, including evaporation, combustion, dissolving, fortification, and storage facilities associated with the recovery cycle.

(14) "Smelt dissolving tank vent" means the vent serving the vessel used to dissolve the molten smelt produced by the

recovery furnace.
(15) "Special problem area" means the formally designated Portland, Eugene-Springfield, and Medford AQMAs and other specifically defined areas that the EQC may formally designate in the future. The purpose of such designation will be to assign more stringent emission limits as may be necessary to attain and maintain ambient air standards or to protect the public health or welfare.
(16) "Tempering oven" means any facility used to bake hardboard following an oil treatment process.
(17) "Wigwam waste burner" means a burner which consists of a single combustion chamber, has the general features of a truncated cone, and is used for incineration of wastes.
[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040 with the exception of references to Total Reduced Sulfur.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025

STATUTES/OTHER IMPLEMENTED: ORS 468A.025

AMEND: 340-234-0210

RULE TITLE: Kraft Pulp Mills: Emission Limitations

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Updating rule end note.
Adding (5) "(5) Emissions from each kraft mill source with specific particulate emission limits included in this rule are exempt the grain loading emission limits in OAR chapter 340, division 226 and division 228 and the opacity limits in OAR chapter 340, division 208."

RULE TEXT:
(1) Emission of Total Reduced Sulfur (TRS):
(a) Recovery Furnaces:
(A) The emissions of TRS from each recovery furnace placed in operation before January 1, 1969, may not exceed:
(i) 10 ppm as daily arithmetic average; and
(ii) 0.15 Kg/metric ton (0.30 pound/ton) of production as a daily arithmetic average;
(B) TRS emissions from each recovery furnace placed in operation after January 1, 1969, and before September 25, 1976, or any recovery furnace modified significantly after January 1, 1969, and before September 25, 1976, to expand production must be controlled such that the emissions of TRS may not exceed:
(i) 5 ppm as a daily arithmetic average; and
(ii) 0.075 Kg/metric ton (0.150 pound/ton) of production as a daily arithmetic average.
(b) Lime Kilns. This subsection applies to those sources where construction was initiated prior to September 25, 1976. Lime kilns must be operated and controlled such that emissions of TRS may not exceed:
(A) 20 ppm as a daily arithmetic average; and
(B) 0.05 Kg/metric ton (0.10 pound/ton) of production as a daily arithmetic average.
(c) Smelt Dissolving Tanks. TRS emissions from each smelt dissolving tank may not exceed 0.0165 gram/Kg BLS (0.033 pound/ton BLS) as a daily arithmetic average.
(d) Non-Condensables. Non-condensables from digesters, multiple-effect evaporators and contaminated condensate stripping must be continuously treated to destroy TRS gases by thermal incineration in a lime kiln or incineration device capable of subjecting the non-condensables to a temperature of not less than 650° C. (1,200° F.) for not less than 0.3 second. An alternate device meeting the above requirements must be available in the event adequate incineration in the primary device cannot be accomplished. Venting of TRS gases during changeover must be minimized but in no case may the time exceed one-hour.
(e) Other Sources:
(A) The total emission of TRS from other sources may not exceed 0.078 Kg/metric ton (0.156 pound/ton) of production as a daily arithmetic average;
(B) Miscellaneous Sources and Practices. If DEQ determines that sewers, drains, and anaerobic lagoons significantly contribute to an odor problem, a program for control will be required.
(2) Particulate Matter:
(a) Recovery Furnaces. The emissions of particulate matter from each recovery furnace stack may not exceed:
(A) 2.0 kilograms per metric ton (4.0 pounds per ton) of production as a daily arithmetic average;
(B) 0.30 gram per dry standard cubic meter (0.13 grain per dry standard cubic foot) as a daily arithmetic average; and
(C) Thirty-five percent opacity for a period or periods aggregating more than 30 minutes in any 180 consecutive minutes or more than 60 minutes in any 24 consecutive hours (excluding periods when the facility is not operating).
(b) Lime Kilns. The emissions of particulate matter from each lime kiln stack may not exceed:
(A) 0.50 kilogram per metric ton (1.00 pound per ton) of production as a daily arithmetic average;
(B) 0.46 gram per dry standard cubic meter (0.20 grain per dry standard cubic foot) as a daily arithmetic average; and
(C) The visible emission limitations in section (4);
(c) Smelt Dissolving Tanks. The emission of particulate matter from each smelt dissolving tank vent may not exceed:

(A) A daily arithmetic average of 0.25 kilogram per metric ton (0.50 pound per ton) of production; and

(B) The visible emission limitations in section (4).

(d) Replacement of or modification or a rebuild of an existing particulate pollution control device for which a capital expenditure of 50 percent or more of the replacement cost of the existing device is required, other than ongoing routine maintenance, after July 1, 1988 will result in more restrictive standards as follows:

(A) Recovery Furnaces:

(i) The emission of particulate matter from each affected recovery furnace stack may not exceed 1.00 kilogram per metric ton (2.00 pounds per ton) of production as a daily arithmetic average; and

(ii) 0.10 gram per dry standard cubic meter (0.044 grain per dry standard cubic foot) as a daily arithmetic average.

(B) Lime Kilns:

(i) The emission of particulate matter from each affected lime kiln stack may not exceed 0.25 kilogram per metric ton (0.50 pound per ton) of production as a daily arithmetic average; and

(ii) 0.15 gram per dry standard cubic meter (0.067 grain per dry standard cubic foot) as a daily arithmetic average when burning gaseous fossil fuel; or

(iii) 0.50 kilogram per metric ton (1.00 pound per ton) of production as a daily arithmetic average; and

(iv) 0.30 gram per dry standard cubic meter 0.13 grain per dry standard cubic foot) as a daily arithmetic average when burning liquid fossil fuel.

(C) Smelt Dissolving Tanks. The emissions of particulate matter from each smelt dissolving tank vent may not exceed 0.15 kilogram per metric ton (0.30 pound per ton) of production as a daily arithmetic average.

(3) Sulfur Dioxide (SO2). Emissions of sulfur dioxide from each recovery furnace stack may not exceed a three-hour arithmetic average of 300 ppm on a dry-gas basis except when burning fuel oil. The sulfur content of fuel oil used must not exceed the sulfur content of residual and distillate oil established in OAR 340-228-0100 and 340-228-0110, respectively.

(4) Emissions from each kraft mill source, with the exception of the mill’s emissions attributable to a recovery furnace, may not equal or exceed 20 percent opacity as a six minute average.

(5) Emissions from each kraft mill source with specific particulate emission limits included in this rule are exempt the grain loading emission limits in OAR chapter 340, division 226 and division 228 and the opacity limits in OAR chapter 340, division 208.

(6) New Source Performance Standards. New or modified sources that commenced construction after September 24, 1976, are subject to each provision of this rule and the New Source Performance Standards, 40 CFR part 60 subpart BB as adopted under OAR 340-238-0060, whichever is more stringent.

[NOTE: This rule is included in the State of Oregon Clean Air Act Implementation Plan that EQC adopted under OAR 340-200-0040 with the exception of references to Total Reduced Sulfur.]

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025

STATUTES/OTHER IMPLEMENTED: ORS 468A.025

AMEND: 340-236-8010

RULE TITLE: Hot Mix Asphalt Plants: Table-Process Weight Table

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Changing rule name from "Solid Waste Landfills" to "Hot Mix Asphalt Plants".

RULE TEXT:

This rule contains the Process Weight Table.

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025, 468A.070

STATUTES/OTHER IMPLEMENTED: ORS 468A.025, 468A.070

OAR 340-236-8010
Process Weight Table

Process Wt/hr (lbs)	Maximum Weight Discharge/hr (lbs)	Process Wt/hr (lbs)	Maximum Weight Discharge/hr (lbs)
50	0.24	3400	5.44
100	0.46	3500	5.52
150	0.66	3600	5.61
200	0.85	3700	5.69
250	1.03	3800	5.77
300	1.20	3900	5.85
350	1.35	4000	5.93
400	1.50	4100	6.01
450	1.63	4200	6.08
500	1.77	4300	6.15
550	1.89	4400	6.22
600	2.01	4500	6.30
650	2.12	4600	6.37
700	2.24	4700	6.45
750	2.34	4800	6.52
800	2.43	4900	6.60
850	2.53	5000	6.67
900	2.62	5500	7.03
950	2.72	6000	7.37
1000	2.80	6500	7.71

OAR 340-236-8010
Process Weight Table

Process Wt/hr (lbs)	Maximum Weight Discharge/hr (lbs)	Process Wt/hr (lbs)	Maximum Weight Discharge/hr (lbs)
1100	2.97	7000	8.05
1200	3.12	7500	8.39
1300	3.26	8000	8.71
1400	3.40	8500	9.03
1500	3.54	9000	9.36
1600	3.66	9500	9.67
1700	3.79	10000	10.00
1800	3.91	11000	10.63
1900	4.03	12000	11.28
2000	4.14	13000	11.89
2100	4.24	14000	12.50
2200	4.34	15000	13.13
2300	4.44	16000	13.74
2400	4.55	17000	14.36
2500	4.64	18000	14.97
2600	4.74	19000	15.58
2700	4.84	20000	16.19
2800	4.92	30000	22.22
2900	5.02	40000	28.30
3000	5.10	50000	34.30

OAR 340-236-8010
Process Weight Table

Process Wt/hr (lbs)	Maximum Weight Discharge/hr (lbs)	Process Wt/hr (lbs)	Maximum Weight Discharge/hr (lbs)
3100	5.18	600000	40.00
3200	5.27	Or	
3300	5.36	More	

AMEND: 340-238-0030

RULE TITLE: Applicability

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Removing "340-238-0050" from division applicability.

RULE TEXT:

This division applies to stationary sources subject to 40 CFR Part 60 as adopted under OAR 340-238-0060.

STATUTORY/OTHER AUTHORITY: ORS 468A

STATUTES/OTHER IMPLEMENTED: ORS 468, 468A

AMEND: 340-238-0040

RULE TITLE: Definitions

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Specifying November 2016 edition of Internal Revenue Service (IRS) Publication 534

RULE TEXT:

The definitions in OAR 340-200-0020 and this rule apply to this division. If the same term is defined in this rule and 340-200-0020, the definition in this rule applies to this division.

(1) "Administrator" means the Administrator of the EPA or authorized representative.

(2) "Affected facility" means, with reference to a stationary source, any apparatus to which a standard is applicable.

(3) "Capital expenditures" means an expenditure for a physical or operational change to an existing facility that exceeds the product of the applicable "annual asset guideline repair allowance percentage" specified in the December 1984 edition of Internal Revenue Service (IRS) Publication 534 and the existing facility's basis, as defined by section 1012 of the Internal Revenue Code. However, the total expenditure for a physical or operational change to an existing facility must not be reduced by any "excluded additions" as defined in IRS Publication 534, as would be done for tax purposes.

(4) "C.F.R." means the July 1, 2020 edition Code of Federal Regulations unless otherwise identified.

(5) "Closed municipal solid waste landfill" (closed landfill) means a landfill in which solid waste is no longer being placed, and in which no additional solid wastes will be placed without first filing a notification of modification as prescribed under 40 C.F.R. 60.7(a)(4). Once a notification of modification has been filed, and additional solid waste is placed in the landfill, the landfill is no longer closed.

(6) "Commenced", with respect to the definition of "new source" in section 111(a)(2) of the federal Clean Air Act, means that an owner or operator has undertaken a continuous program of construction or modification or that an owner or operator has entered into a contractual obligation to undertake and complete, within a reasonable time, a continuous program of construction or modification.

(7) "Existing municipal solid waste landfill" (existing landfill) means a municipal solid waste landfill that began construction, reconstruction or modification before 5/30/91 and has accepted waste at any time since 11/08/87 or has additional design capacity available for future waste deposition.

(8) "Existing facility", with reference to a stationary source, means any apparatus of the type for which a standard is promulgated in 40 C.F.R. Part 60, and the construction or modification of which commenced before the date of proposal by EPA of that standard; or any apparatus that could be altered in such a way as to be of that type.

(9) "Fixed capital cost" means the capital needed to provide all the depreciable components.

(10) "Large municipal solid waste landfill" (large landfill) means a municipal solid waste landfill with a design capacity greater than or equal to 2.5 million megagrams or 2.5 million cubic meters.

(11) "Modification:"

(a) except as provided in subsection (b) of this section, means any physical change in, or change in the method of operation of, an existing facility that increases the amount of any air pollutant (to which a standard applies) emitted into the atmosphere by that facility or that results in the emission of any air pollutant (to which a standard applies) into the atmosphere not previously emitted;

(b) As used in OAR 340-238-0100 means an action that results in an increase in the design capacity of a landfill.

(12) "Municipal solid waste landfill" (landfill) means an entire disposal facility in a contiguous geographical space where household waste is placed in or on land. A municipal solid waste landfill may also receive other types of RCRA Subtitle D wastes such as commercial solid waste, nonhazardous sludge, conditionally exempt small quantity generator waste, and industrial solid waste. Portions of a municipal solid waste landfill may be separated by access roads and may be publicly or privately owned. A municipal solid waste landfill may be a new municipal solid waste landfill, an existing municipal solid waste landfill, or a lateral expansion (modification).

(13) "New municipal solid waste landfill" (new landfill) means a municipal solid waste landfill that began construction, reconstruction or modification or began accepting waste on or after 5/30/91.

(14) "Reconstruction" means the replacement of components of an existing facility to such an extent that:

(a) The fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable entirely new facility; and

(b) It is technologically and economically feasible to meet the applicable standards set forth in 40 C.F.R. Part 60.

(15) "Reference method" means any method of sampling and analyzing for an air pollutant as specified in 40 C.F.R. Part 60.

(16) "Small municipal solid waste landfill" (small landfill) means a municipal solid waste landfill with a design capacity less than 2.5 million megagrams or 2.5 million cubic meters.

(17) "Standard" means a standard of performance proposed or promulgated under 40 C.F.R. Part 60.

(18) "State Plan" means a plan developed for the control of a designated pollutant provided under 40 C.F.R. Part 60.

STATUTORY/OTHER AUTHORITY: ORS 468.020

STATUTES/OTHER IMPLEMENTED: ORS 468A.025

AMEND: 340-238-0070

RULE TITLE: Compliance

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Changing OAR reference from 340-238-0050 to 0060.

RULE TEXT:

Compliance with standards set forth in this division shall be determined by performance tests and monitoring methods as set forth in the Federal Regulation adopted by reference in OAR 340-238-0060.

STATUTORY/OTHER AUTHORITY: ORS 468, 468A

STATUTES/OTHER IMPLEMENTED: ORS 468A.025

AMEND: 340-238-0080

RULE TITLE: More Restrictive Regulations

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Adding "the federal regulation applies. Direct conflict means that compliance with the state rule creates noncompliance with a federal regulation." to the applicability.

RULE TEXT:

If at any time there is a direct conflict between this division or regional authority rules and the Federal Regulation (40 CFR, Part 60), the federal regulation applies. Direct conflict means that compliance with the state rule creates noncompliance with a federal regulation.

STATUTORY/OTHER AUTHORITY: ORS 468, 468A

STATUTES/OTHER IMPLEMENTED: ORS 468A.025

AMEND: 340-244-0040

RULE TITLE: General Provisions for Stationary Sources: List of Hazardous Air Pollutants

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Amending the attached table to include "1-bromopropane (1-BP)"

RULE TEXT:

For purposes of this division the EQC adopts by reference the pollutants, including groups of substances and mixtures, listed in section 112(b), as Hazardous Air Pollutants (Table 1).

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468A.025

STATUTES/OTHER IMPLEMENTED: ORS 468A.025

OAR 340-244-0040

Table 1

LIST OF HAZARDOUS AIR POLLUTANTS

CAS Number	Chemical Name
75-07-0	Acetaldehyde
60-35-5	Acetamide
75-05-8	Acetonitrile
98-86-2	Acetophenone
53-96-3	2-Acetylaminofluorene
107-02-8	Acrolein
79-06-1	Acrylamide
79-10-7	Acrylic acid
107-13-1	Acrylonitrile
107-05-1	Allyl chloride
92-67-1	4-Aminobiphenyl
62-53-3	Aniline
90-04-0	o-Anisidine
1332-21-4	Asbestos
71-43-2	Benzene (including benzene from gasoline)
92-87-5	Benzidine
98-07-7	Benzotrichloride
100-44-7	Benzyl chloride
92-52-4	Biphenyl
117-81-7	Bis(2-ethylhexyl) phthalate (DEHP)
542-88-1	Bis(chloromethyl)ether
75-25-2	Bromoform
106-94-5	1-bromopropane (1-BP)

OAR 340-244-0040

Table 1

LIST OF HAZARDOUS AIR POLLUTANTS

CAS Number	Chemical Name
106-99-0	1,3-Butadiene
156-62-7	Calcium cyanamide
133-06-2	Captan
63-25-2	Carbaryl
75-15-0	Carbon disulfide
56-23-5	Carbon tetrachloride
463-58-1	Carbonyl sulfide
120-80-9	Catechol
133-90-4	Chloramben
57-74-9	Chlordane
7782-50-5	Chlorine
79-11-8	Chloroacetic acid
532-27-4	2-Chloroacetophenone
108-90-7	Chlorobenzene
510-15-6	Chlorobenzilate
67-66-3	Chloroform
107-30-2	Chloromethyl methyl ether
126-99-8	Chloroprene
1319-77-3	Cresols/Cresylic acid (isomers and mixture)
95-48-7	o-Cresol
108-39-4	m-Cresol
106-44-5	p-Cresol
98-82-8	Cumene
94-75-7	2,4-D, salts and esters
3547-04-4	DDE
334-88-3	Diazomethane
132-64-9	Dibenzofurans

OAR 340-244-0040

Table 1

LIST OF HAZARDOUS AIR POLLUTANTS

CAS Number	Chemical Name
96-12-8	1,2-Dibromo-3-chloropropane
84-74-2	Dibutylphthalate
106-46-7	1,4-Dichlorobenzene(p)
91-94-1	3,3-Dichlorobenzidene
111-44-4	Dichloroethyl ether (Bis(2-chloroethyl)ether)
542-75-6	1,3-Dichloropropene
62-73-7	Dichlorvos
111-42-2	Diethanolamine
121-69-7	N,N-Diethyl aniline (N,N-Dimethylaniline)
64-67-5	Diethyl sulfate
119-90-4	3,3-Dimethoxybenzidine
60-11-7	Dimethyl aminoazobenzene
119-93-7	3,3’-Dimethyl benzidine
79-44-7	Dimethyl carbamoyl chloride
68-12-2	Dimethyl formamide
57-14-7	1,1-Dimethyl hydrazine
131-11-3	Dimethyl phthalate
77-78-1	Dimethyl sulfate
534-52-1	4,6-Dinitro-o-cresol, and salts
51-28-5	2,4-Dinitrophenol
121-14-2	2,4-Dinitrotoluene
123-91-1	1,4-Dioxane (1,4-Diethyleneoxide)
122-66-7	1,2-Diphenylhydrazine
106-89-8	Epichlorohydrin (l-Chloro-2,3-epoxypropane)
106-88-7	1,2-Epoxybutane
140-88-5	Ethyl acrylate
100-41-4	Ethyl benzene
51-79-6	Ethyl carbamate (Urethane)
75-00-3	Ethyl chloride (Chloroethane)

OAR 340-244-0040

Table 1

LIST OF HAZARDOUS AIR POLLUTANTS

CAS Number	Chemical Name
106-93-4	Ethylene dibromide (Dibromoethane)
107-06-2	Ethylene dichloride (1,2-Dichloroethane)
107-21-1	Ethylene glycol
151-56-4	Ethylene imine (Aziridine)
75-21-8	Ethylene oxide
96-45-7	Ethylene thiourea
75-34-3	Ethylidene dichloride (1,1-Dichloroethane)
50-00-0	Formaldehyde
76-44-8	Heptachlor
118-74-1	Hexachlorobenzene
87-68-3	Hexachlorobutadiene
77-47-4	Hexachlorocyclopentadiene
67-72-1	Hexachloroethane
822-06-0	Hexamethylene-1,6-diisocyanate
680-31-9	Hexamethylphosphoramide
110-54-3	Hexane
302-01-2	Hydrazine
7647-01-0	Hydrochloric acid
7664-39-3	Hydrogen fluoride (Hydrofluoric acid)
123-31-9	Hydroquinone
78-59-1	Isophorone
58-89-9	Lindane (all isomers)
108-31-6	Maleic anhydride
67-56-1	Methanol
72-43-5	Methoxychlor
74-83-9	Methyl bromide (Bromomethane)
74-87-3	Methyl chloride (Chloromethane)
71-55-6	Methyl chloroform (1,1,1-Trichloroethane)
60-34-4	Methyl hydrazine

OAR 340-244-0040

Table 1

LIST OF HAZARDOUS AIR POLLUTANTS

CAS Number	Chemical Name
74-88-4	Methyl iodide (Iodomethane)
108-10-1	Methyl isobutyl ketone (Hexone)
624-83-9	Methyl isocyanate
80-62-6	Methyl methacrylate
1634-04-4	Methyl tert butyl ether
101-14-4	4,4-Methylene bis(2-chloroaniline)
75-09-2	Methylene chloride (Dichloromethane)
101-68-8	Methylene diphenyl diisocyanate (MDI)
101-77-9	4,4-Methylenedianiline
91-20-3	Naphthalene
98-95-3	Nitrobenzene
92-93-3	4-Nitrobiphenyl
100-02-7	4-Nitrophenol
79-46-9	2-Nitropropane
684-93-5	N-Nitroso-N-methylurea
62-75-9	N-Nitrosodimethylamine
59-89-2	N-Nitrosomorpholine
56-38-2	Parathion
82-68-8	Pentachloronitrobenzene (Quintobenzene)
87-86-5	Pentachlorophenol
108-95-2	Phenol
106-50-3	p-Phenylenediamine
75-44-5	Phosgene
7803-51-2	Phosphine
7723-14-0	Phosphorus
85-44-9	Phthalic anhydride
1336-36-3	Polychlorinated biphenyls (Aroclors)
1120-71-4	1,3-Propane sultone
57-57-8	beta-Propiolactone

OAR 340-244-0040

Table 1

LIST OF HAZARDOUS AIR POLLUTANTS

CAS Number	Chemical Name
123-38-6	Propionaldehyde
114-26-1	Propoxur (Baygon)
78-87-5	Propylene dichloride (1,2-Dichloropropane)
75-56-9	Propylene oxide
75-55-8	1,2-Propylenimine (2-Methyl aziridine)
91-22-5	Quinoline
106-51-4	Quinone
100-42-5	Styrene
96-09-3	Styrene oxide
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin
79-34-5	1,1,2,2-Tetrachloroethane
127-18-4	Tetrachloroethylene (Perchloroethylene)
7550-45-0	Titanium tetrachloride
108-88-3	Toluene
95-80-7	2,4-Toluene diamine
584-84-9	2,4-Toluene diisocyanate
95-53-4	o-Toluidine
8001-35-2	Toxaphene (chlorinated camphene)
120-82-1	1,2,4-Trichlorobenzene
79-00-5	1,1,2-Trichloroethane
79-01-6	Trichloroethylene
95-95-4	2,4,5-Trichlorophenol
88-06-2	2,4,6-Trichlorophenol
121-44-8	Triethylamine
1582-09-8	Trifluralin
540-84-1	2,2,4-Trimethylpentane
108-05-4	Vinyl acetate
593-60-2	Vinyl bromide
75-01-4	Vinyl chloride

OAR 340-244-0040

Table 1

LIST OF HAZARDOUS AIR POLLUTANTS

CAS Number	Chemical Name
75-35-4	Vinylidene chloride (1,1-Dichloroethylene)
1330-20-7	Xylenes (isomers and mixture)
95-47-6	o-Xylenes
108-38-3	m-Xylenes
106-42-3	p-Xylenes
0	Antimony Compounds
0	Arsenic Compounds (inorganic including arsine)
0	Beryllium Compounds
0	Cadmium Compounds
0	Chromium Compounds
0	Cobalt Compounds
0	Coke Oven Emissions
0	Cyanide Compounds[1]
0	Glycol ethers[2]
0	Lead Compounds
0	Manganese Compounds
0	Mercury Compounds
0	Fine mineral fibers[3]
0	Nickel Compounds
0	Polycyclic Organic Matter[4]
0	Radionuclides (including radon)[5]
0	Selenium Compounds

NOTE: *For all listings above that contain the word "compounds" and for glycol ethers, the following applies:* Unless otherwise specified, these listings are defined as including any unique chemical substance that contains the named chemical (i.e., antimony, arsenic, etc.) as part of that chemical's infrastructure.

*1 X'CN where X = H' or any other group where a formal dissociation may occur. For example KCN or $Ca(CN)_2$

*2 Glycol ethers include mono- and di-ethers of ethylene glycol, diethylene glycol, and triethylene glycol $R\text{-}(OCH_2CH_2)_n\text{-}OR'$.

Where:

n = 1, 2, or 3;

R = alkyl C7 or less; or

R = phenyl or alkyl substituted phenyl;

R' = H, or alkyl C7 or less; or

OR' consisting of carboxylic acid ester, sulfate, phosphate, nitrate, or sulfonate. Does not include ethylene glycol monobutyl ether (EGBE, 2-Butoxyethanol)(CAS No. 111-76-2).

*3 Includes mineral fiber emissions from facilities manufacturing or processing glass, rock, or slag fibers (or other mineral derived fibers) of average diameter 1 micrometer or less.

*4 Includes organic compounds with more than one benzene ring, and which have a boiling point greater than or equal to 100°C.

*5 A type of atom which spontaneously undergoes radioactive decay.

AMEND: 340-245-0060

RULE TITLE: Toxics Emissions Units

NOTICE FILED DATE: 05/24/2022

RULE SUMMARY: Changing "emit toxic air contaminants" to "materially contribute risk" in (3)(a).

RULE TEXT:

(1) TEU Designation. An owner or operator must designate TEUs in the same manner as the owner or operator designated emissions units listed in a source's operating or construction permit, if they are designated, unless the owner or operator requests a different designation in writing and DEQ approves that request in writing. The request for a new or a different TEU designation must be compatible with the following:

(a) TEUs may not be designated in such a way as to avoid the requirements of this division;

(b) An individual emissions-producing activity that exhausts through multiple stacks or openings must be designated as an individual TEU;

(c) Where multiple emissions-producing activities exhaust through a common opening, exhaust stack or emissions control device, all of these emissions producing activities may be considered a single TEU or may be considered separate TEUs;

(d) The list of TEUs should not be limited to what is listed in a source's operating or construction permit but should include all processes and activities that emit toxic air contaminants; and

(e) DEQ may require the owner or operator to designate TEUs differently than as listed in the source's operating or construction permit, if DEQ determines such listing is appropriate to meet the purposes of this division.

(2) Aggregated TEUs.

(a) An owner or operator must designate the same TEUs as aggregated TEUs for all of the different types of risk: excess cancer risk, chronic noncancer risk and acute noncancer risk.

(b) An owner or operator may choose to assign risk from aggregated TEUs based on either:

(A) The applicable Aggregate TEU Level in OAR 340-245-8010 Table 1; or

(B) The modeled risk from the approved risk assessment.

(c) An owner or operator must request approval to change any aggregated TEU designation after the source's aggregated TEUs have been designated in a risk assessment approved by DEQ.

(d) An owner or operator may request approval to construct a new aggregated TEU or modify an existing aggregated TEU, following the procedures in section (4) if the total risk from the aggregated TEUs, including the new or modified TEU, remains less than or equal to the applicable Aggregate TEU Level in OAR 340-245-8010 Table 1.

(3) Exempt TEUs. A TEU is an exempt TEU if it meets the criteria in subsection (a) or (b):

(a) The owner or operator of the TEU has demonstrated that the TEU is not likely to materially contribute risk and DEQ approves such demonstration. The demonstration may include any information the owner or operator considers relevant, including but not limited to:

(A) The chemical make-up of the materials handled or processed in the TEU as provided by Environmental, Safety, or Product Data Sheets, or equivalent documents; and

(B) Whether or not the handling or processing of materials in the TEU is likely to alter the chemical make-up of the materials and the chemical make-up or likely chemical make-up of the materials emitted by the TEU.

(b) The TEU is one of the following regulated pollutant emitting activities, principally supporting the source or the major industrial group:

(A) Evaporative and tailpipe emissions from on-site motor vehicle operation;

(B) Distillate oil, kerosene, gasoline, natural gas or propane burning equipment, provided the aggregate expected actual emissions of the equipment identified does not exceed the de minimis level for any regulated pollutant, based on the expected maximum annual operation of the equipment. If a source's expected emissions from all such equipment exceed the de minimis levels, then the source may identify a subgroup of such equipment as an exempt TEU with the remainder not designated as an exempt TEU. The following equipment may never be included as part of the exempt

TEU:

(i) Any individual distillate oil, kerosene or gasoline burning equipment with a rating greater than 0.4 million Btu/hour; and

(ii) Any individual natural gas or propane burning equipment with a rating greater than 2.0 million Btu/hour.

(C) Distillate oil, kerosene, gasoline, natural gas or propane burning equipment brought on site for six months or less for maintenance, construction or similar purposes, such as but not limited to generators, pumps, hot water pressure washers and space heaters, provided that any such equipment that performs the same function as the permanent equipment, must be operated within the source's existing PSEL;

(D) Office activities;

(E) Food service activities;

(F) Janitorial activities;

(G) Personal care activities;

(H) Groundskeeping activities including, but not limited to, building painting and road and parking lot maintenance;

(I) On-site laundry activities;

(J) On-site recreation facilities;

(K) Instrument calibration;

(L) Automotive storage garages;

(M) Refrigeration systems with less than 50 pounds of charge of ozone depleting substances regulated under Title VI, including pressure tanks used in refrigeration systems but excluding any combustion equipment associated with such systems;

(N) Bench scale laboratory equipment and laboratory equipment used exclusively for chemical and physical analysis, including associated vacuum producing devices but excluding research and development facilities;

(O) Temporary construction activities;

(P) Warehouse activities;

(Q) Accidental fires and fire suppression;

(R) Air vents from air compressors;

(S) Air purification systems;

(T) Continuous emissions monitoring vent lines;

(U) Demineralized water tanks;

(V) Pre-treatment of municipal water, including use of deionized water purification systems;

(W) Electrical charging stations;

(X) Fire brigade training;

(Y) Instrument air dryers and distribution;

(Z) Fully enclosed process raw water filtration systems;

(AA) Electric motors;

(BB) Pressurized tanks containing gaseous compounds that do not contain toxic air contaminants;

(CC) Vacuum sheet stacker vents;

(DD) Emissions from wastewater discharges to publicly owned treatment works (POTW) provided the source is authorized to discharge to the POTW, not including on-site wastewater treatment and/or holding facilities;

(EE) Log ponds;

(FF) Stormwater settling basins;

(GG) Paved roads and paved parking lots within an urban growth boundary;

(HH) Hazardous air pollutant emissions in fugitive dust from paved and unpaved roads except for those sources that have processes or activities that contribute to the deposition and entrainment of hazardous air pollutants from surface soils;

(II) Health, safety, and emergency response activities;

(JJ) Non-diesel, compression ignition emergency generators and pumps used only during loss of primary equipment or utility service due to circumstances beyond the reasonable control of the owner or operator, or to address a power emergency, provided that the aggregate horsepower rating of all stationary emergency generator and pump engines is not more than 3,000 horsepower. If the aggregate horsepower rating of all stationary emergency generator and pump engines is more than 3,000 horsepower, then no emergency generators and pumps at the source may be considered categorically insignificant;

(KK) Non-contact steam vents and leaks and safety and relief valves for boiler steam distribution systems;

(LL) Non-contact steam condensate flash tanks;

(MM) Non-contact steam vents on condensate receivers, deaerators and similar equipment;

(NN) Boiler blowdown tanks; and

(OO) Ash piles maintained in a wetted condition and associated handling systems and activities.

(4) New or modified TEU requirements.

(a) The owner or operator of a source that has not been notified in writing by DEQ that they are required to submit a risk assessment and that proposes to construct a new or modified TEU must comply with OAR 340-210-0205 through 340-210-0250 before beginning construction of the new or modified TEU;

(b) The owner or operator of a source that has been notified in writing by DEQ that they are required to submit a risk assessment but has not yet been issued a Toxic Air Contaminant Permit Addendum or an operating permit in compliance with this division and that proposes to construct a new or modified TEU must do the following before beginning construction of the new or modified TEU:

(A) Comply with OAR 340-210-0205 through 340-210-0250; and

(B) Revise and update any materials submitted to date under OAR 340-245-0050 to include the new or modified TEU by a date certain.

(c) The owner or operator of a source that previously has been issued a Toxic Air Contaminant Permit Addendum or an operating permit in compliance with this division and that proposes to construct a new or modified TEU must follow the applicable procedures in paragraphs (c)(A) through (C) and must pay to DEQ all applicable specific activity fees under OAR 340-216-8020 Table 2 Part 4 and OAR 340-216-8030 Table 3.

(A) New or modified exempt TEUs. If the proposed new or modified exempt TEU is subject to National Emission Standards for Hazardous Air Pollutants or New Source Performance Standards requirements, then the owner or operator must request approval of a new or modified exempt TEU under this rule and under OAR 340-210-0205 through 340-210-0250;

(B) New or modified aggregated TEUs.

(i) The owner or operator must request approval of a new or modified TEU to be an aggregated TEU by demonstrating that the risk from the aggregated TEUs, including the new or modified TEU, will be less than or equal to the Aggregate TEU Level. The owner or operator may use any risk assessment procedure, Level 1 through Level 4, under OAR 340-245-0050(8) through (11).

(ii) If the current aggregated TEUs are permitted at the modeled risk levels as specified in OAR 340-245-0060(2)(b)(B), the owner or operator may add the risk from the new or modified aggregated TEU to prior results from the latest risk assessment for the source rather than updating the entire risk assessment for the source.

(iii) The owner or operator must request approval of a new or modified aggregated TEU by submitting an application to modify its Toxic Air Contaminant Permit Addendum or operating permit as required under OAR 340-245-0100(8).

(iv) The owner or operator of a proposed new or modified aggregate TEU may not begin construction until DEQ has issued a Toxic Air Contaminant Permit Addendum or an operating permit that approves the TEU;

(C) New or modified significant TEUs.

(i) The owner or operator must request approval of a new or modified significant TEU by submitting an application to modify its Toxic Air Contaminant Permit Addendum or operating permit that includes the following:

(I) Information necessary to assess the risk from the new or modified significant TEU using any risk assessment procedure, Level 1 through Level 4, under OAR 340-245-0050(8) through (11). The owner or operator may add the risk from the new or modified TEU to prior results from the latest risk assessment for the source rather than updating the

entire risk assessment for the source; and
(II) Information necessary to verify that the new or modified significant TEU meets TLAER, if the source risk is greater than the TLAER Level for a new or reconstructed source, or meets TBACT, if the source risk is greater than the TBACT Level for an existing source using procedures under OAR 340-245-0220;
(ii) The owner or operator of a proposed new or modified significant TEU may not begin construction of the new or modified significant TEU until DEQ has issued a Toxic Air Contaminant Permit Addendum or an operating permit that approves the TEU;
(iii) If a source that was previously determined to be an exempt source under OAR 340-245-0050(6) or a de minimis source under OAR 340-245-0050(7) will no longer be an exempt or a de minimis source after the new or modified significant TEU is constructed, the owner or operator must follow the procedures in this section and apply for a Toxic Air Contaminant Permit Addendum under OAR 340-245-0100. Such an owner or operator may not begin construction of the new or modified significant TEU until DEQ has issued a Toxic Air Contaminant Permit Addendum or an operating permit that approves the TEU; and
(iv) In conjunction with seeking authorization for the construction of a new or modified significant TEU, if the owner or operator makes simultaneous changes to existing TEUs other than the new or modified significant TEU for the purpose of reducing source risk, then the owner or operator may not begin operation of the new or modified significant TEU until DEQ has issued a Toxic Air Contaminant Permit Addendum or operating permit that approves all such changes to the other TEUs;
(d) DEQ will not approve an application for a Toxic Air Contaminant Permit Addendum required under this rule for a new or modified TEU if:
(A) The TEU does not comply with this rule; or
(B) The source does not comply with OAR 340-245-0050, if required.

STATUTORY/OTHER AUTHORITY: ORS 468.020, 468.065, 468A.025, 468A.040, 468A.050, 468A.070, 468A.155, 468A.135, 468A.337

STATUTES/OTHER IMPLEMENTED: 468.065, 468A.025, 468A.040, 468A.050, 468A.070, 468A.155, 468A.010, 468A.015, 468A.035, 468A.337, 468A.335